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COLLABORATION
WITH



FEASIBILITY STUDY TO PROMOTE LOW-CARBON, BEST AVAILABLE TECHNOLOGIES FROM CHINA TO AFRICA

within the Forum on China-Africa
Cooperation (FOCAC)

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ACRONYMS

AfDB	Africa Development Bank
AHRDF	African Human Resources Development Fund
AIBO	Academy for International Business Officials
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
BAT	Best Available Technology
CABC	China-Africa Joint Business Council
CCPIT	China Council for the Promotion of International Trade
CFL	Compact Fluorescent Light Bulb
EAC	East African Community
ECOWAS	Economic Community of West African States
EE	Energy Efficient/Efficiency
ESARPO	Eastern Southern African Regional Programme of WWF
FDI	Foreign Direct Investment
FOCAC	Forum on China-Africa Cooperation
GEF	Global Environment Facility
ISO	International Standards Organisation
LC	Low Carbon
LED	Light Emitting Diode
MCEP	Manufacturing Competitiveness Enhancement Programme
MS	Member States (of FOCAC)
R&D	Research and Development
SADC	Southern African Development Community
UNEP	United Nations Environment Programme
WTO	World Trade Organisation
WWF	Worldwide Fund for Nature

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EXECUTIVE SUMMARY

In recognition of the impact of China's growing economy, and its potential global contribution to renewable energy and clean technology, WWF launched the China for a Global Shift Initiative.

Dramatic growth
in China's production
of energy-efficient
technologies

The Initiative aims to drive China's international trade and capital flows towards supporting global conservation and footprint reduction. It seeks to engage key decision-makers in governments and financial institutions linked to Chinese investments outside China that will have an impact on WWF's priority countries and regions. In Africa, a key entry point for engagement is the Forum on China-Africa Cooperation (FOCAC). Founded in 2000 to strengthen cooperation between China and African countries, FOCAC is primarily a framework for high-level ministerial dialogue. The main form of engagement, the tri-annual Ministerial Conferences, gives rise to declarations and action plans which are then implemented in the period between the Conferences. Various other sub-forums have been formed under FOCAC, and it has given rise to a number of mechanisms that allow for implementation.

This study was commissioned by WWF Switzerland to explore whether there are provisions and mechanisms within the FOCAC framework that could be used to promote the uptake of low-carbon, best available energy-efficient technologies in Africa, including building components, electronics, appliances and mobility technologies. As economies in Africa are growing, the demand for technologies is increasing, and the adoption of best available technologies over poor performers providing the same service has the potential to lower negative environmental impacts.

The study first sets out to explore China's strengths in production of such energy-efficient technologies. It identifies that China's share of the global production of environmentally-favourable goods across a number of product categories has been growing dramatically since the early 1990s. Environmentally-favourable goods include "climate protection goods" (i.e. goods for efficient use of energy; goods for efficient conversion of energy; and goods for use of renewable energy sources) as well as technologies that are concerned with waste, wastewater and air pollution control. The primary growth driver has been the strong internal policy framework that supports demand for such products, although the offering of such goods also extends to the export market.

The study then provides an overview of economic growth and demand patterns for goods in different African countries, with a particular focus on the countries targeted for WWF's engagement with FOCAC. These are Cameroon, the DRC, Gabon, Kenya, Madagascar, Mozambique, Nigeria, South Africa,

Tanzania, Uganda and Zambia. As expected, these countries have differing levels of growth and economic development, which is reflected to some measure in the demand patterns for goods.

The FOCAC framework, and the mechanisms that may be relevant to promoting these products, is described, along with specific opportunities for WWF to engage, either on its own or with relevant partners. Further opportunities are identified through a series of case studies, the first being a roll-out of CFLs in Madagascar, the second the implementation of pico solar technologies, and the third on the establishment of an electronics plant in South Africa.

Finally, the opportunities identified in the individual sections are synthesised and expanded upon to provide the beginnings of an action plan for WWF to engage with FOCAC. In summary, the opportunities identified in the action plan include the following. The main body of the report also identifies the specific FOCAC mechanisms that may be leveraged to achieve each of these:

- Developing an understanding of the specific needs of individual countries and regions through a series of case studies. Such case studies will consider physical technology needs and requirements for technology transfer, requirements for institutional capacity building, and research and development needs in their individual jurisdictions. They will also provide insights into the in-country priorities and barriers to support for roll out of low-carbon, best available energy-efficient technologies;
- Understanding policy requirements relating to technology transfer in low-carbon, best available energy-efficient technologies, and complementing the existing work that is being done in this regard by organisations such as CLASP¹;
- Participating in formal annual meetings and organising side events at the Ministerial Conferences. These include the annual conference of Chinese and African entrepreneurs organised by the China Council for the Promotion of International Trade (CCPIT), and round tables on the topic of technological cooperation organised by the Chinese Ministry of Science and Technology;
- Facilitating opportunities for engagement between stakeholders in China and stakeholders in individual African countries specifically relating

to promoting the value of best available energy-efficient technologies;

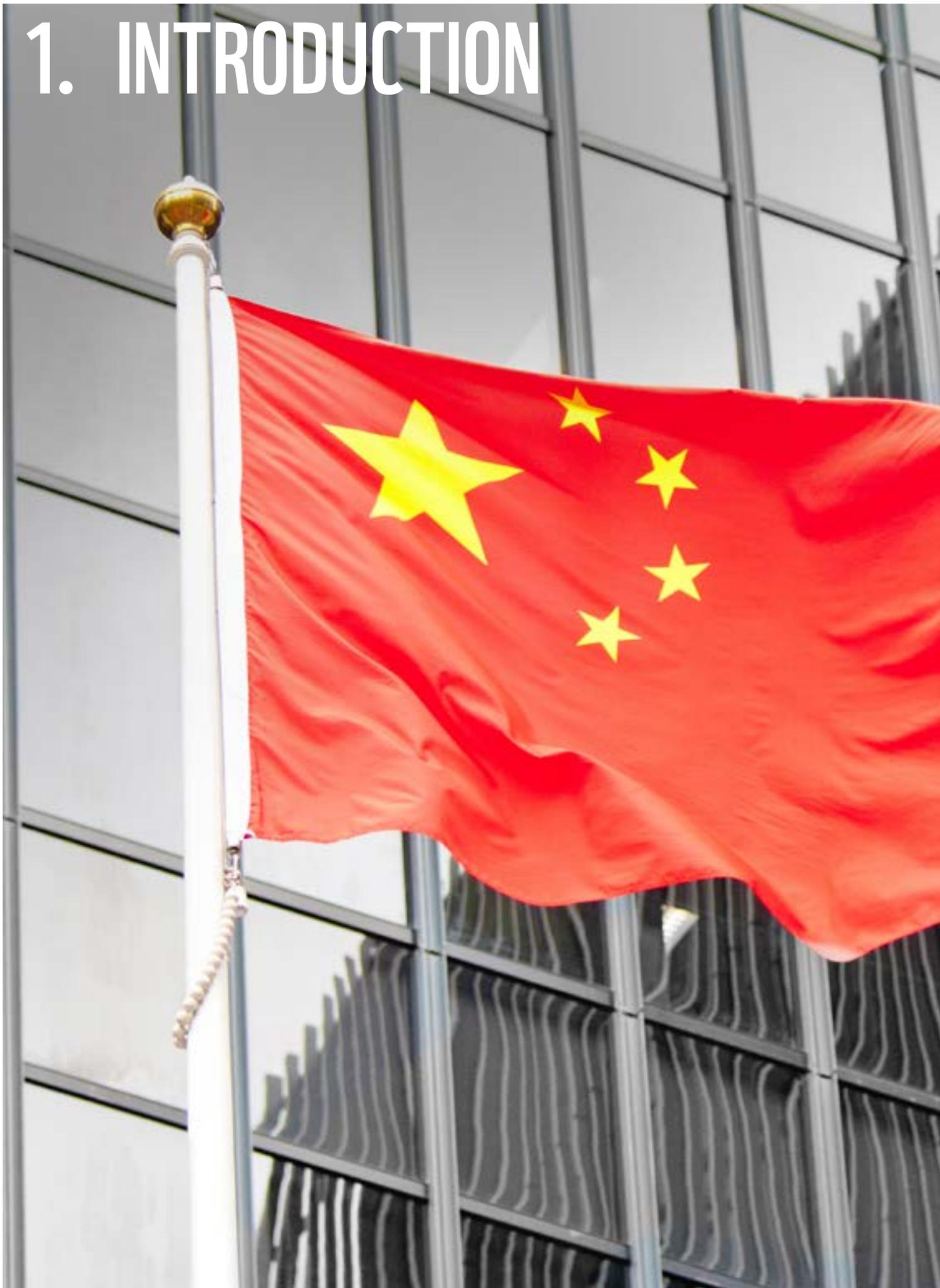
- Organising country relevant training for local distributors and technicians on topics that include standards, installation and maintenance of equipment; promotion of these technologies etc;
- Leveraging the FOCAC mechanisms to remove barriers to trade in low-carbon, best available technologies;
- Conducting policy analysis and supporting policy amendments specific to establishing manufacturing facilities in countries where such investment is likely to be favourable;
- Promoting locally relevant research, particularly around adaptation and customisation of low-carbon, energy-efficient technologies for application in African countries; and
- Partnering with existing organisations currently working on standardisation and testing, such as Topten, en.lighten and Lighting Africa.

Some indications were given as to the kinds of projects that may be relevant in the individual focus countries for WWF's FOCAC engagement. These range from support for energy-efficient appliances in more economically developed countries and those where economies are growing, to roll-out of energy-efficient light bulbs in countries with high urban populations and high rates of electrification, to application of pico solar technologies and energy-efficient cook stoves in countries with low levels of electrification, particularly in rural areas.

In conclusion, it is recognised that FOCAC has already made a number of provisions in the declarations and action plans from the Ministerial Conferences and these can provide a solid basis for promotion of the technologies of interest in this study. Furthermore, there are a number of mechanisms in place that could be leveraged – ranging from funding to capacity building to support for trade and investment to R&D support. None of these are currently specifically focused on such technologies and the case would need to be made for specific support for this particular focus area.

¹ CLASP is an international organisation, that promotes EE standards and labels for appliances, lighting and equipment. CLASP website: <http://www.clasponline.org>.

1. INTRODUCTION





INTRODUCTION

In recognition of the impact of China's growing economy and its potential global contribution to investment in and supply of renewable energy and clean technology, WWF launched the China for a Global Shift Initiative.

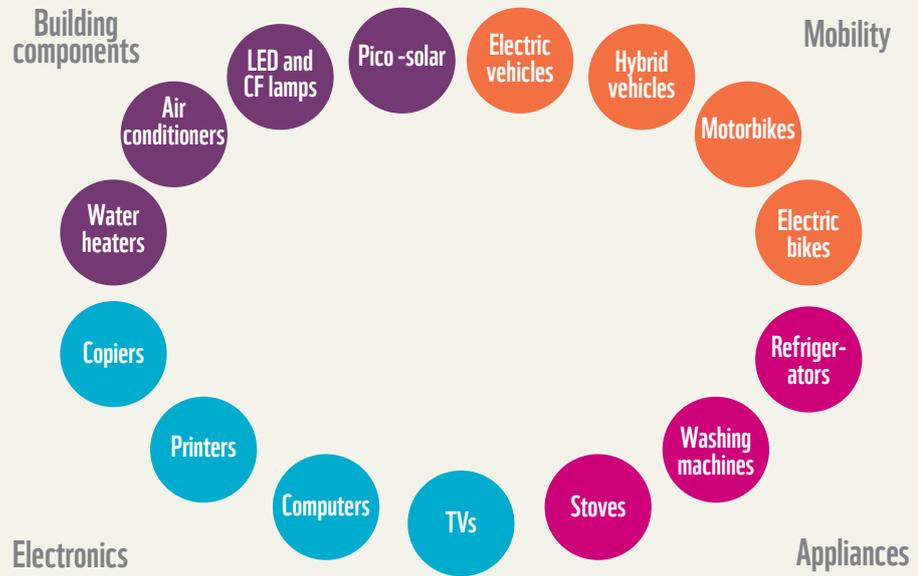
This initiative aims to support China's international trade and capital flows becoming a driving force in global conservation and footprint reduction through engaging key decision-makers in governments, as well as financial institutions linked to Chinese investments outside China that will have an impact on WWF's priority countries and regions. In Africa, a key entry point for engagement is the Forum on China-Africa Cooperation (FOCAC).

According to the 2013 IEA World Energy Outlook, by 2035 global energy demand will increase by one third (IEA, 2013a). Increased energy demand is driven by the energy needs of an expanding middle class, particularly in developing economies, and especially by demand for transport fuels and electricity use for consumer goods. Emerging economies account for 90% of the net energy demand growth until 2035 (IEA, 2013a). It is widely recognised that energy efficiency (EE) has a critical role to play in reducing energy-related emissions to levels needed to avoid dangerous climate change. EE products consume up to two thirds less energy than conventional products. Even though EE is a cost-effective option for reducing emissions, there is still much to be done to realise its full potential.

EE products
consume
up to 66%
less energy than
conventional
products

Recognising how EE products can reduce growth in demand in emerging economies, WWF Switzerland commissioned this study to explore opportunities to leverage FOCAC to promote the transfer of EE low-carbon, best available end-use technologies from China to Africa. EE end-use technologies can be grouped into four categories: appliances, electronics, building components and transport (Topten, 2012). These are depicted in Figure 1. It should be recognised that the potential savings achieved through application of energy efficient technologies in some of these end-use categories needs to be considered in conjunction with the size of the appliance (e.g. a smaller television will consume less energy than a large television) (Hu et al., 2013), as well as country-specific user behaviour.

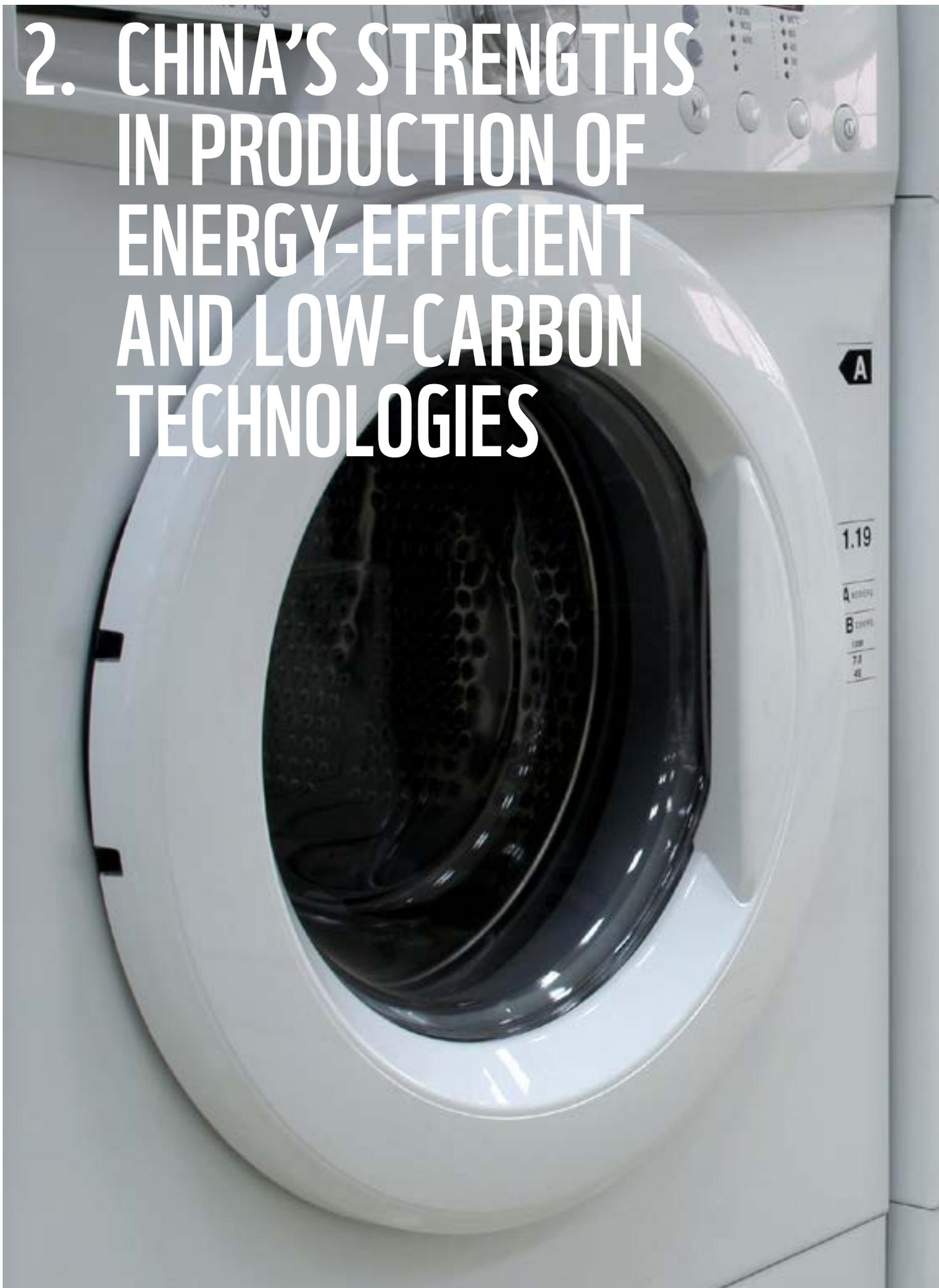
Figure 1 Low-carbon best available end-use technologies (based on Topten, 2012)



The study starts with presenting an overview of China’s strengths with respect to production of low-carbon, best available technologies (Section 2), and the potential markets within Africa (Section 3). Thereafter an overview of FOCAC is presented (Section 4), followed by a discussion on the mechanisms that are available under the Forum that could be leveraged to support technology transfer (Section 5). In each of these sections “highlight boxes” are used to identify the opportunities that WWF, in cooperation with Topten and other partners, could pursue to facilitate technology transfer under the FOCAC framework. In Section 6, a series of case studies on low-carbon, energy-efficiency technology transfer is presented, and is used to highlight further actions that could be taken by WWF in the roll out of similar projects elsewhere. Section 7 summarises and expands on all of the proposed opportunities identified throughout the document towards the start of an action plan for WWF under FOCAC. A brief conclusion is presented in Section 8.

