Status Report
Africa-EU Energy Partnership

Progress, achievements and future perspectives

Africa-EU
Energy Partnership

Status Report
Africa-EU Energy Partnership

Progress, achievements and future perspectives

Africa-EU
Energy Partnership

AEEP 2020 Political Targets

Declaration of the First High Level Meeting of the Africa-EU Energy Partnership

Vienna, Austria, 14 September 2010

"**We**, African Ministers responsible for Energy, and European Union (EU) Ministers responsible for Africa-EU energy relations **resolve** to work within the AEEP to attain the **following targets**, in the timeframe up to 2020:

Energy Access

As a contribution to the African objective of achieving a continent-wide rate of access to modern and sustainable energy of around 50 %, Africa and the EU will take joint action to:

- **bring access to modern and sustainable energy services to at least an additional 100 million Africans**, focusing on sustainable models: to provide energy for basic services (health, education, water, communication); to power productive activities; and to provide safe and sustainable energy services to households.

Energy Security

Africa and the EU will take joint action to improve energy security by:

- **doubling the capacity of cross-border electricity interconnections**, both within Africa and between Africa and Europe, thus increasing trade in electricity while ensuring adequate levels of generation capacity;
- **doubling the use of natural gas in Africa, as well as doubling African gas exports to Europe**, by building natural gas infrastructure, notably to bring currently flared gas to market.

Renewable Energy and Energy Efficiency

Africa and the EU will take joint action to increase both energy efficiency and the use of renewable energy in Africa by:

- building **10,000 MW of new hydropower facilities**, taking into consideration social and environmental standards;
- building **at least 5,000 MW of wind power capacity**;
- building **500 MW of all forms of solar energy capacity**;
- **tripling the capacity of other renewables**, such as geothermal, and modern biomass; and
- **improving energy efficiency in Africa in all sectors**, starting with the electricity sector, in support of Africa's continental, regional and sectoral targets."

Table of Contents

Progress in all areas – but there's more to do

A functioning partnership

The Africa-EU Energy Partnership (AEEP) offers exactly what its title promises: a partnership – whose guiding principle is that by promoting dialogue and providing a framework in which policies and projects can be implemented with high levels of delivery and stakeholder buy-in, the lives of many millions of people can be significantly improved.

The AEEP's work has been successful in lifting energy to the top of the Africa-EU relations agenda – indeed, pushing it up the global agenda with its longstanding focus on this critical issue, which has made a significant contribution to shaping the global Sustainable Energy for All Initiative (SE4 All), launched by the United Nations.

The AEEP is widely considered among the most vibrant expressions of structured Africa-EU relations. It operates at a number of levels: through implementing committees and joint expert groups, supported by the AEEP Secretariat, which is managed by the EU Energy Initiative Partnership Dialogue Facility (EUEI PDF); it engages with academia, civil society and businesses, who are represented in the AEEP's African and EU Focal Point groups; and it hosts initiatives with dynamic practical application, notably the Africa-EU Renewable Energy Cooperation Programme, also supported by EUEI PDF.

The AEEP is a strategic dialogue that is driven by a desire to deliver positive, practical consequences. From the start the AEEP was conceived with the conviction that outcomes must be measured, establishing benchmarks by which the performance of Africa and Europe could be gauged. As this report makes clear, compiling the necessary data is no easy matter: all parties involved in AEEP, and more recent, complementary initiatives, such as SE4 All, agree that huge work is required to obtain accurate data on African access, energy efficiency and other indicators.

The AEEP, with its long-time commitment to linking empirical rigour with practical action, can play a significant role in this process. This is a progress report which is informed by an AEEP Project Database that provides a real-time measure of generation capacity. This helps to show Africa's progress in providing increased electricity to its populations. From this we can extrapolate how well the continent is doing in meeting some of the 2020 targets, as outlined below.

Measuring Europe's exact contribution towards achieving these goals, and in parallel showing how well African governments are doing in raising their support for vital infrastructure development, remains an inexact science. It will require a level of investigation and reporting that goes beyond this report to put accurate numbers to a process that includes very large flows of financial support.

The Africa-EU Energy Partnership

The AEEP is one of eight Joint Africa-EU Strategic Partnerships. It provides a long-term framework for structured dialogue and co-operation between Africa and the EU on energy issues of mutual strategic importance. The AEEP allows Africa and Europe to work together to develop a shared vision, common policy approaches and actions.

The AEEP's overall objective is to improve access to reliable, secure, affordable and sustainable energy services on both continents; it aims to achieve the Millennium Development Goals in Africa. The AEEP's efforts focus on meeting a series of concrete, realistic and visible targets by 2020, as agreed by the ministers present at the Partnership's First High Level Meeting, held in Vienna on 14–15 September 2010.

Those targets are shown in the report below, which aims to describe the AEEP's efforts to set benchmarks and monitor progress in achieving its goals, and to point to directions for continued action.

African and European leaders set the overall agenda for joint relations when they meet at EU-Africa summits, the next of which is scheduled for 2014.

The AEEP was created following the December 2007 Lisbon summit, since when the Partnership has established Joint Expert Groups and African and EU Implementing Teams. Between 2007 and 2014, these groups have been led by co-chairs from Austria and Germany representing the European partners, and from the African Union Commission and Mauritius on the African side.

Financial support is increasing

Levels of financial support for energy projects in Africa are clearly increasing. These include allocations in African government's annual capital spending budgets, for which more data is becoming available. Africa is also looking to draw on previously unexploited resources to finance its infrastructure breakthrough. These include domestic and international bond issues, and pension funds.

Initiatives such as the Programme for Infrastructure Development in Africa (PIDA) are adding to the momentum building behind projects that should substantially increase capacity in the period to 2020 and beyond (see page 12). Equally important is providing access for populations that are, realistically, going to be beyond national grids, for years to come. As the report observes, offgrid and other solutions can help lift isolated communities out of their energy poverty – which is central to the work of a number of AEEP stakeholders.

Indeed, in the period leading up to 2020 EU financial flows for energy projects are expected to rise further. The European Investment Bank is among those committed to providing more, while European national development finance institutions are also increasing their funding, as are private sector investors and private equity funds.

Case studies included throughout the report point to cases where breakthroughs are being made in overcoming previous blockages and bottlenecks to build a stronger energy infrastructure and supply across the continent.

Accelerating performance

Using what the AEEP Secretariat believes to be the best data available, and by taking soundings of work under way to increase the capacity of renewables generation and other indicators, it is clear that progress is being made by both the continental blocs that come together to make common cause in meeting the AEEP's 2020 Targets.

Projections for meeting the AEEP's 2020 Targets are included throughout this report. In some cases – such as increasing generation from hydroelectric power (HEP) – the target may not be met at current rates of project implementation. But as the HEP example shows, European and other developers are getting more active, with a quickening pace of work recorded in the AEEP Project Database. This suggests that more targets can be met as initiatives accelerate, while institutions and business environments become better adapted to delivering results.

Establishing benchmarks

Work on the AEEP's empirical elements has a dual remit: to monitor progress towards meeting the 2020 Targets against a baseline of 2010 – established in the Baseline Monitoring report – and operationalising the AEEP Project Database, to provide an authoritative overview of completed and pipeline generation projects in Africa. Monitoring during 2012–13 has shown positive trends towards meeting some of the AEEP's political targets. However, progress in some major indicators has been slower than desired. Concerns about the quality of data may also limit quantitative conclusions (see box).

Questions of methodology

Much of the data collection and interpretation methodology applied to African energy is subject to severe limitations. Supported by analysis of the available resources, the AEEP has been working to complement international efforts to improve this situation. The AEEP Power Project Database of over 2,700 generation and transmission projects provides a unique tracker of projects even if it requires further work to detail exact financing sources and outcomes.

More problematic is access and energy efficiency monitoring, where extensive analysis has found deficiencies in all main datasets. At present, the AEEP lacks the resources needed for the level of on-the-ground monitoring that would add greatly to the access debate. This might be possible in a future phase, as AEEP stakeholders and complementary initiatives coordinate their activities (see pages 10–12 and 14).

Among problems confronted by the AEEP is assessing the European contribution to all but a few measures, such as gas supply (in Energy Security). For most other measures, centralised or independent data sets are lacking.

An important element in the AEEP's work has been to gain a deeper understanding of the data, as it exists and where gaps lie. The AEEP is a forum in which Africa and Europe can work together to improve our understanding of a difficult situation.

Renewable generation

Renewable generation capacity has been increasing steadily and a substantial increase is expected over the coming years as initiatives such as the South African and Moroccan independent power producer (IPP) procurement programmes begin operating. A number of large hydroelectric projects are scheduled to be commissioned before 2020, which will increase the chances of the AEEP renewable energy targets being met. European entities are heavily involved in delivering on these developments.

Hydroelectric power

Installed hydroelectric capacity increased from 26,762 MW in 2010 to 27,546 MW in 2012. At this rate of addition, HEP will not meet the AEEP target of adding 10 GW by 2020. However, work is accelerating on a number of projects, with the Project Database showing 25,230 MW scheduled to be installed in the next six years – suggesting that the 2020 Target could be achieved.

Wind power

Wind capacity has increased from 1,080 MW in 2010 to 1,192 MW in 2012. This rate of increase is not sufficient to meet AEEP targets, but South African and Moroccan IPP projects, plus an increasing number of schemes elsewhere, are expected to substantially increase the rate at which wind plants are brought into operation. The AEEP target of an additional 5 GW of wind power could be met if the 3.49 GW scheduled to commission by 2020 is delivered.

Solar

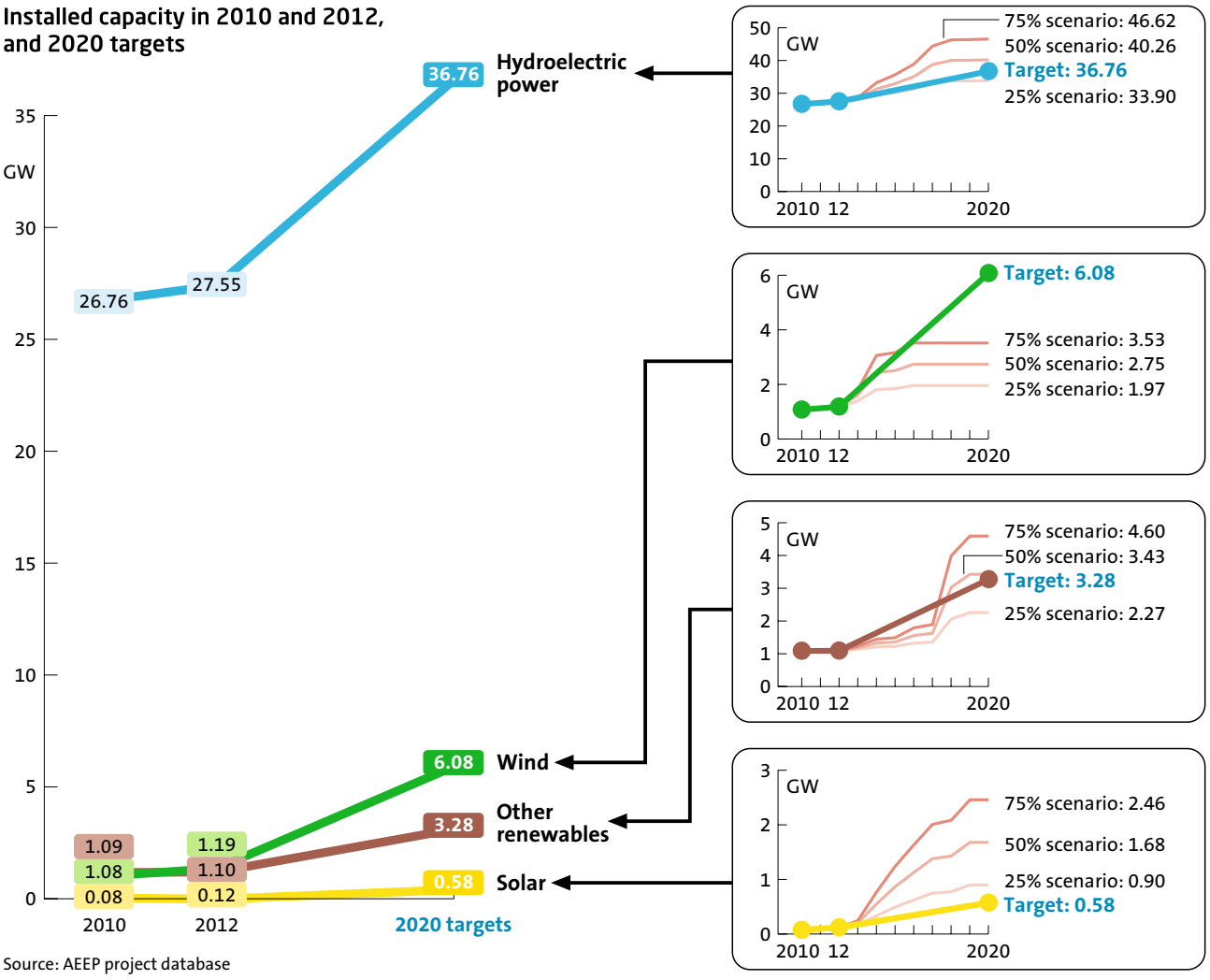
Solar capacity started at the very low level of 77 MW in 2010, but increased by 60 % to reach 123 MW in 2012. An acceleration in the absolute rate of increase is needed to meet the AEEP target of adding 500 MW by 2020. The pipeline of schemes captured by the Project Database suggests this is more than achievable, with 3.1 GW of new solar capacity scheduled to come on line by 2020.

Other renewable technologies

There has been limited progress for biomass, biogas and geothermal projects, with only 6 MW added to the grid between 2010 and 2012. But there is huge potential in everything from geothermal and industrial co-generation schemes to using landfill gas. To meet the AEEP target of tripling other renewables, some 2,185 MW must be added between 2010 and 2020, equivalent to total generation of 3,278 MW. A promising geothermal pipeline of projects totalling 4.57 GW and a total 4.78 GW of other renewables schemes suggest that reaching this target is possible.

AEEP renewable generation targets

Installed capacity in 2010 and 2012, and 2020 targets



Source: AEEP project database

Indicators for access

Indicators for access to electricity and clean, sustainable cooking fuels have hardly increased as a proportion of the population. According to the report's dataset, access to electricity rose from 32.8 % in 2000 to 38.3 % in 2010. Even so, this is the equivalent of 569 m Africans being without access to electricity in 2010. To meet the AEEP access target, this number should fall to 490 m by 2020 – when 558.8 m would have access.

Access to non-solid cooking fuel – used as an indicator for access to modern, sustainable fuel (as data for other clean options such as biomass are not yet available) – rose from 29.3 % to 33.2 % in 2000–10 – leaving 694 m without access.

We note that during this period the African population is estimated to rise from 1,035 m in 2010 to 1,261 m in 2020.

Energy security

The indicators are generally positive, although results are mixed. Among the AEEP's targets, gas consumption in Africa has more than doubled since 2000; in 2010, consumption was 107.8 bcm, rising to 122.8 bcm in 2012. However, a combination of recession in Europe and upheaval in North Africa has reduced exports of gas from Africa to Europe to levels similar to 2000. Although exports via pipeline increased from 34.3 bcm in 2000 to 39.3 bcm in 2012, LNG cargoes fell from 27.2 bcm in 2000 to 22.4 bcm in 2012, despite an increase inbetween. Total exports fell from 78.9 bcm in 2010 to 61.7 bcm in 2012.

Cross-border electricity transfer capacity has been increasing, with big projects in the pipeline, whose long-awaited implementation should improve performance. With improved project delivery the AEEP target of doubling interconnection capacity by 2020 could be met.

Energy efficiency

This report uses energy intensity – calculated as units of energy per unit of GDP – as an indicator of energy efficiency (see page 52). Levels of energy intensity in Africa have improved substantially over the past decade. Between 2000 and 2010 the average final energy intensity measured at purchasing power parity (PPP) on the continent fell by 29 %, from 15.5 to 11 MJ/$ 2005 PPP, according to SE4All statistics.

Data also show a slight deterioration in network losses in Africa's transmission and distribution systems (which may be explained by anomalies resulting from the modelling process in the data source used). This shows a small increase in losses from 21.3 % in 2000 to 22 % in 2010.

The AEEP has assessed the promulgation and implementation of laws and regulations to reinforce energy efficiency, in 55 countries. This covers a number of categories, from losses to building regulations.

Targets to 2020 and beyond

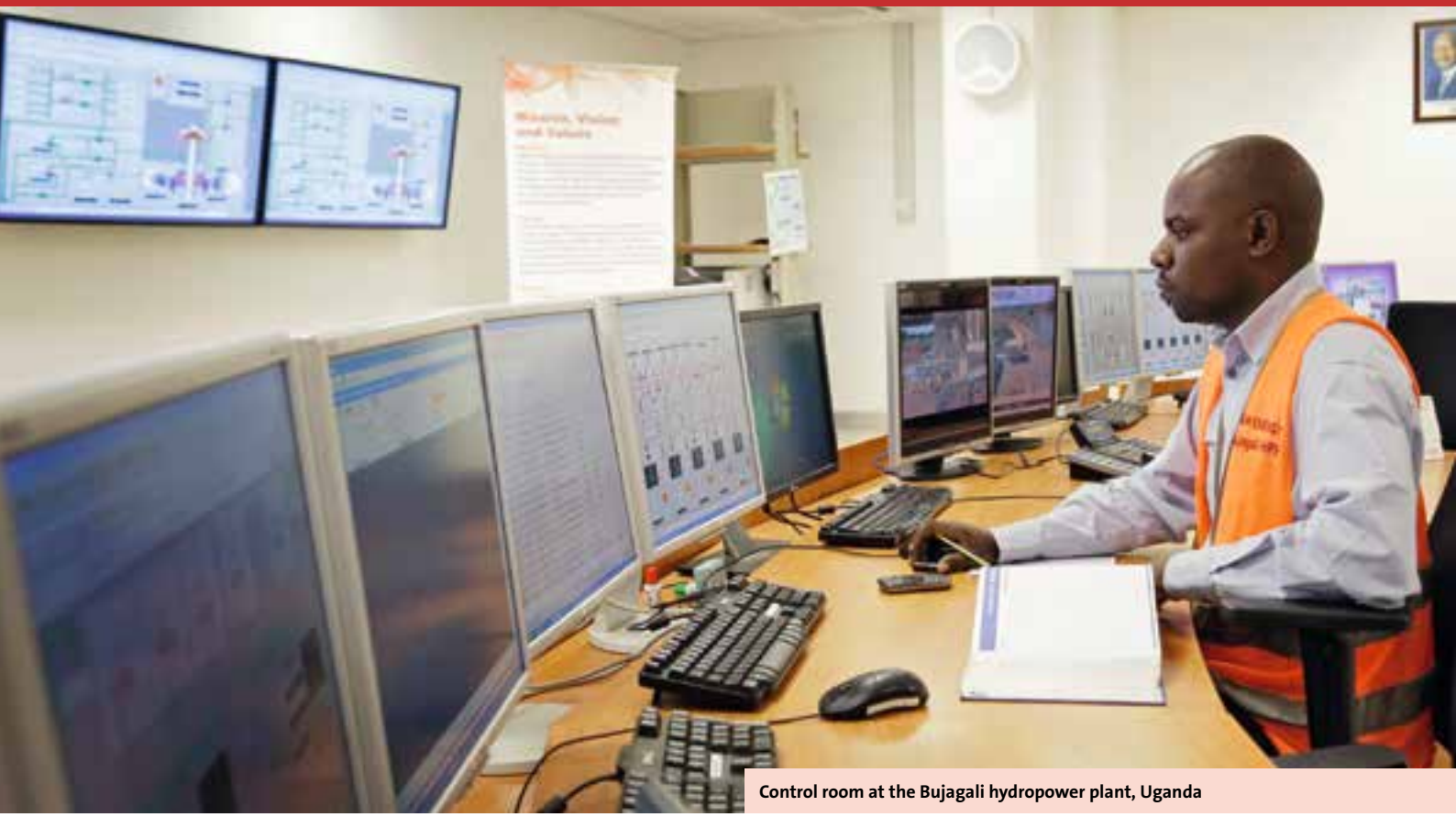
The Africa-EU Energy Partnership has established a dynamic framework in which policies and projects can be implemented with high levels of delivery, sustainability and stakeholder buy-in. That improvement will be consolidated if Africa, strongly supported by Europe, can meet the AEEP's 2020 Political Targets.

The 2020 Political Targets are not the exclusive domain of Europe: many other players are involved. But, as this AEEP Status Report establishes, the EU and its member states are first among equals in helping Africa to meet – and in some cases exceed – the 2020 targets. To better understand these trends, and inform policy-making, the AEEP continuously reviews the available data to ascertain which targets best meet the goals of governments and peoples.

Some data included in this report suggest that Africa can rise above some of the Political Targets decided by the AEEP in 2010. However, even if significant progress is being made on several fronts, it is not necessarily evenly spread across Africa's diverse economies and societies. More specific regional targets might take into account differences in the resource base and demographics across Africa, encouraging a better spread of outcomes.

Although the data is sketchy, it is expected that access to electricity and non-solid cooking fuel targets will be met. With global access initiatives supporting the more focused policies being applied by many governments, a more ambitious performance might be possible. But statistics rarely tell the whole story: population increases mean there could still be more African citizens requiring access in 2020 than there are now.

Working together, the AEEP and partners such as the African Union Commission, African Development Bank and European Commission can promote a continental agenda within the global initiative to improve access over the years to come. An important step along the way will be meeting the AEEP's 2020 Political Targets. For more on this see page 62.



Control room at the Bujagali hydropower plant, Uganda

Tracking progress towards meeting targets

The AEEP Status Report has the objective to track progress against the AEEP 2020 Targets and inform decision-making in Africa-EU energy cooperation as 2020 approaches. It operationalises the AEEP Project Database, building on the comprehensive baseline study Monitoring Progress under the AEEP, launched in 2012 at the 9–10 May First Stakeholder Forum of the AEEP, held in Cape Town, South Africa.

This report laid the foundations for the creation of a Monitoring Tool that would be capable of tracking progress towards achieving the AEEP 2020 Political Targets. The report set the stage for ground-breaking monitoring of electricity generation capacity and cross-border electricity and gas interconnections on the continent.

The approach is allowing project-by-project, country-by-country monitoring of activity in the African power sector, and has led to the creation of a database containing more than 2,700 individual generation projects. From this, the AEEP can monitor the progress made in key indicators, as set out by the Partnership at its First High Level Meeting, held in Vienna, Austria, on 14 September 2010.

The latest phase of the AEEP's work has been undertaken during a period when there have been major shifts in attitudes to, and strategies for, gathering African energy statistics. Data sets have largely been incomplete, rendering the task of benchmarking performance and understanding the challenges needed to improve access and other key indicators all the more difficult.

While the available data remains weak in some areas, and there is still much work to do, movement towards more accurate and reliable statistics is now clearly in the right direction. During 2012–13, initiatives such as the Sustainable Energy for All (SE4 All) have emerged as part of a concerted international effort to improve the quality and depth of data tracking African energy trends. These initiatives complement work undertaken by the AEEP since its inception in 2007.

Reliable data, comprehensive tracking

The data underpinning the AEEP's research comes from three key sources. The AEEP Power Project Database contains information on operating and planned power plants and electricity interconnections in Africa, allowing the installed capacity of renewable and other energy technologies to be tracked accurately through time. The dataset is continually updated, allowing real-time analysis

Definitions

Hydropower includes micro-hydro and pumped storage projects unless otherwise stated.

Biomass is used to cover the burning of organic matter for electricity generation and includes waste-to-power projects.

Solar is utilised as a semantic covering any form of electricity generation which uses the sun as its sole energy source unless further specified.

Thermal covers fossil fuels such as petroleum products and coal.

Abbreviations

bcm	billion cubic metres	**kV**	kilovolt
bn	billion	**kW**	kilowatt
C02 e	C02 equivalent	**m**	million
CSP	concentrated solar power	**MJ/$**	million joules/ dollar
GJ	gigajoule	**MW**	megawatt
GW	gigawatt (MW1,000)	**pV**	photovoltaic
		tcf	trillion cubic feet
HEP	hydroelectric power	**t/yr**	tonnes a year
km	kilometre		

of events and trends in the sector, and comprises details for more than 2,700 power projects.

Following some substantial analysis of available data and data collection projects that could realistically substantially enlarge what is available to track Efficiency trends, the AEEP has opted for a strategy of aligning its monitoring with SE4 All. The question of longer term tracking of Access has yet to be finalised.

Supported by a wide range of major public and private stakeholders, SE4 All published its Global Tracking Framework in May 2013. The report marked a break with previous African energy statistics, endeavouring to provide data for every country on the continent, as well as putting in place financial and technical support to produce better quality statistics in countries that have signed up to the SE4 All programme.

The SE4 All database contains estimates of access to electricity and non-solid fuel for cooking, energy intensity and electricity transmission and distribution losses for all but a handful of African countries. Using modelling techniques, the Global Tracking Framework takes data from surveys carried out to international standards to produce estimates of data points for years and countries where no data currently exists. The underlying data set used by SE4 All and adopted in this report is aggregated from the International Energy Agency, the World Bank's Global Electrification Database and the World Health Organisation's Household Energy Database.

Within the AEEP's energy security remit, information on pipeline and LNG natural gas exports from Africa to Europe and the consumption of natural gas is contained in the annual Statistical Review of World Energy, published by BP. This report is well respected internationally and has been published since 1951, providing an unrivalled dataset.

These data sources together form the basis for the AEEP's work in tracking progress towards the 2020 Political Targets.

Information gaps

Significant efforts to improve the quality and coverage of African energy statistics are now well under way. SE4 All will be working with member countries to provide much deeper and more up-to-date data on energy issues. International organisations such as the African Development Bank have undertaken large monitoring assignments to improve statistics relating to investment in energy infrastructure by African governments. The Infrastructure Consortium for Africa is expanding its coverage of financing trends.

However, despite these promising signs, substantial gaps remain in the data; many new statistical initiatives are to be welcomed, but are at a very early stage of development. In many cases, good data is simply not currently available. Many countries lack adequately resourced (and, in many cases, politically independent) national statistical offices and utilities. Much work remains to be done to develop the data essential to deepening our understanding of the energy situation in Africa.

This report uses the best of the data available to produce estimates of trends and quantities, in the case of several key indicators following unique research work carried out for the AEEP. The data set out below is of sufficient quality to illustrate trends and provide an indication of current values and rates. It does not claim to be either definitive or infallible, but it aspires to making a contribution towards better understanding the trends by which African populations can be supplied with the clean, sustainable energy, to which it is everyone's right to have access.

Questions of methodology

At the present time, much of the data collection and interpretation methodology that is applied to the African energy sector is subject to severe limitations. Constrained resources at national statistical offices, coupled with very widely dispersed populations, communications and transport infrastructure restrictions, limited state presence in some locations, large informal economies and the ubiquitous use of diesel generators all contribute to a high degree of uncertainty and complication in data production and analysis.

Reporting by national utilities and governments on energy matters in many cases leaves much to be desired when it comes to providing up-to-date, comprehensive and publicly available statistics. This situation is especially acute when it comes to assessing levels of access to modern, sustainable energy. For example, in some cases an electricity connection to one or a cluster of houses may be registered as a whole settlement or even town having access, which would clearly skew the data.

The situation appears to be improving, but this report – like other work in the sector – remains subject to these constraints. To mitigate these problems as much as is possible, the AEEP has drawn on the best available data sources; where these have not been available, it has created its own dataset with a methodology designed to bypass some of the limitations associated with pre-existing data. **The AEEP's overall findings are shown in the table below.**

The AEEP Power Project Database

The AEEP Power Project Database, which forms the basis of the interconnection and renewable energy power generation statistics in this report, attempts to remove the opacity and improve on the reliability of existing datasets. It records detail including each of the recorded project's name, location, size and fuel type for over 2,700 actual and planned generation plants across the continent.