The report has been based on a combination of a review of the open literature, case studies and interviews. A list of interviewees is included as Appendix A. Observations are not ascribed to individual interviewees.

2. CHINA'S STRENGTHS IN PRODUCTION OF ENERGY-EFFICIENT AND LOW-CARBON TECHNOLOGIES





CHINA'S STRENGTHS IN PRODUCTION OF ENERGY-EFFICIENT AND LOW-CARBON TECHNOLOGIES

China's significant economic growth over the last decades, together with rapid urbanisation and an increasing middle class, has resulted in substantial increased energy demand and associated growth in greenhouse gas emissions (Watson et al., 2011). China is now the largest global emitter of greenhouse gases, contributing over a quarter of global CO₂ emissions (IEA, 2013b).

On a per capita basis, China's CO₂ emissions remain lower than some other industrialised countries, notably the United States (6.1 vs. 17.5 tonnes of CO₂ per capita in 2010; UNdata, 2010). However, per capita emissions continue to rise by over 6% per year and are now on par with the European Union (Wilson, 2014).

This level of economic growth has also come with challenges, not only in terms of meeting energy demand, but also regarding negative environmental impacts associated with energy-intensive and highly-polluting industries (Watson et al., 2011). Such impacts include local air pollution, water pollution and depletion of natural resources. China is responding to these challenges and the government has taken significant steps to save energy, reduce emissions and address climate change. These low-carbon development intentions are articulated in China's central economic planning document, the Five-Year Plan. The 12th Five-Year Plan, which runs from 2011 to 2015, includes the following binding renewable-energy, energy-intensity and CO₂-intensity targets (IEA, 2013b; Australian Government, 2013; NPC, 2011):

- Increase of non-fossil fuel usage in primary energy consumption (%) to 11.4% by 2015
- Decrease in energy consumption per unit of GDP (%) by 16% over 5 years
- Decrease in CO₂ emissions per unit of GDP (%) by 17% over 5 years

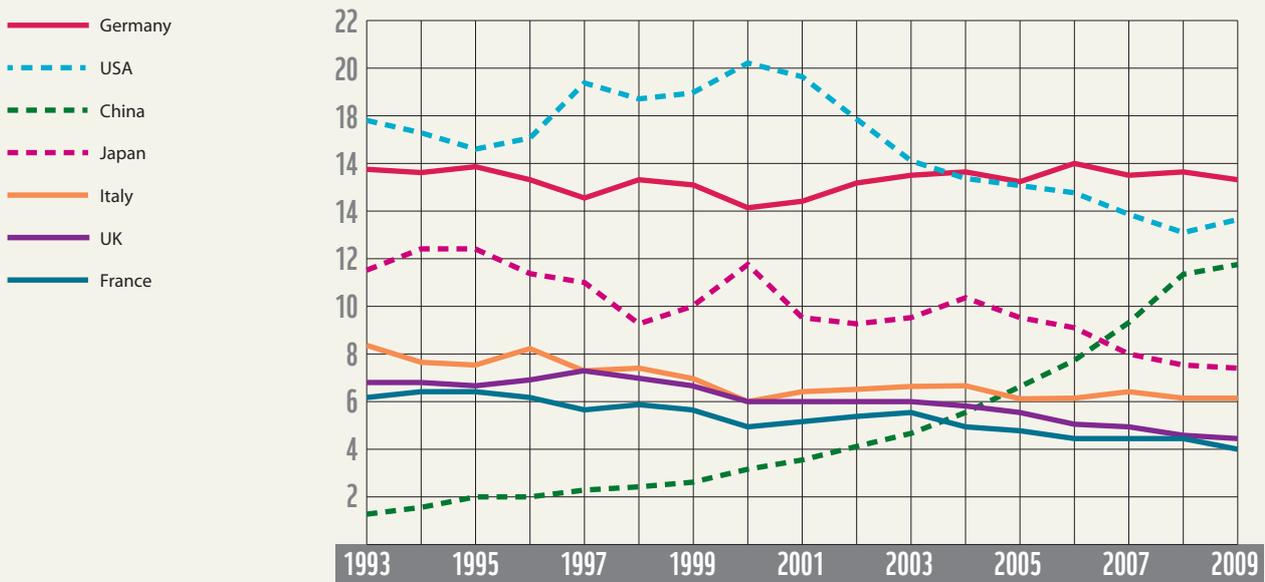
This is not only to benefit the domestic market, China's 12th Five-Year plan also states an intention to "strictly limit the export of products that require wasteful use of energy and resources" (NPC, 2011). Key technologies include renewable electric power sources (e.g. photovoltaics and wind), intelligent white goods, and hybrid, electric and fuel-cell vehicles (NPC, 2011). China's response has also been supported by significant government funding into research and development (R&D) for these technologies, with incentives for renewables and demonstration trials in electric vehicles, for example (Watson et al., 2011). China is now considered a leader in some of these fields. For example, by 2010 China was the leading manufacturer of solar cells, with 48% of the world market share (BMU, 2011). No data was found on the contribution to other reduced-impact product categories such as LEDs.

China leads
in many key
renewable and
energy saving
technologies

11.8%
China's share in
world trade in
environmental
goods in 2009

No consolidated statistics relating to the proportion of energy-efficient technologies to total Chinese production and trade are available, with statistics rather being reported per overall product category. The OECD and Eurostat have, however, developed a methodology to determine the contribution of the “environmental goods and services sector” to the economy (OECD, 1999). Here “environmental goods” include “climate protection goods” (i.e. goods for efficient use of energy; goods for efficient conversion of energy; and goods for use of renewable energy sources) and technologies that are concerned with waste, wastewater and air pollution control. China had an 11.8% share of world trade in these goods in 2009 (BMU, 2011). This was only surpassed by Germany with 15.4% and the US with 13.6% in the same year (BMU, 2011). China’s environmental goods sector – climate protection goods and photovoltaics in particular – has grown significantly as can be seen in Figure 2. This trend has likely continued since 2009.

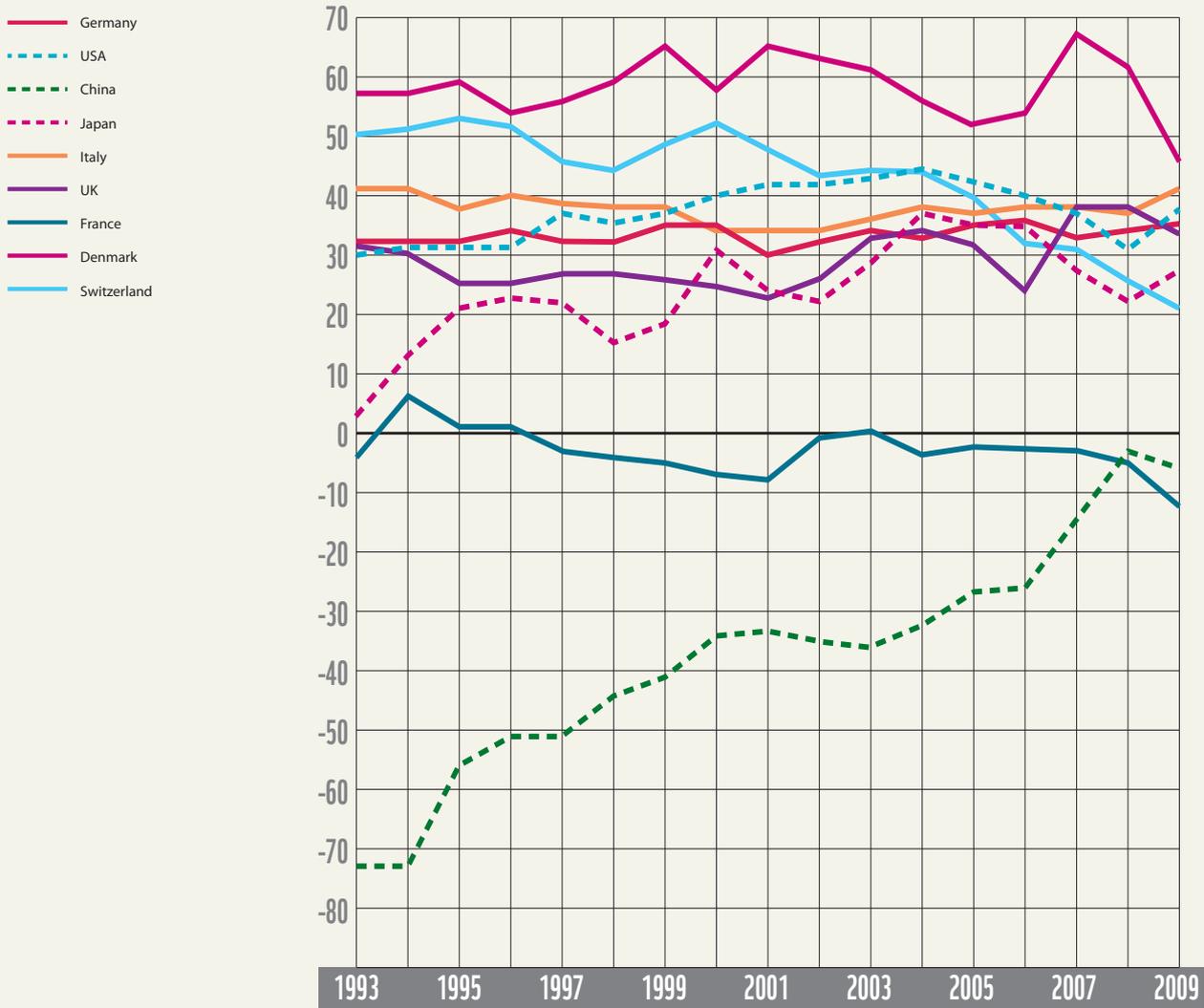
Figure 2 Historical world trade shares of the biggest suppliers of potential environmental goods



Source: BMU, 2011

In terms of specialisation in low-carbon technologies, China is also seen to be rapidly increasing the proportion of environmental goods to total processed industrial goods (Figure 3).

Figure 3 Specialisation of China and selected countries in potential environmental goods



Source: BMU, 2011

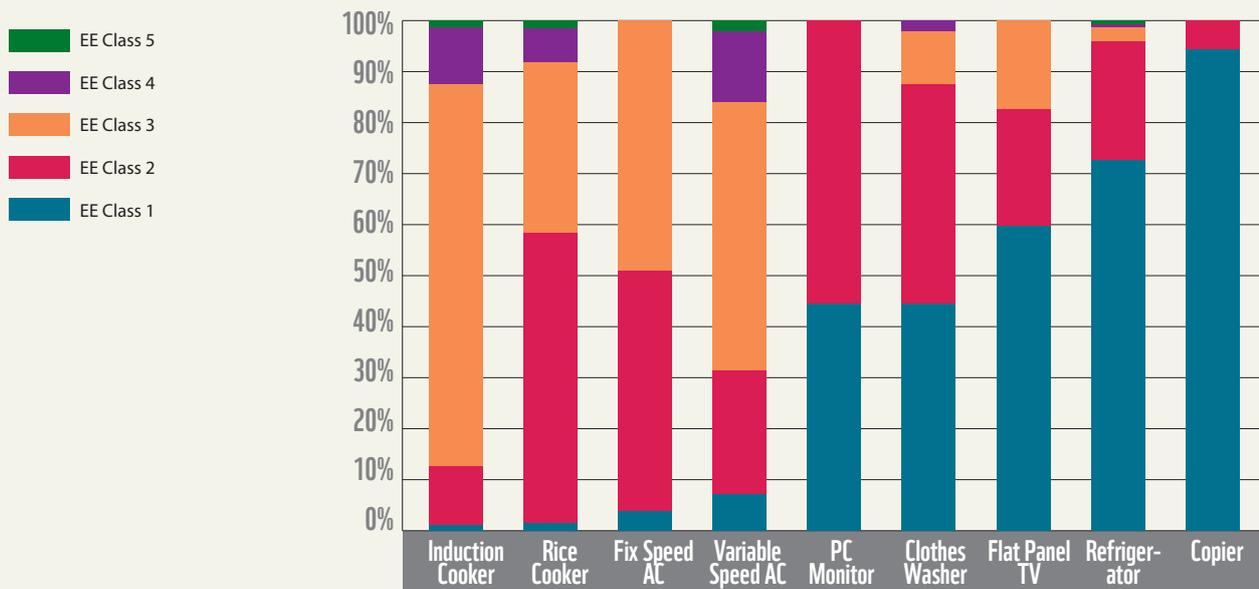
The shift shown in Figure 3 has been driven primarily by policies to support the uptake of energy-efficient products domestically. In addition to existing, new and revised minimum energy performance standards, and mandatory comparative energy labels for appliances, China has three incentive programmes in place. These are: subsidised trade-in of home appliances “Old to New”, “Appliances to Rural Areas” and the “Subsidy Program for EE Products” (Cleff & Rennings, 2013; Hu et al., 2013). Incandescent lamps are also in the process of being phased out (Zhou et al., 2012).

Figure 4 shows the share of energy-efficient products in terms of total number of models manufactured in China for a number of products (Hu et al., 2013). Here, EE Class 1 is the most energy efficient and EE Class 5 is the least energy efficient. Product categories from China that represent best available technology in terms of energy efficiency include refrigerators, air-conditioning units, light bulbs,

EE Class 1 is the most energy efficient

copy machines and computer monitors (Zhou et al., 2012). Whereas historically exports from China were perceived to be of poor quality, the drive for technological development and innovation is seeing China challenge this perception by delivering products that are both low cost and high quality (van Wyk, 2010).

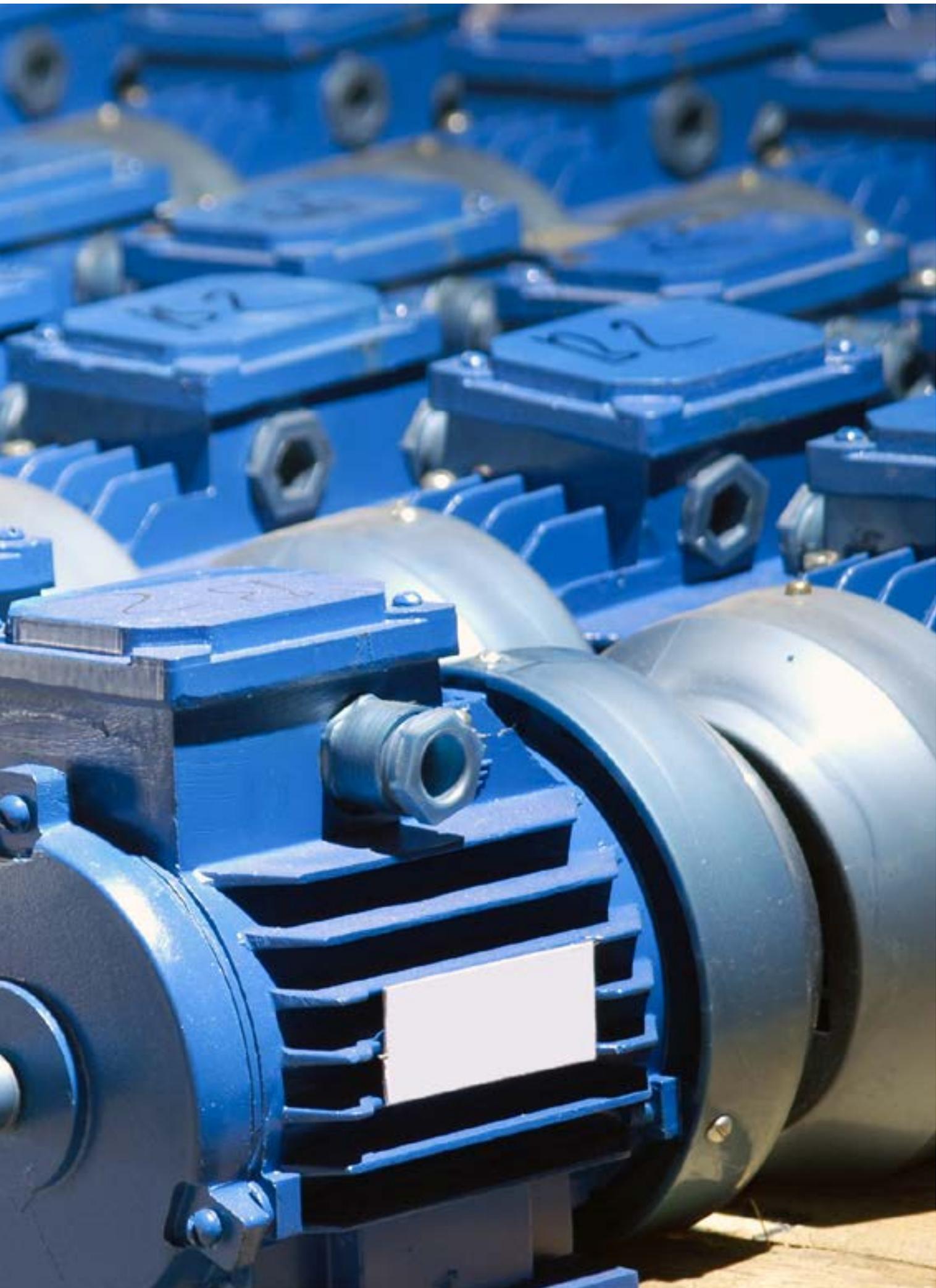
Figure 4 Share of energy-efficiency products (in terms of number of models) in the household appliance sector



Source: Hu et al., 2013

3. ENERGY-EFFICIENCY AND LOW-CARBON TECHNOLOGIES IN A GROWING AFRICAN MARKET





ENERGY-EFFICIENCY AND LOW-CARBON TECHNOLOGIES IN A GROWING AFRICAN MARKET

Since the turn of the century Africa has gone through a process of economic transformation. Today 22 of 55 countries on the continent, with a combined population of 400 million people, are considered middle class, or having more than US\$ 1,000 per capita average monthly income.

Another 10 countries, with a combined population of 200 million, could join this group by 2025 if current growth trends continue (World Bank, 2014). By 2040 Africa's working-age population is projected to be over a billion – a significant consumer market whose demand for end-use technologies is expected to converge to Western standards (Bartlett, 2013).

Although on average high growth has been seen across the continent, there is wide variability between countries in the degree of socio-economic development. Figure 5 shows the average GDP per capita growth rates for Sub-Saharan countries for the period 1996 to 2008. The figure groups countries into four categories. "Emerging countries" are those where economic growth has been accompanied by increases in trade and investment, rising school enrolments, improved health indicators, declining poverty rates and the adoption of some measure of democracy². "Threshold countries" are on course to becoming "Emerging countries". "Oil exporters" have made little progress in diversifying their exports³ and improving other parameters of socio-economic development, despite often exhibiting high growth rates (a similar observation may be made about certain countries that are heavily invested in mining and the export of mineral resources). "Other countries" have seen little or no progress either in their economies or other spheres of development (Radelet, 2010).

The countries targeted for WWF's engagement with FOCAC fall into each of these categories:

- Emerging countries: Mozambique, South Africa, Tanzania, Uganda and Zambia;
- Threshold countries: Kenya;
- Oil Exporters: Cameroon, Gabon and Nigeria; and
- Other countries: DRC and Madagascar.

2 Other indicators of an "Emerging economy" found in literature also include a fairly efficient macroeconomic framework accompanied by an appreciable level of international competitiveness, reasonably efficient and competitive domestic markets, a level of human resource development as well as the quality of infrastructure and institutions consistent with the needs of an economy set for rapid expansion, an adequate level of governance and political accommodation and finally, a marked reduction on aid, relying more on domestic savings and foreign private inflows for investment (Bigsten, 1999).

3 For example, the share of oil in total exports in 2011 was over 97 percent in Angola and around 85 percent for Nigeria (World Bank, 2013).

>1 billion
The projected
working age
population in Africa
in 2040 that will
lead to increased
demands for end-
use technologies

China is Africa's largest single trade partner

Notwithstanding these social development challenges, in line with economic growth and public and private investment, many African countries have experienced an increase in demand for goods, much of which has been met by China (AEO, 2013). China is now Africa's largest single trade partner, and Africa is China's primary source of imports, second largest foreign construction project contract market and fourth largest investment destination (Information Office of China's State Council, 2013). While the imports from Africa to China are concentrated mainly in mineral products and base metals (the top 20 products imported accounted for 96% of all imports from Africa), the exports to Africa are far more diverse (Tralac, 2013).

The demand for energy-efficient goods and low-carbon best available technologies depends not only on the country's development status, but also on the degree of electrification (whilst recognising that these two factors are related). The International Energy Agency publishes statistics on electricity access and other indicators of energy access, summarised into a normalised Energy Development Index (EDI)⁵ to allow comparison between countries. Electricity access statistics as well as the EDI are listed in Table 1 and Table 2 respectively for this study's focus countries.

Table 1 2011 Electricity access statistics for focus African countries

Region	Population without electricity millions	Electrification rate %	Urban electrification rate %	Rural electrification rate %
Sub-Saharan Africa	599	31.8	55.2	18.3
South Africa	8	85	96	67
Gabon	1	60	64	34
Zambia	11	22	51	3
Cameroon	9	54	88	17
Madagascar	18	14	62	-
Nigeria	85	48	35	61
Kenya	34	19	58	7
Tanzania	39	15	46	4
Mozambique	19	20	55	5
DR of Congo	62	9	26	0
Uganda	30	15	55	7
North Africa	1	99.4	100.0	98.7
Africa	600	42.6	65.2	27.8

Source: IEA, 2013a

Of the focus countries, South Africa is considered the most developed in terms of energy access, with 85% of the population having access to electricity and high urban and rural electrification rates. It is thus a key market for energy-efficient appliances and technologies. Even though only just over half of Nigeria's population has access to electricity, the size of the country means that it too represents a large market for these goods. Cameroon, while a smaller country population wise, also has

⁵ The EDI is a combination of the following indicators: access to electricity, access to clean cooking facilities, access to energy for public services, access to energy for productive use. More information is available at www.worldenergyoutlook.org



The demand for energy-efficient goods and low-carbon best available technologies depends not only on the country's development status, but also on the degree of electrification.

relatively high electrification rates in its urban areas. Countries with lower rates of electrification represent a future potential market for these goods, but also indicate that decentralised renewable electricity-supply technologies would find a market here. Examples are Kenya, Tanzania, Cameroon, Mozambique and the DRC.

Table 2 Energy Development Index (EDI) and country rating for focus African countries – 2010 data

Region	EDI country ranking (out of 80 countries)	EDI'
South Africa	14	0.65
Gabon	45	0.27
Zambia	60	0.14
Cameroon	61	0.14
Madagascar	65	0.12
Nigeria	66	0.11
Kenya	68	0.10
Tanzania	69	0.10
Mozambique	70	0.10
DR of Congo	73	0.09
Uganda	76	0.07

Source: IEA, 2012

Demand
for energy-efficient
goods is a product
of development
status and degree of
electrification

3.1 Appliances

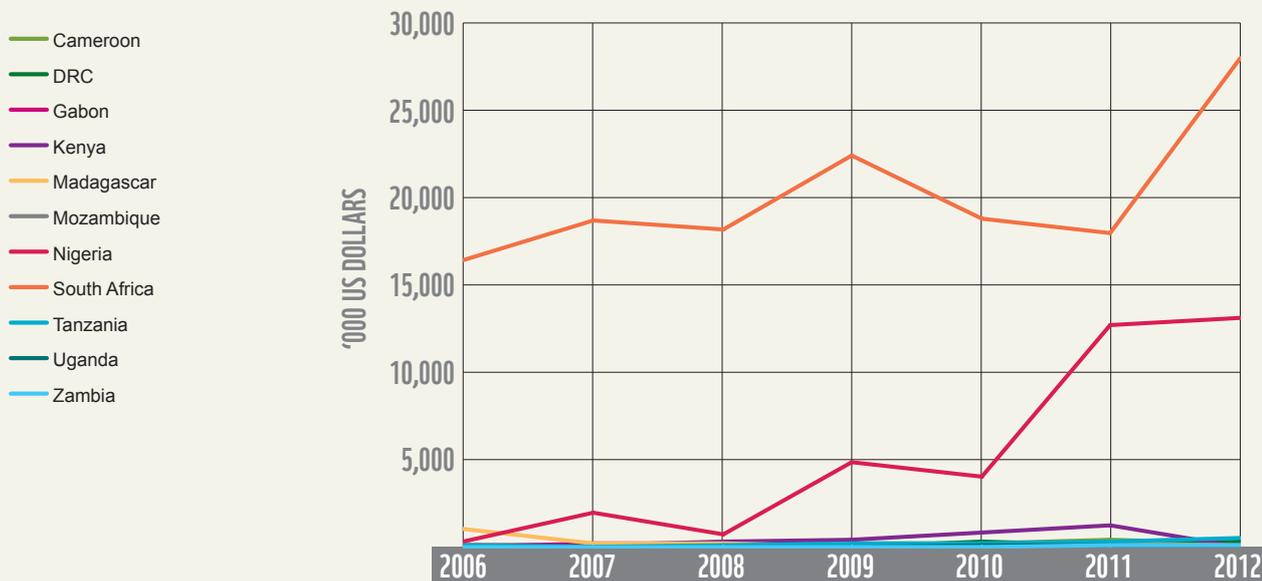
In terms of energy-consuming appliances, the following figures show the historical trade from China to the focus African countries for refrigerators and washing machines. Trade statistics are provided at the level of commodity categories and sub-categories, and don't distinguish between qualities or efficiencies of products.

Figure 6 Imports from China of [8418] refrigerators, freezers etc. in thousands of US dollars



Source: UN Comtrade statistics

Figure 7 Imports from China of [8450] household or laundry-type washing machines in thousands of US dollars



Source: UN Comtrade statistics

Nigeria & South Africa are the largest markets for appliances

As suggested above, Nigeria and South Africa represent the largest markets for appliances due to their populations, development status and access to electricity. Of appliance imports (including refrigerators, stoves, washing machines and dishwashers) to Africa from China, refrigerators represent the greatest trade volume (in US dollars), ranking 29th in 2012 in terms of all commodity categories exported to Africa (Tralac, 2013). Further, China is observed to hold a significant and increasing market share in this category, accounting for 64% of refrigerators imported by Nigeria and 40% of those imported by South Africa. Some slight growth is observed in terms of imports into other African countries and there is certainly a role for BAT from China capturing these growing markets or establishing manufacturing facilities within these countries, where the infrastructure and economic climate allow.

3.2 Building components

China exports many categories of energy-consuming building components to Africa, with air conditioners, lamps and light fittings, and water and space heaters ranking 18th, 19th and 39th respectively in terms of trade volume in US dollars in 2012 (Tralac, 2013). For illustrative purposes, the figures below show the historical trade between China and the African countries under consideration for air conditioners (an increasing proportion of which could be EE BAT) as well as PV cells and LEDs that are both best available, low-carbon technologies.

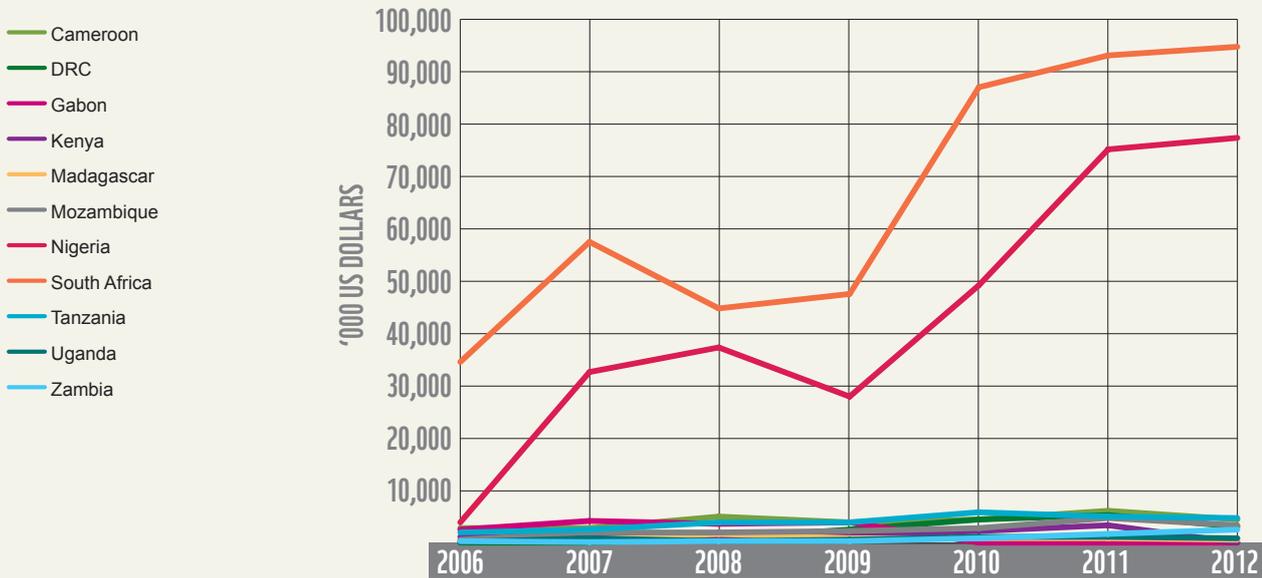
It is recognised that while air conditioners rank highly in terms of imports to Africa from China, demand is greater in North African countries than in sub-Saharan Africa. Figure 8 shows that air conditioning units display similar trends to household appliances in terms of trade volumes, with South Africa and Nigeria representing the largest markets and increasing imports from China. China's share of the import market in these two countries for air conditioners was 43% and 57% respectively in 2012. The current market share of imports in other African countries varies between 20 and 45%⁶. As smaller countries develop, demand is likely to increase, again suggesting a role for Chinese BAT.



As smaller countries in Africa develop, demand for air conditioners from China is likely to rise.

⁶ Data availability on import volumes as well as unit imports is not consistent between countries, and data may be lacking for smaller countries for more recent years.

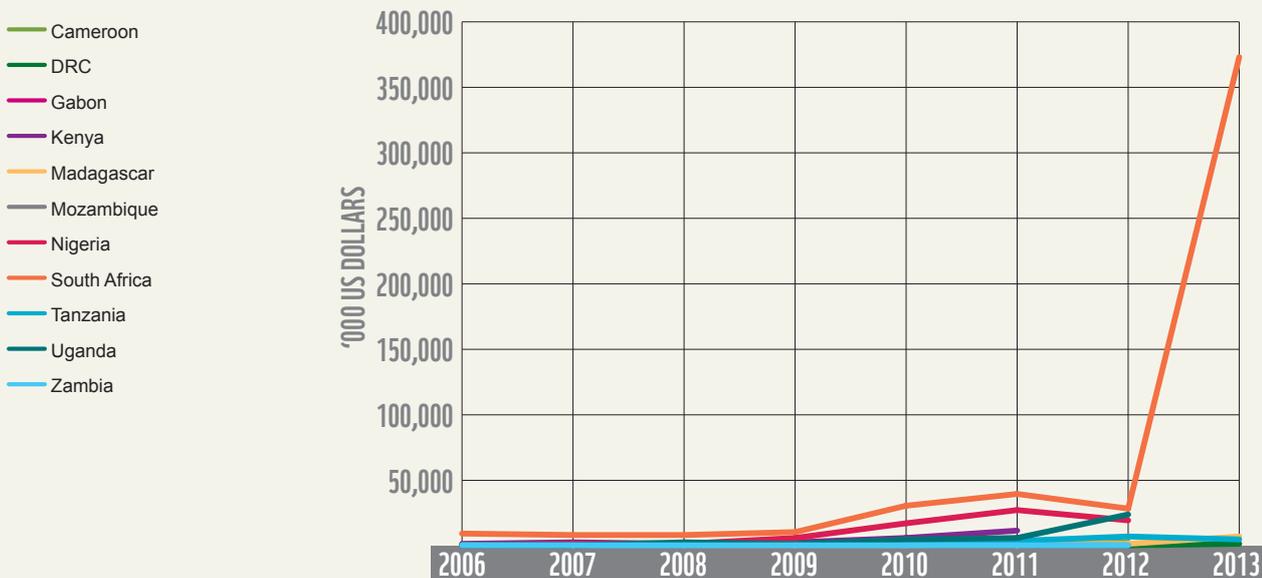
Figure 8 Imports from China of [8415] air-conditioning machines in thousands of US dollars



Source: UN Comtrade statistics

Figure 9 shows imports from China of PV cells, other photosensitive semiconducting devices and LEDs (disaggregated data is only available for some countries). The spike in imports to South Africa is due to increases in PV cells for large-scale renewable electricity generation. Given that imports of conventional electric lamps to these countries remain high (from China and elsewhere), it is suggested that there is the potential to drive growth in imports of LEDs to Africa from China.