The approach of individually researching, verifying and recording power projects across the continent cannot claim to be comprehensive or guarantee the accuracy of all of the data. The approach is limited in its ability to record certain types of data which may be increasingly important

AEEP 2020 Political Target	Baseline 2010 (Monitoring Report)	Numeric 2020 Target	AEEP 2020 Will the target be met?
Energy Security			
Double capacity of cross-border interconnections	11,417 MW	22,833 MW	Missed
Double the use of natural gas in Africa	107.8 bcm	215.6 bcm	Missed
Double African gas exports to Europe	78.9 bcm	157.8 bcm	Missed
Renewable Energy			
10,000 MW Hydro	26,762 MW	36,762 MW	Missed on historical trend Achieved on pipeline scenario
5,000 MW Wind	1,080 MW	6,080 MW	Missed on historical trend Missed on pipeline scenario*
500 MW Solar	77 MW	577 MW	Achieved in all pipeline scenarios
Tripling of other renewables (geothermal, biomass)	1,093 MW	+ 2,186 MW = 3,279 MW	Missed on historical trend Achieved in halfway & optimistic pipeline scenario
Energy Efficiency			
Network losses	24.4	na	No target defined Trend goes in opposite direction
Energy intensity (MJ/US$2005 PPP)	10.99	na	No target defined: Trend goes in right direction
Energy Access			
Electricity Access (for an additional 100 million)	458.8 m	558.8 m	Achievable pending policy implementation
Cooking (for an additional 100 million)	319.3 m	419.3 m	Achievable pending policy implementation

as more offgrid solutions are implemented to overcome generation shortfalls; one example would be statistics on solar water heaters and household energy solutions (such as solar home systems and diesel generators).

The AEEP's current approach may also lack the authority of aggregations based on data received from efficient, well-resourced national statistical offices. However, despite shortcomings, the AEEP is confident that this work is an improvement on comparable datasets – and provides a platform for further African-European cooperation to develop monitoring.

Issues of Access

Data on Access is widely accepted to be patchy and problematic, based on a few, very incomplete datasets. Addressing this problem is high on the agenda of the AEEP and of complementary initiatives, such as Sustainable Energy for All (SE4 All), which seeks to give access to modern energy to another 1 billion people by 2030 (see Access, below).

From a monitoring perspective, the AEEP is aligned with SE4 All, in what all parties agree is a work in progress. The methodological challenges relating to the SE4 All dataset are discussed at length in its Global Tracking Framework (GTF) report, published in 2013.

Critical problems relate to the need for regular surveys conducted to international standards in most African countries. This means the GTF has, so far, been forced to generate data based on estimates from econometric models. The GTF report shows that in countries where data is available the model shows an acceptable fit, but it is not possible to verify this for a majority African countries, where surveys are too often many years out of date, if they have been conducted at all.

There are particular issues with transmission and distribution losses data, with several countries recording impossible (greater than 100 %) or implausible (greater than 80 %) losses. These were removed from the dataset for the purposes of this report, potentially biasing the network losses indicator downwards.

The security situation is clearer

As established in the Energy Security chapter, for the purposes of establishing long-term trends in natural gas supply, the BP Statistical Review of World Energy is the

	Historical trends for 2020 target (based on annual average increases)			Scenarios (based % on current project pipeline)		
	Long-term (2000–12)	Medium-term (2007–12)	Short-term (2010–12)	Pessimistic (25 % online)	Halfway (50 % online)	Optimistic (75 % online)
Energy Security						
Double capacity of cross-border interconnections	+3,467 MW = 14,884 MW	+4,292 MW = 15,709 MW	+4,595 MW = 16,012 MW	na	na	na
Double the use of natural gas in Africa	No data	No data	No data	na	na	na
Double African gas exports to Europe	2020: 91 bcm 2030: 130 bcm*			na	na	na
Renewable Energy						
10,000 MW Hydro	+4,991 MW = 31,753 MW	+7,138 MW = 33,900 MW	+4,925 MW = 31,687 MW	+7,142 MW = 33,904 MW	+13,500 MW = 40,262 MW	+19,859 MW = 46,621 MW
5,000 MW Wind	+837 MW = 1,917 MW	+1,118 MW = 2,198 MW	+1,259 MW = 2,339 MW	+890 MW = 1,970 MW	+1,668 MW = 2,748 MW	+2,446 MW = 3,526 MW
500 MW Solar	Not applicable due to recency of solar developments			+780 MW = 903 MW	+1,560 MW = 1,683 MW	+2,340 MW = 2,463 MW
Tripling of other renewables (geothermal, biomass)	+208 MW = 1301 MW	+263 MW = 1,356 MW	+370 MW = 1,463 MW	+1,172 MW = 2,265 MW	+2,340 MW = 3,433 MW	+3,507 MW = 4600 MW
Energy Efficiency						
Network losses	Based on 2000–2010, losses in 2020: 28 % Based on 2007–2010, losses in 2020: 36 %			na	na	na
Energy intensity (MJ/US$2005 PPP)	8.5 MJ/ US$2005 PPP	6.9 MJ/ US$2005 PPP	No data	na	na	na
Energy Access						
Electricity Access (for an additional 100 million)	590 m without electricity (2010)**					
Cooking (for an additional 100 million)	698 m without access to clean cooking fuels (2010)**					

*pipeline scenario limitations (Wind Energy, P38) **IEA WEO 2012 new policies estimates ***African pop expected to rise to 1,261 m (2020) from 1,035 m (2010)

best source. However, the BP Statistical Review is also subject to methodological constraints.

Comparable reports such as the International Energy Agency's World Energy Outlook and ENI's World Oil and Gas Review produce generally similar, but sometimes substantially different results. This is due to different methods employed by each institution and the quality and availability of data. Gaining an understanding of the weaknesses apparent in datasets that might support more accurate benchmarking of AEEP and other monitoring of African energy indicators has been a substantial element in the AEEP's work.

Europe and Africa have mutual interest in PIDA's success

Some of the largest projects tracked by the AEEP Power Project Database are of critical importance to the Programme for Infrastructure Development in Africa (PIDA), a major African Union (AU) initiative that targets game-changing energy, transport, information and communication technologies (ICT) and trans-boundary water resources projects for accelerated development. PIDA's ultimate aim is to lift millions out of poverty by leveraging the benefits of developing major infrastructure projects across Africa.

Many European public and private sector actors see PIDA as an important element in the evolving architecture that will help to structure Africa's accelerated socio-economic development.

PIDA is based on an initial list of 51 long-awaited big infrastructure schemes, whose accelerated development forms a 'priority action plan'; 15 of the named projects are in the energy sector; nine of these are hydroelectric schemes, which are high on the AEEP's agenda. PIDA is led by three continental institutions: the AU Commission (AUC), New Partnership for Africa's Development (Nepad) Secretariat and African Development Bank.

Some of the biggest PIDA energy sector projects are shown in the map opposite, and more in the map on page 23.

Major PIDA projects looking for support include Inga III, now planned as the first phase of the potential 40 GW development of the Congo River hydroelectric resource; the Kaléta and Sambangalou hydroelectric dams, which will feed into the Gambia River Basin Development Organisation grid serving The Gambia, Guinea, Guinea-Bissau and Senegal; the Zambia-Tanzania-Kenya interconnection; and the Rusomo Falls and Ruzizi III HEP schemes.

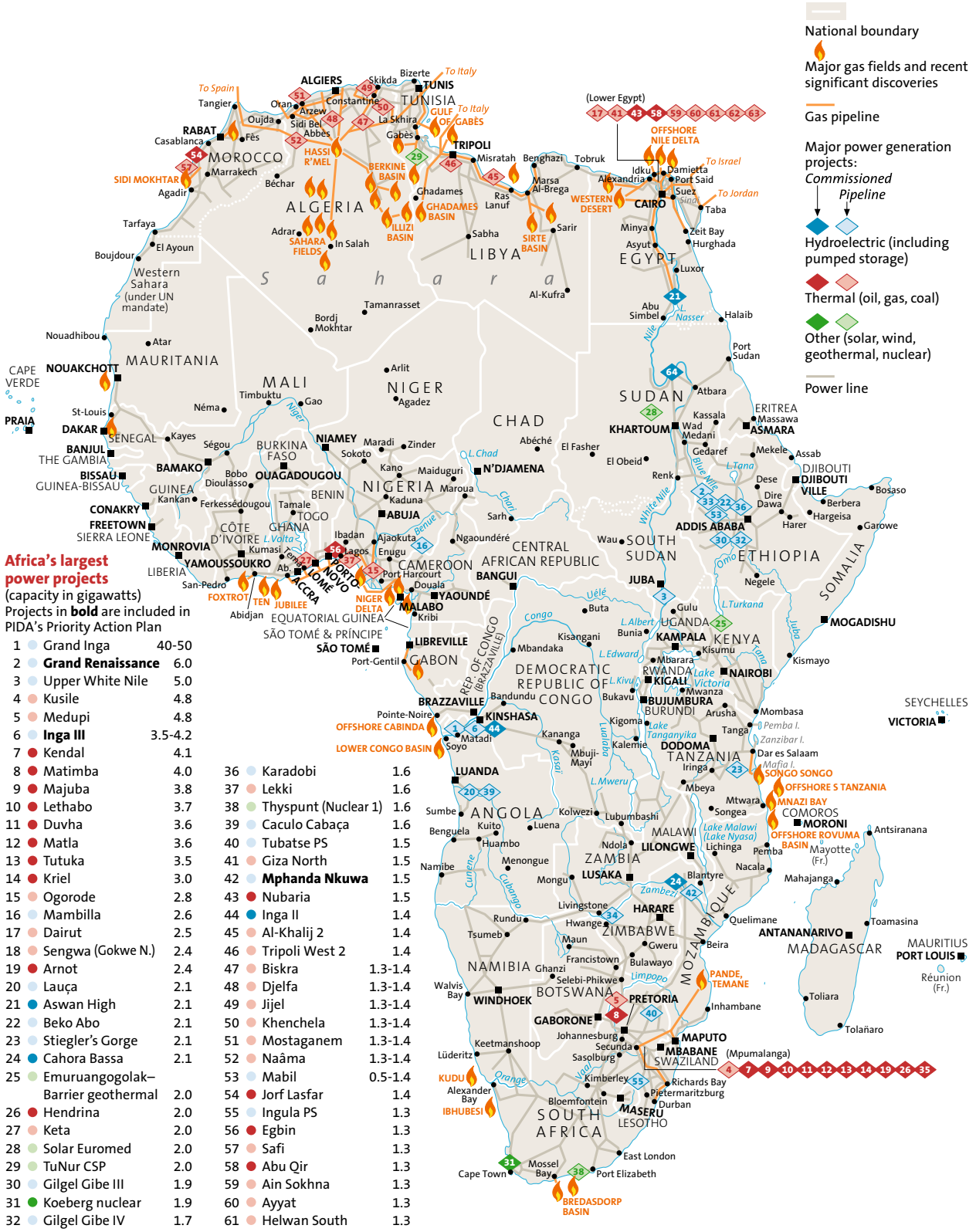
The development of these complex projects will involve a range of financing sources, consultants and companies, from Europe, Africa and other regions.

AUC Chairperson Nkosazana Dlamini-Zuma argues that infrastructure development is essential for effective integration, the goal of Africa's evolving 'Agenda 2063' vision. "We can integrate economically only when we are integrated physically," she says. Dlamini-Zuma has emphasised the importance of setting targets and milestones along the way towards achieving the Agenda 2063 vision.

According to data compiled by the Infrastructure Consortium for Africa, in 2012 alone, PIDA energy projects received some of the biggest disbursements from European donors, including the European Investment Bank (EIB). This included $96.8 m for the West African Gas Pipeline from the EIB.

Much more support from the EIB and other agencies is expected as PIDA gathers pace in the 2014–2020 period.

Africa's energy infrastructure



Africa's largest power projects

(capacity in gigawatts)
Projects in **bold** are included in PIDA's Priority Action Plan

1	Grand Inga	40-50
2	**Grand Renaissance**	6.0
3	Upper White Nile	5.0
4	Kusile	4.8
5	Medupi	4.8
6	**Inga III**	3.5-4.2
7	Kendal	4.1
8	Matimba	4.0
9	Majuba	3.8
10	Lethabo	3.7
11	Duvha	3.6
12	Matla	3.6
13	Tutuka	3.5
14	Kriel	3.0
15	Ogorode	2.8
16	Mambilla	2.6
17	Dairut	2.5
18	Sengwa (Gokwe N.)	2.4
19	Arnot	2.4
20	Lauça	2.1
21	Aswan High	2.1
22	Beko Abo	2.1
23	Stiegler's Gorge	2.1
24	Cahora Bassa	2.1
25	Emuruangogolak–Barrier geothermal	2.0
26	Hendrina	2.0
27	Keta	2.0
28	Solar Euromed	2.0
29	TuNur CSP	2.0
30	Gilgel Gibe III	1.9
31	Koeberg nuclear	1.9
32	Gilgel Gibe IV	1.7
33	Mandaya	1.7
34	**Batoka Gorge**	1.6
35	Camden	1.6
36	Karadobi	1.6
37	Lekki	1.6
38	Thyspunt (Nuclear 1)	1.6
39	Caculo Cabaça	1.6
40	Tubatse PS	1.5
41	Giza North	1.5
42	**Mphanda Nkuwa**	1.5
43	Nubaria	1.5
44	Inga II	1.4
45	Al-Khalij 2	1.4
46	Tripoli West 2	1.4
47	Biskra	1.3-1.4
48	Djelfa	1.3-1.4
49	Jijel	1.3-1.4
50	Khenchela	1.3-1.4
51	Mostaganem	1.3-1.4
52	Naâma	1.3-1.4
53	Mabil	0.5-1.4
54	Jorf Lasfar	1.4
55	Ingula PS	1.3
56	Egbin	1.3
57	Safi	1.3
58	Abu Qir	1.3
59	Ain Sokhna	1.3
60	Ayyat	1.3
61	Helwan South	1.3
62	Qena	1.3
63	Safaga	1.3
64	Merowe	1.3

Sources: AEEP monitoring tool; AEEP project database; Programme for Infrastructure Development in Africa

Energy Access

Access to modern and sustainable energy services involves more than electrical connection. The concept covers the quality, safety and affordability of connection, and other areas of household consumption such as cooking and lighting. Measuring 'access' is a major challenge that requires greater resources being channelled into national surveys and support for statistical authorities. Since its inception, the AEEP has supported projects and research that help extend access across the continent, from rural electrification to the introduction of Improved Cooking Stoves (see Case Study on page 19).

The launch in 2013 of the global Sustainable Energy for All (SE4 All) initiative adds to the momentum. SE4 All has adopted a similar conception of access to the AEEP and other, earlier initiatives. It is introducing new statistical and monitoring programmes in countries that sign up. This will add to the global understanding of access levels – and the lack of modern and sustainable energy services to a huge swathe of the world's population – in the years to come.

Statistics don't tell the whole story

Meanwhile, accurate data on access in Africa remains patchy, as noted on pages 4, 5 and 10 above, and debate continues over the definition of access – for example, between the SE4 All model and the German-Dutch-Norwegian partnership Energising Development (EnDev)'s 'tiered model'. Indeed, until full datasets are available, statistics may serve to obscure the challenges, rather than enlighten them.

Data compiled by the AEEP, which is drawn from SE4 All, International Energy Agency and other datasets, suggests that levels of access have been rising in Sub-Saharan Africa (SSA) and will continue to do so. This suggests that the AEEP's target of bringing access to 100 m more people by 2020 can be met. Accelerated implementation of domestic policy initiatives and concerted international action should improve access for tens of millions.

However, the continent's continuing elevated population growth rates mean that even if AEEP, SE4 All and other targets are met for 2020 and 2030, a larger number still of Africans may be denied access than is the case now.

Tracking access to energy

The international effort is now focused on tracking access through multi-tier frameworks for cooking and electricity. For cooking, the framework will measure the technical grade of the cookstove, as well as monitoring how the stove is used. SE4 All proposes tracking access to electricity using six characteristics of supply and five tiers of electricity use, based on the appliances for which the supply is sufficient to drive.

This approach is expected to take a number of years to implement. In the short term, the SE4 All Global Tracking Framework is using two existing datasets, the World Bank's Global Electrification Database (GED) and the World Health Organisation's Global Household Energy Database (GHED), to provide estimates of access to electricity and non-solid cooking fuel as a percentage of total population in 1990, 2000 and 2010. The exercise will be repeated every two years to track progress.

The GED and GHED use surveys carried out to international standards to produce estimates of data points for years and countries where no data currently exists. This approach has substantially improved coverage of access in Africa. Access to electricity data is available for 54 African countries and data covering access to non-solid cooking fuels is available for 53 countries, comparing favourably with the dataset used for the AEEP baseline report, Monitoring Progress in the Africa-EU Energy Partnership, for which the only available data was frequently out of date or unavailable.

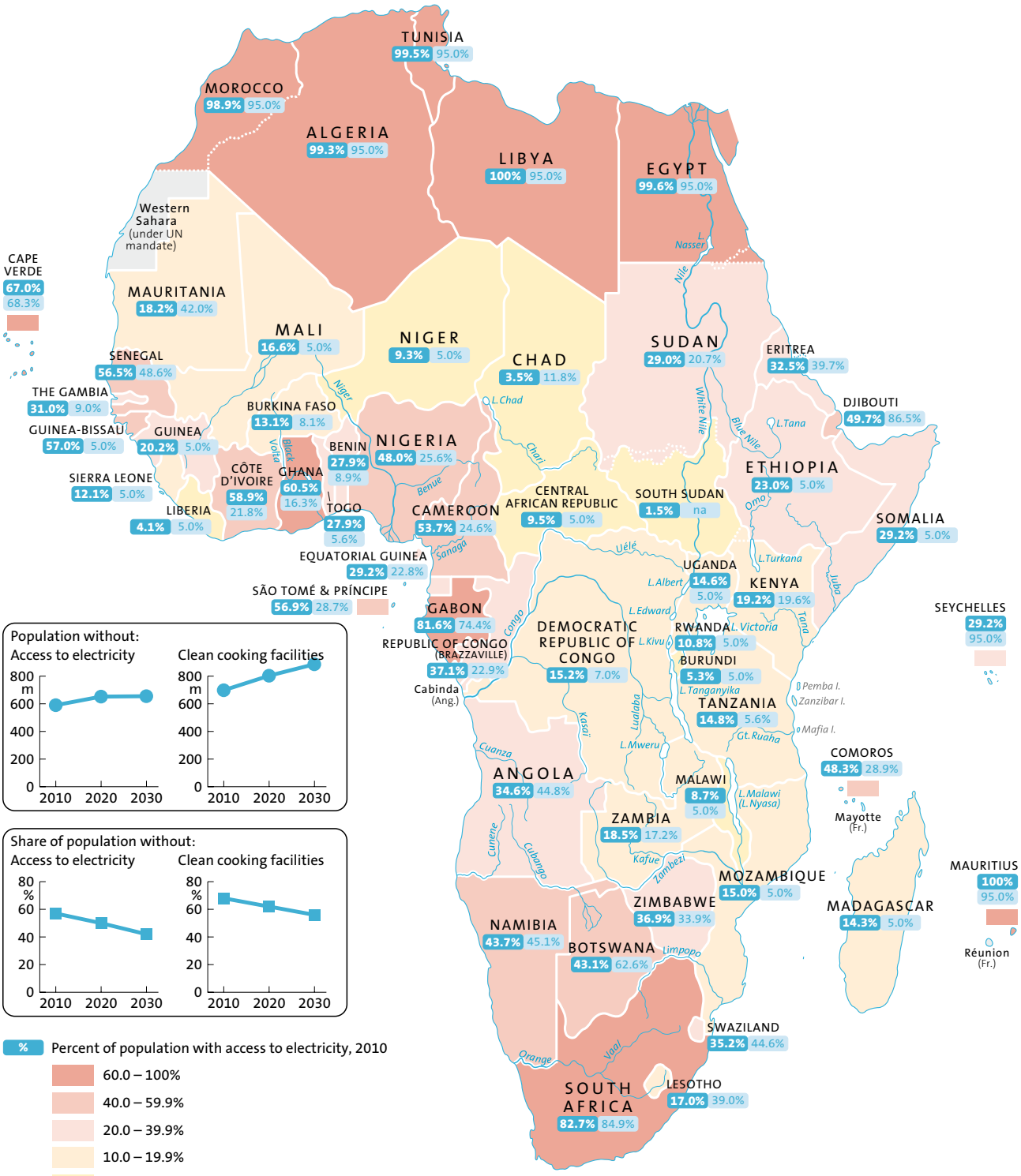
The AEEP has opted to use the SE4 All Global Tracking Framework as the basis for its monitoring of access. SE4 All uses access to non-solid fuels for cooking as an indicator of access. Solid fuel is defined as including traditional biomass, such as wood and charcoal, and processed biomass, such as pellets and briquettes, as well as coal and lignite. Access to non-solid fuels for cooking was chosen as a short-term measure because the question is asked, in differing formats, in a number of internationally recognised surveys which comprise the WHO's GHED. Population data came from the United Nations Populations Prospects.

Policy factors are critical

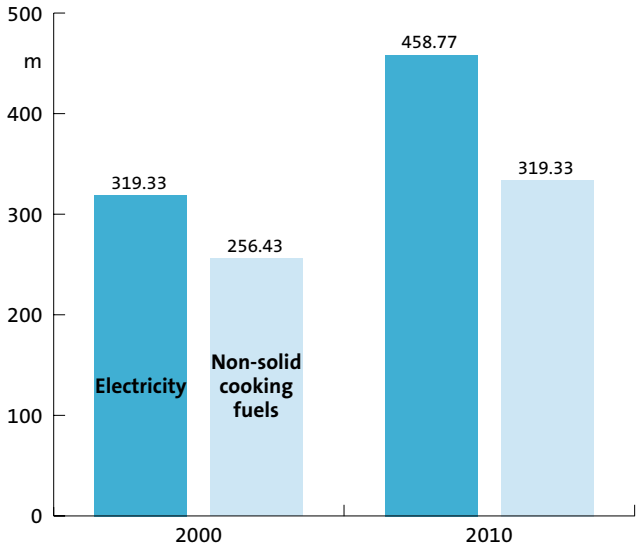
Improved access is generally driven by changes in policy, establishing new financing channels and a clear allocation of responsibility for driving the process to a particular body, such as a rural electrification authority. When it comes to forecasting future developments, estimates based on weighted averages and historical data may be inaccurate by a significant margin. This is more marked

continued on p. 16

Access to electricity and non-solid fuels



Access to electricity and non-solid cooking fuels, 2000 and 2010



Sources: SE4All Global Tracking Framework; UN World Population Prospects

at a national than regional or continental level. However, SE4 All notes that comparisons between modelled data and survey data show an 83 % alignment.

Renewable energy can play an important role in improving levels of access in SSA, whose vast, sometimes sparsely populated spaces, may be best electrified using isolated grids powered mostly using sustainable technologies. Without the environmental and transportation costs associated with diesel generators or economically harmful fluctuations in fuel costs, RE offers an attractive option.

Overcoming subsidy dependency

In the constant battle for financial and other resources, access has often lost out to the drive to industrialise. By providing cheap power to major industrial and mining consumers, governments sought to improve comparative advantage and bring in trade. However, this approach may neglect the economic benefits that a population with access to modern and sustainable energy sources enjoys. Ultimately, policies that have entrenched subsidised electricity in economies have left populations in the dark and hampered the development of small- and medium-size enterprises (SMEs); meanwhile the electricity sector in particular is too often unable to expand, as unprofitable and inefficient utilities struggle to make ends meet.

Over the past decade a new emphasis on access for the broader population has begun to yield results in SSA, as increasing numbers of people have gained access to electricity and non-solid cooking fuel – even if there is much more to do.

Regional variations

Access to modern and sustainable energy services varies substantially between regions as shown in the table on page 18. North Africa has experienced a very different historical trajectory to SSA. As a result, a substantially higher proportion of people north of the Sahara have access to electricity and non-solid cooking fuel.

It is estimated that West Africa loses around 44 % of electricity generated, compared to only 17.9 % in East Africa.

Data show that West Africa, the continent's most populous region, added nearly 50 m people to the grid between 2000 and 2010, from an estimated population of 345 m. This was helped by large-scale electrification programmes in Ghana (see Case Study on page 17) and some other countries. Improved monitoring of the quality of supply will show how sustainable these initiatives are. Issues such as the regional discrepancy in transmission and distribution losses must be addressed.

East Africa had only 13.9 % electricity access in 2000; 29 m people had been added to the grid by 2010; but with an estimated population of 312 m people in 2010, this was only sufficient to increase the proportion of people with access to an electrical connection to 19.7 %.

The data suggest the equivalent of one-third of Southern Africa's population was electrified between 2000 and 2010, giving access to 44 % of the population – the highest level of electrification in SSA. However, when the Republic of South Africa is removed from these statistics, Southern Africa had a rate of access to electricity of only 23.3 % in 2010, up from 19.3 % in 2000, after 7.5 m people gained connections. Meawhile, in Central Africa 8.7 m people gained access to electricity over the period, taking the total number to around 21.1 m in 2010, implying an electrification rate of around 34 % – a figure which could also benefit from analysis.

More sustainable cooking fuels

A total of 86.6 m Africans gained access to non-solid cooking fuels between 2000 and 2010, compared with 146.9 m who gained access to electricity. In some economies this reflects an improving demand side situation, which may also have seen populations converting to more sustainable fuel options. But in still too many jurisdictions, cleaner cooking has not been a priority for many policy-makers.

Only in Southern Africa (including and excluding South Africa) is the proportion of people with access to non-solid cooking fuels close to the proportion of people with access to electricity. The most substantial discrepancy is in West Africa, where there has barely been an increase in

continued on p. 18

Case Study

Ghana's electrification scheme builds on success

Ghana's progress towards achieving universal access to electricity over the last two decades has made such headway that the government has brought forward its completion target date. A report published in March 2012 by researchers at Kwame Nkrumah University of Science and Technology under the European Union Energy Initiative Partnership Dialogue Facility (EUEI-PDF) concluded: "Ghana has made significant strides in electricity access due to long-range energy planning with clear targets, availability of external funding, political/popular demand and active role of central government in the implementation of energy policies."

Ghanaian officials and external observers agreed that these are key factors, but add that another important element was at play: Ghana is a vibrant democracy (of the sort the EU is strongly committed to supporting) and its politicians know that to get elected they must be seen to be delivering on projects that widen access.

The National Electrification Scheme (NES), initiated in 1990, aimed to provide universal access to electricity by 2020 in six five-year phases. Priority was given to the lighting of district capitals, now numbering 215. In 1996, the government introduced a Self-Help Electrification Scheme (SHEP), to bring power to other 'economically viable' towns. Support came from the Nordic Development Fund ($46.88 m), the Dutch government via ORET ($31 m) and Danida ($24.35 m). The World Bank provided $35.3 m and $42.5 m under the Ghana Energy Development and Access Project.

Energy minister Emmanuel Armah-Kofi Buah in July 2013 redefined the rural electrification programme's objectives, advancing the completion date for universal access to 2016. More than 5,300 communities should be connected to the grid by 2016, boosting the access rate from just over 60 % in 2010 – rivalled only by Cape Verde and South Africa in sub-Saharan Africa – to 93 % (from just 15 % in 1990).

Buah outlined other targets, including doubling generation capacity from 2.71 GW now to 5 GW by 2016; increasing the share of renewables in generation to 10 % by 2020 (including hydropower schemes under 100 MW); making 80 % of power plants run on gas by 2015; developing a non-congested transmission system by 2015; promoting private sector investment, energy efficiency and conservation; and achieving comprehensive inter-connectivity in the sub-region.

According to Energy and Petroleum Ministry senior engineer Delali Abochie, completion of the NES now requires defining what "economically viable" towns are and adding communities en route to district capitals which were not identified in initial surveys. "The main aim of the NES is access rather than intensification, so it is only when we hand over the new networks to the distribution companies – Electricity Company of Ghana in the south and the Northern Electrification Department – that we can gather detailed data on the real number of new users," he says.

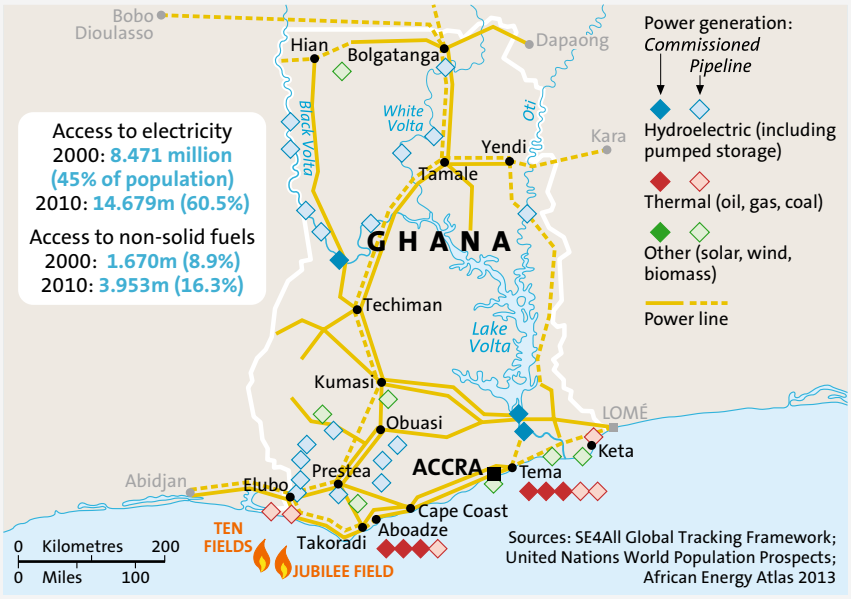
While transmission systems meet international standards, the distribution system remains problematic, suffering technical and commercial losses (including from illegal connections) estimated at 26 % at end-2012. The situation is said to have improved since then, but substantial investment is required, as are measures to prevent theft, such as the installation of pre-paid meters.

Following a power supply crisis in mid-2012, which lasted for most of the next year, robust policy responses have included a tariff rise of 78 % – making electricity prices more cost-reflective and renewable energy (RE) more attractive. A feed-in tariff and RE purchase obligations for larger customers have been put in place.

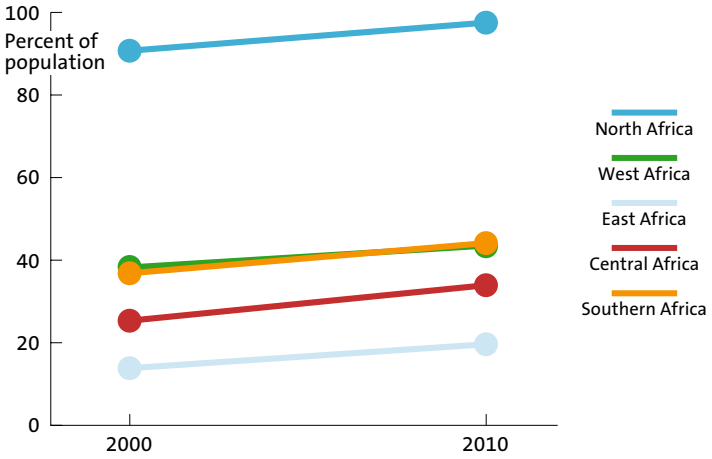
More initiatives are planned, such as net metering, which will allow consumers who generate themselves to deliver to local distribution facilities, offsetting their purchases of electricity from state utilities.

The recent price rise will enable power utilities to invest in much-needed new infrastructure. Ghana has also received funding from the EU to back RE. Beyond hydropower, Ghana has yet to develop any significant renewable resources, with just one 2 MW solar system in place at Navrongo. Three new mini-hydro schemes have remained on the drawing board for several years.

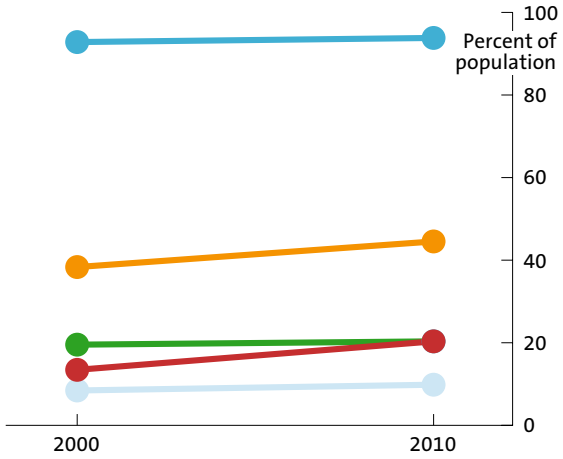
A new Renewables Directorate has been set up in the energy ministry. However, progress to date has been slow, John-Peter Amewu, senior policy analyst at the Africa Centre for Energy Policy, says – suggesting that the government's aim of raising renewables use to 10 % of total generation by 2020 will be difficult to achieve.
The government will have to give more encouragement to independent power producers, he argues. As Ghana has shown itself to be open to private investment this is by no means impossible.



Access to electricity by region, 2000 and 2010



Access to non-solid cooking fuels by region, 2000 and 2010



Sources: SE4All Global Tracking Framework; United Nations World Population Prospects

the proportion of people with access to non-solid cooking fuels. While 43.6 % of West Africans had an electrical connection in 2010, only 20.4 % had access to non-solid fuels for cooking. With a growing population, this still entailed an additional 19 m people, showing the level of investment required even to 'stand still'.

In East Africa, access to non-solid cooking fuels was still in single digits in 2010, despite nearly 11 m more people using these since 2000.

Regional breakdown of access to electricity and non-solid cooking fuel

	North Africa	West Africa	East Africa	Central Africa	Southern Africa	Southern Africa (minus RSA)
Population						
Total population in 2010	166,980,017	344,689,073	311,972,109	62,213,965	142,165,723	92,174,423
Total population in 2000	144,013,942	261,907,593	234,646,825	49,007,850	116,699,945	72,699,945
Electricity						
No. people with access 2010	163,054,957	150,342,020	61,393,964	21,136,671	62,841,129	21,498,324
No. people with access 2000	130,761,458	100,412,009	32,596,933	12,458,735	43,099,971	14,015,971
No. people added 2000–2010	32,293,500	49,930,011	28,797,031	8,677,936	19,741,158	7,482,353
2010 regional access rate (%)	97.6	43.6	19.7	34.0	44.2	23.3
2000 regional access rate (%)	90.8	38.3	13.9	25.4	36.9	19.3
Non-solid cooking fuel						
No. people with access 2010	156,719,007	70,309,619	30,998,437	12,672,052	63,399,832	20,938,861
No. people with access 2000	133,733,696	51,221,181	20,042,533	6,612,872	44,814,965	12,012,688
No. people added 2000–2010	22,985,311	19,088,437	10,955,905	6,059,179	18,584,867	8,926,174
2010 regional access rate (%)	93.9	20.4	9.9	20.4	44.6	22.7
2000 regional access rate (%)	92.9	19.6	8.5	13.5	38.4	16.5

Case Study

Improved cooking stoves make a difference in East Africa

The extent to which Improved Cooking Stoves (ICSs) have been adopted at the expense of inefficient traditional metallic charcoal stoves and open fireplace cooking is rapidly becoming a success story in Kenya and across East Africa, reflecting positive demand-side trends as well as an improvement in the fuel supply side.

An ICS is a mud or clay moulded stove that burns biomass – mainly charcoal and wood fuel – in a more effective way than previous techniques. In Kenya, the spread of the technology has its origins in the Kenya Renewable Energy Development Project, which, in the early 1980 s, adapted the design of a Thai 'bucket' stove for local needs, building on its simplicity of design and dramatic fuel savings.

Burning up to around 40 % less charcoal than the alternatives, the Kenya Ceramic Jiko (KCJ) quickly caught on in Nairobi, providing a market for a growing band of local producers. Urban households have completely abandoned the metallic charcoal stove for the KCJ, which is now commonplace in East Africa's urban areas. More recent versions, such as the Rocket Stove, are up to 60 % more efficient than the traditional three-stone fireplace.

Now the focus is on boosting usage in rural areas, where all aspects of energy provision remain heavily dependent on biomass burning, especially where there is no electricity. Biomass, mainly wood fuel and charcoal, still accounts for more than 90 % of rural energy requirements for cooking. The majority of rural Kenyans still use the traditional three-stone fireplace, overstretching demand for firewood.

Kenyan wood fuel demand is estimated at 3.5 m t/yr, against supply of 1.5 m t/yr and that gap is widening, according to the government. This has led to accelerated deforestation with adverse environmental effects, as well as having a detrimental impact on the economy. Women and girls spend time searching for firewood that could be used more productively in education and income generation.

The picture is similar across the region, where ICS uptake is being promoted, especially in arid and semi-arid areas, supported by a range of donors including UN agencies, the World Bank, Germany's GIZ, GVEP International, the UK's Department for International Development (DFiD) and SNV. Some eight models of the ICS have evolved over the years and replication is continuing across the region, according to Francis Muchiri of Practical Action Eastern Africa, which supports ICS production and usage.

In Kenya, Energising Development (EnDev) says it has initiated a dynamic market for improved cooking devices, with over 1.3 m stoves disseminated. EnDev is an initiative launched by the Netherlands and Germany, implemented by GIZ and now supported by a number of other donors, including Norway, the UK, Ireland, Australia and Switzerland. EnDev Kenya promotes JikoKisasa and Rocket Stove technologies in 20 counties of the western, central and lower eastern Kenya.

According to EnDev Kenya programme manager Reimund Hoffmann, one stove saves 1.09 t/yr of firewood, equivalent to 0.06 hectares of primary forest. Each stove also saves 0.72 t/yr in carbon dioxide emissions. The environmental benefit makes ICS manufacture and distribution projects eligible for UN Clean Development Mechanism (CDM) tradable certified emissions reduction (CER) credits.

"Efforts to promote ICS in Africa are worthwhile from a sustainable development perspective. Whether it is economically worthwhile depends on the CER prices and financial set up of each project," says Mette Annelie Rasmussen of the UNEP Risø Centre on Energy, Environment and Sustainable Development in Denmark.

Africa has gained little benefit from the CDM to date, but there are efforts to make access to CER credits easier for small and micro-scale activities, including ICS schemes, under the Programme of Activities (PoA) concept. PoA allows a lot of smaller emissions reductions projects to be co-ordinated under one programme by a public or private body, cutting administration and overheads. As of mid-2013, there were 18 ICS PoAs in East Africa (in Burundi, Ethiopia, Kenya, Madagascar, Malawi, Rwanda and Uganda) and three ICS CDM projects (two in Malawi and one in Mozambique). Globally there are 49 CDM ICS projects and 50 ICS PoAs.

Making rural electrification productive

Rural communities without a connection to power from the grid have traditionally had to do without electricity, or rely on costly, polluting diesel generators to provide it. But a combination of increased cooperation between public, private, donor and non-governmental organisations and the falling cost of renewable technologies mean that off-grid solutions are becoming increasingly viable methods of bringing power to remote communities.

The role of offgrid electricity is poised to become increasingly important. The International Energy Agency estimates that more than 80 % of the 1.3 billion people in the world without electricity are in rural areas and that, as a result, some 60 % of the world's new generating capacity built by 2030 will need to come from offgrid sources if universal electricity access is to be achieved by then.

The industry will be building on long-established foundations. Small-scale hydropower (SHP) has provided off-grid electricity in some parts of rural Africa for decades and has already shown its potential for alleviating poverty and mitigating climate change. South Africa's gold mines were using hydropower in the late 19 th century, Zimbabwean farmers installed it in the 1930 s and churches in Tanzania built SHP schemes over 40 years ago that are still operating today. In the intervening time, off-grid power development has suffered from a lack of clear renewable energy policy in some countries and limited funding opportunities.

However, this is changing. Solar and wind power have become more viable, providing potential for cheap, clean offgrid supply beyond the hilly regions where hydropower can be used – and on a timescale unlikely to be met by public utilities often focused on developing power networks in urban areas rather than sparsely populated and expensive-to-connect rural regions.

New offgrid schemes are sprouting up across Africa in countries such as Senegal, Ghana, Mali, Kenya, Rwanda, Malawi, Namibia, South Africa, Uganda, Tanzania and Zimbabwe. Typically, today's offgrid development – especially where solar or wind energy is involved – will be a hybrid system using renewable energy, diesel for back up and batteries for storage. Despite the intermittency of the power source, such hybrid systems can produce 75 % – 99 % of total supply, according to the Alliance for Rural Electrification (ARE), a global business association that is a private-sector focal point for the Africa-EU Energy Partnership (AEEP).

The attractions are clear: offgrid renewables offer electricity to those that have never had it and provide a low-carbon replacement for diesel generation, which, in the long term, also works out cheaper. Electricity from the most efficient rural PV systems now costs around half that generated by diesel on a levelised cost basis, the ARE says. In some countries, locally produced off-grid electricity may even be a more reliable power source than that from a sometimes overstretched and underfunded national grid.

The donor community and NGOs are playing an important role in kick-starting offgrid projects, especially where the public and private sectors are not in a position to take on the initial investment costs or work with the local community.

Practical action in Kenya

In Kenya, for example, NGO Practical Action worked with Nottingham Trent University and the Kenyan government to build two community hydropower schemes in remote areas of Kathama and Thima near Mount Kenya. These provide power for more than 200 households, enabling battery charging and boosting productivity of chicken farming due to the extra warmth provided by electric lights. Replacing kerosene lamps with electric ones also saved the equivalent of 42 tonnes of carbon, according to Practical Action, a civil society focal point for the AEEP.

Strong involvement from end-users in rural communities from the start is regarded as crucial, especially where projects are structured so that the community eventually becomes the owner and operator.

This was the case for the Kenyan hydropower projects, where local people provided building materials, land, labour and some funding for the scheme. The communities now manage, operate and maintain the projects, and pay monthly charges for the power generated, making them self-sustaining. Crucially, the schemes have also acted as a blueprint to develop standards and codes of practice for further offgrid projects, as well as informing government policy on opening up the power sector to smaller independent operators.

Where the local community is heavily involved like this, preparation needs to be lengthy and capacity-building measures painstakingly implemented to ensure the technical and administrative skills are available locally, according to ARE secretary-general Marcus Wiemann.

Case Study

Offgrid power set to transform rural Africa

Connecting a rural community to an electricity supply does not in itself guarantee that the local economy will take off. For local people to benefit, this new energy source needs to be put to productive use that raises the incomes of local businesses and increases employment, as well as boosting living standards by providing power for light, cooling, phone charging and so on.

Given the expense of switching to grid-powered equipment, getting the right financial support in place to enable businesses to upgrade is vital if the economies of poorer communities are to prosper. The potential pitfalls have been illustrated by research carried out for Productive Use of Energy (PRODUSE) in Benin, which found that the financial burden imposed on firms by the investment needed to upgrade equipment and connect to the new supply, as well as paying electricity bills, could reduce the profitability of firms in the short term, before the benefits of electrification are felt.

A collaboration between the Energy Sector Management Assistance Programme (ESMAP), the Africa Electrification Initiative (AEI), EUEI PDF and GIZ, PRODUSE aims to provide practical guidelines based on systematic evidence of the relationship between access to modern energy and poverty alleviation, as well as detailed evaluations of energy access programmes, which are very limited in Africa. The initiative has produced the PRODUSE Manual, which provides those working on electrification programmes with step-by-step guidance on the design and implementation of activities to boost productive use of energy.

PRODUSE highlights progress in Zimbabwe, where support for productive uses of electricity has become a major focus for the country's Rural Electrification Agency (REA), in addition to the more traditional role of connecting public infrastructure, such as schools, clinics and administrative buildings. A central pillar of this effort has been promoting the uptake of irrigation and maize milling through a revolving fund that has been offering loans for electrical appliances to small and medium-sized businesses since 2009.

The fund is now managed by a commercial bank, which brings experience gained elsewhere in the economy to assess the viability of credit applications and loan recovery rates. Potential borrowers present project proposals to one of REA's eight provincial offices, which then passes them on to the local branch of the bank. The bank is then responsible for due diligence, as well as credit disbursement and recovery. Hundreds of loans have been processed in this way to date.

Typically, loan conditions have required a 10 % deposit from the borrower, a two-year tenure and a 7.5 % annual interest rate, following a grace period of three months. Getting these terms right is crucial to the success of such a programme, both in terms of the number of applications and the loan recovery rate, according to PRODUSE.

Private sector initiative

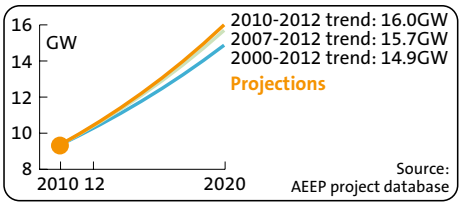
Where the model involves a private sector operator with a long-term concession, driven by incentives, the preparation period can be shorter.

Wiemann says that if private sector involvement is to be encouraged, governments need to lay the groundwork first. A long-term master plan and clearly defined institutional, legal and regulatory frameworks are needed, together with support schemes to facilitate financing, such as cheap loans, credit schemes to enable end-users to pay for power and equipment, and guarantees for bank lending. Wiemann also calls for low import duties and tax exemptions to encourage private investment.

Whether it is the local community or the private sector taking the lead, training to provide the right technical and business skills is vital, as is an integrated approach to ensure that the development of offgrid schemes is tied in with other vital sectors, such as water, food and telecommunications, to maximise its effectiveness, Wiemann says.

PV power plant for health centre in Ethiopia

Energy Security



Cross-border Interconnection projections

The supply of quality, sustainable and affordable energy services is ever more essential as economies across Africa grow rapidly while trying to find appropriate policy responses that take into account their widely varying resource bases. To support this, governments are gradually putting in place more effective energy sector governance, organisation and regulation to ensure a financially and technically competent industry.

International co-operation is essential: large distances between electricity generation hotspots and demand centres add to the argument that regional integration promises better economies of scale and cheaper electricity. The development of electricity interconnections is an important element in this process, which is strongly encouraged by the AEEP. Similarly, the construction of gas pipelines that can supply Africa's sub-regions – such as the West Africa Gas Pipeline (WAGP) – and transport fuel into the European market are a focus for Africa-EU action.

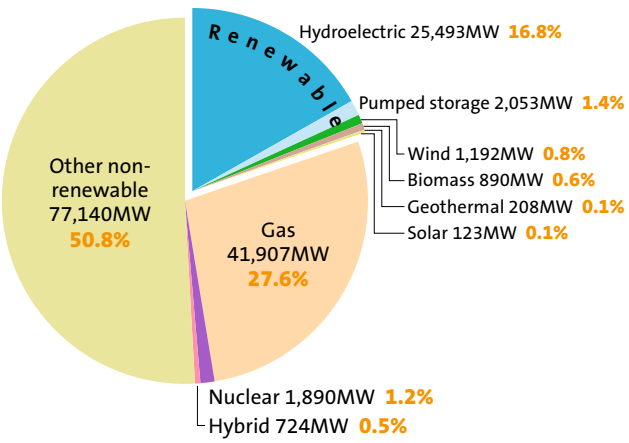
Gas and renewables are fuel sources that can improve development outcomes and reduce exposure to expensive and fluctuating oil prices. In Africa, increasing natural gas consumption is expected to reduce reliance on high carbon-content fuels such as coal, diesel and heavy fuel oil (HFO), while in many instances lowering the cost of producing electricity. The introduction of gas into the energy mix diversifies reliance on a wider range of fuels, reducing exposure to price fluctuations in any one market. African gas allows the European Union to diversify its supply sources, which is a stated policy aim of several large EU consumer countries that can give benefits to all involved.

Africa faces specific challenges to its energy security: these include political and social difficulties associated with introducing cost-reflective pricing, insufficient investment in ailing infrastructure, weak regulation, unfinished sector organisation and volatile hydrocarbons prices.

Over-reliance on one energy technology source is a major threat to energy security on both sides of the Mediterranean. Droughts have caused countries that rely on hydropower to rely on costly rental power, while traditional biomass use – which accounted for 66 % of final energy consumption in sub-Saharan Africa in 2010, according to SE4 All – has often had a devastating impact through deforestation and desertification. Even countries that use coal for the majority of generation are starting to see fuel supply problems with potentially serious economic consequences.

Installed capacity by technology, 2012

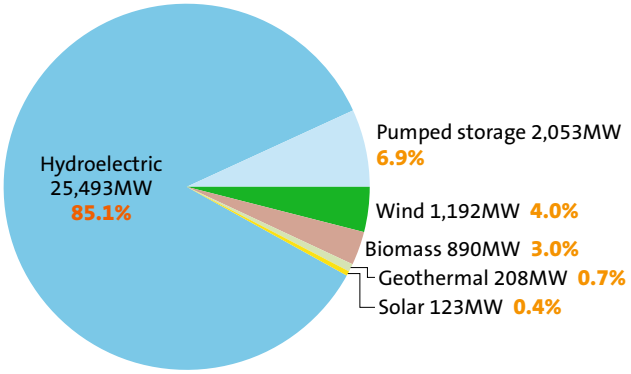
Total capacity: **151,803MW**



Source: AEEP project database

Installed renewable capacity by technology, 2012

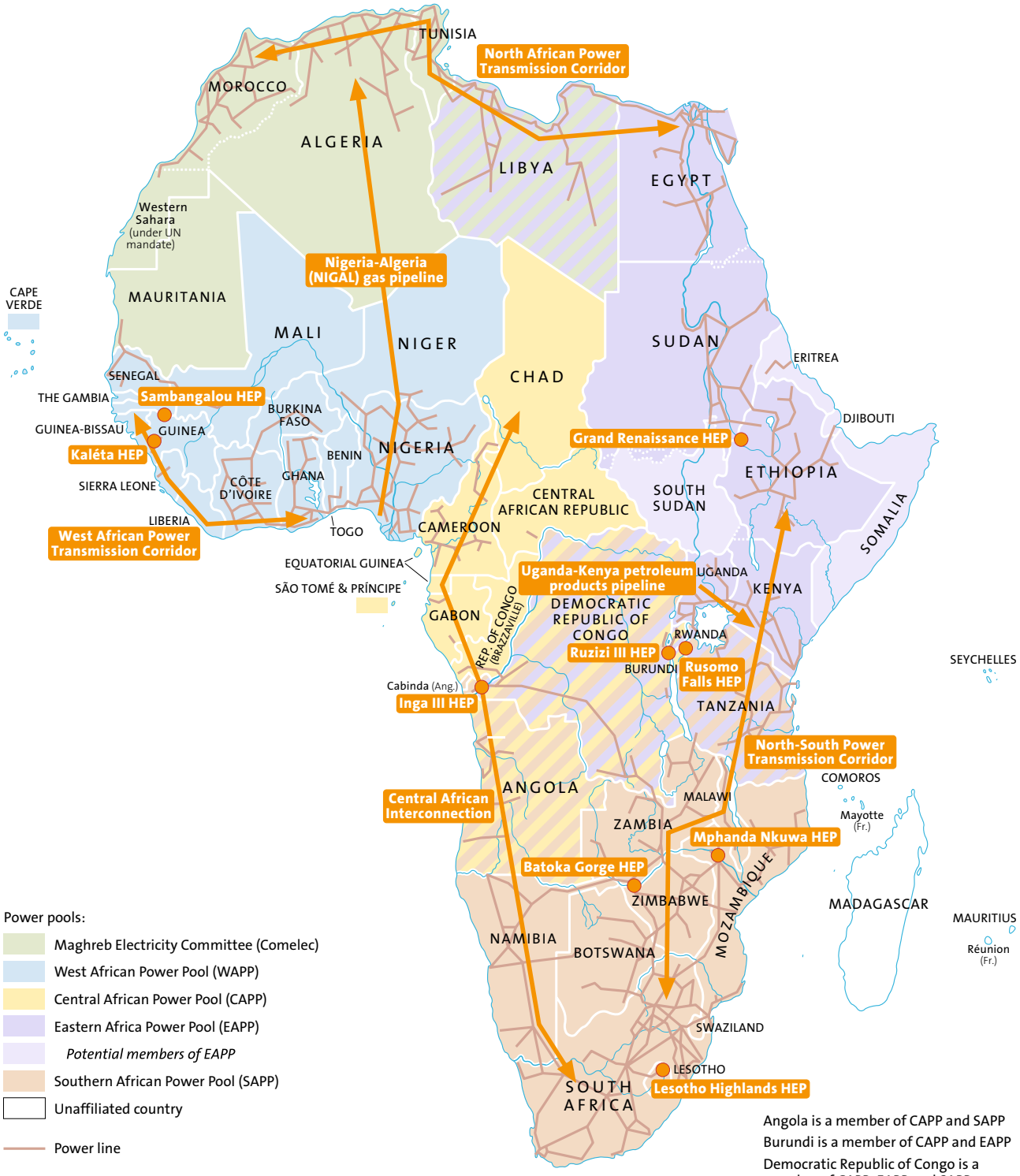
Total renewable capacity: **29,962MW**



Source: AEEP project database

continued on p. 24

Power pools, power lines and PIDA projects



Sources: AEEP project database; African Energy Atlas 2013; Programme for Infrastructure Development in Africa

Angola is a member of CAPP and SAPP
Burundi is a member of CAPP and EAPP
Democratic Republic of Congo is a member of CAPP, EAPP and SAPP
Libya is a member of Comelec and EAPP
Rwanda is a member of EAPP and a potential member of CAPP
Tanzania is a member of EAPP and SAPP

The AEEP Power Project Database reveals that hydropower accounts for more than 80 % of generation capacity in seven African countries. One country relies on coal for more than 80 % of generation, while three countries rely on unspecified fossil fuels. Ten countries rely on oil-based fuels for at least 80 % of their electricity generation. This is without counting small household or business generators (the AEEP Power Project Database only includes generators larger than 50 kW and is likely to underestimate diesel generation).

Oil and gas prices have risen beyond expectations in recent years, and look unlikely to decrease significantly over the medium term. This has had a severe effect on Africa's largely fossil fuel dependent energy sector: the fact that 80 % of Africa's electricity is generated using fossil fuels has squeezed revenues, putting irresistible upward pressure on prices and draining foreign exchange reserves. Although most countries have planned diversification away from fossil fuels, investment in renewables has been slow to take off. Natural gas is underutilised in many countries that rely instead on costly and polluting oil-derivatives.

Better regional integration would allow countries with substantial energy resources to exploit their full potential without becoming over-reliant on a particular resource or requiring large domestic markets, at the same time as providing access to new sources of potentially cheaper energy to neighbours.

Interconnecting Africa

Africa predominantly comprises large, sparsely populated countries. This geographical reality vastly increases the costs of building and operating an electrical grid. It means that electricity frequently has to be transported long distances, and in large quantities, from areas where it can be generated cheaply to places where it is needed. Limited electrical interconnection means that, where an abundance of generation resources exists, there is often insufficient access to a large enough customer base to justify the cost of building and operating a conventional power plant. It also encourages over-reliance on the cheapest source of domestic power generation, increasing energy insecurity.

Synchronising the electricity grids of two countries to allow interconnection is a complex process that is made even more difficult by the instability of power grids in many African countries.

The groundwork for future interconnections is being laid through work developing high-voltage transmission backbones and reinforcing existing grids in a number of African countries. However, most are many years away from completion, which means that cross-border electricity trading in Africa is likely to remain comparatively limited in the short and medium term.

Measuring maximum transfer capacity is an imprecise science. Transfer capacity is determined by a number of factors such as load levels in the connected countries, available power plants and transmission lines and the equipment used. In this sense, any single figure for transfer capacity is only an approximation.

An ideal monitoring system would track the volume of electricity traded between countries, as well as the physical transfer capacity of interconnections. Information

continued on p. 26

Case Study

Spain-Morocco electricity interconnection adds to substantial trans-Mediterranean links

The economies of North Africa and their neighbours north of the Mediterranean are becoming even more inter-connected, by developing a network of gas pipelines and electricity interconnections. The map below shows how all countries of the region are involved, with gas and power links already in place or planned to build trans-Mediterranean energy highways.