Figure 9 Imports from China of [854140] photosensitive semiconducting devices, photovoltaic cells & LEDs



Source: UN Comtrade statistics, South African Revenue Service

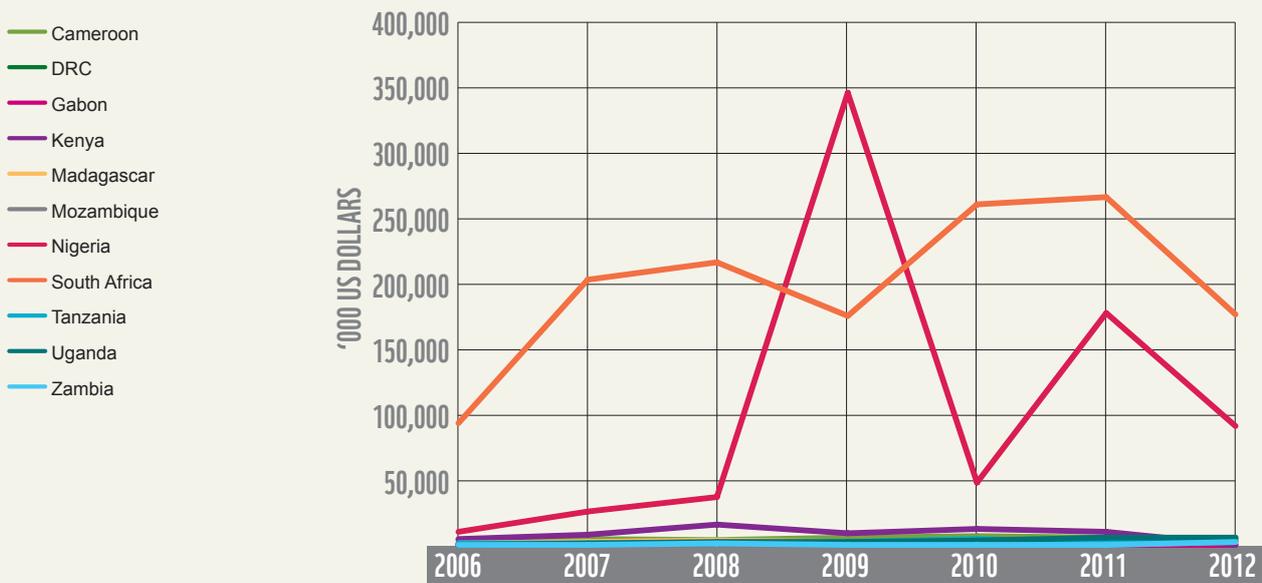
66%
Chinese market
share of South
African electronics
market in 2012

3.3 Electronics

Imports to Africa from China in the electronics category are high: in 2012 telecommunication devices (including mobile phones) ranked 3rd in terms of trade volumes in US dollars and televisions ranked 22nd (Tralac, 2013). Figure 10 shows imports of the latter from China into the countries of interest. As with appliances, imports to South Africa and Nigeria are significant but with less of a steady increase observed. In 2012 China’s market share was 66% for South Africa and 34% for Nigeria. Madagascar also showed a preference for Chinese imports, with China accounting for 61% of television imports.

As for appliances, given the growing demand for electronics in Africa, China could contribute to meeting this demand with EE product exports and/or by establishing local manufacturing facilities. With regards to mobile phone technologies, small-scale renewable technologies for charging mobile phones in areas without electrification could see significant uptake.

Figure 10 Imports from China of [8528] television receivers (incl. video monitors and projectors)



Source: UN Comtrade statistics



PHOTO: BALONCI, SHUTTERSTOCK.COM

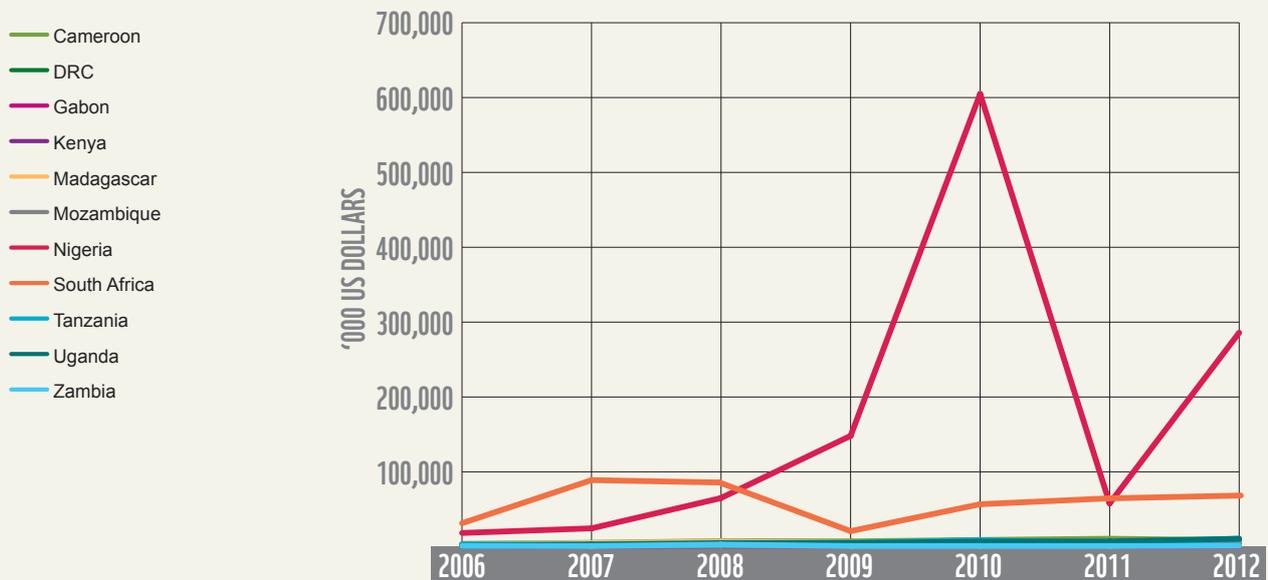
Chinese vehicles made up less than 10% of imported vehicles to all African countries considered.

3.4 Transport

Although imports of passenger vehicles to Africa from China rank highly in terms of overall trade volumes (31st in 2012; Tralac, 2013), imports to the African countries analysed in this study are fairly low (Figure 11). Further, Chinese vehicles made up less than 10% of imported vehicles to all countries considered.

The potential role for China in this category of imports is not only in the supply of EE conventional vehicles, but also in the supply of hybrid and electric vehicles and possibly developing local production in the longer term. China is rapidly developing expertise and manufacturing capacity in electric vehicle technologies that could be transferred to Africa (The Climate Group, 2010).

Figure 11 Imports from China of [8703] cars (incl. station wagons)



Source: UN Comtrade statistics

4. ABOUT FOCAC





ABOUT FOCAC

The Forum on China-Africa Cooperation (FOCAC) was founded in 2000 to strengthen cooperation between China and African countries, with a particular focus on meeting the challenges of economic globalisation, seeking opportunities for common development and political support (FOCAC, 2013).

FOCAC is considered one of the most important platforms for Chinese-African discourse that can affect China's trade and investment in Africa (WWF, 2012). A summary of the workings of FOCAC is presented here.

4.1 Ministerial Conferences

The Ministerial Conference, held every three years, produces two main outputs: a declaration and an action plan. The declaration presents a common view on current global affairs, and states a high-level vision for FOCAC's on-going work. The programme or action plan presents details of the challenges and opportunities relating to the themes identified in the declaration, and actions that will be taken with respect to these.

The steps in the preparation for the Ministerial Conferences are understood to be as follows (WWF, 2013, Jansson, 2009). Discussions start about 12 months before the Conference with the China-Africa Senior Officials Meeting. This meeting provides a platform to follow up on activities from the last Ministerial Conference, and to define preparations for the next. Co-chaired by China and the host country, this meeting is held alternately in China and Africa and includes four members from each delegation at the director-general level. At about the same time as this meeting, the Chinese Follow-up Committee consults with relevant Chinese ministries. The Follow-up Committee includes the participation of government ministries and other organisations⁷.

⁷ Members of the Chinese Follow-up Committee are: Ministry of Foreign Affairs, Ministry of Commerce, Ministry of Finance, International Department of CPC Central Committee, National Development and Reform Commission, Ministry of Education, Ministry of Science and Technology, Ministry of Land and Resources, Ministry of Communications, Ministry of Information Industry, Ministry of Agriculture, Ministry of Culture, Ministry of Health, People's Bank of China, General Administration of Customs, State Administration of Taxation, General Administration of Quality Supervision, Inspection and Quarantine, State Environmental Protection Administration, General Administration of Civil Aviation, State Administration of Radio, Film and Television, National Tourism Administration, Information Office of the State Council, Chinese Communist Youth League, China Council for the Promotion of International Trade, Bank of China, Export-Import Bank of China, Beijing Municipal Government.

The first draft of the declaration is developed by the Chinese government and is sent to the African Member States (MS)⁸ for input and comment, about six months before the Ministerial Conference. In the six months leading up to the Conference, meetings are organised at various levels within the Chinese government, between Chinese Ministries and Embassies in Africa, within the African diplomatic community in China, between the African diplomatic community and their respective capitals, within African governments and with national FOCAC delegations. Projects identified through these meetings are consolidated and presented for consideration and incorporation into the Action Plan.

Opportunity 1

WWF could play a role in engaging its offices across Africa in helping to identify energy end-use technology needs specific to the regions, and identify what cooperation mechanisms at a ministerial level could help to support technology transfer, recognising that there are already some provisions in place within FOCAC.

FOCAC
is one of the most
important platforms
for Chinese-African
discourse

It is not entirely clear how the Action Plan is implemented, and at present the process appears to largely be left to the initiative of each African country. The responsibility for implementation in China lies with the Ministries of Foreign Affairs. If FOCAC projects require involvement of other ministries, the Ministry of Foreign Affairs is responsible for making the connection through the Chinese Follow-up Committee. In many of the African MS, there has been limited involvement in follow up and implementation from other ministries, with only South Africa and Ethiopia having had follow-up committees by the end of 2010 (Anshan, 2011).

Despite the lack of clarity on implementation, there is some understanding of the project development cycle under FOCAC (WWF, 2013):

- The Chinese Embassy invites the host African country to make proposals for discussion.
- The African government proposes projects to be undertaken as part of the FOCAC agreements.
- The Chinese Ambassador reports to the Chinese Ministry of Foreign Affairs (MFA) and Ministry of Commerce (MOFCOM) for approval of the projects, based on the findings from consultations and field visits.
- The relevant MOFCOM department carries out inspections of the enterprises preparing to implement the projects. Other Chinese Ministry may also be involved.
- Negotiations may be held involving the African Embassy in China.
- The African Department of the MFA, acting as Secretariat of the Follow-up Committee with the Department of West Asian and African Affairs under MOFCOM, submits the reports to the Ministry of Finance and applies for disbursements.

⁸ The FOCAC Member States (MS) are China, Algeria, Angola, Benin, Botswana, Burundi, Cameroon, Cape Verde, Central Africa, Chad, Comoros, DR of Congo, Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sierra Leone, Seychelles, Senegal, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe. In 2011, the African Union Commission was also accepted as a formal FOCAC "member" (FOCAC, 2012a).

- The Ministry of Finance makes the final decision on which projects are funded and approves the budget.
- If applicable, China's Ex-Im Bank, the main financial institution involved in FOCAC implementation projects, sends delegations to undertake feasibility studies and evaluate impacts; projects can be vetoed in consideration of risks and based on Ex-Im Bank policies.
- The Ministry of Finance is responsible for auditing and supervision.

Opportunity 2

Through its local and regional offices, WWF, in cooperation with relevant partners, could identify specific projects that are suitable for support through the FOCAC mechanisms, and assist local offices in developing sound project proposals that could be channelled through the process described above for action or support through FOCAC. The DRC is an example of where this is already happening.

To date, five Ministerial Conferences have been held, with the outcomes of these Conferences being summarised in Appendix B. Current cooperation focus areas, which have been established through the Ministerial Conferences, include (FOCAC, 2012a):

- Political affairs and regional peace and security;
- Cooperation in international affairs;
- Economic cooperation in different areas, one of which includes energy and resources;
- Cooperation in the field of development, which includes considerations of climate change and environmental protection amongst others; and
- Cultural and “people-to-people” exchanges, including culture, education, press, publishing and media, exchanges between academia and think tanks, youth and women exchanges and sports.

Of these, the most relevant to this study are the latter three.

4.2 Other engagements

In the time between Ministerial Conferences, both formal and informal dialogues and consultations are held. Some of the follow up discussions include (WWF, 2013):

- **Every 3 months (or at least twice a year):** China's Follow-up Committee meets with the African diplomatic corps to report on the latest developments and on the implementation of FOCAC measures.
- **Every 4 months:** China's Ministerial Review meetings.
- **Every 6 months:** China's Follow-up Committee holds plenary conferences with representatives from Chinese Ministries and other relevant agencies to report on the implementation of FOCAC measures.
- **One year later:** Publication of China's White Paper on China-Africa Economic and Trade Cooperation, which includes the state-of-the-art on FOCAC. Political consultation on issues of common interest.
- **+/- Every year:** Sub-forum meetings.

**Cooperation
focus areas**
are established
through the
Ministerial
Conferences

Informal channels are available to stakeholders in African countries

Two other formal platforms related to this study are:

- The annual event organised by the China Council for the Promotion of International Trade (CCPIT), known as the conference of Chinese and African entrepreneurs, which focuses on business cooperation. WWF organised a speaker at the 2012 conference, on the topic of green investment and corporate social responsibility.
- The Chinese Ministry of Science and Technology organises round table events on the topic of technological cooperation. These events are not as regular or as high-level as the CCPIT events.

Opportunity 3

WWF could engage with the organisers of these events to see whether it would be possible to have one that focuses on issues related to low-carbon, best available technologies and their transfer into Africa, and offer to identify and organise speakers on these topics. WWF China has the networks to identify further events and to facilitate engagement with the organisers and speakers.

In addition to these specific channels, FOCAC is reported to support the development of subforums under its framework, spanning the fields of agriculture, science and technology, law, finance, culture, think tanks, youth, NGOs, women, media and local governments (FOCAC, 2013a). The 2012 Beijing Action Plan also made provision for the establishment of a China-Africa energy forum. These subforums could theoretically offer a point of entry into the Forum for other stakeholders but information on how these operate is difficult to access.

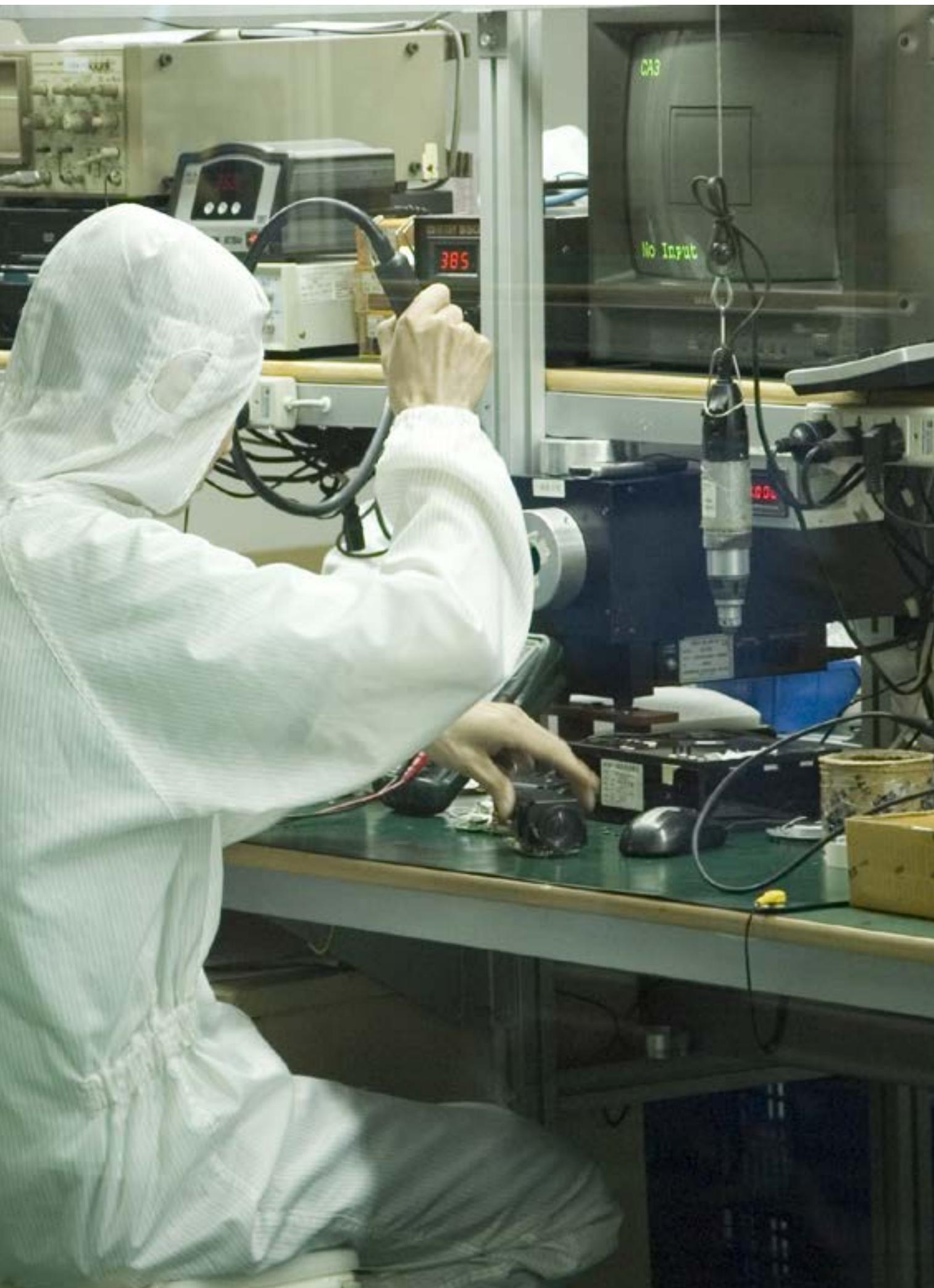
The majority of other engagements outside of the Ministerial Conference occur on an *ad hoc* basis, with the workings not being entirely clear from information in the public domain. Unofficial sideevents are held with business leaders during Ministerial Conferences, and separate engagements are held at the request of stakeholders in China or individual African countries, with requests being channelled through their embassies.