The Mediterranean Energy Ring (Medring) interconnected grid network is largely in place, although tricky issues remain – like syncronising the Tunisian and Libyan grids, which has held up the reinforcement of the ELTAM interconnection between Egypt, Libya, Tunisia, Algeria and Morocco to 400/500 kV .

Meanwhile several North African states share electricity with each other and Morocco trades it with Europe. This trade could expand substantially in the coming decade – especially if solar and other renewables generation in the south can be transported to Europe via high-voltage direct current (HVDC) lines, as well as being used by African consumers.

Without major hydrocarbons resources of its own (pending a future find), Morocco has developed a sustainable electricity industry based on international interconnections. The Moroccan state utility, Office National de l'Electricité et de l'Eau (ONEE), and Spain's Red Eléctrica de España (REE) have, for over a decade, had a connection across the Strait of Gibraltar, through which 700 MW can now be traded, with plans to double this to 1,400 MW. As a paper presented by REE executives put it, the 400 kV link "represents one of the maximum exponents of [Euro-Mediterranean] cooperation policy". It "contributes to the stability of the frequency and voltage of the Moroccan network... and it "improves [both countries'] generation and transport. ONEE also shares power with its Algerian counterpart Sonelgaz, helping both sides to cope with peak demand.

Expanding the link to Spain, an HVDC line is planned parallel to the existing ONEE/REE interconnection. This would allow electricity from Morocco's huge renewables programme to be exported into Europe – a goal of the Desertec Industrial Initiative and other schemes to develop Africa's solar potential in a mutually beneficial way. The EU's Medring plan for connecting grids around the Mediterranean Sea also envisages building dedicated HVDC submarine power line corridors to connect southern Mediterranean states with the EU-27 by the most direct routes possible.

ONEE is also a consumer of Algerian natural gas, piped through the Pedro Duran Farell Gas Pipeline (also known as the GME), which ships the feedstock over 1,620 km, from Algeria to Spain and Portugal, as part of a 2,200 km pipeline system. The GME, owned by Europe-Maghreb Pipeline Ltd, and has maximum 11.5 bcm/yr throughput – part of which is used by a 384 MW combined cycle power plant in northern Morocco. Owned by the Energie Electrique de Tahaddart (EET) joint venture – operated by Germany's Siemens Project Ventures in consortium with ONEE and Spain's Endesa – the plant sells power to ONEE under a 20-year contract.

Awarding ISO 14001 certification for the Tahaddart plant, Bureau Veritas said its output "covers 12 % of Morocco's electricity needs. It emits six times less nitrogen oxide (NO_x) and a third less carbon dioxide (CO_2) than a conventional power plant, thus demonstrating the commitment of Morocco regarding environmental requirements".

on cross-border trade is limited so this report looks only at estimates of interconnection transfer capacity.

Slow progress but more to come

Around 50 cross-border transmission lines are operating between African countries, with a maximum transfer capacity of around 10,167 MW. Added to this are two transmission lines with combined transfer capacity of 1,400 MW which operate between Morocco and Spain. The voltage of the lines is shown in the table opposite.

Only three cross-border transmission lines have been commissioned since the end of 2010. The 230 kV line connecting Ethiopia and Djibouti was commissioned in May 2011; it has the capacity to transfer around 100 MW, although only 30 MW was exported from Ethiopia to Djibouti initially. A 225 kV transmission line between Ferkéssédougou in Côte d'Ivoire and Ségou in Mali capable of transferring between 50 MW and 90 MW was commissioned in November 2012, but its operation has been complicated by voltage fluctuations.

The final line to begin operating was a 34.5 kV network facilitating rural electrification in Burkina Faso from Ghana. This network was commissioned in May 2012 and transferred to Burkina Faso utility Sonabel.

The 230 kV transmission lines connecting the grids of Ethiopia and Sudan were completed in March 2012, but delays installing two shunt reactors at the Shehedi substation and telecoms equipment meant the connection did not begin operating during the year.

However, adding to this infrastructure, several major interconnection projects are expected to be implemented in coming years.

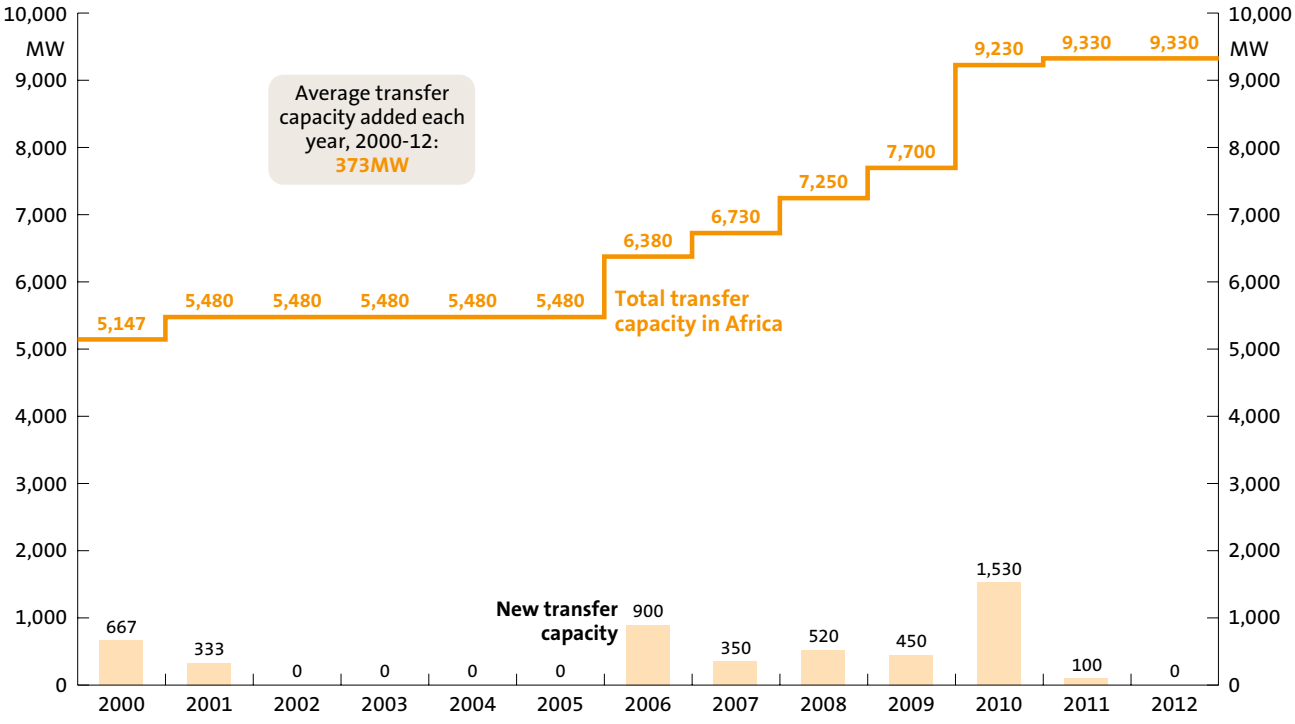
The Ethiopia-Kenya transmission line is discussed on page 23. Progress is also being made on regional projects such as Zizabona and the Nile Equatorial Lakes countries interconnection project.

African power interconnections

Line Voltage (kV)	Number of interconnections
< 50	4
51 – 100	3
101 – 150	9
151 – 200	2
201 – 300	16
301 – 400*	16
> 400	2

* including Morocco-Spain interconnection

Transfer capacity, 2000-12



Source: AEEP project database

Case Study

East Africa's cross-border power networks take shape

The drive to establish cross-border electricity trade in East Africa has taken a major stride with approval of funding for a 1,000 km-plus high-voltage 'electricity highway' between Ethiopia and Kenya.

The $1.26 bn project was agreed by the two countries in 2009, with support for feasibility studies and environmental and social impact assessment provided by the EU-Africa Infrastructure Trust Fund.

The project was formally launched in May 2013, following the approval of funding from the African Development Bank (AfDB, $338 m), the Kenyan government ($88 m), the Ethiopian government ($32 m), Agence Française de Développement ($118 m) and World Bank ($684 m).

The interconnection involves construction of 437 km of transmission lines in Ethiopia and some 631 km in Kenya, as well as AC/DC converter stations at Wolayta-Sodo in Ethiopia and Suswa in Kenya. Providing a transfer capacity of up to 2 GW in either direction, the system is expected to be completed within five years. It represents the first stage of an East Africa power integration programme also including Burundi, Tanzania, Uganda and Rwanda.

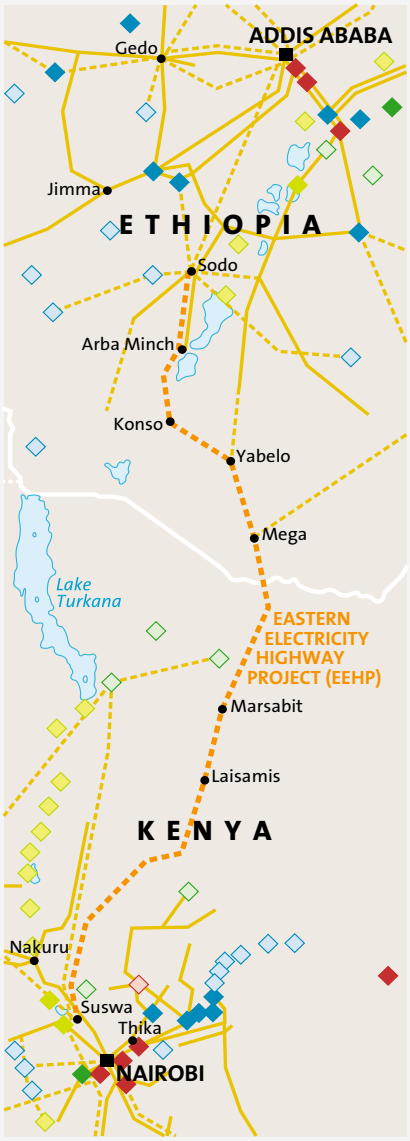
On launching the project, AfDB's regional director Gabriel Negatu said the interconnection would "ensure access to reliable and affordable energy to around 870,000 households by 2018". The two countries still have overall electrification rates of less than 25 % of the population.

One benefit for the interconnector will be to enable Ethiopia to sell electricity generated from its huge low-carbon hydropower resources – whose potential some estimates put at 45 GW – to Kenya, the region's biggest economy and largest power consumer.

But maximising its potential will require further investment on both sides of the border. Ethiopia is already ploughing vast sums into new hydroelectric power (HEP) capacity, including the Grand Ethiopian Renaissance Dam project on the Blue Nile, where it plans to build Africa's largest power plant, and the Gigel Gibe III project on the Omo River (see page 35).

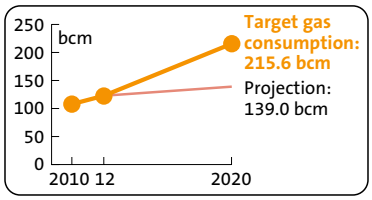
Ethiopia hopes to use the interconnector project as a springboard to realising its ambitions of becoming a regional electricity hub. It also has plans to develop connections to countries such as Djibouti, Sudan and Egypt.

Kenya, meanwhile, relies on output from polluting thermal power stations for much of its power. It has outlined plans to spend up to $50 bn over the next two decades to meet an increase in electricity demand expected to run at 14 %/yr between now and 2031, when it is forecast that Kenya will need access to almost 17 GW of electricity capacity, compared to around 1.5 GW now. Kenya is also developing its geothermal resources as part of this push (see page 43).



Feeding the grid: the Gibe III dam under construction in Ethiopia's Omo valley.

Doubling the use of natural gas



Gas consumption projection and target

Increasing the use of natural gas in Africa is an important target for the AEEP. Doubling consumption will improve energy security, living standards and in many cases help meet climate change-related goals.

Data from the BP Statistical Review of World Energy 2013 shows that good progress has been made in this regard, despite supply disruptions in North Africa and a major shutdown of the West African Gas Pipeline for much of the year. Some 122.8 bcm was consumed in 2012, compared with 107.8 bcm in 2010 and only 58.4 bcm in 2000. This rate of increase demonstrates that the ambitious AEEP target is achievable.

High oil prices have laid bare the need to diversify the energy supply. Subsidies paid by governments in an attempt to keep prices affordable have in the past become unaffordable, leading to aggravated budget deficits, fuel shortages and black market trading.

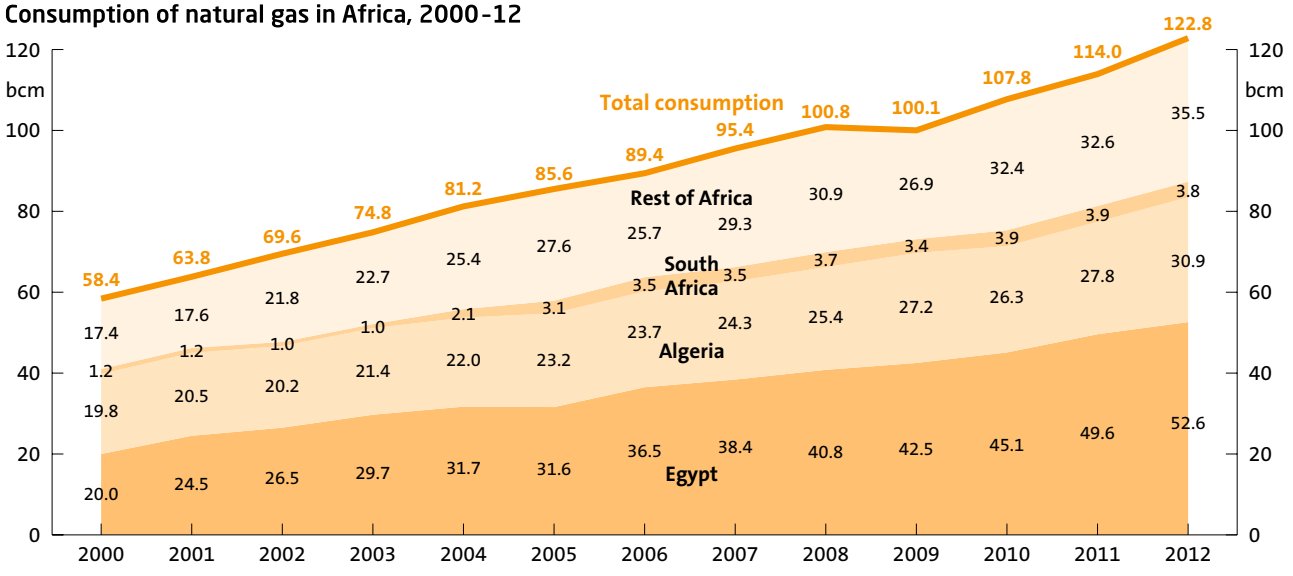
Effective regulation of the natural gas sector by producers' governments and better management of gas utilities is being targeted as a way of lowering prices. Meanwhile, new financing techniques, such as partial risk guarantees, are being used to distribute risk more effectively, decreasing costs and facilitating increased investment in natural gas infrastructure.

A flexible fuel

Natural gas can be used to produce baseload or peaking power, while new discoveries are increasing reserves and have reduced prices. According to the World Bank report Toward a Sustainable Energy Future for All: Directions for the World Bank Group's Energy Sector, released in July 2013, gas can make an important contribution when transitioning to more sustainable power sectors. "Natural gas, which has half the carbon footprint of coal at the point of combustion, can be the least-cost means of providing flexible electricity supply where demand and supply fluctuate," the report says. "This flexibility becomes increasingly important as more solar and wind power is integrated into electricity grids."

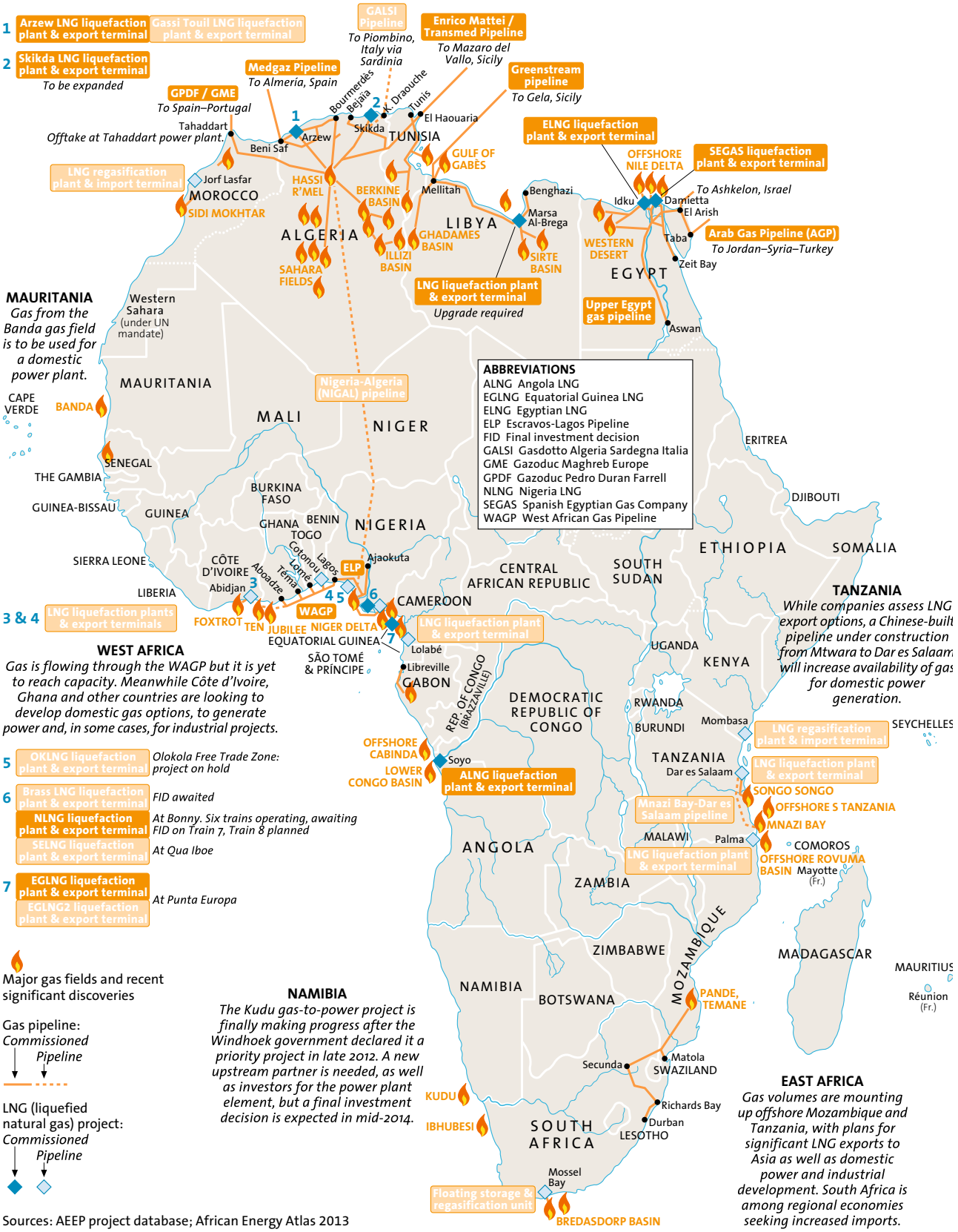
North Africa has long been an important supplier of natural gas to Europe, while Nigeria is also an established LNG supplier, followed by Equatorial Guinea and, most recently, Angola. With major new discoveries being made off the coasts of Mozambique, Tanzania and other countries, this important trading relationship is set to consolidate in coming years.

Consumption of natural gas in Africa, 2000-12



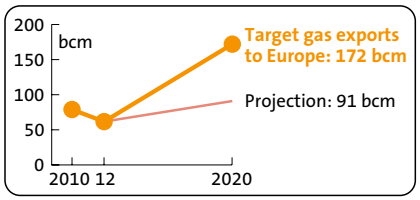
Source: BP Statistical Review of World Energy 2013

Natural gas infrastructure and trade routes



Sources: AEEP project database; African Energy Atlas 2013

Exporting gas from Africa to Europe



Gas exports to Europe: projection and target

North Africa is a long-established natural gas producer, supplying the fuel to Europe in liquefied natural gas (LNG) cargoes and via four pipelines. These trans-Mediterranean connections are shown in the map on page 24.

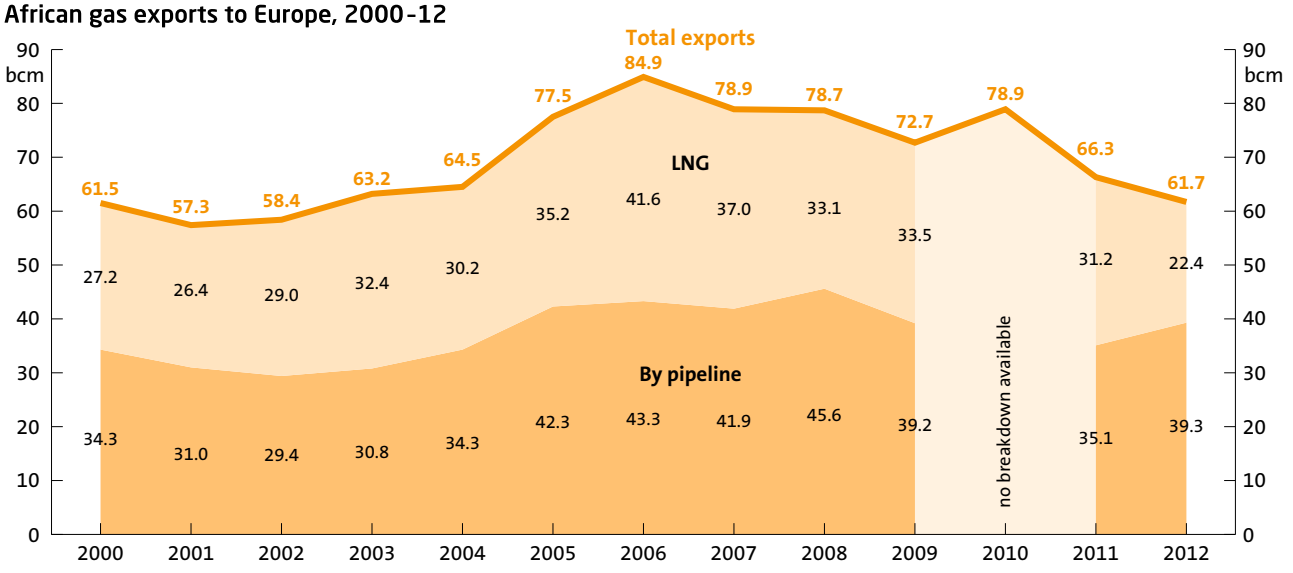
Algeria was Europe's original source of LNG (its first cargo arriving at Canvey Island in the UK in 1982). The Algerian state company Sonatrach also supplies gas by pipeline, as does Libya (through the Greenstream pipeline to Italy and smaller LNG carriers). Egypt is another source of LNG imports into Europe, with two gas liquefaction plants on the Mediterranean coast and plans for more, once competing pressures to supply gas into the domestic market are met.

Europe is no longer the only major market for African gas – a fact recognised by EU governments, who are keen to consolidate their links with African suppliers. Burgeoning oil and gas industries in the rest of Africa promise new sources of supply that are stimulating global interest. Angola shipped its first LNG cargo to Brazil in 2013.

Discoveries in East Africa show real potential. UK-based BG Group and Norway's Statoil are leading plans to build an export LNG industry in Tanzania. In Mozambique, China and Japan are looking to secure gas for their own markets, following discoveries of large reserves by companies including Italy's ENI. Japan signed a memorandum of understanding to import gas from Mozambique in October 2012, even though first LNG is not expected until around 2018.

Despite the positive longer term direction of the sector, exports from Africa to Europe have been severely damaged by recession in Europe and the 'Arab spring'. This is borne out by BP World Statistical Review figures, which show that exports fell from 78.9 bcm in 2010 to 61.7 bcm in 2012. A high of 84.9 bcm was achieved in 2006. LNG exports have taken a particular hit, falling by 28 % from 2011 to 22.4 bcm in 2012 and from a peak of 41.6 bcm in 2006.

African gas exports to Europe, 2000-12



Source: BP Statistical Review of World Energy 2013

Case Study

Boosting domestic gas use: Songas in Tanzania

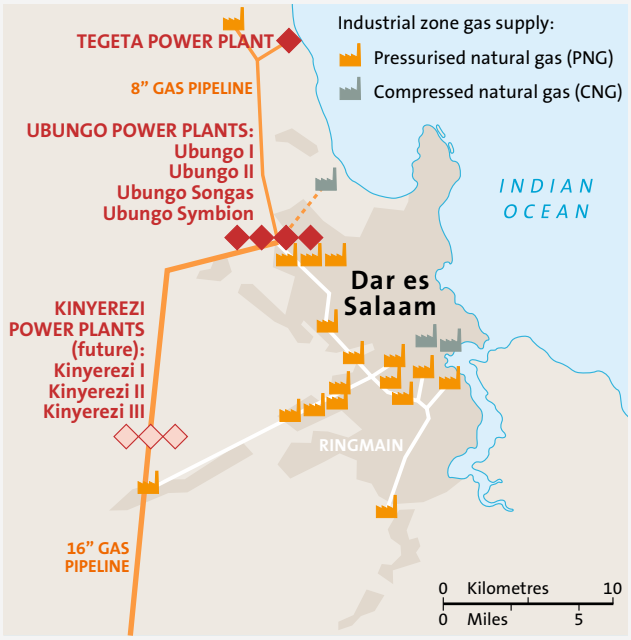
With power demand increasing by 15 %–20 % per year, Tanzania's government is under pressure to use huge natural gas reserves in the offshore Ruvuma Basin – estimated at around 150 tcf – to develop industry, create jobs and provide cheap electricity. Most international oil companies would prefer to monetise their natural gas through export. However, advocates for greater domestic use of gas point to the success of the Songas gas-to-power project as evidence that such riches can, and should, be used domestically.

Songas is operated by a private consortium controlled by Globeleq, a power company that was owned by the UK government's Commonwealth Development Corporation at the time of commissioning in 2004 and is now a commercial developer.

Songas now provides Tanzania with around 20 % if its electricity needs, significantly reducing its dependence on expensive heavy fuel imports and seasonally unreliable hydroelectric power, while at the same time providing some 30 industrial clients in Dar es Salaam with piped natural gas

Steel Masters, a steel re-rolling company in Dar es Salaam, which buys 4,000 GJ per month from Songas, said in 2013 that, during the three years it had been buying power from Songas, there had been no interruption to supply; previously, the company had relied on costly fuel oil imports.

The project is fed with natural gas from the Orca Exploration-operated Songo Songo Island gas field off the southern coast of Tanzania, where the gas is stripped of water and other hydrocarbons condensates at a processing facility, before being transported to Dar es Salaam through a 225 km pipeline. On arrival, the gas is passed through six aero-derivative turbines at the Ubungo power plant, generating 180 MW of electricity.



Songas is often cited as a model independent power project, but nevertheless had a protracted birth. Having initially pledged its support, the World Bank pulled out of Songas when the government signed a controversial agreement with Malaysian investors to build the 100 MW Independent Power Tanzania (IPTL) plant near Tegeta, Dar es Salaam, which runs on fuel imports, saying the economy could ill-afford both projects. That resulted in a four-year delay. Eventually, Trans Canada Pipelines sold its interest in Songas to US-based AES, and UK-based Globeleq took control in 2003.

Songas has a 20-year power purchase agreement with the state-owned Tanzania Electric Supply Company (Tanesco), signed in July 2004. Songas says that, because it uses domestic gas resources, it can sell electricity at the cheap rate of $0.055/kWh, saving Tanzanian industry $1.8 bn since its operations began.

During a planned inspection of the Songo Songo gas-processing facility in March 2011, Tanesco was forced to introduce daily 15-hour power cuts due to the supply deficit, providing testament to the project's importance to the economy.