Opportunity 4

WWF needs to recognise and possibly promote the fact that informal channels are available to stakeholders in African countries to engage with FOCAC on an as-need basis. Such engagement would occur in the context of the different support mechanisms discussed in Section 5.

5. MECHANISMS TO SUPPORT TECHNOLOGY TRANSFER UNDER THE FOCAC FRAMEWORK





MECHANISMS TO SUPPORT TECHNOLOGY TRANSFER UNDER THE FOCAC FRAMEWORK

A number of specific cooperation mechanisms have been established under FOCAC that could be leveraged to achieve market transformation for low-carbon, energy-efficient technology options, especially if a coordinated approach is taken across different areas.

In understanding what mechanisms are relevant, it is important to highlight that ‘technology’ includes not only a physical component (products, equipment, blueprints, techniques, and processes), but also an information component (know-how in management, marketing, production, quality control, reliability, skilled labour and functional areas) (Wahab et al., 2012). The following sections provide an overview of possibilities for transfer of both the physical and information components of technology through relationship building, funding, capacity building and R&D collaboration that could be facilitated through FOCAC. Furthermore, standardisation and testing was identified throughout this study as being critical to ensure that technologies which enter the African markets are not substandard, do what they claim to and, in the context of this study, are beneficial in terms of reducing emissions or limiting emissions growth.

It is important to keep in mind that as technology transfer comprises a number of coordinated actions, these channels of technology transfer should not be seen as mutually exclusive.

5.1 Relationship building

Relationship building between Africa and China has been addressed in a number of the Ministerial Conferences, with follow-up actions being included in the action plans. Table 3 shows the follow-up actions that could possibly facilitate low-carbon technology transfer.

Of the FOCAC actions and resulting mechanisms identified in Table 3, it is suggested that the China-Africa Joint Business Council could be a worthwhile body to support marketing of specific technologies in Africa, given its established networks and the wide range of services that it offers to businesses. This suggestion is driven by the observation by a number of interviewees consulted that the keys to technology transfer are: providing multiple product options in the local market; providing platforms for engagement between suppliers and customers; and providing local training in the EE technologies.

Specific FOCAC
cooperation
mechanisms can be
leveraged by using a
**Coordinated
approach**

Table 3 FOCAC-initiated actions that could support relationship building

Action plan	Actions related to relationship building
Programme for China-Africa Cooperation in Economic and Social Development (2000)	<p>China to continue to support its Investment and Trade Centres in Africa and facilitate establishment of similar centres of African countries in China. By 2012 there were 11 countries with such Centres (Huang & Qi, 2012) and appear to serve the purpose of providing information relating to trade and investment in that country, promotion of the country through trade fairs and other mechanisms, product and market development, facilitating the investment process and ensuring a favourable investment environment for prospective investors.</p> <p>Establishment of a China-Africa Joint Business Council in co-ordination with the Chambers of Commerce of African countries and other professional organisations, to put in place a dialogue and consultation mechanism with African enterprises and promote economic co-operation and trade between them. This Council was ultimately established in 2005, with the stated mission being to “actively guide and serve Chinese enterprises in their process of ‘going abroad’. Through establishing close relationships with domestic and foreign partners, create a favourable environment for China-Africa economic and technical cooperation and thus facilitate global exchange about the Guangcai Program, to promote China-Africa and South-South Cooperation” (China-Africa Business Council, n.d.). Services include organising business visits, supporting projects, information services, financial services, HR services and exhibition services.</p>
Addis Ababa Action Plan (2003)	Establishment of a China-Africa Chamber of Industry and Commerce. The China-Africa Joint Chamber of Commerce and Industry was ultimately established in 2006, with the aim of promoting trade through “various forms of interactive communication activities”. However the organisation’s website provides no further information in English on what such activities involve (CAJCCI, 2011).
Beijing Action Plan (2012)	China to implement the “Special Plan on Trade with Africa” and send investment and trade promotion missions to Africa. At the time of writing this document, it appeared that this action was still in the early stages of being implemented.

Opportunity 5

Once specific country needs for low-carbon, energy-efficient end-use technologies have been identified in conjunction with individual country and regional offices, WWF, in cooperation with Topten and other partners, could engage with the China-Africa Joint Business Council (CABC) to help communicate the needs of individual countries for best available EE technologies, and support training of their members in the benefits of offering EE technologies on the market. Furthermore, the possibility of organising trade exhibits specific to such technologies could be explored with the Council. Contact details for the Council are available from their website, <http://www.cabc.org.cn/enindex/index.jhtml>.

5.2 Funding and support

A wide range of funding mechanisms has been established under FOCAC to support investment, trade, credit facilities, capacity building and establishment of SMEs. These are summarised in Table 4.

Table 4 FOCAC-initiated actions relating to funding

Action plan	Action related to funding
Programme for China-Africa Cooperation in Economic and Social Development (2000)	China established the African Human Resources Development Fund (AHRDF) and has increased financial contribution to the Fund for the training of professionals of different disciplines from African countries.
Beijing Action Plan (2006)	Establishment of the China-Africa Development Fund with an initial investment capacity of US\$1 billion, to be gradually increased to US\$ 5 billion to support Chinese companies in wanting to invest in projects in Africa. Projects should contribute to local technological progress, employment opportunities and sustainable socio-economic development. The fund was established in 2006.
	Both sides to support cooperation between relevant Chinese financial institutions and African financial institutions such as the African Development Bank (AfDB), the Eastern and Southern African Trade and Development Bank (ESATD) and the West African Development Bank (WADB). China has already contributed to the funding of the AfDB and has formally pledged to participate in the plan to increase resources of the ESATD (FOCAC, 2009).
	China has set up a US\$1 billion Special Loans for SME Investment in Africa.
Beijing Action Plan (2012)	China to provide a credit line of US\$20 billion to African countries to mainly support the development of infrastructure, agriculture, manufacturing and development of small and medium-sized enterprises in Africa.

Technology transfer to date has not followed rapid growth in China-Africa trade

As mentioned previously, since the establishment of FOCAC, China-Africa trade has grown rapidly and so has FDI into various ventures, from manufacturing facilities to construction projects. However, this has on the whole not been sufficient to achieve technology transfer in general, let alone transfer of low-carbon technologies, since the transfer of tacit knowledge has not always accompanied export of capital goods or new investment to a sufficient degree to allow African organisations to absorb the necessary know-how and use it independently.

Technology transfer does not feature specifically in FOCAC's trade- and financing-related initiatives. Support for technology transfer and local technological development are only explicitly mentioned in two loosely formulated provisions:

- In the 2006 Beijing Action Plan, establishing the China-Africa Development Fund, where it is stated that projects it supports should contribute to local technological progress;
- In the 2012 Beijing Action Plan's commitment to "encourage" enterprises in Chinese economic and trade cooperation zones in Africa⁹ to increase links with local enterprises and communities (FOCAC, 2012a).

⁹ China has so far established its economic and trade cooperation zones in Zambia, Egypt, Mauritius, Nigeria and Ethiopia (Huang & Qi, 2012).

China-Africa
Development Fund
can play key role in
financing
low carbon
technologies

While such provisions do not in themselves commit Chinese enterprises to transfer their technologies, they are at least a start in the right direction, as most technology transfer does happen on an enterprise level.

Most other FOCAC trade- and financing-related initiatives mentioned in Table 4 could theoretically be leveraged to facilitate exchanges between Chinese enterprises and their African counterparts. Of the funding activities, the China-Africa Development Fund and Chinese contributions to regional development funds are most likely to have a role on financing low-carbon technology transfer, as projects involving low-carbon technologies often offer a development dividend and it is within the mandate of development funds and banks to finance such ventures.

One further relevant mechanism to the above worth noting that is relevant to this study is the opportunity of accessing energy-efficient Chinese technology through the Division of International Cooperation, the Department of Climate Change, and the National Development and Reform Commission, under the banner of South-South Cooperation to address climate change. This would entail a request from a national department (or regional department that have delegated authority to contract), channelled via the Chinese ambassador. The technology comes at no cost, but there is no provision for installation costs, maintenance or training.

Opportunities for leveraging finance depend on the activities that require support. A number of examples of where specific funding may be relevant are presented later in this document.

**Capacity
building**
is an important
component of
technology transfer



PHOTO: SHUTTERSTOCK.COM

5.3 Capacity building

One of the critical success factors for technology transfer is the ability of the recipient country to adopt the new technologies, in terms of understanding, marketing, installing, maintaining and end-of-life management (Hoppe, 2005), as well as local manufacturing and assembly where relevant. As such, capacity building is an important component of technology transfer. FOCAC has directed significant

effort and funds into numerous capacity building activities (Table 5), although many of these relate to broad human or institutional capacity development.

Table 5 FOCAC-initiated actions on capacity building that could be leveraged for low-carbon technology transfer

Ability to adopt new technologies is key to ensure technology transfer

Area of capacity building	Action plan	Provisions related to capacity building
Professional training	Programme for China-Africa Cooperation in Economic and Social Development (2000)	China established the AHRDF and has gradually increased financial contribution to the Fund for the training of professionals of different disciplines from African countries. This appears to include support for both Chinese experts visiting Africa and for individuals from Africa to attend training courses in China. The AHRDF has provided training for tens of thousands of African professionals in the areas of agriculture, industry, health, education, communication, media, science and technology, disaster prevention and reduction, and administration, through scholarships, workshops and training programmes (Niu, undated). This Fund thus represents a critical entry point for supporting capacity-building programmes in adoption of low-carbon, best available technologies. In the short term, opportunities could be sought to add a low-carbon technology component to the existing training programmes on agriculture, industry and science and technology training sponsored by the Fund, while in the longer term training programmes on other low-carbon technology areas could be added as independent activities. Although such training can contribute to increasing a country's long-term ability to absorb new technologies, it will not necessarily support the immediate technology transfer to the same scale as FDI would. A substantial part of the training of officials from developing countries is undertaken through the Academy for International Business Officials (AIBO), which is operated by the Ministry of Commerce in China. A review of the recent training courses identify only two of relevance to this study, one being related to the Green Economy and the other related to adopting high-tech appliances.
Institutional capacity building	Sharm el-Sheikh Action Plan (2009)	China implemented the 20+20 Cooperation Plan for Chinese and African Institutions of Higher Education to establish a new type of one-to-one inter-institutional cooperation model between 20 Chinese universities (or vocational colleges) and 20 African universities (or vocational colleges). No consolidated details of the specific cooperation activities between universities could be found.
		China to intensify efforts to train teachers for primary, secondary and vocational schools in Africa.
Tertiary education	Sharm el-Sheikh Action Plan (2009)	China to provide 5,500 scholarships per year to African undergraduate and graduate students (an increase from 4,000 per year).
	Beijing Action Plan (2012)	China to provide US\$2 million annually under the framework of the UNESCO trust fund to support education development programmes in Africa, in particular higher education.

Area of capacity building	Action plan	Provisions related to capacity building
Capacity building in support of technology transfer	Beijing Action Plan (2006)	Both sides to promote cooperation in the development, application and transfer of technologies. China to continue providing training courses of practical technologies and carry out demonstration projects in Africa.
	Sharm el-Sheikh Action Plan (2009)	China established the China-Africa Science and Technology Partnership Plan, which aims to promote technology transfer to Africa and expand the sharing of scientific achievements in basic and applied research, technological demonstration and research findings. It should give priority to areas concerning people's wellbeing, such as water resources, food, health, energy, environment and others that would greatly facilitate socio-economic development (CASTEP, 2010). The Plan seems to still be under development at the time of writing of this document.
	Beijing Action Plan (2012)	China to continue strengthening cooperation with Africa on technology and management, step up technological support and experience sharing and help African countries enhance their capability for independent development.
		Both sides to increase exchanges in terms of experts, technology and research findings in a number of areas, including small hydro-power projects.
		China to launch the "Science and technology for a better life" campaign in Africa to enhance cooperation and exchanges with Africa in the science and technology areas that concern people's well-being.

Of the actions identified in the Table, the most relevant to supporting capacity building are the African Human Resources Development Fund (AHRDF) and the 20+20 Cooperation Plan for Chinese and African Institutions of Higher Education. However there is no consolidated information on the 20+20 Cooperation Plan. The China-Africa Science and Technology Partnership Plan is also likely to be an important mechanism, but this Plan appears to still be under development.

Opportunity 6

The AHRDF is a substantial source of finance for any projects relating to human development. Not only could WWF with its partners apply to this fund for resources for any projects which require skills transfer of low-carbon, energy-efficient technology, but should also play an active role in advertising the availability of this fund through its country offices to both organisations and government institutions seeking to carry out relevant projects.

Opportunity 7

WWF in cooperation with Topten could work with AIBO to develop and promote courses for officials focusing specifically on transfer of low-carbon EE end-use technologies from China to Africa.

2006 Beijing
Action Plan called
on both sides to
increase
scientific and
technological
cooperation

5.4 Research and development

A related consideration to capacity building is the implementation of joint research and development (R&D) programmes to develop new locally relevant technologies, to enable the recipient country to optimise existing technologies for local conditions and to later produce these independently. Research and development collaboration has, however, not enjoyed as much attention under FOCAC as capacity building has, although the 2006 Beijing Action Plan did call on both sides to increase scientific and technological cooperation in areas of common interest (of which solar energy utilisation is one).

The most important action on R&D support emerging from FOCAC is the ‘China-Africa Joint Research and Exchange Programme’ established by China in 2010, this supports Chinese and African think tanks and academic institutions. To date it has been instrumental in organising 14 international seminars, has sponsored more than 500 Chinese and African scholars for field trips and academic exchanges and has supported over 60 research projects in the form of workshops, subject research, academic exchanges and publishing research outcomes (China State Council Information Office, 2013). The application form for funding suggests no restrictions on subjects that will be considered under this Programme¹⁰.

Other mechanisms include the China Development Bank having set up a special fund to support academic exchanges between China and Africa (FOCAC, 2012b) and the 2012 Beijing Action Plan committing both sides to sponsor 100 programmes by academic institutions and scholars in the next three years covering topical research, international symposiums, mutual visits of scholars and publication of works. The latter proposes to implement a “China-Africa Think Tanks 10+10 Partnership Plan”: to select 10 Chinese think tanks and 10 think tanks from African countries to establish long-term paired cooperation relationships. No suggestions seem to have been made so far as to the topics covered by the think tanks in the proposed partnership plan, hence no evident obstacle seems to exist to a partnership between Chinese and African low-carbon technology think tanks.

Opportunity 8

WWF can seek finance from the China-Africa Joint Research and Exchange Programme, the China Development Bank and the Think Tanks 10+10 Partnership Plan to support its “blue skies” strategic work in individual countries and regions as well as support needs for academic exchanges relating to the topics of interest in this study that have been identified as relevant to particular countries. The latter will require engagement with its academic partners in those countries.

Furthermore, WWF can play a role in advertising the availability of research funding to institutions working in this area.

Two mechanisms identified under the heading of capacity building above have relevance here, being the 20+20 Cooperation Plan for Chinese and African Institutions of Higher Education and the China-Africa Science and Technology Partnership Plan, which aims to promote technology transfer to Africa and expand

¹⁰ See <http://www.focac.org/eng/xsjl/zflhyjjljh/t1040088.htm> for the application form.



PHOTO: SHUTTERSTOCK.COM

One of the critical success factors for technology transfer is the ability of the recipient country to adopt the new technologies, in terms of understanding, marketing, installing, maintaining and end-of-life management.

the sharing of scientific achievements. As identified above, however, insufficient information is available to understand how these programmes could be leveraged.

5.5 Standards and testing

Importance of
**standards
and testing**
was acknowledged
in Beijing Action
Plan of 2006

Agreeing on standard methods for determining product performance, minimum performance standards for products in terms of their energy and environmental performance, and availability of the necessary testing laboratories are all critical requirements to facilitate the transfer of products that offer lowest possible emissions intensity of operation. The importance of standards and testing was acknowledged in the Beijing Action Plan of 2006, that identified the need for “both sides to enhance cooperation in certification and accreditation, technology standards, measurement, consumer goods safety, quality inspection of industrial products and a number of other areas.”

A number of global activities already exist in attempting to address this need, with the World Trade Organisation (WTO) and the International Standards Organisation (ISO) running initiatives that focus on developing global standards for products – either uniform approaches or approaches that are somewhat modified to take into account local usage practices. However many of the less-developed African countries have no standards for product testing or minimum performance standards, or have no access to laboratories for testing. In many places there is not the capacity available to develop such systems and laboratories. This limitation is important to overcome, in supporting penetration of low-carbon, best available technologies in preference to products with poorer environmental and technological performance. It is noted that each country does not need its own, in-country testing facilities, it is rather access to facilities that is necessary.

In identifying areas in which WWF could leverage the FOCAC framework to improve standardisation and testing, there is value in collaborating with existing initiatives. Three initiatives are worth mentioning here. Firstly, Topten is an organisation that aims at providing consumers with verified information on energy efficiency, impact on the environment, health and quality. The Topten approach is based on the presence of a regulatory environment with relation to standards and testing to be successful. Secondly, the en.lighten initiative, started by GEF and UNEP, supports national regulators and regional bodies in developing countries to advance policies, strategies and actions for the phase-out of inefficient lighting products. Finally, Lighting Africa aims to support markets for clean off-grid lighting products in sub-Saharan Africa, with one of their activities being quality assurance.

Collaboration with existing initiatives can establish and improve standards and testing

Opportunity 9

Cooperate with CLASP and Topten, together with national stakeholders, on issues related to testing and standards. CLASP would continue in its current role of initiating dialogues and supporting decision makers on the establishment of standards and labels; Topten's contribution would be to increase the market "pull" towards EE technologies by improving and updating standards and labels based on market research, as well as alignment of testing methods globally; and WWF would fulfil the role of communication and awareness raising on this topic. Consideration could also be given to exploring whether there is opportunity for regional collaboration on this issue, through engagement with existing trading blocks.

Leverage the necessary training and financial support to meet individual countries' or regions' needs through the China-Africa Joint Business Council, with funding being potentially available from the African Human Resources Development Fund.

South Africa has advanced standards and testing facilities that are in line with international efforts at standardisation. There may be value in seeing whether local knowledge could be leveraged to support other countries in the region and whether facilities could service a wider area, within the provisions of the FOCAC co-operation agreements.

Opportunity 10

Collaborate with Topten China, who are interested in organising training in Africa and in China for African countries with respect to standards and testing, but currently lack the financial and human resources. Such training would need to involve the Ministry of Commerce in China, responsible for trade and carries out institutional capacity building and the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), the ministerial-level department responsible for quality and standardisation. Together these two bodies represent the key entry points in China.

Opportunity 11

The China-Africa Science and Technology Partnership Plan, understood to still be under development, could include capacity building around standards and testing. It is not clear where the responsibility for developing this plan sits, however an attempt could be made to engage with the developers of the Plan for including such provisions.

6. CASE STUDIES: TECHNOLOGY TRANSFER FROM AFRICA TO CHINA





CASE STUDIES: TECHNOLOGY TRANSFER FROM AFRICA TO CHINA

Trade and investment is currently the most widely used mechanism for technology transfer from China to Africa. A selection of case studies is presented here on low carbon, best available energy efficient technology transfer in order to demonstrate some of the challenges and successes.

The first of these relates to the roll-out of compact fluorescent light bulbs (CFLs) in Madagascar, the second to distribute pico solar technologies across a number of countries in Africa and the third to establishment of a manufacturing facility for low-carbon, best available technology end-use appliances in South Africa. On the basis of each of the case studies, recommendations are made on how FOCAC can be leveraged for WWFs activities.



PHOTO: THE GREEN HOUSE

The energy-efficient 20W CFLs each has an average rated lifetime of 10,000 hours.

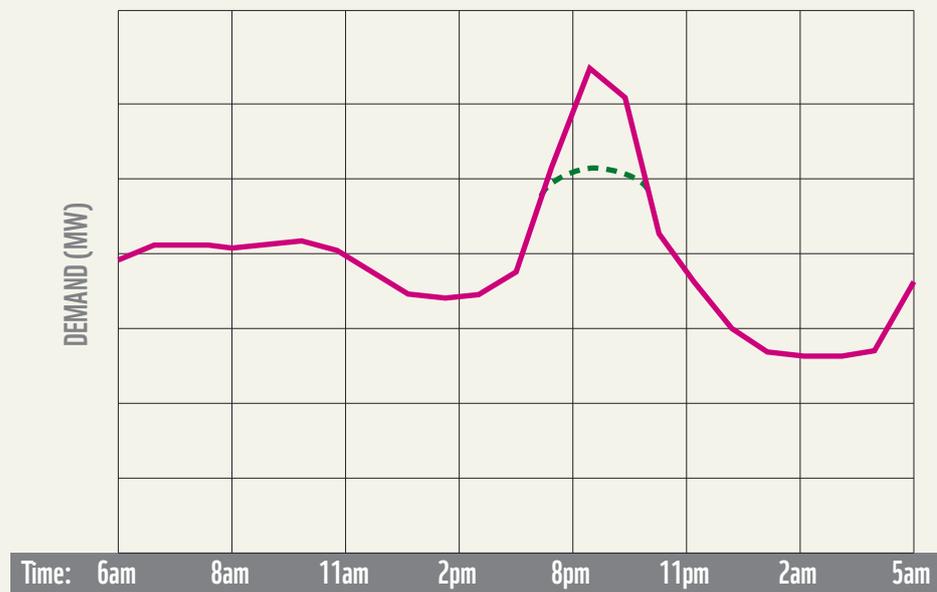
45%
of electricity in
Madagascar is
produced by thermal
plants that run on oil
and diesel

6.1 Roll out of CFLs in Madagascar

In Madagascar, 45% of the electricity produced by the national energy supplier, JIRAMA, is from thermal power plants that run on fuel and diesel. The country imports oil, costing around US\$ 100 million to sustain these power plants (The Gold Standard, 2013). A particular concern in terms of power supply is meeting the evening peak, which runs from about 5 pm to 9 pm (Figure 12).

Households consume 30% of total electricity produced in the country, with household lighting accounting for 10 to 20% of household electricity consumption (WWF Madagascar, 2011). The price of electricity is high given the purchasing power of the majority of the local population. The use of compact fluorescent light bulbs (CFLs) could potentially save the average household at least 7% on their electricity bills and reduce national electricity demand and the associated cost to the country (WWF Madagascar, 2011). However, high quality CFLs are 15 to 20 times more expensive than incandescent light bulbs, making them unaffordable to the majority of households (The Gold Standard, 2013). A further consideration is that CFL bulbs need to be responsibly managed at the end of their lifetime and recycled.

Figure 12 Indicative daily demand pattern. The green dotted line illustrates the potential for CFLs to reduce the peak.



Data: Jirama

At least 7%
of the average
household
electricity bill
can be saved by
compact fluorescent
light bulbs (CFLs)

In October 2011 The Malagasy Ministry of Energy, JIRAMA, the Telma Foundation (the philanthropic arm of Telma, a mobile phone and internet company in Madagascar) and WWF conducted a pilot study which distributed 5,873 CFLs to households in the town of Ambositra, with the intention of rolling out a national programme with at least 500,000 CFLs to create a market for energy-efficient light bulbs (The Gold Standard, 2013; WWF Madagascar, 2011). The Ministry of Energy was responsible for financial facilitation and coordination of the regulatory framework. JIRAMA was involved in the management of the CFL contract with Philips (who manufactures the CFLs in China), establishment of the distribution

500,000
The intended amount
of 20W CFLs to be
distributed in pilot
project

network and quality assurance, process facilitation and impact monitoring. Telma's responsibilities included distribution, sales and collection of CFLs and ICLs and communication. Finally, WWF's Madagascar and the Western Indian Ocean Programme Office (WWF MWIOPO) was the project coordinator, managing the communication, carbon credit, financing, fundraising and the monitoring and impact analysis.

The 20W CFLs, each with an average rated lifetime of 10,000 hours, were produced in China (which currently produces more than 70% of CFLs globally) and purchased through a loan provided by the World Bank (The Gold Standard, 2013). The project is also affiliated to Gold Standard, the most rigorous international-standard certifying high-quality greenhouse gas mitigation projects. The income from the carbon credits generated by the project contributes towards further finance for the scheme (The Gold Standard, 2011). The supplier, Philips, was chosen through a global tender issued by the World Bank.

In projects such as this it is important to ensure that the technologies delivered meet performance standards and deliver the energy and carbon savings envisaged. Given that testing standards do not currently apply in Madagascar and no local testing facilities are available, the CFL specifications used in the roll-out were verified by a lab test conducted at the Philips ISO 17025 Accredited Testing Lab in Shanghai (The Gold Standard, 2013). However given the tight timelines on the project, two critical performance parameters, being lifetime and number of on/off cycles, were not tested. Therefore reliance had to be made on information provided by the supplier for information on these performance parameters. In addition, WWF had the lamps tested by the German-based VDE Testing and Certification Institute to verify the information provided by Philips for these parameters.

Following the success of the pilot study, a further 540,000 CFLs were planned to be distributed in the capital of Antananarivo in late 2013, as part of the project now known as Lumitsits. Through the roll-out of the energy-efficient light bulbs, a reduction in the average power demand during peak conditions was expected, with an associated savings of more than US\$ 6 million in fuel consumption. Furthermore, it is estimated that over a seven-year period, 52,000 tonnes of CO₂e can be saved (WWF Madagascar, 2013).

Public awareness and an effective communication campaign were particularly important for this project. In the pilot phase, the campaign was initiated by WWF before the CFL distribution started and continued until it was complete. Objectives included creating awareness with regards to the advantages of CFLs, informing households about the aim and benefits of the project, encouraging households to obtain the CFLs and promote the use of high-quality CFLs. An official mascot for the project (a hero firefly who lights up the city was introduced. The campaign included radio adverts, print media, gadgets (caps, t-shirts, key chains), TV and door-to-door visits (The Gold Standard, 2013).

A feasibility study on building a local recycling facility will be conducted starting in April 2014.

On the basis of the case study, a number of areas are identified where WWF could play a role in roll-out and scale up of similar technologies elsewhere in Africa. It is noted, however, that CFLs are no longer considered "best available" technologies,

\$6 million
Estimated savings
in fuel consumption
expected through
roll-out of EE bulbs.

given the availability of LEDs on the market, although LEDs are currently more expensive.

Opportunity 12

Opportunities for WWF to support large scale roll-outs of technologies such as CFLs, LEDs and energy efficient cook stoves under the FOCAC framework include:

- Working with local and regional offices to identify local needs for such technologies. These will be a function of level of electrification, current fuel uses for cooking, etc.;
- Working with local partners to develop project proposals for pilot studies to roll out technologies in specific locations;
- Supporting the partners in procuring FOCAC funding through engagement with the relevant government department (such as the Department of Environment or Energy), and the local Ministry of Foreign Affairs;
- Through its partnership with Topten, collaborating with CLASP, the Enlighten Initiative and local authorities it can determine appropriate standards to be used for assessing the technologies to be rolled out. It could then assist project implementers in ensuring technologies being rolled out meet these standards. See the discussion in Section 5.5 for further detail on standards;
- Driving the awareness campaigns required for the success of such roll-outs. Funding could be leveraged through one of the funding sources identified in Table 4;
- Facilitating the establishment of recycling centres in countries if CFL is pursued rather than the better performing LEDs. FOCAC could be leveraged to provide financial support (through the mechanisms identified in Section 5.2) and technical support (through the mechanisms identified in Sections 5.1 and 5.4); and
- WWF Madagascar could offer technical advice to stakeholders in other countries doing similar roll-outs, based on their own experience. Depending on the nature of the support required, funding could be secured from one of the sources identified in Table 2. Notable here is the AHRDF, which supports training.

The range in power generating capacity of pico solar technologies ranges between 1-40W

6.2 Pico solar technologies

Pico solar technologies are small solar systems that range in capacity from one or two watts up to 40W of power and are used for applications such as lighting, radios and charging mobile phones. Such systems, many of which are made in China, are already being sold across the continent, with successes in countries including Kenya, Ghana, Mali, Senegal, Uganda and others. The importance of pico solar systems in alleviating challenges related to energy poverty have historically been overlooked by planners and decision-makers in developing countries, who have focussed on electricity-generation systems that provide power at scale – either on grid technologies or those that provide electricity to a village or number of households. It is noted that the models for technology penetration of such technologies are different



Pico solar technologies are small solar systems that range in capacity from one or two watts up to 40W of power and are used for applications such as lighting, radios and charging mobile phones.

to the mass scale roll-outs of CFL or LEDs discussed in the previous section. The difference is that here each product needs to be sold individually or in small consignments.

A number of different business models have been trialled for achieving the penetration of such technologies into Africa. The first of these is where international companies import and market products under their own brand that are manufactured in China. An example of this is Barefoot Power Uganda¹¹, where dedicated entrepreneurs are trained to run micro-franchises that market the Barefoot Power products. The second business model is where African-based distributors offer products from a number of different manufacturers. A strong view expressed by stakeholders is that the latter model is preferred, as it offers consumers choice. An application of this business model is Solar Sister¹², an organisation that provides local women with training and an inventory of solar technologies from multiple suppliers to start their own businesses marketing these products. This has an added empowerment benefit.

In introducing these technologies into Africa, standards and testing are once again critical. There has been a long history of inferior quality imports with poor environmental performance and that don't deliver to their stated performance specifications. However, where standards and testing systems are in place, the cost of obtaining approvals for imports can be expensive, particularly if different standards and testing requirements differ between countries.

WWF has worked extensively with Barefoot Power¹³, a company offering its pico solar products in various African countries. Barefoot Power markets a variety of products, the simplest of these being stand-alone LED torches and lamps and mobile phone chargers, which operate on 1.5W solar panels. It also markets integrated solar systems, which can power lights, mobile phone chargers, radios and televisions. There are also plans to introduce systems on which refrigerators can be operated. All of Barefoot Power's equipment is manufactured in China.

One of the key challenges Barefoot Power has experienced, relevant in the roll-out of similar systems in other countries, is that of accessing working capital for their projects. Where communities are purchasing equipment themselves – the aim in many installations – there is a need for securing working capital to bridge the period between project conceptualisation and initiation, purchasing and installing equipment and receiving payment. As an implementing partner, WWF has played a role in various installations in securing such working capital. WWF has also played an advocacy role in promoting the technologies.

11 Barefoot Power Uganda website: <http://barefootpoweruganda.com>

12 Solar Sister website: <http://www.solarsister.org>

13 Barefoot Power website: <http://www.barefootpower.com>

Opportunity 13

WWF's role in creating markets for best available low-carbon energy-efficient products in Africa leveraging the FOCAC framework, could include:

- Supporting the development of common standards for low-carbon, best available technologies across countries in a region in cooperation with CLASP and Topten, to avoid having to obtain import permits in each individual country, utilising the mechanisms and channels identified in Section 5.5;
- Leveraging the AHRDF in providing training for distributors within African countries; and
- Leveraging financial support for roll-outs and communication campaigns through the development banks.

6.3 Establishment of an appliance manufacturing plant in South Africa

Hisense opened a
R350 million
manufacturing
facility in
South Africa

Hisense¹⁴, listed on the Hong Kong and Shanghai stock exchanges as two separate companies, manufactures televisions, household appliances and mobile technology, with sales in more than 140 countries. The company has 13 factories in China and manufacturing and operation plants around the world. Their African operations include a refrigerator plant in Egypt, a television plant in Nigeria and a television and refrigerator plant in South Africa; the latter is the focus of this case study (Hisense, 2012a). The company initiated a so-called 'Green Development Programme' that facilitates strategic planning for green-design innovations. This programme has formulated and implemented Green Design Standards for Hisense products, thus driving the development and production of energy-efficient eco-products. Not only are products designed to be less energy-intensive during operation, their design incorporates provision for recycling and safe disposal at the end of their useful lives. For example, Hisense claims that their LED/LCD televisions are 40% less energy intensive on average than ordinary televisions. It also offers energy-efficient air conditioners on the market (Hisense, 2012b). Their commitment to green technology and sustainable development extends to pursuing energy efficiency and renewable energy in their manufacturing operations.

In June 2013, Hisense opened a R350 million manufacturing facility in Atlantis, Western Cape, South Africa. The factory is currently manufacturing flat screen televisions and refrigerators, but will be expanding to include washing machines, air-conditioning units and wine coolers (Hisense SA, 2013). Products are sold primarily on the local market.

For the manufacturing of televisions, a number of components are imported from China, with building of circuit boards, assembly of final units and testing done on site. The components for refrigerators are mostly manufactured in South Africa, with only a small number of components being imported. All R&D is done in China and models are standardised globally (although not all models are produced in all countries). The operation employs primarily local people, which is important

14 Hisense website: <http://global.hisense.com>

given the high unemployment in the local area. There are a few Chinese engineers stationed at the plant to overcome technical challenges. The assembly workers are trained on site and can typically operate more than one workstation.

One of the interviewees consulted during the project identified the importance of understanding local cultures and practices in determining the success of such a project, given how different this is to China. The developers conducted extensive feasibility studies in understanding local culture and regulations, using people with local knowledge.

Funding for the plant was primarily from the Chain Africa Development Fund (see Table 4), which has a part equity and part debt share in the operation. The debt component of the arrangement is offered at highly competitive interest rates. Other financial support was obtained from the South African Department of Trade and Industry, that awarded Hisense a cash grant under the Manufacturing Competitiveness Enhancement Programme (MCEP), that seeks to increase economic growth, create employment and attract investment in the country. Wesgro, a government-led trade promotion agency for the province in which Atlantis is located, played a critical support role in unlocking regulatory hurdles and supported Hisense in obtaining the right approvals on time. The Provincial Government of the Western Cape provided assistance associated with a youth-intern programme.