Renewable Energy

Renewable energy (RE) technologies represent a sustainable, cost-competitive option that can play a critical role in diversifying the power generation mix. The promotion of solar, wind and other renewable technologies has been an essential element in the AEEP's vision since its inception, in the understanding that by freeing consumers from complex fuel supply chains, RE offers a credible option for rural electrification. The rapidly falling price of wind and solar power means they can offer competitive alternatives to fossil fuels for supplying national grids. RE options also reduce exposure to fuel price and currency risks.

Africa can tap into Europe's experience running power grids that include substantial quantities of RE, backed by an ever more complex network of cross-border renewable power trading. The AEEP is a natural vehicle helping to facilitate the transfer of this knowledge and technology, for example in developing smart grids.

The promotion of RE sources of power generation is an essential part of the AEEP, tapping the continent's vast potential to meet future energy needs in Africa and Europe. The expansion of renewables in the energy mix will reduce dependency on fossil fuels, improve energy security and provide the backbone of a future low-carbon energy system.

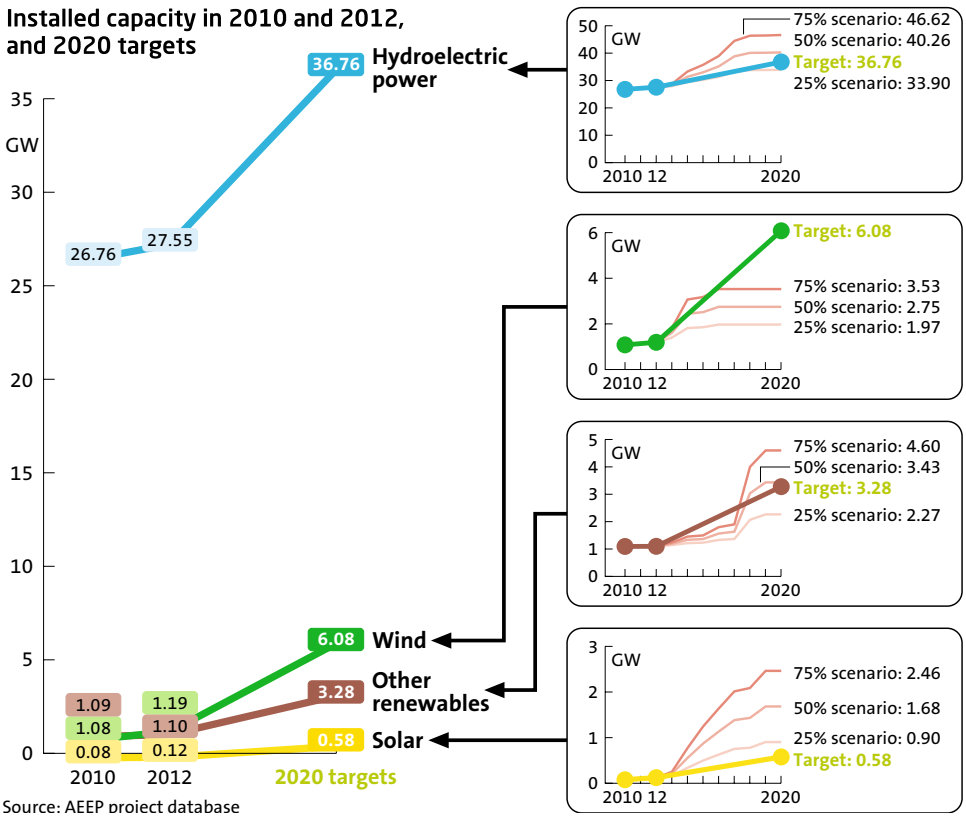
The development of RE capabilities can help Africa meet its rapidly growing need to expand access, promote social progress and drive economic growth. The EU is ideally placed to partner Africa in this, given the strong scientific and industrial base that has made it a world leader in developing RE technologies.

It was in this context that African and EU leaders launched the Africa-EU Renewable Energy Cooperation Programme (RECP) at the AEEP's First High Level Meeting, in September 2010. The RECP commits Africa and Europe to develop renewable energy markets on the continent and facilitate RE investments, complementing existing Africa-EU co-operation and supporting the growth of a new industrial sector on the continent.

New policies, innovative approaches

Hydroelectric power (HEP) has a long history in Africa, but other renewable technologies on the continent are in their infancy. In 2000, the combined capacity of all wind, solar and geothermal power plants in Africa was only 122 MW. This had grown to 1,362 MW in 2010 and 1,523 MW in 2012. At these levels of growth, most of the AEEP targets would be missed, but there are signs that real improvements may be around the corner.

Bid rounds to provide solar and wind capacity in Morocco and South Africa promise to increase renewable generation capacity by several thousand megawatts in the period to 2020 and have generated huge private sector



Source: AEEP project database

continued on p. 34

Case Study

Cape Verde's pioneering renewables push

A decade ago, Cape Verde was a small nation of islands with a major problem: an almost total reliance on expensive imported diesel to generate electricity had left its already poor population facing unreliable supply and spiralling electricity bills. Many people had to severely ration their power use or forego it altogether. Now, more than a quarter of Cape Verde's electricity comes from renewables, giving substance to the government's ambition to raise this figure to 50% by 2020, in a programme in which wind, solar and possibly wave power could all play a part.

The government tackled its energy supply problems by mobilising financing from Europe and elsewhere to prioritise generation from the sun and wind – which these Atlantic islands have in abundance. The success of this approach has turned Cape Verde's experience into a blueprint for how smaller economies can bring major projects to fruition.

The Cabeólica wind project now accounts for around one-fifth of the country's electricity over the course of a year. The project comprises four wind farms on different islands, with 30 turbines in all, providing a total capacity of 25.5 MW. While this is small-scale compared to wind farms in the big markets of North America, Europe and Asia, Cabeólica is the first significant commercial wind project in West Africa and is therefore a major breakthrough in that respect.

Political will is crucial, according to Anna Monteiro, head of Cabeólica's environment, social and administrative department: "The secret ingredients are government support and stability. The government allowed us to get the investment we needed. The electricity company [Electra] – our only client – was bankrupt, so you needed a government whose guarantees the banks would accept."

Denmark's Vestas, which started construction in 2010, had to meet the challenge of importing sizeable turbine components to this relatively remote Atlantic location and transport them across often difficult terrain. The four farms were commissioned between September 2011 and July 2012.

National utility Electra was then responsible for integrating these highly variable wind resources into the national grid. The developers estimate that the project has already saved Cape Verde 22,000 tonnes of oil imports, as well as cutting generating costs for Electra, reducing the number of power cuts and reducing greenhouse gas emissions by 68,000 tonnes CO_2e.

Also critical was the creation of a public/private partnership (PPP) to develop the wind farms as the country's first independent power project. Limited local expertise, resources and access to international financial markets in a state as small as Cape Verde – with a population of only around 450,000 – had stymied two previous attempts to develop commercial wind power on the islands. The involvement of UK-based lead developer InfraCo Africa from 2006, and a decision by the government to increase the size of the project to introduce greater economies of scale, changed the financing climate.

InfraCo Africa – funded by the Private Infrastructure Development Group (PIDG) of development agencies – was able to bring together the Cabeólica consortium in 2009, which consists of InfraCo Africa, the Africa Finance Corporation, FinnFund, Electra and the Cape Verde government. Their standing, together with innovative financial structuring and detailed stakeholder consultations, enabled Cabeólica to raise $78 m of debt and equity finance to kick-start the project in 2010 from the European Investment Bank, African Development Bank and the consortium members.

The skills gained by local workers involved in developing the project and integrating it into the power grid – all of Cabeólica's staff comes from Cape Verde – has given the country an edge in advancing a sector that could flourish in Africa.

The next major challenge is to better harness the massive potential of solar power on the islands, where the sun shines intensely virtually all year round. Cape Verde already boasts one of sub-Saharan Africa's largest photovoltaic (PV) solar farms near the capital Praia, on the island of Santiago, which covers 13 hectares and has a capacity of 5 MW. Another PV farm on the island of Sal has a capacity of 2.5 MW. Both facilities were built by Portugal's Martifer at a total budget of €19 m. Financing used resources from a €100 m credit line supplied by the Portuguese government.

interest. A number of governments are implementing feed-in tariffs for RE power projects and donors, led by the EU and its member governments, are offering a wide range of financing options for projects that are expected to lead to a large increase in renewable generation. Innovative projects such as large geothermal complexes in Kenya show that Africa can be at the forefront of RE technology.

Targets for renewable energy

The AEEP is targeting a 10,000 MW increase in HEP, 5,000 MW of additional wind, 500 MW of solar and a tripling of other renewables. The AEEP Power Project Database is being used by to track progress towards these targets, allowing for monitoring in real time and enabling changes to be traced back to particular power plants being brought on line. Developments such as financing or regulatory changes can also be traced to their effect on aggregated statistics.

The AEEP database aims to include every facility larger than 50 kW operating in Africa – whether the plant serves the grid, a mini-grid or a private company. The database shows that around 1,468 power plants were operating in Africa in 2012, of which 580 were renewable. Renewables accounted for 19.7 % of total generation in 2012, very similar to the 19.9 % recorded by Eurostat in the EU-27. This overwhelmingly comprises HEP and pumped storage, accounting for 85.1 % and 6.9 % of RE capacity respectively.

The AEEP database includes information on the total installed capacity of projects operating in Africa, verified where possible. The AEEP results compare favourably with SE4 All data for generation capacity, which have been compiled on a different basis; the two are within 1 % agreement in terms of total installed capacity in 2010.

The data used at this stage of the AEEP's work is for installed capacity. The project pipeline contains projects for which a credible development schedule has been announced and for which preparation for procurement is under way. Operating capacity would give an even better picture of the actual situation, but would require the application of much greater resources: existing information on operating capacity is insufficiently available for use in aggregate statistics.

It is not expected that all projects included in the project pipeline will be completed, or that they will all be completed on time. Rather, the pipeline gives an indication of the number and size of projects being considered from which estimates of future generation over the short and medium term can be produced using a range of different scenarios. The size of the project pipeline can also reveal whether the expected level of implementation is sufficient to reach intended goals, in the process helping to inform policy-making.

Ecowas members harmonise policy

Providing adequate energy services is a challenge across the 15-member Economic Community of West African States (Ecowas). The region's abundant renewable energy (RE) potential could be harnessed to confront the challenges posed by growing populations and volatile global fuel prices.

Supported by the Africa-EU Renewable Energy Cooperation Programme (RECP), the Ecowas Centre for Renewable Energy and Energy Efficiency (ECREEE), a Cape Verde-based institution supported by a number of EU partners – including Austria, Spain, Germany, alongside the United Nations Industrial Development Organization (UNIDO) – has developed the Ecowas Regional Renewable Energy Programme (EREP).

EREP serves the region as a policy platform, adopted by Ecowas energy ministers at their High-Level Forum in Accra, Ghana, in October 2012, and signed and endorsed by Ecowas heads of state in Abuja, Nigeria, in July 2013. It is now being followed-up at national level with support by ECREEE to its member states, as well as several iniatives of EU donors.

EREP is designed to combat growing energy deficits, extreme disparities in the supply of urban and rural energy services, climate change pressures and the region's unsustainable reliance on wood fuel. It falls under the auspices of RECP's second component, to support the development of conducive renewable energy policies.

EREP facilitates the standardisation of RE technologies, promotes a regional market for investment and complements existing and planned national policies.

EREP incorporates a range of targets. For grid-connected RE, EREP options aim to cover 10 % of demand at peak time by 2020 and 19 % by 2030. From off-grid and stand-alone renewables systems, EREP aims to provide energy to 22 % of rural populations by 2020, increasing to 25 % by 2030.

Targets for domestic RE applications include improving efficient charcoal production shares to 60 % in 2020 and 100 % in 2030; ensuring that new detached houses (costing €75,000-plus) have at least one solar water heating system installed; and increasing biofuel and biodiesel consumption to 5 % in 2020 and 15 % and 10 %, respectively, in 2030.

Case Study

South Africa's renewables plan creates development model

South African policy-makers are seeking to promote wind, solar and other renewable energy (RE) technologies, as alternatives to low-cost coal-fired generation that remains central to state power company Eskom's output. Investment in RE is intended to provide clean, sustainable energy at competitive prices. It is backed by private finance, and will create jobs and develop know-how.

The programme's size is driving an upturn in renewables projects that can help Africa and Europe meet the AEEP 2020 targets.

The 2010 Integrated Resource Plan (IRP) outlined a strategy to install 18,955 MW of new capacity, of which 9,100 MW would come from wind power, 8,400 MW from solar photovoltaic (PV), 1,200 MW from concentrated solar power, 125 MW landfill gas and small hydro, and 130 MW of biomass and biogas. The National Treasury's Public Private Partnership (PPP) Unit has played a leading role in helping projects towards the tendering phase – with spectacular results.

The PPP Unit has overseen the Renewable Energy Independent Power Producers Procurement Programme (REIPPP), a highly structured bid round process in which projects are selected by independent transaction advisors on the basis of the price of electricity (70 %) and socioeconomic criteria including local content, job creation, community benefits and technical viability (30 %). The process includes elements of a feed-in tariff (FiT), with ceiling tariffs used to control costs.

REIPPP's initial rounds have enjoyed remarkable success in attracting private investment and meeting socioeconomic objectives. A high proportion of successful bids have come from European companies, bidding with local partners.

The government initially envisaged a conventional FiT system, but the dramatic fall in the cost of PV panels and wind turbines in 2010–11 led to a 'hybrid' process that has appealed to investors. After allocating 3,725 MW to the REIPPP's first three rounds (2011–16), 3,200 MW was added in December 2012, to meet exceptional demand from developers.

Some 28 projects were selected (from 53 bids) in round one with a combined capacity of around 1,400 MW, representing a fixed investment of around $5.6 bn. Investor appetite grew in REIPPP2, with 19 bids worth $3.4 bn accepted (from 79 bids) with a combined capacity of about 1,000 MW. Prices came down substantially in REIPPP2 and the cost of renewable energy is becoming more competitive.

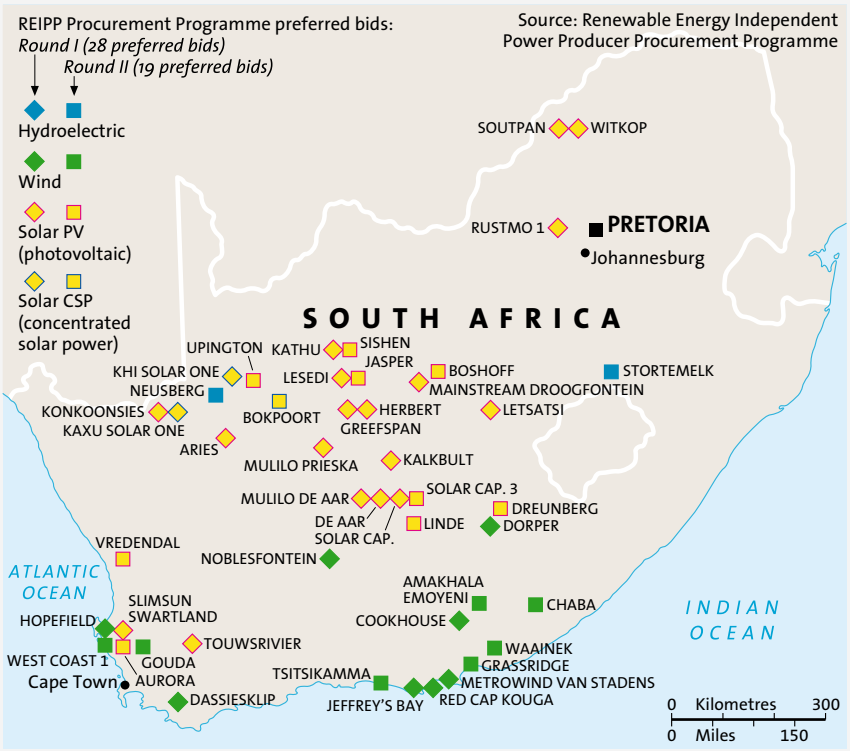
International backing and investment is already playing a key role. REIPPP procurement is being part-funded by donors, as well as tariff rises and considerable commercial financing. The European Investment Bank has invested in several projects and European firms, such as Spanish firms Abengoa (concentrated solar power) and Gestamp Wind, are already developing projects.

Major international companies have submitted bids in a third round with financial backing from leading South African institutions and a ground-breaking $100 m renewable energy bond.

Underlining the wider socioeconomic impact of well-planned RE programmes, the South African government has integrated local content policy requirements into the REIPPP. Levels of local content have increased round on round, with manufacturing facilities being set up around South Africa. The local content average increased from 28.5 % for solar PV in REIPP1 to 47.5 % in REIPP2 and from 21.7 % to 36.7 % for wind.

Developers have adapted their practices to encourage the use and production of locally manufactured key components. Christian Lie Hansen, project development manager at Scatec Solar, says that the 70/30 price to economic development ratio for REIPPP bidding represents a "good balance", which provides a real opportunity to promote local economic and social outcomes.

Basil Read Energy director Ian Curry concludes that REIPPP is "revolutionary in terms of what it has done for the renewable industry globally. It's really shown that renewables are a rival energy source that can compete and can get to close to grid parity very quickly."



Europe's role in developing renewables

Many suppliers are making significant contributions to developing renewable energy (RE) in Africa, providing finance, equipment and technical expertise, but most substantial is the contribution of European institutions. Europe and Africa have developed a mutually beneficial partnership to develop RE solutions, from large-scale wind and solar to innovative offgrid projects, that can improve access to secure, reliable, affordable and sustainable energy. The AEEP is a crucial element of this partnership.

As noted below, the European Investment Bank (EIB) is a major player, financing vitally important RE projects across the continent. In 2013 alone, the EIB – often cofinancing alongside African partners such as the African Development Bank (AfDB) – funded €50 m of the 120 MW Itezhi-Tezhi hydroelectric plant and transmission line in Zambia; it provided €75 m to Sierra Leone for the inter-connection between Côte d'Ivoire, Liberia, Sierra Leone and Guinea. The Luxembourg-based bank also committed €250 m for the 200 MW second phase of Morocco's Ouarzazate concentrated solar power (CSP) plant.

The EIB has pledged to commit €3.65 bn in loans to Africa, Caribbean and Pacific (ACP) states between 2014 and 2020. African RE is set to be a major beneficiary. South Africa's opening to RE (see page 35) has provided a focus for support, with the EIB approving a €210 m loan for Abengoa's 2 KaXu Solar One CSP project, expected to begin operating in June 2014. In 2012, the EIB agreed to a €50 m facility to fund Abengoa's Khi Solar One power plant. The EIB is considering financing three wind farms in Morocco, with a total project cost of €704 m, and is widely expected to back the Grand Inga hydropower development in Democratic Republic of Congo.

The European Commission (EC) is deeply engaged in financing RE projects. Recent facilities include a €25 m grant for a 30 MW photovoltaic plant at Zagtouli in Burkina Faso (see page 45). The EC and EIB have been considering further support for Zagtouli; together with €19 m from Agence Française de Développement (AFD), this would cover the project's entire cost.

National development banks provide essential support. Germany's KfW, building on the bank's success in supporting domestic RE projects, is providing €100 m for the Essaouira and Tangier wind farms in Morocco – where in November 2013 it committed a €654 m loan package for the construction of two solar units at Ouarzazate.

European expertise has been exported to boost technical capacity – for example, for geothermal development in Kenya (see page 49). This has, encouraged Ethiopia, Tanzania, Uganda and other countries to exploit the East African Rift System's enormous geothermal potential. The process is very expensive and fraught with challenges without a history of geothermal exploration, technical capacity and funding. Europe has sought to counter this by boosting technical capacity, while also providing financial instruments that derisk projects and ensure they get off the ground. The Geothermal Risk Mitigation Facility is an initiative of the African Union Commission, German Federal Ministry for Economic Co-operation and Development, EC and EU-Africa Infrastructure Trust Fund, via KfW, that seeks to reduce private developers' risks.

Iceland has also helped to boost technical capacity. The Reykjavik-based United Nations University Geothermal Training Programme has seen a rapid increase in East African students.

Encouraging partnership: the RECP

An expression of the AEEP's ambitions, the Africa-EU Renewable Energy Cooperation Programme (RECP) has established a reputation for fostering technical expertise and encouraging business cooperation. Set up in 2010, RECP complements international development finance institutions, SE4 All and other initiatives, working to a strategy for 2014–20, agreed on by African and European partners. This strategy comprises four priority areas, firstly seeking to facilitate an enabling environment for RE developments by supporting improved regulatory frameworks and strengthening institutions through its policy advisory services.

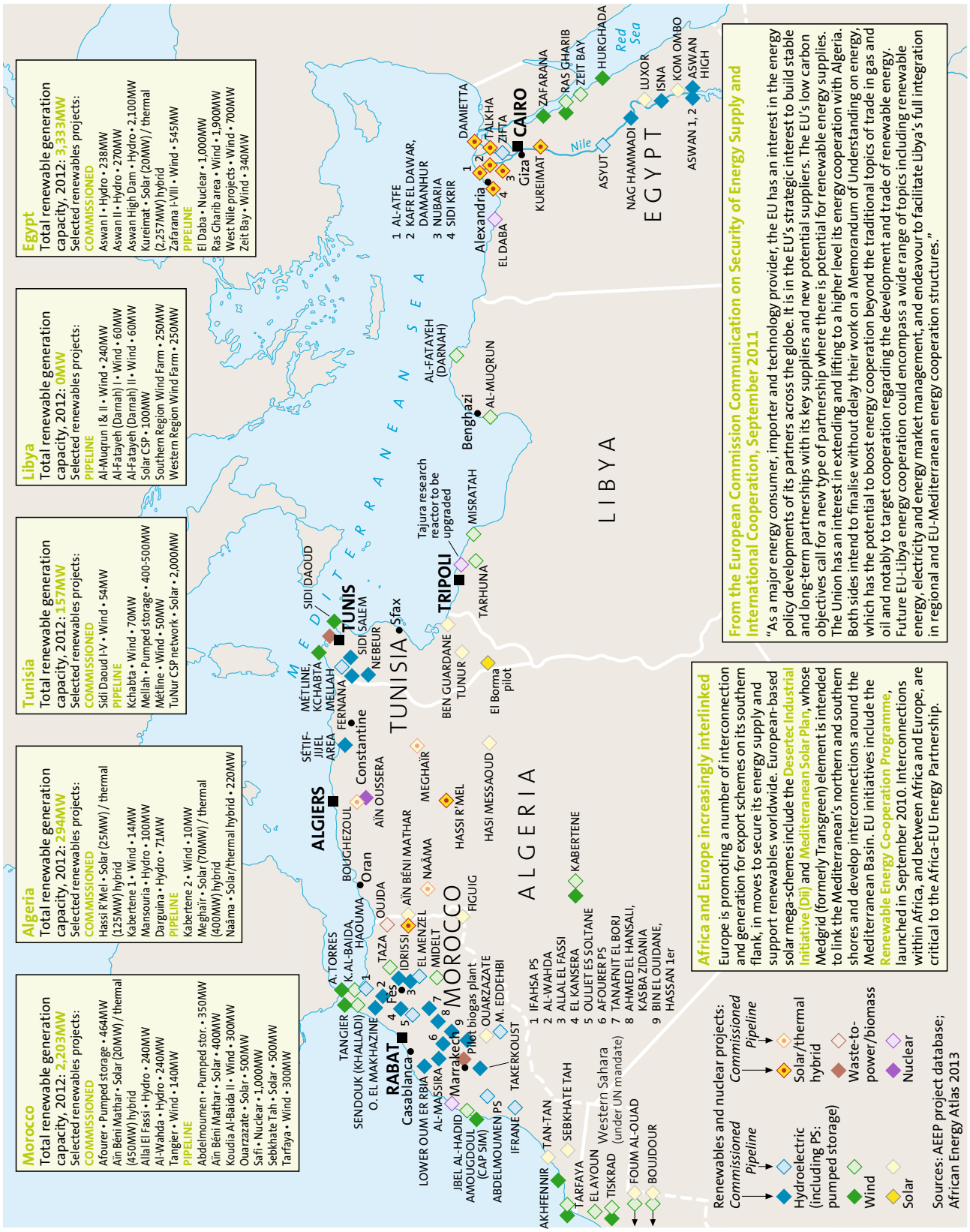
RECP also sets up private sector networking and business meetings. It aims at lowering initial development costs and bringing projects to bankability by providing technical assistance with financing. And, benefitting from its European members' experience, RECP has set up workshops and training programmes to boost local technical capacity and knowledge, until now a blockage to project development.

RECP's country studies (with more to come) include an electricity strategy for Djibouti and renewables law for Gambia; advising on regulation in Kenya, on implementing Senegal's new electricity law and supporting Rwanda's emerging geothermal industry. The programme has helped the Economic Community of West Africa States to develop its Regional Renewable Energy Policy (see page 32), is working with the Southern African Development Community (SADC) to set up a regional RE centre, and with the Regional Electricity Regulators Association of Southern Africa and SADC to develop mini-grid and hybrid generation policy, initially for Zimbabwe and Namibia.

The RECP has also held RE development workshops, in Nairobi, Ouagadougou and Maputo, and will continue with a conference on RE and rural electrification and other events.

continued on p. 38

North African renewables projects



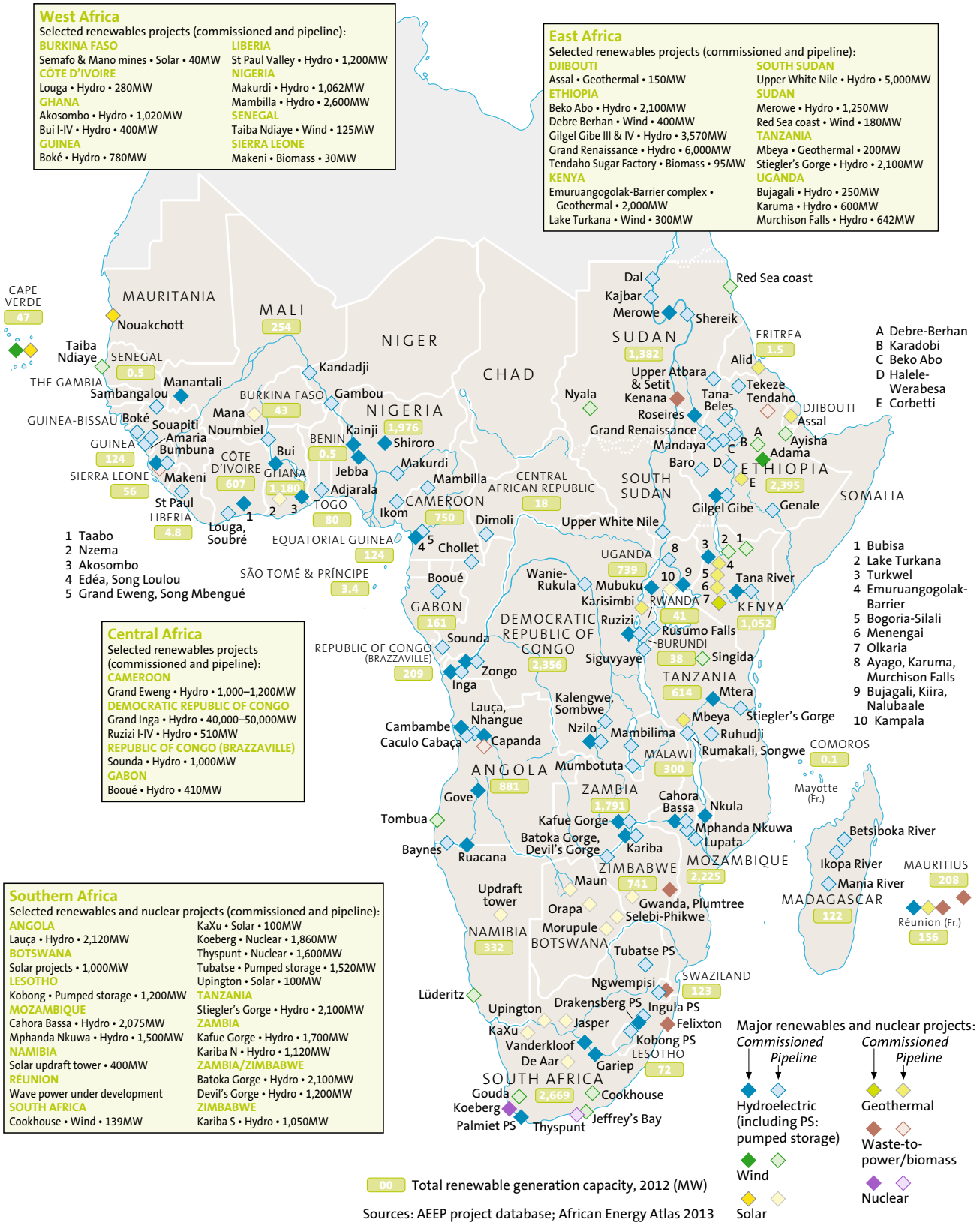
Wind turbine towers for Moroccan projects under manufacture in Casablanca

In October 2013, the Ethiopian government signed a 1 GW deal with Iceland's Reykjavik Geothermal to develop a project in the Corbetti Caldera area. The previous month, Icelandic International Development Agency, in conjunction with the Nordic Development Fund, signed a partnership agreement with the Ethiopian government for geothermal surface exploration and capacity-building.