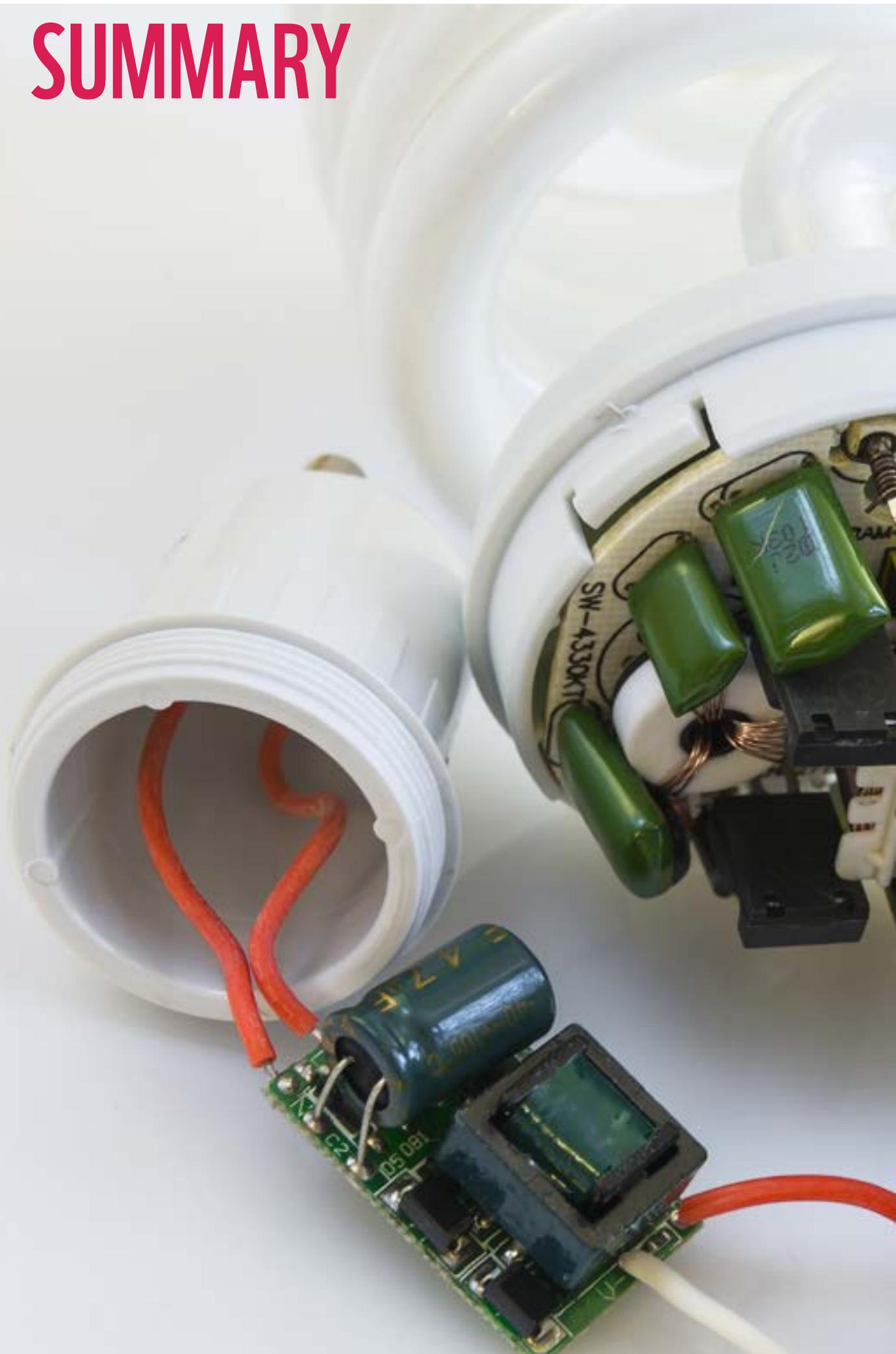
High tech manufacturing facilities such as Hisense are best suited to countries that already have existing manufacturing infrastructure, good transport links, a stable macroeconomic environment, and an existing or growing market for their products.

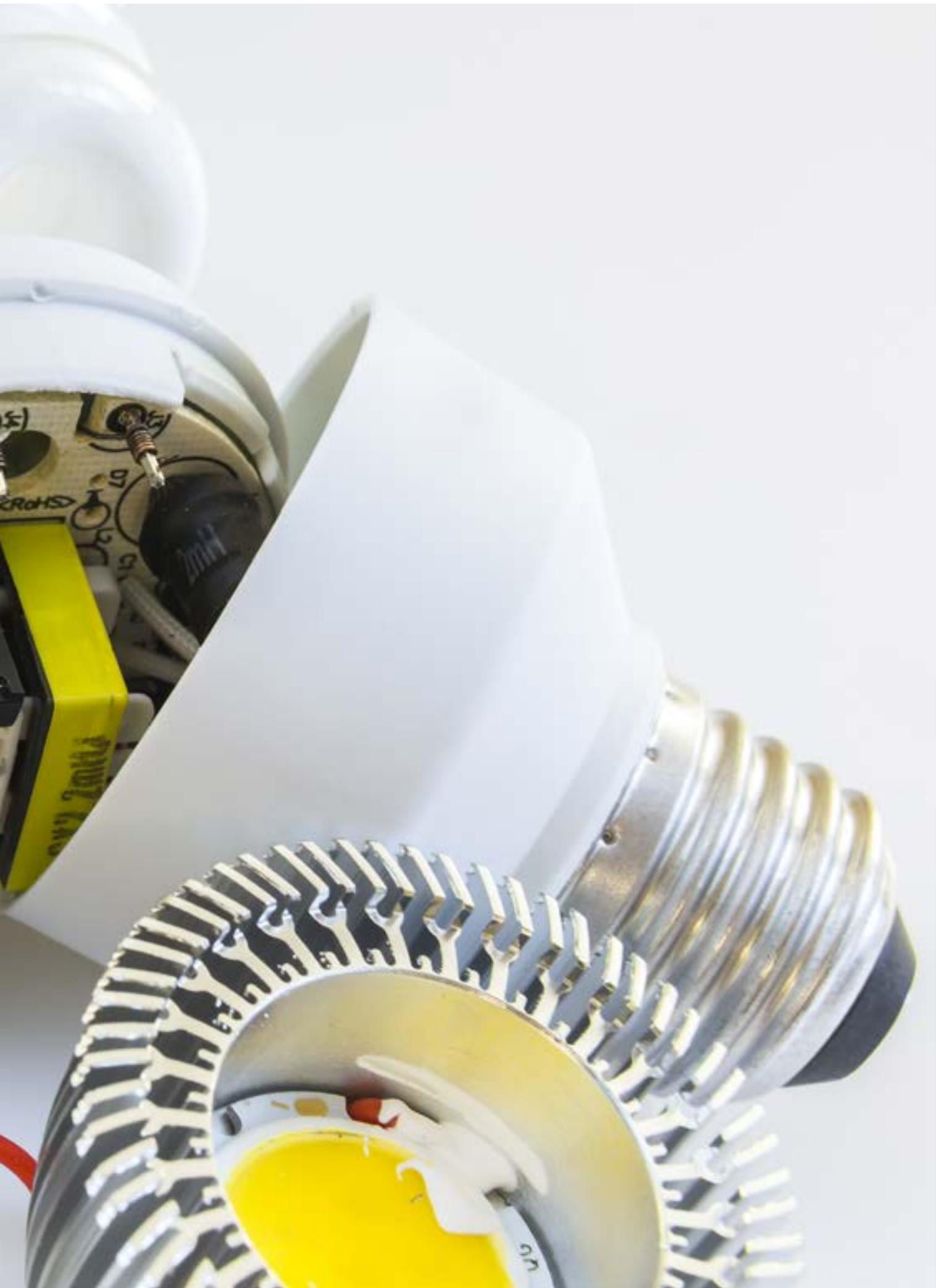
Opportunity 14

While trade and investment is likely to be driven by market forces, there could be opportunities for countries to attract manufacturing facilities for environmentally superior products through FOCAC. WWF could:

- **Conduct or commission policy analysis in potential target countries to understand whether there are any existing or potential future regulations, incentives and barriers to entry related specifically to environmentally superior products (such as green growth strategies). Such analysis should also consider where such investments could be facilitated through policy amendments;**
- **Leverage support through the AHRDF to provide institutional capacity building to ensure that skills are available to help to facilitate such investments (as was provided by Wesgro in the Hisense case study); and**
- **Use its local networks to support feasibility studies by Chinese companies who seek to invest in manufacturing facilities for such products, through mechanisms such as the China-Africa Joint Business Council and the Trade and Investment Centres.**

7. SUMMARY





SUMMARY: OPPORTUNITIES FOR PROMOTION OF LOW-CARBON BEST AVAILABLE TECHNOLOGIES UNDER FOCAC

Throughout this document opportunities have been identified as to how WWF, in cooperation with its partners where suitable, can leverage the FOCAC provisions to support the transfer of low-carbon, best available technologies from China to Africa.

This section summarises and synthesises the opportunities and provides some additional suggestions, firstly in terms of general recommendations and secondly specific recommendations derived from the case studies. Finally, potential target countries for specific types of projects are identified.

In understanding how opportunities can be accessed, it is relevant to present a simplified process flow model for access to FOCAC's mechanisms, as shown in Figure 13, based on the discussion presented in Section 4. Any organisation can identify a project and develop a project proposal. Depending on the activity and support being sought, certain funding sources can be applied for directly. For access to other FOCAC mechanisms, the parties will engage the relevant government department in that African country, who will, in conjunction with the Ministry of Foreign Affairs in the African country, bring a proposal for the activity to the Chinese representative. This is then communicated to the Ministry of Foreign Affairs and Ministry of Commerce in China. Implementation is conducted through these two ministries, supported by the Chinese Follow-up Committee, which in turn includes the participation of other ministries and organisations.

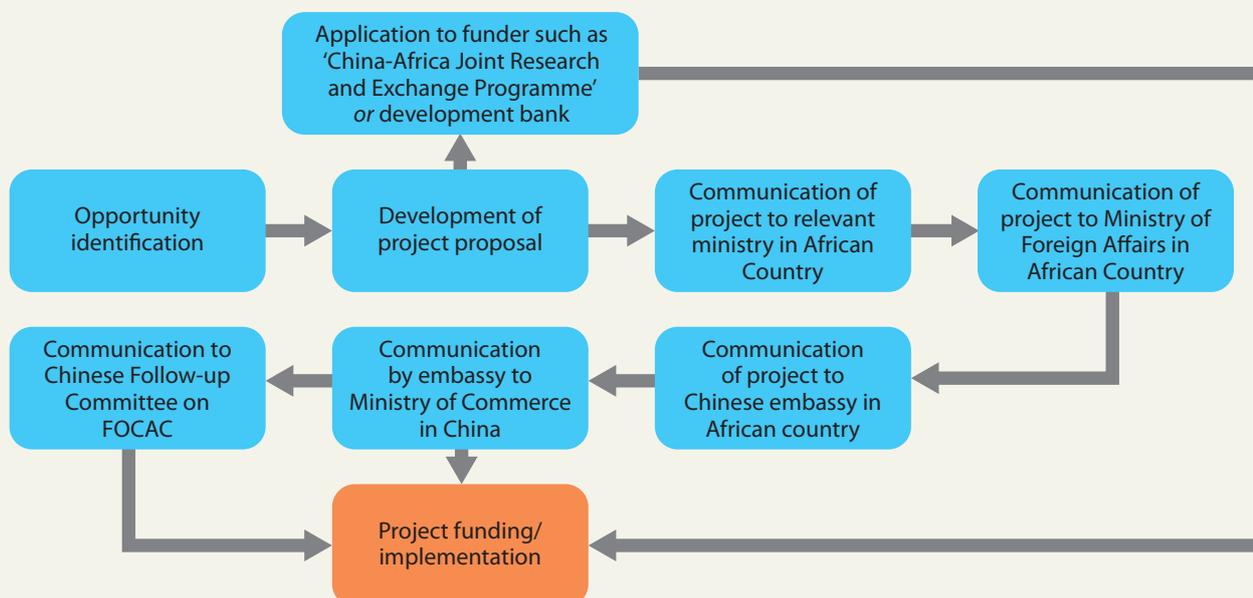
7.1 General recommendations

7.1.1 Develop a database of needs for individual countries and regions through a series of case studies

WWF country and regional offices will have the best understanding of the physical technology needs and requirements for technology transfer, requirements for institutional capacity building, and research and development needs in their individual jurisdictions. They will also understand the in-country priorities and barriers to support for roll-out of low-carbon, best available energy-efficient technologies.

The first critical step is to develop a database of needs on a national level

Figure 13 Process flow for access to FOCAC mechanisms



The first critical step in identifying individual opportunities for supporting technology transfer is to develop a database of what these needs are at a national level. A series of scoping studies should be carried out with the individual offices. In addition to targeting in-country activities, the data collected can then be analysed to determine where there are common needs between countries. As has been highlighted in this document, regional approaches to leveraging action from FOCAC have a greater potential for success than when activities are being driven by a single country.

7.1.2 Understand policy requirements relating to technology transfer in low-carbon, best available energy efficient technologies

Currently technological cooperation is not done strategically, particularly around the introduction of clean technologies. It has been suggested that far more favourable outcomes could be achieved if African countries have a consolidated vision and strategy for clean technologies, and set policy to support implementation of such strategies. Work is already being done by CLASP relating to energy-efficiency standards, labelling and testing. However there are other policy mechanisms that are required. These could include considerations relating to import tariffs, targets, tax regimes, incentives for EE technologies and others. WWF could identify needs in this regard and leverage the FOCAC framework to facilitate updates to policy where relevant and appropriate.

7.1.3 Participate in formal annual meetings and organise side events at the Ministerial Conferences

Although much of the engagement in FOCAC beyond the Ministerial Conference is *ad hoc* and on a bilateral basis between China and individual countries, there are some more formal events for engagement, such as:

- The annual event organised by the China Council for the Promotion of International Trade (CCPIT), known as the conference of Chinese and African

entrepreneurs, which focuses on business cooperation. WWF organised a speaker at the 2012 conference, on the topic of green investment and FOCAC.

- The Chinese Ministry of Science and Technology organises round tables on the topic of technological cooperation. These events are not as regular or as high level as the CCPIT events.

Furthermore, at the Ministerial Conferences informal side events are organised. WWF could engage with the organisers of these events to see whether it would be possible to have one of the events focus on issues related to low-carbon, best available technologies and their transfer into Africa, and offer to identify and organise speakers on these topics. WWF China has the networks to identify further events and to facilitate engagement with the organisers and speakers.

7.1.4 Facilitate opportunities for engagement between stakeholders in China and stakeholders in individual African countries to promote information sharing and advancement on best available EE technologies

The need for developing deeper relationships was highlighted as a critical component of technology transfer, in order to understand what each party has to offer, what each party needs, barriers to trade and how business can be facilitated. The specific role of WWF here is not to promote individual products, but rather to support engagement between stakeholders relating to the promotion of best available EE technologies in contrast to poorer performers. Different modes of engagement will be required for different countries, but could include:

- Organising and hosting workshops to discuss and promote the benefits of EE technologies;
- Participation in relevant technology exhibitions in both China and Africa to promote sale and adoption of EE products; and
- Trade and research visits relating to increased adoption and advancement of these products.

The primary source of funding is once again the AHRDF, while technical input and collaboration on organising events will be through the China-Africa Joint Business Council and the Trade and Investment Centres. Relevant stakeholders include government officials, technology developers, technology manufacturers in China, distributors in Africa, industry associations and technology users.

7.1.5 Organise country-relevant training for local distributors and technicians

One of the critical factors that has been identified for effective technology transfer is ensuring that the receiving country has sufficient capacity, systems and standards in place to be receptive to new technologies and implement technology options. Under the FOCAC framework there are a number of opportunities for training, some of which is offered under the African Human Resources Development Fund. Other training opportunities are offered by individual ministries in China such as Trade and Industry and Science and Technology, who may apply to the Ministry of Commerce for funding of such courses. One particular area that is highlighted as a strong opportunity for capacity building is training local people in the installation and maintenance of technologies from China. However such needs are technology and location specific, so will need to be identified during the scoping studies. WWF can play a facilitator role in organising such training.

Developing deeper relationships is a critical component of technology transfer



A strong opportunity for capacity building in Africa is training local people in the installation and maintenance of technologies from China.

WWF could also work with AIBO to develop and promote courses for officials focusing specifically on topics related to achieving the transfer of low-carbon best available technologies from China to Africa.

7.1.6 Leverage the FOCAC mechanisms to remove barriers to trade in low-carbon, best available technologies

There are a number of barriers to trade, which, if overcome, could help technologies enter the African market. These include administrative barriers, import taxes and customs. The Sharm el Sheikh Action Plan of 2009 included reference to the removal of barriers to trade: “The two sides agreed to further enhance cooperation in customs, taxation, inspection and quarantine and to conclude and implement relevant cooperation agreements for the sound development of China-Africa trade.”

This Action Plan made specific reference to climate change and environmental protection and highlights that “China supports Africa’s legitimate demands, including those for more financial support and necessary technological transfer from developed countries to Africa. China stands ready to strengthen cooperation with Africa in tackling climate change.” As such, there are already the principles in place to support this action; implementation is now required.

Based on the findings of the policy analysis studies recommended in Section 7.1.2, WWF could assist the relevant ministry controlling trade in individual countries to identify key barriers that need to be addressed in that country with respect to import of low-carbon, best available technologies and thereafter facilitate the dialogues between that ministry, the Ministry of Foreign Affairs, the Chinese embassy in the African country and the Chinese Follow-up Committee on FOCAC.

Existing regional trading blocks, such as SADC, ECOWAS and the EAC could also be mobilised in such activities. Engagements would be through the secretariats of the

trading blocks and the Ministries of Foreign Affairs, Science and Technology, and Trade and Industry in the individual countries.

7.1.7 Conduct policy analysis and support policy amendments specific to manufacturing, in countries where such investment is likely to be favourable

As identified previously, high-tech manufacturing facilities such as those of Hisense are best suited to countries that already have existing manufacturing infrastructure, good transport links and a stable macroeconomic environment. While trade and investment is likely to be driven by market forces, there could be opportunities for countries to attract manufacturing facilities for environmentally-superior products through FOCAC. WWF could conduct policy analysis in potential target countries to understand whether there are any existing or potential future regulations, incentives and barriers to entry, related specifically to environmentally superior products (such as green growth strategies). Such analysis should also consider where such investments could be facilitated through policy amendments and, if applicable, WWF could support implementation of such amendments.

7.1.8 Promote locally relevant research

At present it appears that there is little research being conducted on adaptation and customisation of low carbon, energy efficient technologies for application in African countries. WWF could play a role in identifying research needs (through the scoping studies described previously), using its networks to identify potential partnerships between Chinese and African universities and promoting funding opportunities to support such research, notably the 'China-Africa Joint Research and Exchange Programme'.

7.1.9 Partner with existing organisations currently working on standardisation and testing

There are a number of organisations already doing work in the area of standardisation and testing in Africa. As such it would make sense for WWF not to initiate new actions, but rather to partner with other organisations. The opportunities related to standardisation, and that were identified as being relevant here, are as follows:

- Collaborate with Topten, and especially Topten China, to organise training and collaboration in China for African countries with respect to standards and testing. Such training would need to involve the Ministry of Commerce in China who is responsible for trade and already undertakes institutional capacity building and AQSIQ. Explore potential for collaboration with en.lighten and Lighting Africa, with a specific focus on standardisation and testing for lighting.
- Explore whether there is opportunity for regional collaboration around this matter, through engagement with trading blocks such as the ECOWAS states or the countries that fall under WWF's programmes.
- Organise the necessary training and capacity building, as well as establishment of testing facilities, for implementation of standards and testing facilities in individual countries and trading blocks, through the China-Africa Joint Business Council and funding from the African Human Resources Development Fund in cooperation with relevant partners.
- South Africa has advanced standards and testing facilities that are in line with international efforts at standardisation. There may be value in seeing whether

local knowledge could be leveraged to support other countries in the region within the provisions of the FOCAC cooperation agreements.

7.2 Specific recommendations arising from the three case studies

In addition to the general recommendations, which will be better defined by the proposed series of scoping studies, there are some specific recommendations identified in the case studies that may be transferred to other projects of a similar nature. These are as follows:

For projects involving large-scale roll-outs of technologies such as energy-efficient light bulbs and cook stoves, WWF could:

- Identify and bring together the relevant parties to support the roll-out;
- Use its extensive experience from acting in an educational role around environmental issues elsewhere to help drive the awareness campaigns required for the success of such roll-outs. Funding could be leveraged through one of the funding sources identified in Table 4;
- Facilitate the establishment of recycling centres in countries if CFL roll-outs are being implemented (recognising that LEDs are currently considered as best available technology). FOCAC could be leveraged to provide financial support through the mechanisms identified in Section 5.2 and technical support through the mechanisms identified in Sections 5.1 and 5.4.

For projects involving creation of markets for individual technologies that are not rolled out at scale, WWF could:

- Leverage the AHRDF in providing training for distributors within African countries;
- Leverage financial support for roll-outs and communication campaigns through the development banks;
- Run awareness campaigns that communicate how the long-term benefits of energy-efficient appliances offset additional upfront costs, to address the barrier that consumers are price sensitive in many African countries. Such activities could be funded through the AHRDF, for example; and
- Assist in the set up of local distributors for Chinese manufacturers, by leveraging funding from the facility relating to special loans for SME Investment in Africa, for example.

For projects to support investment in manufacturing facilities in African countries:

- Leverage support through the AHRDF to provide institutional capacity building to ensure that skills are available to help facilitate such investments (as was provided by Wesgro in the Hisense case study); and
- Provide local knowledge.

7.3 Potential target countries for specific activities

Although the specific technology requirements for individual countries will be highlighted through the scoping studies recommended in Section 7.1.1, there are some broad generalisations as to types of projects that would be applicable to certain countries, based on the information presented in Section 3. Some suggestions for these and the relevant stakeholders who could be engaged to support their roll-out, are shown in Table 6.

Table 6 Potential target countries for specific project types

Country	Brief description	Types of projects that could be relevant	Relevant institutions and potential partners
Cameroon	High urban electrification rates, but low rural electrification rates.	Roll-out of low emission cook stoves and pico solar systems in rural areas. Large-scale energy-efficient light bulb rollouts in large cities.	Ministry of Energy and Water Resources; Ministry of Environment and Nature Protection; Ministry of Industry, Mines and Technological Development; Ministry of Transport; AES-SONEL (La Société nationale d'Electricite); Centre for Environment and Development; Electricity Regulatory Agency (ARSEL); Rural Electrification Agency (REA); Electricity Development Corporation (EDC); African Development Bank (AfDB).
DRC	Very low electrification rates in urban areas; no rural electrification. Very high levels of poverty.	Roll-out of low-emission cook stoves. Roll-out of pico solar systems.	National Electricity Company of DRC (Société Nationale d'Electricite, SNEL); Ministry of Energy; Ministry of the Environment; UNDP's Low-Emission Capacity-Building Project.
Gabon	Very high electrification rates; high GDP per capita. Oil exporter.	Large-scale energy-efficient light bulb roll-outs in large cities and possibly in rural areas. Import of energy-efficient air conditioners, white goods and electronics.	Ministry of Energy and Hydraulic Resources; Ministry of Housing, Accommodation, Town Planning, the Environment and Sustainable Development; National Agency for the Promotion of SMEs; Energy and Water Company of Gabon (SEEG); Topten; en.lighten; CLASP.
Kenya	Large urban areas; developed markets. Threshold country. Relatively low private vehicle ownership.	Large-scale energy-efficient light bulb roll-outs in large cities. Import of energy-efficient air conditioners, white goods and electronics. Attracting investment in local manufacturing industries. Efficient motors.	The Ministry of Energy; Practical Action (PA); Community Development Trust Fund (CDTF); UNEP; Topten; en.lighten; The Kenya Renewable Energy Association (KEREAA); Ministry of Transport and Infrastructure; UNDP's Low-Emission Capacity-Building Project.
Madagascar	Reasonably high electrification rates. Relatively low GDP per capita, with little growth.	Further roll-out of energy-efficient light bulb, building on the existing programme. Establishment of a facility for recycling CFLs if these are being pursued.	Ministry of Energy; Ministry of Environment and Forests; Rural Electrification Agency (ADER); State-owned electric power distribution company (Jiro sy Rano Malagasy, Jirama); en.lighten; CLASP.
Mozambique	Low overall electrification rates, very low rural electrification rates. High levels of poverty.	Roll-out of low emission cook stoves. Roll-out of pico solar systems.	Ministry for Co-ordination of Environmental Action; Ministry of Energy; Ministry of Industry and Commerce; National Electricity Advisory Council (CNELEC); National Energy Fund (FUNAE); Electricidade de Moçambique (EDM).
Nigeria	Very high population; big urban centres; reasonably high overall electrification; growing upper and middle class. Oil exporter. Strong industrial base. Relatively low private vehicle ownership per capita, although the high population still means there is a large number of private vehicles on the road.	Large-scale energy-efficient light bulb roll-outs in large cities. Import of energy-efficient air conditioners, white goods and electronics, recognising that imports from China are already high. Attracting investment in local manufacturing industries. Efficient motors. Efficient vehicles.	The Power Holding Company of Nigeria; Local Electric Distribution Companies; the Energy Commission of Nigeria; the Federal Ministry of Power and the Federal Ministry of Environment; Topten; en.lighten.

Country	Brief description	Types of projects that could be relevant	Relevant institutions and potential partners
South Africa	High electricity access, wide range of household incomes. Emerging country. Strong industrial base. Private vehicle ownership higher than many other countries in Africa.	Import of energy-efficient air conditioners, white goods and electronics, recognising that imports from China are already high. Attracting investment in local manufacturing industries. Efficient motors. Efficient vehicles.	Department of Energy; Department of Environmental Affairs; Department of Trade and Industry; Department of Transport; Topten.
Tanzania	Reasonable urban electrification; low rural electrification. Fast growing economy – emerging country. Very high use of traditional biomass.	Large-scale energy-efficient light bulb roll-outs in large cities. Import of energy-efficient air conditioners and white goods. Efficient cook stoves in rural areas.	Rural Energy Agency (REA) in the Ministry of Energy; Local Non-Governmental Organisations (NGOs) such as The Tanzania Traditional Energy Development Organisation (TaTEDO); Tanzania Students' Entrepreneurship Association (TASEA); Zanzibar Solar Energy Association (ZASEA); Indian NGO called Appropriate Rural Technology Institute (ARTI); Tanzania Electricity Supply Company (TANESCO); The Department of Environment (DoE) in Zanzibar; Tanzania Industrial Research and Development Organisation (TIRDO); Topten; en.lighten; CLASP; Barefoot Power; UNDP's Low-Emission Capacity-Building Project; Solarsister.
Uganda	Reasonable urban electrification, low rural electrification. Fast growing economy – emerging country. Very high use of traditional biomass. Low vehicle ownership.	Large-scale energy-efficient light bulb roll-outs in large cities. Import of energy-efficient air conditioners, white goods and electronics. Roll out of pico solar technologies in rural areas. Efficient cook stoves in rural areas.	Ministry of Finance Planning and Economic Development (MFPED); Ministry of Water and Environment (MWE); Ministry of Energy and Mineral Development (MEMD); Joint Energy and Environment Project (JEEP); Topten (cooperation is already ongoing); National Environmental Management Authority; Barefoot Power; UNDP's Low-Emission Capacity-Building Project; Solarsister.
Zambia	Relatively high electrification in urban areas, very low in rural areas. Emerging country	Large-scale energy-efficient light bulb roll-outs in large cities. Import of energy efficient air conditioners, white goods and electronics. Efficient cook stoves in rural areas.	Ministry of Commerce; Trade and Industry; Ministry of Environment, Natural Resources and Tourism; Ministry of Energy and Water Development; Topten; en.lighten; CLASP; Zambia Institute of Environmental Management (ZIEM); UNDP's Low-Emission Capacity-Building Project.



CONCLUSION

This study set out to explore whether the FOCAC framework has potential to promote the uptake of low-carbon, best available energy-efficiency technologies in Africa, including building components, appliances, mobility and electronics. The production of such technologies by China is identified to be growing, taking up increasing shares of the global markets. At the same time, with strong economic growth in many parts of Africa, there is a demand for new products, much of which is being met by China. Promoting the uptake of these products in preference to those with poorer performance could contribute to reducing the negative environmental impacts associated with their usage.

FOCAC
provides a base
for promotion of
energy-efficient
technologies

In reviewing the FOCAC framework and its achievements, it was identified that there are a number of provisions in the declarations and action plans from the Ministerial Conferences that can provide a solid basis for promotion of these technologies. Furthermore, there are a number of mechanisms in place that could be leveraged – ranging from funding, to capacity building, to support for trade and investment, to R&D support. At present, however, none of these are currently specifically focused on such technologies, and the case would need to be made for specific support for this particular focus area.

Section 7 presented details of the different opportunities for WWF to leverage the FOCAC framework towards technology promotion, either on their own or in conjunction with partners who are already working in specific focus areas. These include identifying policy needs and influencing policy, facilitating and participating in stakeholder engagements, removal of barriers to trade, training and capacity building, and promoting relevant research and development. It is recommended that country-specific opportunities be identified in collaboration with the country offices, although it is recognised that regional programmes could allow for greater traction across a number of different focus areas.

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APPENDIX A: INTERVIEWS CONDUCTED FOR THE STUDY

Interviewee	Organisation
Boldewijn Sloet	Barefoot Power
Boping Chen	WWF China
Cecile Pompei	Independent
Claudia Delpero	Independent
Eddie Oketcho	WWF Uganda
Jean-Phillipe Denruyter	WWF International
Kaying Lau	Independent
Louise Scholtz	WWF South Africa
Laurent Some	WWF ESARPO
Robert Damulira	WWF ESARPO
Solo Thierry Randriamanalina	WWF Madagascar
Sophie Attalie	Topten International
Tan Zhang	Top10 China
Tao Wang	Carnegie-Tsinghua Center for Global Policy
Thomas Winther	Innogate

APPENDIX B: TOPICS AND OUTCOMES OF THE FOCAC MINISTERIAL CONFERENCES TO DATE

Conference	Conference topic/theme	Conference outcomes
1 st Ministerial Conference (Beijing, October 2000)	“How to promote establishment of a new international political and economic order in the 21st century” and “How to further strengthen Sino-African economic cooperation and trade under new circumstances”	Beijing Declaration and Programme for China-Africa Cooperation in Economic and Social Development; The latter included the Chinese government pledge to cancel RMB10 billion of debts to a number of heavily indebted poor countries and least developed countries (LDCs) and to establish the Human Resources Development Fund for Africa for the training of professionals of different disciplines from African countries.
2 nd Ministerial Conference (Addis Ababa, December 2003)	“Pragmatic and Action-Oriented Cooperation”	Addis Ababa Action Plan (2004-2006); Included the Chinese government plan to further increase assistance for Africa, pledging to train 10,000 professionals in various fields, and give zero-tariff treatment to products exported to China from African LDCs.
Beijing Summit and 3 rd Ministerial Conference (Beijing, November 2006)	“Friendship, peace, cooperation and development”	Declaration of the Beijing Summit and Beijing Action Plan (2007-2009); The latter instituted the additional consultation between foreign ministers to be held during the UN General Assembly the year after each Ministerial Conference, as well as the Chinese government announcement of 8 measures to strengthen practical cooperation between China and Africa in support of national development in Africa, namely increased assistance, provision of preferential loans and preferential export buyer's credit, establishment of the China-Africa Development Fund, offering assistance in building the AU conference centre, debt and customs exemption, establishment of economic cooperation and trade zones, enhancement of human resources development and cooperation in education, health care and other areas for Africa.
4 th Ministerial Conference (Sharm el-Sheikh, November 2009)	“Deepen New Type of China-Africa Strategic Partnership for Sustainable Development”	Declaration of Sharm el-Sheikh and Sharm el-Sheikh Action Plan (2010-2012); The latter included the Chinese government announcement of 8 new measures for China-Africa cooperation, covering agriculture, environmental protection, investment promotion, debt exemption, market access expansion, addressing climate change, scientific and technological cooperation, health care, education, cultural exchanges and other areas.
5 th Ministerial Conference (Beijing, July 2012)	“Open up New Prospects for New Type of China-Africa Strategic Partnership”	Beijing Declaration and Beijing Action Plan (2013-2015); The latter included the Chinese government announcement of a series of new measures to support Africa's development and strengthen China-Africa cooperation in five major areas of investment and financing, assistance, African integration, non-governmental exchanges and peace and security. Those include China providing US\$20 billion credit line to African countries to assist their development of infrastructure, agriculture, manufacturing and small and medium-sized enterprises; building more agricultural technology demonstration centres; helping Africa train 30,000 personnel in various sectors; offering 18,000 government scholarships, and building cultural and vocational skills training facilities in African countries; deepening medical and health care cooperation by sending 1,500 medical personnel and continuing to offer free treatment to cataract patients in Africa; continuing to carry out well-drilling and water supply projects in Africa; establishing transnational and transregional infrastructural development partnership by supporting the related project planning and feasibility studies and encouraging established Chinese companies and financial institutions to take part in those projects. China also proposed to carry out the China-Africa People-to-People Friendship Action; set up the China-Africa Press Exchange Center in China; continue to implement the China-Africa Joint Research and Exchange Programme to sponsor 100 projects of research, exchange and cooperation involving academic institutions and scholars from the two sides; launch the Initiative on China-Africa Cooperative Partnership for Peace and Security and provide financial support for the AU peace-keeping missions and development of the African Standby Force, and train more AU peace and security officials and peace-keepers.

Source: (FOCAC, 2013a)

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WWF is active in more than 100 countries, with almost five million supporters worldwide. Our mission is to build a future in which we all live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful production and consumption. In South Africa, we focus on an ecosystems-based approach to development, including work in the areas of marine, freshwater, agriculture, food, energy, transport and protected areas.

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The Green House

The Green House is a niche technical sustainability consulting firm based in Cape Town, with experience working on a wide range of energy, carbon and sustainability-related projects, including strategic energy planning, carbon footprinting and life-cycle assessment. The Green House has significant experience in energy, transport, urban systems, bioenergy, biofuels, industry, commerce, agriculture, municipal waste management, mining and minerals.

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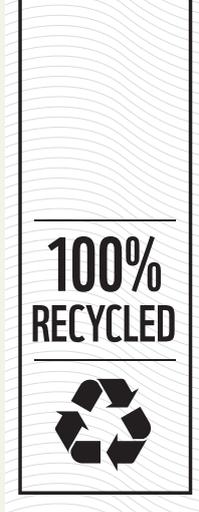
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OPPORTUNITIES FOR WWF:



Understanding policy requirements relating to technology transfer in low-carbon, best available energy-efficient technologies, and complementing existing work

Developing an understanding of the specific needs of individual countries and regions through a series of case studies

Participating in formal annual meetings and organizing side events at the FOCAC Ministerial Conferences

Partnering with existing organizations currently working on standardization and testing

Conducting policy analysis and supporting policy amendments

Facilitating opportunities for engagement between stakeholders in China and stakeholders in individual African countries specifically relating to promoting the value in best available energy-efficiency technologies

Promoting locally relevant research

Organizing country relevant training for local distributors and technicians



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

panda.org/climateandenergy