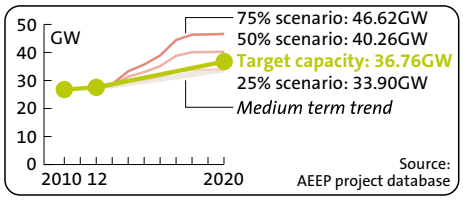
As European finance institutions seek to support African RE projects, European construction and engineering firms are benefitting as well. Spain's Isolux Corsán has an engineering, procurement and construction contract worth €145 m for the 428 km 400 kV Loiyangalani-Suswa transmission line, which will connect the 300 MW Lake Turkana Wind Power project in Kenya to the grid. Germany's Lahmeyer and Portuguese consultancy Coba have both recently won lucrative contracts to assist Angolan utility Empresa Nacional de Electricidade to design, provide technical assistance in contract negotiation, equipment design and tendering for the 2,070 MW Luca hydro plant on the Kwanza River. Among French companies active in the sector, GDF Suez is building the 300 MW Tarfaya wind farm in partnership with local developer Nareva Holdings in Morocco. Theolia is building the first phase of the 100 MW expansion at the ground-breaking Koudia Al-Baïda wind farm, on Morocco's Mediterranean coast.

European firms have been prominent in South Africa's REIPPP bid round. Denmark's Vestas and Germany's SMA Solar Technology have large contracts. Germany's SMA Solar Technology is supplying inverters for the 40 MW Linde and 75 MW Dreunberg solar PV power plants being developed by Norway's Scatec Solar. Given the scale of South Africa's programme, there will be many more contracts – linked into local content deals that develop indigenous industries and involve ever more stakeholder groups – to come.

Sub-Saharan renewables projects



Hydroelectric power



Hydroelectric power projections and target

Water-powered turbines were one of the first technologies used to generate electricity in Africa; they remain by far the most important renewable technology on the continent and there is huge potential left to exploit from a number of hydrological basins – the so-called 'water towers' (see map on page 42. One of the cheapest sources of power available and capable of sustaining a baseload under the right conditions, hydroelectric power (HEP) has considerable allure for policy-makers.

Environmental and social concerns, as well as volatility caused by drought, seasons and climate change, have led to valid questions about the wisdom of relying too heavily on hydroelectricity. But as a new generation of HEP schemes emerge, more stringent environmental and social safeguards are integral to the project development process.

Many of the new generation HEP schemes will be in Africa, building on the long history of hydroelectric power plants on the continent, as shown below. This graph only includes plants that are still operating, revealing the age of many such facilities. Commissioning dates were only available for 52 % of hydroelectric power plants, but these account for 96.7 % of generation capacity, suggesting that the figure is strongly illustrative of the historical trend.

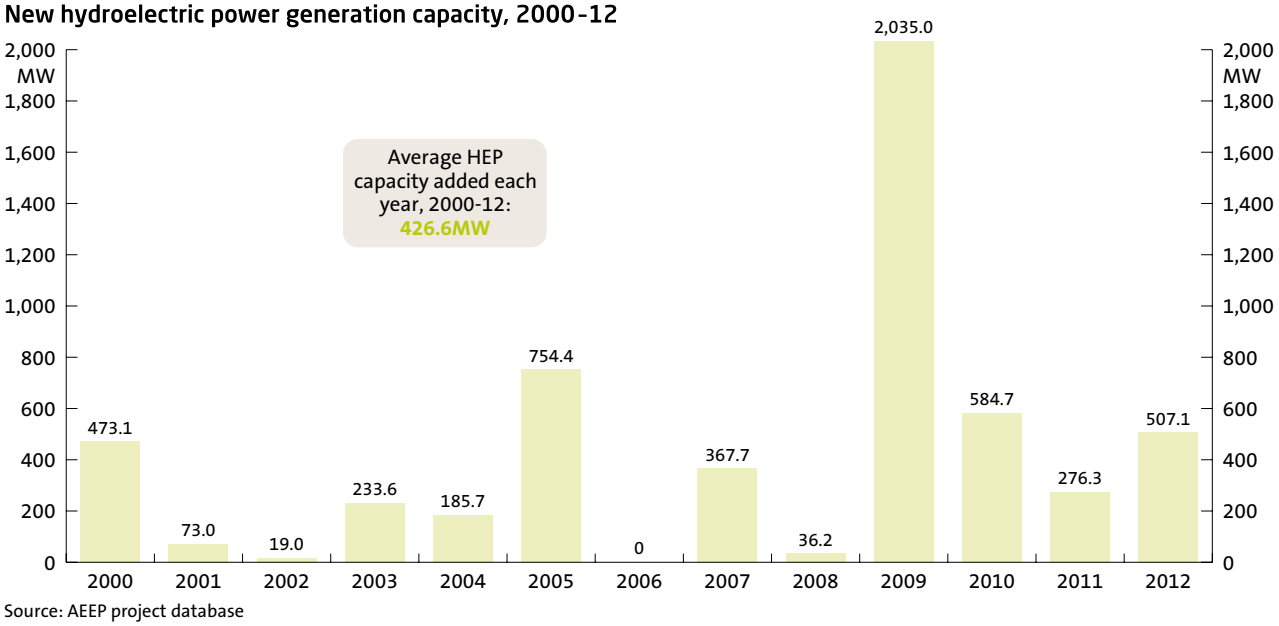
International development institutions, including the European Investment Bank (EIB) and World Bank, have publicly stated their intention to resume financing for large HEP projects – as the cheapest and most effective way of increasing generation capacity while keeping a lid on carbon emissions. Large projects such as Grand Inga in Democratic Republic of Congo and Mphanda Nkuwa in Mozambique are being put forward as possible solutions to the supply deficit gripping much of Africa.

Sector performance

The AEEP Power Project Database shows that progress in increasing HEP capacity has been limited since 2010: only 783.4 MW of capacity was added between end-2010 and end-2012. Some 27,536 MW of hydroelectric capacity was installed in total in 2012.

However, there is a lot more HEP planned, with a substantial project pipeline totalling 26,730 MW. This suggests that the AEEP target of installing 10,000 MW of additional HEP capacity can be met, provided half of the projects the AEEP Power Project Database has registered as scheduled to commission by 2020 are completed on time. Six HEP projects larger than 1,000 MW are expected to begin operating by 2020: three in Ethiopia, two in Angola and one in Mozambique. These account for 56 %

New hydroelectric power generation capacity, 2000-12



Source: AEEP project database

continued on p. 42

Case Study

Ethiopia: Major hydropower projects could light the region

Major hydroelectric power projects constitute a critical element of Ethiopia's ambitious plans to become a regional electricity supplier and keep up with growing domestic demand. In the process Ethiopia is positioning itself as a major supplier of electricity to its neighbours, who are putting in place infrastructure to make this happen (see page 27).

At present, electricity access rates are low, oscillating between 15 % and 20 %, according to the source. Meanwhile demand has boomed in recent years, averaging 15 % in 2005 – 10, 25 % in 2011 and reaching 32 % in 2012.

As a result, Ethiopia's five-year Growth and Transformation Programme (GTP) 2010 – 15 seeks to boost power generation capacity from 2 gigawatts (GW) to 10 GW, doubling the number of consumers to 4 m, and connecting 75 % of remote villages to the national grid.

Some sources suggest that Ethiopia's hydropower potential is as much as 46 GW, some of which is already harnessed by existing projects. The 420 MW Gilgel Gibe II dam, part-financed by €50 m from the European Investment Bank and €180 m from the Italian government, was commissioned in 2009, while the 184 MW Gilgel Gibe I, also on the Omo River, has been operational since 2004. The 300 MW Teheze 1 project came on line in 2009, and the Beles dam was commissioned the following year, adding 460 MW of generating capacity to the national grid

Two massive projects are now under construction: the $1.7 bn 1.87 GW, Gilgel Gibe III is the third in what is intended to be a four-dam series, designed to bring a total of 4.174 GW on line. Even bigger is the 6 GW $4.7 bn Grand Renaissance dam. The government is planning 15 further projects.

With this infrastructure being put in place, the World Bank forecasts Ethiopian electricity sales to rise from 4,000 GWh in 2011 to 8,300 GWh in 2015 and 17,211 GWh in 2020, with more than 60 % of that figure sold to Djibouti, Sudan and Kenya.

Major hydroelectric projects anywhere can be controversial. Initial environmental and social assessments for Gilgel Gibe III were criticised for being 'inadequate'.

The Grand Renaissance project, costing the Ethiopian government $800 m/yr – around one-tenth of the annual state budget – has triggered a widely publicised controversy with downstream countries, who fear it will disrupt the Nile's flow.

The government's preference for direct negotiations with contractors, rather than competitive bidding processes, has put off support from many major donors – raising the percentage of Ethiopian state financing for recent big dam projects above the regional norm. But the work continues, with the government in Addis Ababa taking steps to raise its own finance, including launching a series of 'diaspora bonds' to attract funds from patriotic investors, and introducing a civil servants' donations campaign. An initial bond, released in 2009, was under-subscribed, and in 2011, the government issued a second bond to raise finance for Grand Renaissance.

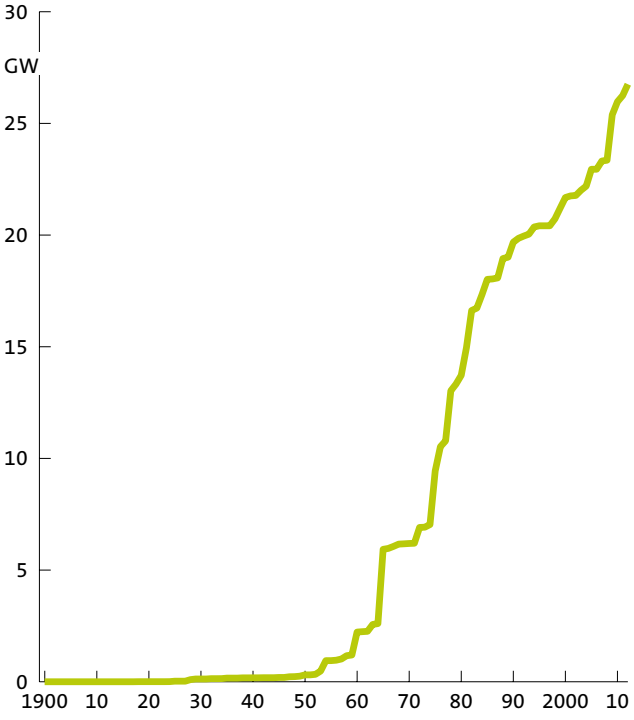
It is a model its supporters believe could be replicated elsewhere, as African projects look, increasingly, to African human and financial resources for their implementation, from within the continent and the diaspora.

Gibe III dam

of the project pipeline, which makes them central to efforts to meet the target of 10,000 MW additional HEP capacity.

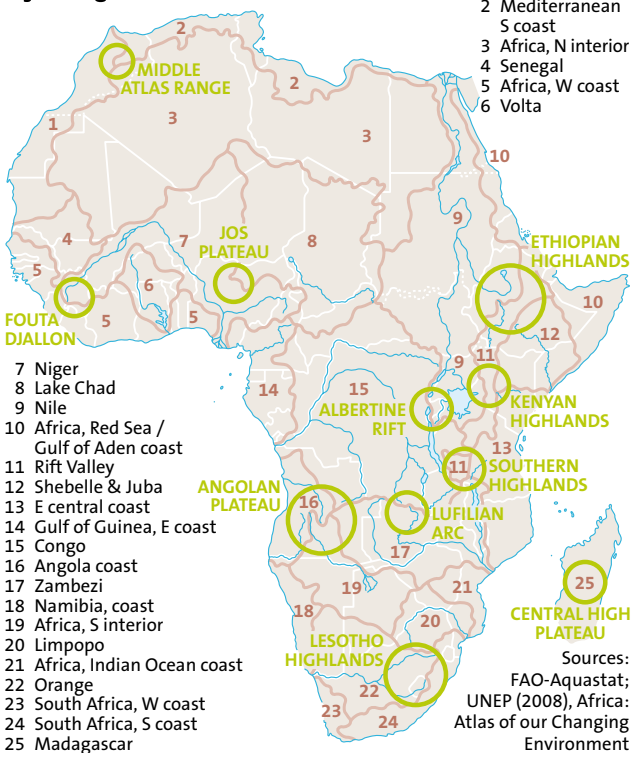
In terms of historical trend, the projections are less positive. A continuation of the 2000–12 trend would result in a total capacity of only 31,753 MW in 2020, an increase of just 4,991 MW. The 2007–12 trend is somewhat better but would still result in the AEEP target being missed, with total hydropower capacity in 2020 reaching 33,900 MW, an increase of 7,138 MW since 2010. The 2010–12 trend yields a nearly identical projection to the 2000–12 trend. The acceleration in hydropower project implementation, as recorded in the AEEP Power Project Database is thus essential for targets to be met.

Hydroelectric power installed capacity, 1900–2012



Source: AEEP project database

Hydrological basins and water towers



1 Africa, NW coast
2 Mediterranean S coast
3 Africa, N interior
4 Senegal
5 Africa, W coast
6 Volta
7 Niger
8 Lake Chad
9 Nile
10 Africa, Red Sea / Gulf of Aden coast
11 Rift Valley
12 Shebelle & Juba
13 E central coast
14 Gulf of Guinea, E coast
15 Congo
16 Angola coast
17 Zambezi
18 Namibia, coast
19 Africa, S interior
20 Limpopo
21 Africa, Indian Ocean coast
22 Orange
23 South Africa, W coast
24 South Africa, S coast
25 Madagascar

Sources: FAO-Aquastat; UNEP (2008), Africa: Atlas of our Changing Environment

Case Study

Encouraging private micro-hydro investment in Rwanda

An innovative approach to developing micro-hydro plants in Rwanda shows that careful targeting of longer-term donor assistance can create successful public-private partnerships that lay the foundation for future private sector projects.

The Energising Development Partnership (EnDev), implemented by Germany's GIZ – with funding from the Netherlands, Germany, Norway, Irelend, the UK, Switzerland and AusAID – provided support and technical assistance to a programme run by Rwanda's Ministry of Infrastructure (Mininfra), which has resulted in the development of three private hydropower plants of 95 kW, 440 kW and 500 kW. These private developers are now working on larger second plants and three more plants under development by other firms.

"The impact of the project has been quite considerable, as it has shown that a private sector-led approach can work," says Robert van der Plas, managing director of MARGE, a European consultancy, who advised GIZ on the project.

The scheme was drawn up with the idea of making a 50/50 split between financing raised by project developers and public-sector subsidies. The government had envisaged using finance from Development Bank of Rwanda, which is mainly funded by state bodies and donors, but when doubts over its capacity to provide the finance needed arose, developers were encouraged to seek more finance from their own banks.

That decision yielded positive results, speeding up the funding process. Cost-escalations during development meant the projects needed more funding than originally envisaged, but the developers were able to find that extra money from the private sector. In the end, the developers and their private backers provided, on average, around 65 % of the financing for their projects; public subsidies made up the other 35 %. The average costs of micro-hydro power in Rwanda is roughly €3,000 – 3,500/kW.

The private sector-oriented ethos that these projects have engendered is likely to be their most important legacy. Previously, the government had assumed all of the financial risk for small-scale hydro projects, providing little incentive for developers to plan carefully. When Mininfra made its first call for proposals, none of the original six applicants – later reduced to three – had a business plan. The need to develop a viable plan meant the companies had to go out and get to know their clients, find out who would be buying and make proper market appraisals in a way not commonly done in the sector.

Support provided by GIZ was vital to creating what is intended to be a self-sustaining model. The German agency advised and collaborated across the development process, working on procedures for environmental impact assessments, independent power contracts, power purchase agreements, a renewable energy feed-in tariff (Refit) mechanism, improved electricity law, capacity-building, dealing with banks and other key areas.

Now, having benefitted from assistance in the development of their projects during a gestation period of around two to four years, the firms are now able to operate their plants independently, supplying power to the national grid. Long-term power purchase agreements with Rwanda's Energy, Water and Sanitation Authority (EWSA) have provided reassurance for their private lenders. Meanwhile, a new regulatory framework for the sector means no more plants will be built by the public sector and all existing micro-hydro plants will be privately run and connected to the fast-expanding national grid.

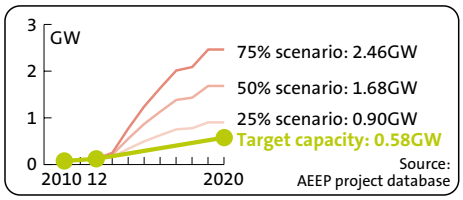
To facilitate and promote the construction of new hydro plants, the government also recently introduced a favourable Refit that awards higher tariffs to smaller plants compared to larger ones.

The path from proposal submission through preparation to project implementation inevitably threw up some difficult issues, as developers sought approvals and licences, applied to banks for capital and sought the right contractors and workers. However, Van der Plas says such problems were resolved by the participants in the process. Issues relating to fraud, theft, in-fighting and lack of competence – all factors that affect public as well as private sector projects – were overcome in-house.

While greater coordination with EWSA and clearer regulations could have increased the pace at which the projects were put into operation, the outcome has been an improvement in capacity which should allow for replication. The switch from reliance on government funding to more flexible private financing should remove the bottleneck caused by budgetary constraints: the path for private sector-led developments is now well established.

Visit of the Rwandan prime minister to the Mazimeru hydropower plant

Solar power



Solar power projections and target

Limited largely to small-scale photovoltaic (PV) installations until 2010, the solar industry in Africa is now worth billions of dollars, and is projected to continue growing over the next two decades. In 2010, total solar capacity in Africa was around 77 MW. By 2012 this had increased by 60 % to reach 123 MW. A growing number of solar projects in Morocco and South Africa promise to significantly expand capacity (see case studies on pages 32 and 37). Large, privately-owned and often privately-funded PV and concentrated solar power (CSP) plants are being built in Morocco and South Africa alone will exceed the AEEP target of adding 500 MW solar power by 2020 by a large margin.

The market in commercial and household rooftop solar PV systems is also showing signs of takeoff, particularly in South Africa, where at least 2 MW commercial rooftop systems was in place by end-July 2013 and numerous commercial partnerships have been signed by companies looking to tap new opportunities in the country (see case study on page 43).

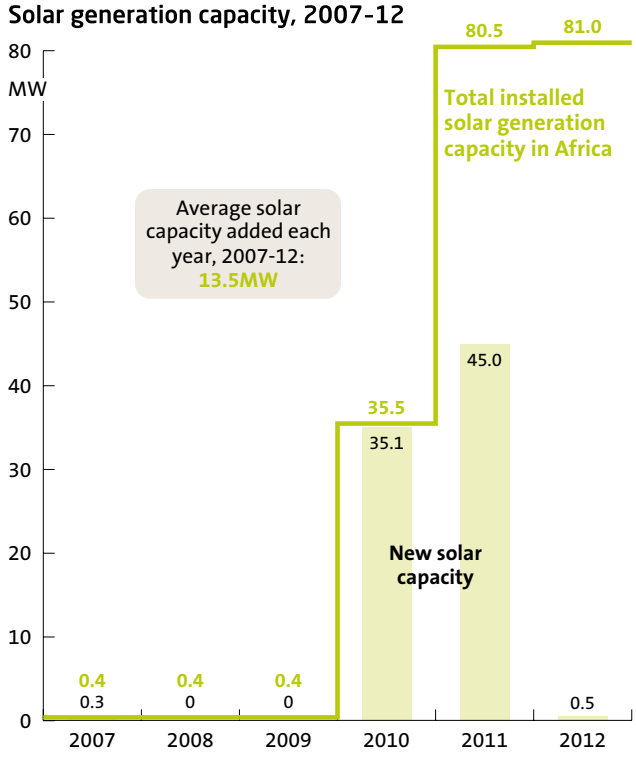
Offgrid electrification

Solar power is among the most flexible technologies available and, with prices falling rapidly over the past five years, it is being seen as suitable for a wide variety of applications. A number of remote mining operations have installed solar plants and more are in the pipeline. Solar-diesel hybrid solutions are being offered to energy-intensive consumers by several European firms in Africa.

Countries without well developed infrastructure for delivering fuels and lacking a large joined up national grid are also considering solar: for example a 15 MW solar plant was installed in Nouakchott in April 2013.

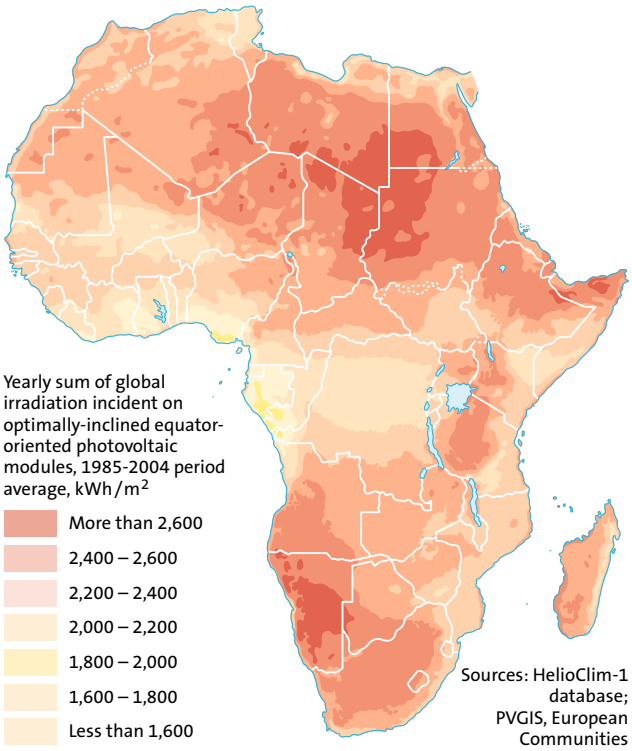
Solar is widely used for rural electrification. Solar PV systems are used to provide electricity to rural health centres, schools and government buildings while larger plants may be suitable for powering mini-grids, to reduce reliance on diesel generators. There have been issues with poor design and inappropriate use of some

Solar generation capacity, 2007-12



Source: AEEP project database

Photovoltaic solar electricity potential



Case Study

Photovoltaic boost for Burkina Faso

A 33 MW capacity solar farm – West Africa's largest photovoltaic array – to be built in Burkina Faso will help this arid, landlocked country to diversify its energy needs in an environmentally friendly manner, away from the biomass and imported fossil fuels on which it is heavily dependent.

Consisting of 96,000 solar panels, the plant at Zagtouli, on the edge of the capital Ouagadougou, will generate 32 GWh a year, boosting domestic electricity production by 6 %.

That is enough power to meet the needs of around 400,000 people in a country where only 15 % of the population currently has access to electricity – a limitation that is stifling economic development.

International backing is vital in a country with limited financial resources of its own. The plant's cost, expected to be around 41 bn CFA francs (€63 m), is being supported by the European Union, which is providing €25 m, while the European Investment Bank (EIB) and Agence Française de Développement (AFD) are providing loans totalling €38 m between them.

Following a funding agreement with EU, signed in April 2013, construction is expected to start in 2014. Burkina Faso's Ministry of Economy and Finance, its state power utility Société Nationale d'Electricité du Burkina (Sonabel) and French electricity firm EDF are coordinating preparatory work on the project.

Morocco's 2,000 MW ambitions

Morocco has made the development of renewable energies a cornerstone of its policy to install clean, sustainable generation capacity that also bolsters its energy security, helping to overcome its dependency on costly and polluting oil and gas imports. This is a long-term policy measured by a series of milestones, including the ambition of installing 2,000 MW of solar generation capacity by 2020. Considerable progress has been made with the launch of a 500 MW complex in the Ouarzazate region, whose several phases will use concentrated solar power (CSP) and photovoltaic (PV) technology. Ouarzazate's production will feed into national utility ONEE's grid, but the complex could eventually also provide electricity for export to Europe.

The project's 160 MW first phase, the Noor 1 CSP facility, is being developed by Saudi Arabia's Acwa Power and Spanish specialists Aries Ingeniería y Sistemas and TSK Electrónica y Electricidad. Noor 1 will incorporate three hours of thermal storage and will be the world's largest parabolic trough CSP power plant, according to Acwa. The 300 MW second phase at Ouarzazate is divided into a 100 MW CSP tower and 200 MW parabolic trough project.

The project is overseen by the Moroccan Agency for Solar Energy (Masen), which has been created as a focal point for promoting projects, supported by a number of local financial institutions. The initial Acwa Power Ouarzazate project has received substantial European funding support, notably from the EIB, European Commission, AFD and KfW.

of these systems; a recent study by Durham University in the UK highlighted the reduced lifespans and high costs associated with some solar PV systems serving health centres in Rwanda. However, such problems can be overcome, and better education and care when designing systems and selecting components will substantially improve outcomes.

Big strides to come

The project pipeline for solar power exceeds the AEEP target by a big margin. A total of 3,278 MW capacity is scheduled to come online by 2020. The quick lead times for solar projects means they are likely to grow in coming years as more independent power producer bid rounds are held in Morocco, South Africa and other countries, and as more governments and regulators bring RE feed in-tariffs into operation.

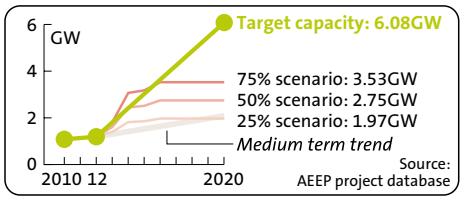
Emphasis should be on supporting the integration of these projects into power grids and maintaining momentum in the countries that are pioneering the industry. Support by European and African institutions for initiatives such as the GET FiT in Uganda – which is supported by the governments of Uganda, Germany, Norway and the United Kingdom, along with the World Bank, is essential for establishing utility scale solar power generation outside of the continental powerhouses.

Similar to the situation with wind, solar projects are predominantly located in North African countries and South Africa. Up to 2020, 49.6 % of projects planned are scheduled to be built in North Africa and 43.7 % in South Africa. As of end-June 2013, 73.1 % of solar power generation capacity was based in North Africa, with West Africa accounting for 12.2 % and South Africa 10.9 %. This points towards the importance of working with governments, regulators and utilities to develop markets away from these areas.

Smaller is beautiful

Small-scale solar installations are also becoming more common. Solar water heaters are playing an important role in providing heating in African houses, while simultaneously taking pressure off the electricity grid and reducing reliance on unsustainable fuels (see page 51 for a South African example).

Wind power



Wind power projections and target

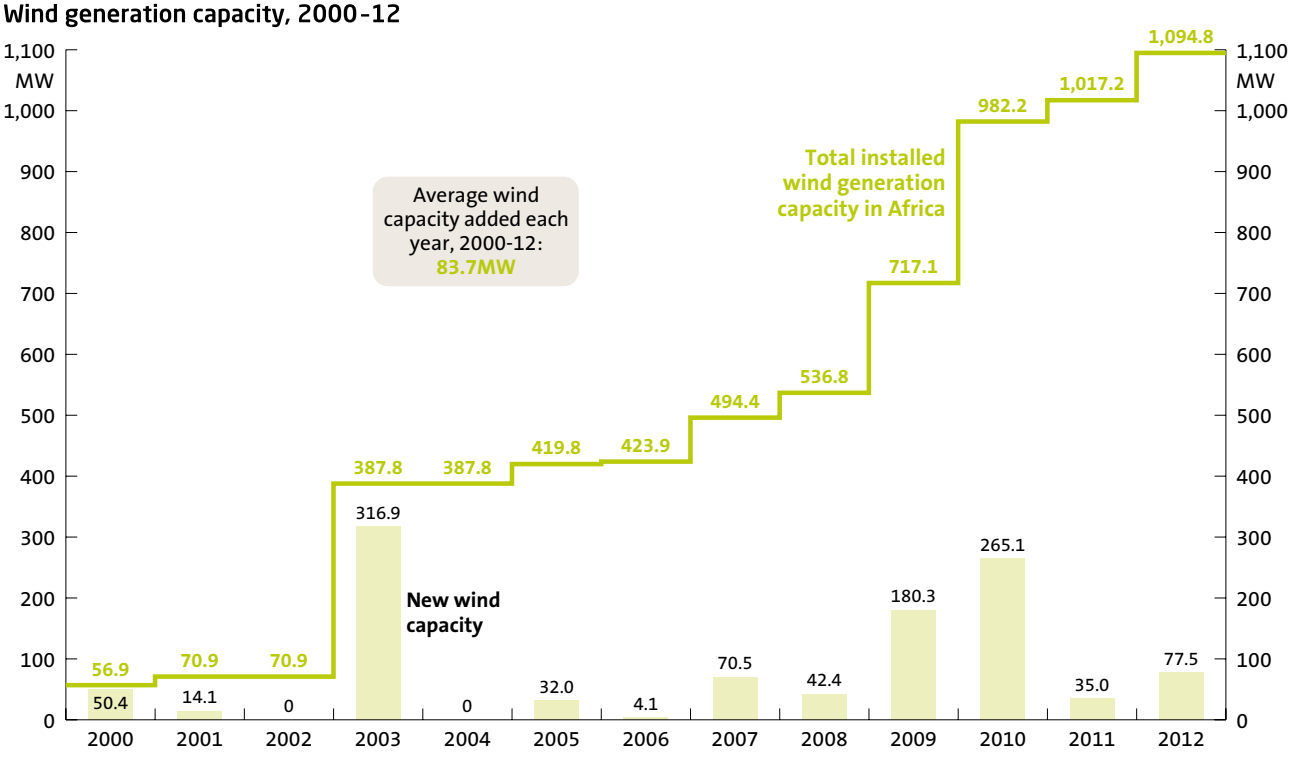
After slow beginnings, wind and solar power are poised to become important elements in the African electricity supply industry over the years to 2020. Wind power, in particular, has the potential to play a major role supplying electricity to African grids, and also offgrid, including to industrial consumers. The possibility of developing large-scale onshore wind farms in sparsely populated areas, at prices which in South Africa have already achieved close to parity with new-build coal-fired power plants, makes wind power an attractive way of diversifying supply and reducing carbon emissions.

Many African countries have some way to go with mapping their wind resources and putting in place suitable pricing strategies to attract major international investment. Wind generation capacity has increased by 10.4 % since 2010, from 1,080 MW to 1,192 MW. Those countries where the ground has been prepared are beginning to reap the benefits. Large-scale independent power producer (IPP) procurement programmes in Morocco and South Africa, as well as new installations in Egypt, Ethiopia, Kenya, Tanzania and Tunisia, promise a step change in the industry.

The comparatively short lead time of wind projects means the current pipeline will be added to as we move towards 2020. This will be particularly true as future bid rounds take place in Morocco and South Africa, as projects in these countries are not counted until they receive preferred bidder status. Thus the size of the project pipeline, at 3,490 MW, is not unduly worrying. However, it does point to the need to continue work with countries looking to implement workable renewable energy feed-in tariffs and to map wind resources, as well as to continue financial support for early stage project preparation.

Regional disparities are an issue and may become worse over the short and medium term. North Africa currently accounts for 86 % of wind generation capacity and 73.1 % of solar capacity. In terms of wind, the remainder is concentrated in East Africa, which accounts for 10.4 %.

Wind generation capacity, 2000-12

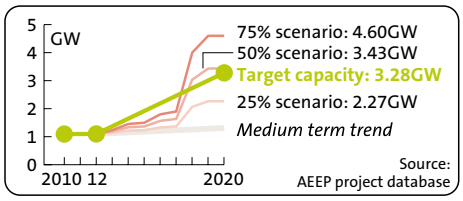


Source: AEEP project database

This is likely to be exacerbated by a project pipeline that is overwhelmingly based in North Africa and South Africa. Some 50.9 % of wind projects scheduled to commission before 2020 are planned in North Africa; 42.4 % are expected to be built in South Africa.

Regional variation is caused in part by the process of putting appropriate regulatory structures in place, which is still in its early stages outside of the sophisticated economies of the North African region and South Africa. As a result, projects in the rest of Africa are not yet able to reach the milestones necessary for inclusion in the analysis. Concentration on creating these structures will allow the proliferation of solar and wind projects across the continent.

Tripling other renewables



Other renewables projections and target

Other renewable technologies have the potential to play an important role in the African energy mix. Biomass and geothermal power have particular promise, but tidal, wave and ocean current technologies may become important in the long term.

In Europe, biomass was used to produce nearly as much power as wind in 2010, according to Eurostat: 129 TWh compared with 149 TWh. In Africa, biomass and biogas have the potential for widespread use in rural electrification and by major agricultural producers who may also feed substantial amounts of power into the grid. But outside of Mauritius, which has pioneered the use of biomass and coal hybrid plants, use of biomass was limited to around 745 MW capacity in 2012.

Biomass could flourish

Biomass is more flexible and is expected to increase across the continent. Based on the pipeline of projects included in the AEEP database, the number of larger biomass schemes is likely to increase, not least as South Africa implements its ambitious biomass strategy. Meanwhile, bagasse-fuelled generators are becoming more common at sugar producers across the continent – for example in Kenya, Mauritius and Uganda – pointing to the potential for co-generation linked to agro-industry.

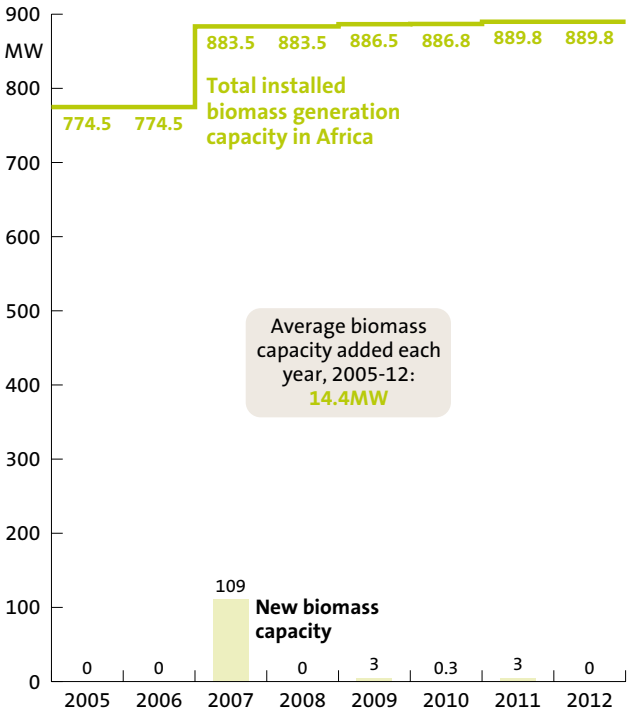
The flexibility of biomass projects and their potential importance for rural electrification and increasing agricultural revenues could have important economic development benefits.

Regional disparities are very pronounced. 43.8 % of biomass electricity generation capacity is installed in South Africa and 42.7 % in East Africa. These biomass power plants are predominantly fuelled using agricultural waste.

Meanwhile, landfill gas is largely under-utilised, although projects are emerging in major urban centres such as Abidjan, Lusaka and Harare.

Biomass is defined here as the burning of sustainably- or commercially-produced organic matter, landfill waste or biogas. Bioenergy offers a near unique opportunity in terms of the flexibility of the size and geographical spread of bioenergy generators across Africa. There is

Biomass generation capacity, 2005-12



Source: AEEP project database

also potential to couple the introduction of bioenergy with agricultural development.

Rural populations that rely on agriculture can mobilise biomass or biogas resources by building facilities that generate electricity from waste products to supply mini-grids or community buildings such as schools and health centres. This can give farmers added revenue streams as they sell what was unproductive waste. The installation of larger waste-to-power generators requires levels of organisation and agricultural activity that come with improved farming methods and cooperation between local landowners coming to a region. In this positive context, small biomass generators are increasingly supplying community buildings.

KENYAN BIOGAS An employee picks and classifies wet sisal fibres for drying at Kilifi Plantations, where sisal waste is converted into biogas, providing half the farm's electricity needs; it is also used to make biofertiliser.

Most biomass generation in Africa uses waste from large commercial agriculture, generally bagasse from sugar plantations. This is particularly the case in East and Southern Africa. In West Africa, several attempts have been made to establish commercial biomass plantations to feed power plants supplying electricity to large industrial and mining operations. At least two waste-to-power plants are operating in North Africa, but the bulk of the region's 25 MW biomass capacity is provided by two co-generation facilities fed by agricultural waste.

Geothermal can provide baseload

Geothermal energy is able to sustain a baseload and can be produced cheaply if exploration and steam risk are properly distributed. According to Martin Schubert, senior project manager at German development bank KfW Entwicklungsbank, "geothermal has one main benefit compared to other renewables: 24/7, you don't depend on light and weather conditions: it is baseload and it is renewable. Also from a cost perspective, it's very competitive with other renewable resources."

KfW has supported the Geothermal Risk Mitigation Facility which has been designed to help overcome these risks (see Case Study on page 49). Geothermal power is well established at the Olkaria complex in Kenya and a number of projects are at the early stages of development along the East African Rift. Exploration is also under way away from the Rift in countries such as Zambia and Comoros.

Ethiopia and Kenya provide a useful indication of how developing geothermal resources can be helped by a regional electricity interconnection. The interconnection will allow Kenya to sell geothermal baseload capacity to Ethiopia, which in turn can sell it hydropower at peak times to reduce Kenya's reliance on fuel oil peaker plants.

Africa has huge potential for power generation using geothermal energy and thus the project pipeline for 'other renewables' recorded by the AEEP Project Database is dominated by geothermal projects looking to exploit the East African Rift. Of the 4,653 MW of other renewables projects in the pipeline, 4,427 MW would be generated from geothermal sources (95.1 %).

All of the geothermal power plants currently commissioned are located in East Africa. Geothermal power is restricted to where the resource is located.

Case Study

Supporting East Africa's geothermal aspirations

The potential of the East African Rift Valley's geothermal resources to meet the region's urgent need for power is now being realised. New funding avenues are opening up to help reduce early exploration risks, in turn encouraging developers to take on projects in several countries.

Geothermal projects from Kenya and Ethiopia to Djibouti and the Comoros are gaining traction. One sign of the sector's increasing vigour is the strong interest shown in the Geothermal Risk Mitigation Facility (GRMF), developed by EU and AU partners. The facility was launched in April 2012, backed by an initial €50 m, to stimulate investment, and especially public/private partnerships (PPPs).

The initiative has been developed jointly by the African Union Commission (AUC) and German development bank KfW Entwicklungsbank, which is working on behalf of Germany's Ministry for Economic Co-operation and Development and the EU-Africa Infrastructure Trust Fund.

A major obstacle to geothermal development is the cost of exploration: a prospect's potential cannot be ascertained without paying substantial drilling costs. According to Ralph Nyakabwa-Atwoki, consultant for the Katwe-Bunyampaka Geothermal Power project in Uganda, the biggest challenge now is to get reluctant investors to finance drilling: "Everyone wants to see steam and then talk money. It is very expensive and hard to get money for exploration." GRMF funding can fill this gap by supporting surface studies to determine the best locations to drill reservoir confirmation wells and then drilling and testing of those wells. With that helping hand, project developers should find it easier to secure financing for further field development, given the reduction of risk for potential investors.

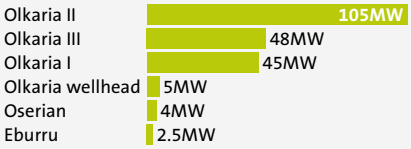
Seven developers – three in Ethiopia, three in Kenya and one in Rwanda – applied for the GRMF's first licensing round, while the facility is making €30 m available through a second application round which opened on 28 October 2013. According to KfW senior project manager Martin Schubert, "the GRMF is an instrument which has created a lot of attention already, so we hope to get developers to benefit from the eligible 11 countries". With demand for GRMF funding far surpassing initial expectations, the facility is now being opened up to more countries. While first round applications were restricted to Ethiopia, Kenya, Rwanda, Tanzania and Uganda, projects from Burundi, Comoros, Djibouti, Democratic Republic of Congo, Eritrea and Zambia will also be eligible to apply in the second round. Other projects are already planned.

The GRMF builds on foundations laid down in Kenya, whose rich geothermal resources in and around the Rift Valley have enabled it to spearhead development of the sector in the region. The country currently has a little over 200 MW of geothermal capacity, mainly from three projects on the Olkaria field, but has plans to add around 2.6 GW of capacity by 2020/21 and possibly take capacity to 5 GW by 2031. Speaking in Nairobi during September 2013, United Nations University Geothermal Training Programme director Ludvik Georgsson commended the country's focus on geothermal, but cautioned that "Kenya needs a lot of support to keep this up".

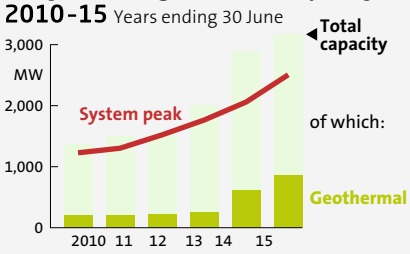
The state-owned Geothermal Development Corporation (GDC) already has several expansion projects in train. A 280 MW expansion of the Olkaria development is due for completion in April 2014, with funding being provided by KfW and the World Bank. Further expansion at Olkaria is planned for following years.

Larger still is the 400 MW Menengai Geothermal Development Phase 1 Project in Nakuru, where bids have been submitted from a number of companies competing to generate electricity either as an independent power producer or through a PPP for sale to state utility KenGen. By July 2013, 15 exploratory wells had been completed, revealing around 60 MW of capacity. The phase is due to be completed by around 2017 at a cost of around $488 m. Initial support for exploratory drilling and testing came from the African Development Bank, which is providing a $120 m concessional loan and a $25 m grant from the Climate Investment Funds, which the AfDB hosts. The World Bank has also pledged around $150 m to the project. Eventually Kenya hopes to boost capacity to 1,600 MWe on the Menengai site.

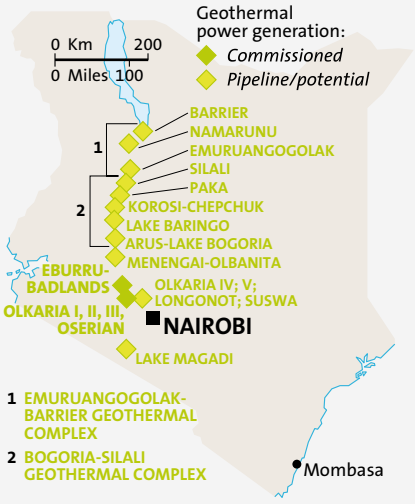
Kenya's current geothermal generation capacity



Kenya's total generation capacity, 2010-15 Years ending 30 June



Kenya's geothermal areas



New generation capacity, 2011-31

Least cost power development plan, base case

Geothermal	**5,040MW**	Wind	1,500MW
Nuclear	4,000MW	Medium-speed	
Coal	2,400MW	diesel	1,440MW
Gas turbine	2,340MW	Hydro	200MW
Import	2,000MW	**TOTAL**	**18,902MW**

Commissioning schedule, 2013-20

2013/14	**Olkaria I units 4&5; Olkaria IV**	280MW
2015/16	**Longonot I; Menengai I**	280MW
2016/17	**Paka I; Silali I**	280MW
2017/18	**Menengai II**	140MW
2018/19	**Longonot II; Silali II**	280MW
2019/20	**Paka II**	140MW

Source: Geothermal Development Co. Ltd.

Energy Efficiency

Improving energy efficiency (EE) is often a cheaper and more effective way of improving energy outcomes than increasing generation capacity. Energy saving measures applied by consumers decrease demand for electricity and improves economic outcomes by reducing costs. Efficient energy supply industries are more financially sustainable and have lower tariffs for consumers. In carbon-intensive sectors, improved EE can considerably reduce emissions.

There is growing recognition that energy infrastructure across much of Africa is in need of rehabilitation or upgrading. Investment in existing infrastructure could yield many of the outcomes sought when expanding electricity supply, such as reduced blackouts, cheaper tariffs, higher rates of access. The dilapidated state of infrastructure in many countries is indicative of the tight finances with which national utilities are constrained. Poor financial situations may result from below-cost tariffs, mismanagement and low bill collection rates. Lacking the funds necessary for adequate maintenance and to upgrade key infrastructure, utilities may be incapable of meeting the demands of growing economies. The lack of cost-reflective tariffs discourages infrastructure investors, and also means that consumers lack the incentive to invest in energy-saving measures.

Measuring efficiency

Measuring EE is fraught with problems, and controversy surrounds its methodologies. This report takes a dual approach by adopting the energy intensity and transmission and distribution losses framework proposed by SE4 All, while also introducing a continent-wide review of energy efficiency laws (see page 56). The approach gives indications of trends, while tracking qualitatively measures being taken by governments to advance EE goals, recognising the importance of government policy and incentives in improving outcomes.

EE is a multifaceted area referring to a range of stakeholders – including households, industrial processes, commerce and the electricity supply industry – which makes it difficult to generate a single metric representing changes to EE as a whole. Energy intensity can serve as an imperfect proxy for efficiency but different ways of calculating intensity measure different phenomena. Energy intensity measures the ratio of aggregate economic output to aggregate energy input and can be applied at a regional, national, sectoral or subsectoral level, where data is available (as discussed on page 52).

Energy intensity measures are complemented by tracking transmission and distribution – or network – losses, which are a major cause of inefficiency and contribute towards the sector's financial weaknesses. Measuring the efficiency of renewable technologies is complicated by the need to convert final energy outputs to primary energy inputs. SE4 All has compiled data on thermal efficiency showing African power supply averaged 31.8 % in 2010, up from 29.9 % in 2000.

Cameroon's national EE policy

Faced with systemic inefficiencies in energy infrastructure and usage, Cameroon's Ministry of Water Resources and Energy (MINEE) called for EU Energy Initiative Partnership Dialogue Facility (EUEI PDF) assistance to formulate a National Policy, Strategy and Action Plan, to help tackle increasing demand for secure energy provision by implementing energy efficiency measures. The new policy is intended to provide vital strategic guidance to EE projects through the short- and medium-term.

Currently low levels of EE are having negative impacts across the electricity sector and wider economy. Studies show that present losses in generation, transport and distribution stand at 890,000 MWh, representing 18.6 % of the total output. As in many countries, a weak regulatory framework, coupled with a general lack of awareness about the importance of EE, means that most consumers are dependent on cheap, antiquated technology, which adds to inefficiencies.

Combatting demand-side causes will help to reduce short-term, peak-time strains on energy infrastructure. Invariably, however, substantial change will require the construction and rehabilitation of supply-side technology. The final policy has yet to be published but weaknesses in the transmission grid are clearly a major cause inefficiency. However, studies so far suggest that hydropower generation efficiency is generally positive, with further benefits expected from implementing more sophisticated water flow model instruments.

Marshalling finance for EE projects will remain a challenge, as the financial sector continues to resist engagement, even though Cameroonian institutions have sufficient liquidity to invest in EE. As a national EE policy develops, issues like banking reforms and the creation of an SME-focused development bank take on added importance.

Case Study

South Africa: Solar water heaters to ease power crunch

The urgent need to ensure that fast-growing demand for power does not overwhelm electricity generating capacity, and so it can meet ambitious carbon emissions targets, has led South Africa to seek fresh ways to take pressure off the grid. One innovative strand of this push is a programme now under way to promote widespread use of solar water heaters (SWHs), which could make a big difference in a country where water heating accounts for up to 50 % of domestic electricity bills.

As an incentive for consumers to install SWHs, the National Electricity Regulator of South Africa (Nersa) rolled out a rebate programme, implemented by state power firm Eskom, in 2008. For low-cost housing, a 110 litre solar-powered storage tank, or geyser, was offered for free and wealthier homes received subsidies for using solar power.

The programme was designed to run for five years initially, backed by R1.06 bn E81 m) of funding to cover the rebate and marketing costs. It was later extended to April 2015, with the aim of installing 1 m SWHs throughout the country by then. A decision has yet to be made on whether to extend the scheme beyond that date.

By July 2013, 360,000 SWHs had been installed, the majority of which were low-pressure systems. Meanwhile, jobs were created in the sector, as the number of SWH suppliers rose from just 20 in 1997 to more than 400 by 2011.

This explosive growth has not been without issues. According to Ciska Terblanche, managing director of CDM Africa Climate Solutions, an advisory firm involved in calculating carbon savings from the scheme, "It's a great initiative, but it has been fraught with problems." The fast pace at which the programme was rolled out, the need to improve project management processes and erratic quality control has created problems, Terblanche says. Some of the often imported systems have proved unsuitable for the local climate and conditions.

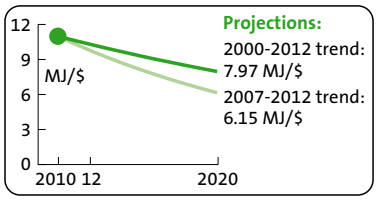
The programme was intended to contribute 23 % of a Department of Energy target to replace 10,000 GWh of electricity with renewable energy by 2013. That target remains some way off. Eskom estimated the programme was saving around 60 GWh/yr of energy use by 2011. The government said that in the year to end-March 2012, the scheme effectively saved electricity generating capacity of 22 MW at a total cost of R766 m.

While much remains to be done, the SWH scheme has already brought hot water to tens of thousands of previously deprived homes. Demand has risen faster than expected as the programme unleashed 'supressed demand' for SWHs. "These people never had heaters or hot water before so they weren't using electricity in the same way – and of course usage is rising," Terblanche says. "This must be factored in when considering energy savings. It may skew the figures now, but in five to seven years these households would have had non-solar geysers, so there are long-term savings and benefits," she concludes.

According to Andrew Etzinger, who leads Eskom's SWH rebate programme, the utility has learnt lessons and is improving the scheme. "Verification logistics of a rebate programme are very onerous... For this reason, the low-pressure rebate programme is being converted to a contracting model under which... auditors will be on site at the time of installation, which will provide much more effective control over quality and turnaround time for supplier payment." More could be done to encourage local industry: "We need to seize opportunities to develop and support local manufacturers."

Jobs are being created, as the number of solar water heaters installed rises. There were just 20 South African SWH suppliers in 1997, but by 2011 there were more than 400.

Energy intensity



Energy Intensity projections

Energy intensity is a measure of a national economy's energy efficiency. It is calculated as units of energy per unit of gross domestic product (GDP). Energy Intensity has been used as a measure of energy efficiency by the AEEP Secretariat in part because, unlike other potential measures, a body of data exists for African economies.

This is not to deny that a number of problems are posed using energy intensity as an indicator. It is at least as much an indicator of national economic performance as of energy efficiency; structural changes in an economy can lead to changes in energy intensity where there has not been an improvement in energy efficiency. For example, a shift towards services and away from manufacturing would be likely to decrease energy intensity, even where manufacturing is highly energy efficient and the service industries are less efficient. Decomposing energy intensity measures by sector can help negate this effect but sectoral and subsectoral data are not readily available for most African countries.

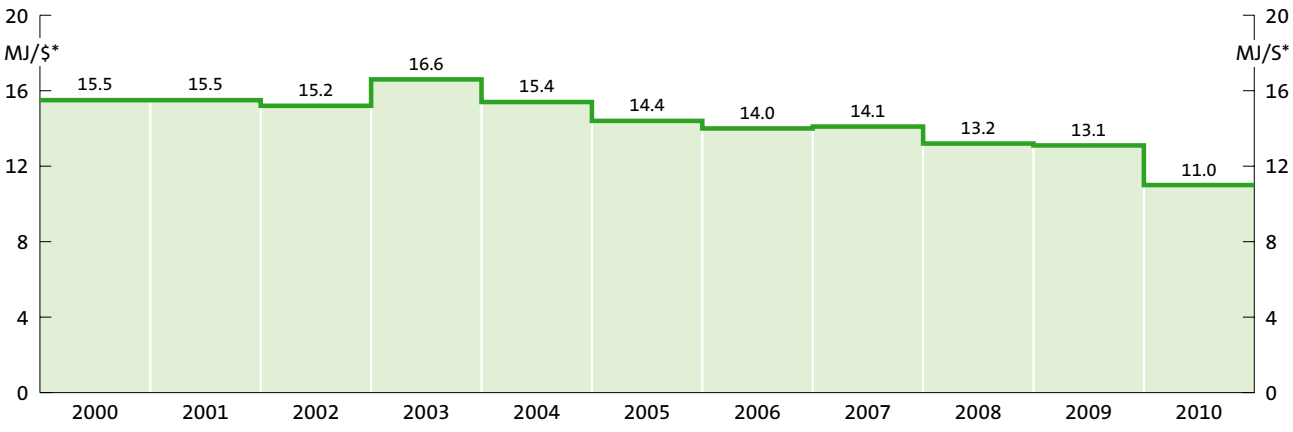
Another difficulty with energy intensity measures is whether to measure GDP at purchasing power parity (PPP) or using a market exchange rate. In line with SE4 All, this report uses PPP. The advantage of PPP is that using a market exchange rate tends to underestimate output in developing countries, thereby overestimating energy intensity. Perhaps a more serious caveat is the accuracy of GDP measurements themselves. A number of experts have questioned whether GDP figures in Africa can be used at all, given huge variation in approaches and definitions, often relating to the shadow economy, and the widespread use of unsatisfactory proxy statistics. If accepted, these arguments would invalidate the entire energy intensity exercise.

A second measurement issue is whether to use primary or final energy consumption as the energy component. This report is aligned with other current research initiatives in using final energy consumption. Final energy consumption only measures changes in the demand side of the energy industry equation and does not track efficiency changes in the supply side. However, using final energy will allow a sectoral and subsectoral analysis in future where data is available.

Based on the data used for the assessment of energy efficient trends, a trend is revealed, which is clearly in the right direction. The average energy intensity (calculated as units of energy per unit of GDP) found in African countries decreased by 29 % between 2000 and 2010, as illustrated on page 46, from 15.47 MJ/$2005 PPP to 10.99 MJ/$2005 PPP. When weighted according to economic output, using GDP data in current US dollars at market rates from the World Bank, energy intensity was even smaller in 2010, at 7.02 MJ/US$2005 PPP.

Although a crude proxy, the weighted average suggests that energy efficiency may have been improving in the continent's largest economies, where energy consumption is likely to be highest. However, without a sectoral analysis

Average energy intensity of final energy, 2000-10



Source: SE4All Global Tracking Framework

* US$ 2005 purchasing power parity

this is impossible to establish, particularly as Africa's service sector has been growing.

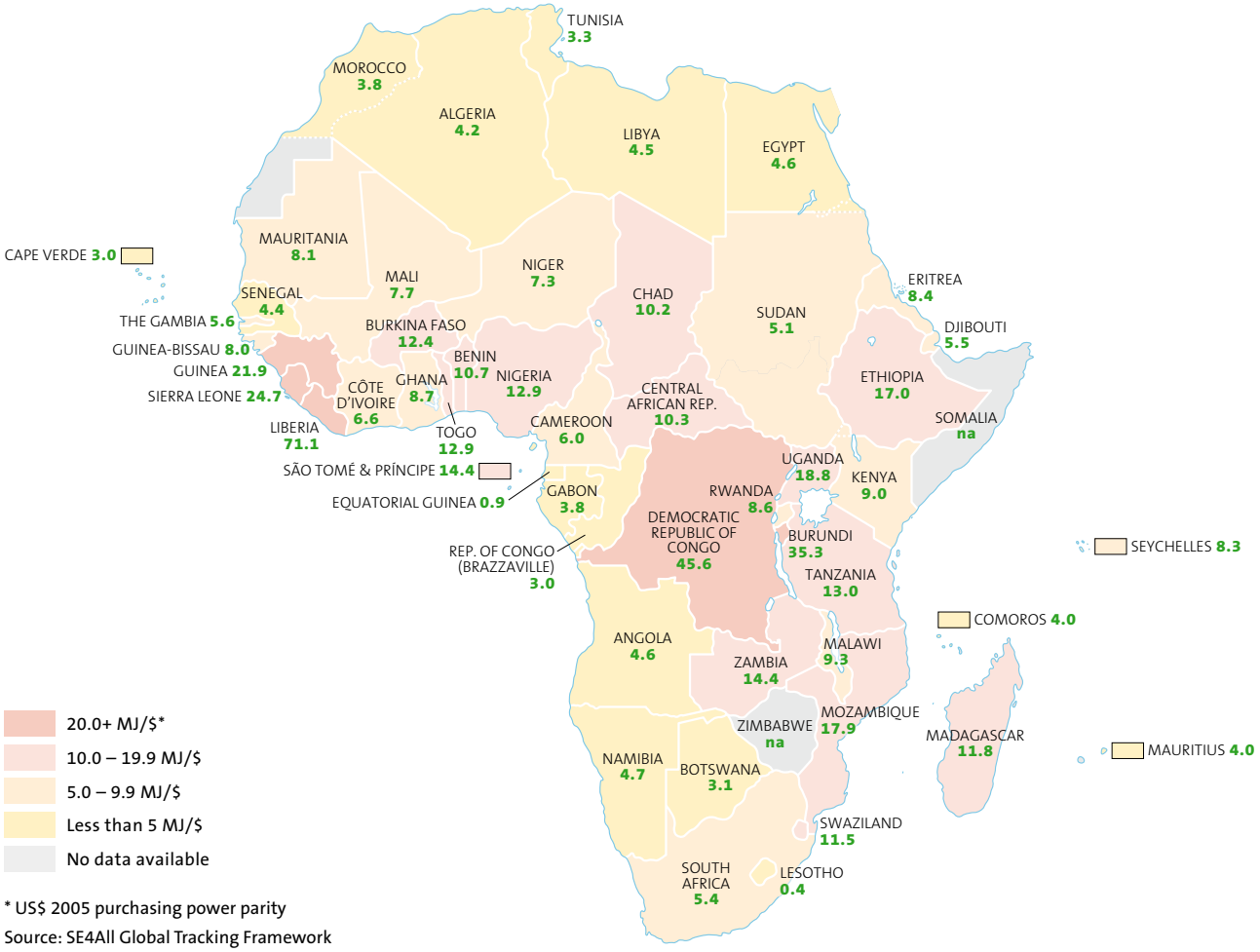
According to McKinsey & Company, the banking sector has been growing faster than GDP in "most of the continent's main markets". This means that banking has grown as a proportion of national output and, as a comparatively energy-light industry, this will lower energy intensity regardless of improvements in energy efficiency or otherwise. Further analysis of the changing composition of African economies is required to build upon current national energy intensity statistics.

Installation of solar water heating in Rwanda

Data for some, not all, countries

Data was available from SE4 All for 25 countries for 2000 and 2010 covering energy intensity in the industrial sector and 'other sectors', not including agriculture. Data was only available for 19 countries for agricultural energy intensity in 2010 and 16 countries in 2000. In industry, the average energy intensity for the 25 countries fell from 7.0 MJ/$2005 in 2000 to 5.5 MJ/$2005 in 2010. Energy intensity rose somewhat in agriculture, from 1.6 MJ/$2005 in 2000 to 2.2 MJ/$2005 in 2010, possibly affected by increasing mechanisation. There was a substantial fall in the average energy intensity of other sectors, from 27.3 MJ/$2005 in 2000 to 18.3 MJ/$2005 in 2010.

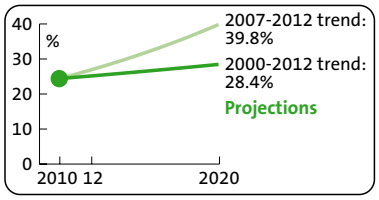
Energy intensity level of final energy, 2010



* US$ 2005 purchasing power parity

Source: SE4All Global Tracking Framework

Network losses



Network losses projections

Measuring transmission and distribution (T&D) losses is essential for monitoring the health of the electricity supply sector. T&D (network) losses cover a range of phenomena, including technical losses that occur as a result of faults in physical infrastructure and losses from theft.

Failure to adequately invest in maintaining and upgrading T&D has led to very high levels of network losses in many African countries. This in turn has resulted in unplanned blackouts and financial losses as a result of losing a sizeable proportion of electricity generated in transit.

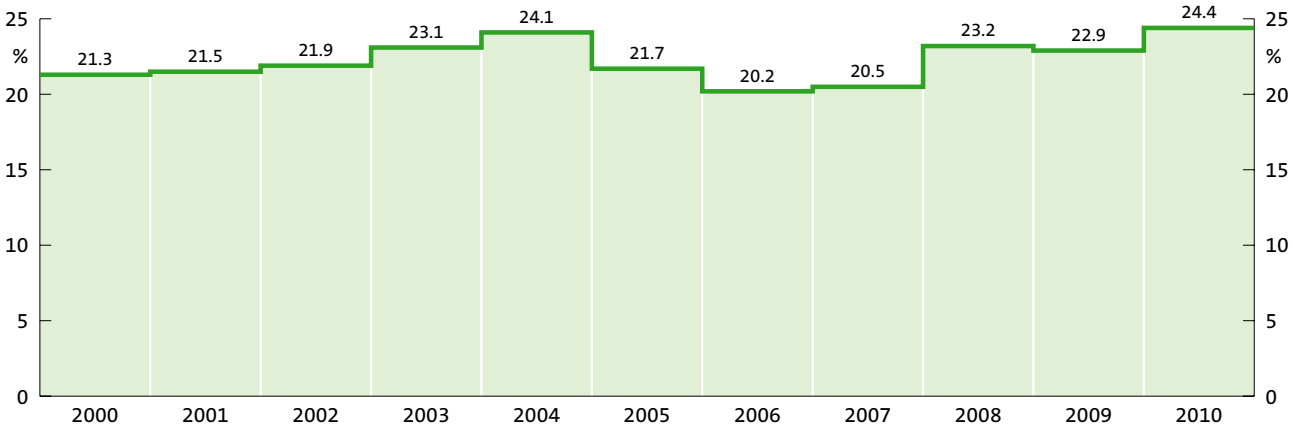
Development finance institutions have been increasingly active in this area and projects to improve the electricity network are under way in several countries. Similarly, national governments and utilities have woken up to the need to invest in the electricity grid to achieve ambitious targets set for the electricity supply industry. However, outcomes have so far been disappointing with many projects only in the early stages of development.

The result is that average network losses appear to have increased over the period 2000 to 2010, from 21.3 % to 24.4 %, according to SE4 All data provided by the World Bank. However, the 2010 losses come down to 22 % when an anomalous figure (related to losses in Togo) is removed from the calculation. It is instructive that when weighted by electricity output there is virtually no change in network losses between 2000 and 2010 and losses are much smaller.

Fixing electrical cables in the Plateau, district Abidjan, Cote d'Ivoire.

The average loss when weighted in this way was 12.6 % in 2000 and 12.7 % in 2010. This illustrates that T&D losses tend to be highest in smaller and poorer countries. Focus on reducing losses in these countries would dramatically reduce average losses in Africa.

Average network losses, 2000-10



Source: SE4All Global Tracking Framework

Average network losses by region, 2010 and 2000

Average network losses (%)	North Africa	West Africa	East Africa	Central Africa	Southern Africa	Southern Africa (minus RSA)
2010	13.1	21.5	16.6	31.9	20.2	22.0
2000	14.7	45.3	17.9	33.3	13.6	14.4

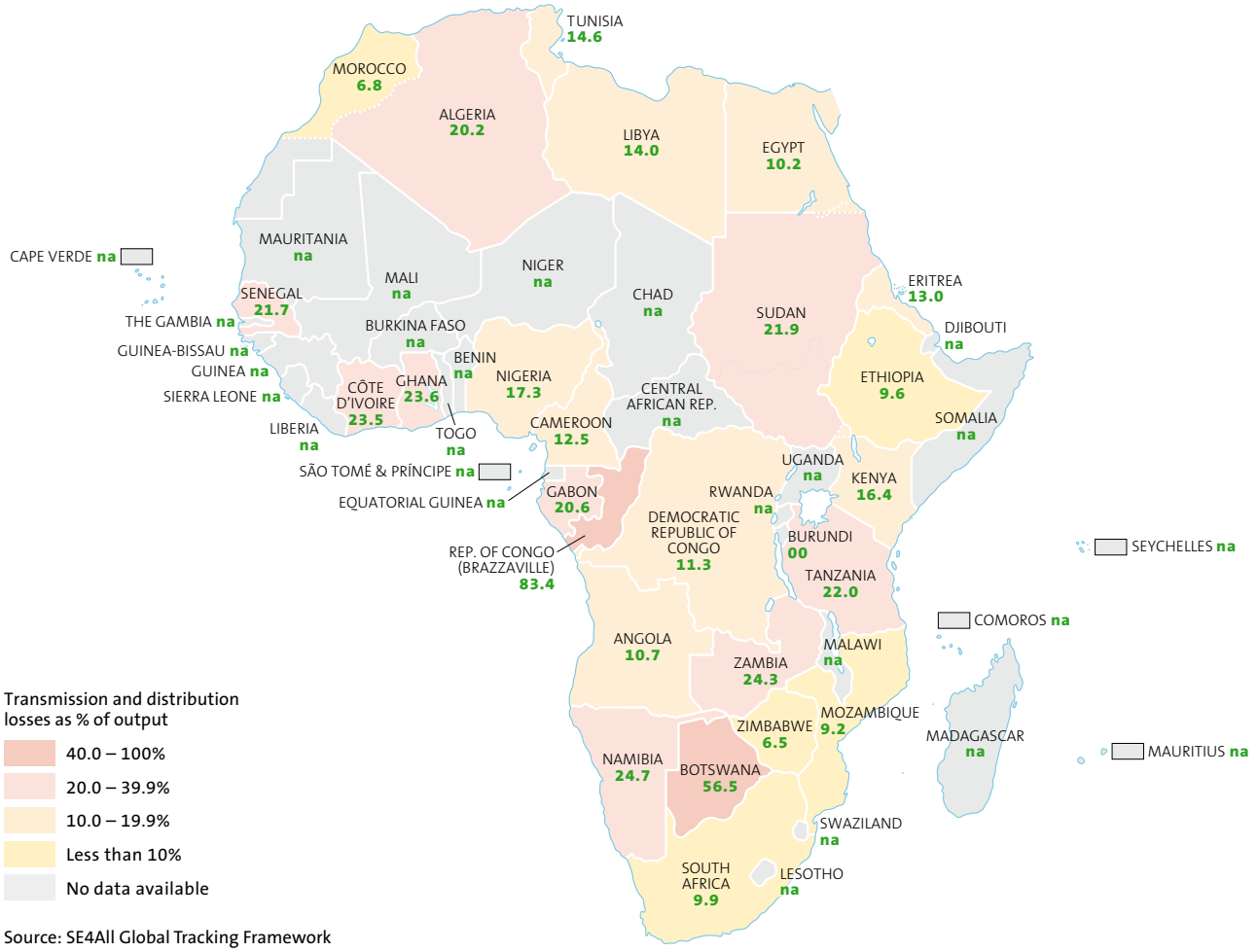
However, there is some doubt about the validity of the trend as a number of anomalous results were found in the dataset, where losses were estimated at higher than 100 %. These were removed, but it is unclear whether remaining data points are subject to the same problems. Furthermore, data was only available for 26 countries.

But overall, the numbers are close to estimates made by the International Energy Agency, which estimated that the average network loss in Africa was 20.7 % in 2009. At present, no more comprehensive or accurate database is available.

Energy Efficiency Laws

To complement the quantitative monitoring of energy efficiency data, a table has been compiled for the AEEP showing the extent of legal and institutional infrastructure across the continent. The Energy Efficiency Laws table, on pages 56 and 57, seeks to provide a thumbnail picture of the extent of policy coverage in each of 55 countries. It also checks on whether the jurdisdiction has legislation to help implement policy, institutions that can regulate energy efficiency measures, financial incentives and projects under way.

Network losses, 2010



Source: SE4All Global Tracking Framework

Energy Efficiency Laws

Country	National energy efficiency policy	Extent of policy coverage					
		Public sector	Domestic sector	Construction	Transport Sector	Industrial and commercial	Additional provisions for power and extractive sectors
Algeria	Yes		Yes	Yes	Yes	Yes	Yes
Angola	No	–	–	–	–	–	–
Benin	Yes	Yes	Yes	No	No	Yes	No
Botswana	Yes	Yes	Yes	Yes	Yes	Yes	No
Burkina Faso	Yes	Yes	Yes	–	–	Yes	No
Burundi	No	–	–	–	–	–	–
Cameroon	Yes	–	–	–	–	–	–
Cape Verde	Yes	Yes	Yes	Yes	No	Yes	No
Central African Rep	No	–	–	–	–	–	–
Chad	No	–	–	–	–	–	–
Comoros	No	–	–	–	–	–	–
Congo (Dem Republic)	No	–	–	–	–	–	–
Congo (Republic)	Yes	Yes	Yes	No	No	No	No
Côte d'Ivoire	No	–	–	–	–	–	–
Djibouti	No	–	–	–	–	–	–
Egypt	Yes	Yes	Yes	Yes	Yes	Yes	No
Equatorial Guinea	No	–	–	–	–	–	–
Eritrea	Yes	Yes	Yes	–	–	Yes	–
Ethiopia	Yes	No	Yes	Yes	Yes	Yes	No
Gabon	No	–	–	–	–	–	–
Gambia	Yes	Yes	Yes	No	Yes	Yes	Yes
Ghana	Yes	Yes	Yes	No	Yes	Yes	No
Guinea	No	–	–	–	–	–	–
Guinea Bissau	Yes	No	Yes	Yes	No	Yes	No
Kenya	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lesotho	Yes	Yes	Yes	Yes	No	Yes	No
Liberia	Yes	Yes	No	No	No	Yes	No
Libya	No	–	–	–	–	–	–
Madagascar	No	–	–	–	–	–	–
Malawi	No	–	–	–	–	–	–
Mali	No	–	–	–	–	–	–
Mauritania	No	–	–	–	–	–	–
Mauritius	Yes	Yes	No	Yes	Yes	Yes	No
Morocco	Yes	Yes	Yes	Yes	Yes	Yes	No
Mozambique	No	–	–	–	–	–	–
Namibia	Yes	Yes	Yes	Yes	Yes	Yes	No
Niger	Yes	No	No	No	No	No	No
Nigeria	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rwanda	Yes	Yes	Yes	Yes	Yes	Yes	No
Sao Tome &Principe	No	–	–	–	–	–	–
Senegal	No	No	Yes	No	No	No	No
Seychelles	Yes	No	Yes	No	Yes	–	Yes
Sierra Leone	Yes	No	No	No	No	Yes	No
Somalia	No	–	–	–	–	–	–
South Africa	Yes	Yes	Yes	Yes	Yes	Yes	No
South Sudan	No	–	–	–	–	–	–
Sudan	No	–	–	–	–	–	–
Swaziland	Yes	Yes	No	No	No	No	No
Tanzania	Yes	Yes	Yes	Yes	No	Yes	No
Togo	No	–	–	–	–	–	–
Tunisia	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Uganda	Yes	Yes	No	No	No	Yes	Yes
Zambia	Yes	Yes	Yes	Yes	No	Yes	No
Zimbabwe	Yes	Yes	No	No	Yes	Yes	Yes

Country	Legislation implementing policy	Institutions regulating energy efficiency	Financial incentives	Energy efficiency projects under way	Notes
Algeria	Yes	Yes	Yes	Yes	Energy Efficiency Law (1999). APRUE promotes energy efficiency
Angola	No	Yes	No	No	Challenges include subsidy packages (averaging $4/MW) and operational deficiencies
Benin	No	Yes	Yes	Yes	NOC and Sonacop regulate energy efficiency. Ecowas energy efficiency policy applies
Botswana	No	Yes	No	Yes	Policy, divided by sector, aims to lessen energy dependence on South Africa
Burkina Faso	No	Yes	Yes	Yes (donor-led)	National policy has broad scope but considered vague. Ecowas policy also applies
Burundi	No	No	–	Yes	No specific national policy but Comesa energy efficiency policy applies
Cameroon	–	–	No	No	EUIE PDF assisting Arsel with policy formulation. Poor Infrastructure poses problems
Cape Verde	No	Yes	Yes	Yes	National Energy Plan 2003–2012 but no specific efficiency policy. Ecowas policy applies
Central African Rep	No	No	No	Yes	Small developments in the renewable sector: some hydro facilities being improved
Chad	No	No	No	Yes	AfDB/GEF: Lake Chad Basin Regional Program (2012) includes energy efficiency
Comoros	No	Yes	No	–	No dedicated policy. Poverty Reduction and Growth Strategy Paper includes measures
Congo (Dem Republic)	No	No	No	Yes	Electricity sector development programme has 2030 access goals. Comesa policy applies
Congo (Republic)	No	Yes	No	Yes	2001 national renewable energy programme highlights need for efficiency reforms
Côte d'Ivoire	No	Yes	No	Yes	Letter of Development Policy for the Electricity Sector (2009) calls for efficiency reforms
Djibouti	No	No	No	No	National energy strategy/policy being developed. Comesa policy applies
Egypt	No	Yes	No	Yes	KfW funding renewable energy master plan (2012). Comesa policy applies
Equatorial Guinea	No	No	No	Yes	No dedicated policy. Plans to increase renewable energy, small scale rural electrification
Eritrea	–	Yes	Yes	Yes	Energy Policies and Strategies document (1997) addresses efficiency. Comesa policy applies
Ethiopia	Yes	Yes	No	Yes	National Energy Policy includes an energy conservation and efficiency section
Gabon	No	No	No	No	No dedicated laws. National energy policy focuses on diversifying energy sources
Gambia	Yes	Yes	Yes	Yes	National Energy Policy (2005). Vision 2020 doc includes efficiency targets. Ecowas member
Ghana	Yes	Yes	Yes	Yes	National Energy Policy (2010) includes efficiency measures. Ecowas policy also applies
Guinea	No	No	Yes	Yes	No dedicated law but GEF/World Bank Electricity Sector Efficiency Improvement Project
Guinea Bissau	Yes	Yes	Yes	–	2010 Energy Sector Development Policy Paper. Low electrification rate. Ecowas member
Kenya	Yes	Yes	Yes	Yes	Laws include: Sessional Paper No.4 of 2004 on energy; the Energy Act of 2006
Lesotho	No	No	Yes	Yes	Energy Policy for the Kingdom of Lesotho (2006) includes efficiency measures
Liberia	No	Yes	Yes	Yes	2009 Renewable Energy and Energy Efficiency Policy and Action Plan. Ecowas member
Libya	No	No	No	No	Reaol drawing up energy efficiency policy, to be implemented 2014. Comesa member
Madagascar	No	No	No	Yes	ADES project to replace charcoal/firewood with solar cookers. Comesa policy applies.
Malawi	No	Yes	No	Yes	World Bank Energy Sector Support Project includes efficiency measures. Comesa member
Mali	No	Yes	No	Yes	World Bank/AfDB help to implement energy efficiency policy incentives. Ecowas member
Mauritania	No	No	No	Yes	No dedicated policy. Government focus on increasing renewables and rural electrification
Mauritius	Yes	Yes	Yes	Yes	Long Term Energy Strategy 2009–2025 includes efficiency measures and incentives
Morocco	Yes	No	No	Yes	ADEREE oversees renewables and energy efficiency planning and incentives
Mozambique	No	No	No	Yes	Projects including Energy Reform and Access (2003–2011) contain efficiency measures
Namibia	No	No	Yes	–	1998 National Energy Policy includes detailed efficiency goals for multiple sectors
Niger	No	No	No	Yes	No dedicated policy but Ecowas efficiency policy applies
Nigeria	No	Yes	Yes	Yes	National Energy Policy includes efficiency strategies for transport and industry
Rwanda	–	No	Yes	Yes	National Energy Policy includes efficiency measures. Comesa member
Sao Tome and Principe	–	No	No	No	Very little has been done to promote energy efficiency
Senegal	No	No	Yes	–	No dedicated policy but some projects aimed at promoting energy efficiency in rural areas
Seychelles	No	No	No	Yes	Second National Energy Policy (2010–2030) includes efficiency measures. Comesa member
Sierra Leone	No	No	No	No	No dedicated policy but UN SEFA has outlined goals for energy efficiency and renewables
Somalia	No	No	No	No	2010 National Energy Policy does not include specific energy efficiency goals
South Africa	Yes	Yes	Yes	Yes	The 2009 National Energy Act set up the National Energy Efficiency Agency
South Sudan	No	No	No	No	No dedicated policy. Overuse of inefficient biomass energy sources
Sudan	–	No	Yes	No	No dedicated policy. Some energy efficiency related projects/schemes/policies are in place
Swaziland	No	Yes	No	–	Policy focuses on the public sector e.g. increasing renewables use in government buildings
Tanzania	No	No	No	Yes	Projects underway include helping rural communities purchase energy efficient equipment
Togo	No	No	No	Yes	Laws include Emergency Infrastructure Rehabilitation and Energy Project (2009–2013)
Tunisia	Yes	Yes	Yes	Yes	Efficiency plan focuses on financial incentives, national programmes, education, investment
Uganda	No	Yes	Yes	Yes	German government assistance to promote energy efficiency. Comesa member
Zambia	No	Yes	Yes	Yes	Energy Regulation Board oversees energy efficiency. Comesa policy also applies
Zimbabwe	No	Yes	Yes	–	Policy under demand-side sectors, households & institutions, mining & industry & transport

African and European Contributions

While it is clear that European Union institutions, member states and their corporate and individual citizens play a very important role in helping to develop Africa's energy infrastructures and capabilities, measuring the extent of that role remains highly problematic. That is one reason why the First AEEP Monitoring Report has included so many case studies and analytical articles; these are intended to highlight qualitatively the depth and intensity of the Africa-EU relationship in a situation where quantitative data is often lacking.

Wide-ranging enquiries have confirmed that even groups of development finance institutions do not yet collate data on their financing flows and outcomes. When it comes to measuring contributions that pass via institutions such as the World Bank Group and African Development Bank (AfDB) Group – both of which have a substantial European shareholding and, thus, a stake in their high levels of support for African energy projects – added layers of complexity (such as double counting) are attached. Even the AEEP Power Projects Database does not yet have the ability to produce accurate numbers; much more work is needed to identify each of the financial instruments that fed into each of the several thousand projects recorded.

There is no complete record of European commitments to the African energy sector. The most complete time series of commitments by bodies within the EU is kept by the Infrastructure Consortium for Africa (ICA), which is managed by the AfDB in Tunis. This useful tool has its limits: it only tracks commitments made by the European Investment Bank (EIB), European Commission (EC), France, Germany and the UK. However, these are major donors to African infrastructure finance, and the trend in their allocations for energy projects is indicative of wider trends.

Expanding African budgets

Neither is there a central database from which African budget or other data on energy infrastructure spending can be authoritatively tracked. However, progress is being made in this area. The African Development Bank has started compiling such data and its statistics department has now tracked the budgets of 20 countries, as shown in the table below.

This data shows substantial growth in African commitments to the sector. Between 2010 and 2012, the AfDB's 20 – who include several of the continent's bigger economies, while being limited to Sub-Saharan Africa (thereby missing some of the biggest, including Algeria and Egypt) – reported an increase in energy-related budgets of an average 17 % per year.

Cameroon, Central African Republic, Côte d'Ivoire, Ethiopia, Kenya and South Africa displayed the most consistent budget growth rates over the three-year period. Ghana, Lesotho, Mali and Uganda had particularly high budget allocations in 2011, as did Kenya and Liberia in 2012.

African budget allocations for energy, 2010-12

Energy ($m)	2010	2011	2012
Cameroon	84.0	150.1	165.6
Cape Verde	77.7	28.4	16.3
Central African Republic	10.5	20.5	38.0
Côte d'Ivoire	170.1	217.4	289.8
Ethiopia	70.9	92.3	96.5
Ghana	2.2	240.5	13.4
Kenya	462.0	506.2	998.5
Lesotho	15.4	49.7	11.3
Liberia	0.5	–	64.7
Mali	12.3	52.0	37.5
Namibia	121.4	141.1	78.2
Rwanda	96.8	84.5	N/A
Sao Tome and Principe	10.5	1.7	–
Sierra Leone	41.4	20.6	24.7
South Africa	7,537.8	8,619.4	10,419.0
South Sudan	36.8	25.4	42.9
Tanzania	222.0	232.2	218.4
Uganda	155.4	529.3	N/A
Zimbabwe	15.5	65.0	47.5
Total	**9,143.2**	**11,076.3**	**12,562.3**

Source: AfDB Statistics, country focal point data.

Case Study

New African instruments will widen financial options

Not only are African governments increasing their budget allocations for energy infrastructure – a trend likely to continue with sustained economic growth in many countries and improved revenue collection and management – but parastatal, capital markets and other private sector sources of funding are emerging that will broaden the options for financing energy projects.

It is early days, but the development of African energy infrastructure is benefitting from a range of new home-grown financial instruments and investment funds, which are quick to capitalise on opportunities across the continent. There are likely to be many more to come, as African infrastructure financing becomes established as an asset class, and local financial markets become deeper, allowing more African citizens and foreign funds to invest.

A new generation of investment funds is emerging, such as the $250 m ARM-Harith Infrastructure Fund, launched by South Africa-based Harith General Partners and Nigerian financial services company Asset and Resource Management (ARM). The fund will invest in infrastructure projects and companies across West Africa, with a Nigerian focus. In November 2013, the African Development Bank (AfDB) approved a $20 m equity investment in the fund. Harith also runs the $630 m Pan African Infrastructure Development Fund.

Sovereign and other bonds

Africa's generally improved credit ratings, following many countries' emergence from past debt and payments problems, has opened up capital markets options. Outside established borrowers like South African utility Eskom, government issuers are looking to link project developments to borrowing. Sovereign Eurobond issues are providing new means of financing infrastructure projects.

Zambia in September 2012 successfully issued a $750 m Eurobond which, initially released at $500 m, was massively oversubscribed, receiving bids of $12 bn. This pointed to market appetite, and since then other African governments have followed suit. Rwanda issued a $400 m bond in April 2013, Nigeria ($500 m) and Ghana ($740 m) issued bonds in July, and Gabon closed 2013 by issuing a $1.5 bn Eurobond. Other bond issues are planned and include provision for part of the funding to go to energy projects.

Tapping domestic sources

Domestic bond and equities issuance, backed by increased investment by local funds – often pension funds – is another increasingly important source of energy infrastructure finance on the continent. One example to follow is Botswana Public Officers Pension Fund, which now has a strong focus on infrastructure investment, and an asset base of $4 bn. Other pension funds with an infrastructure interest include Nigeria's Social Insurance Trust Fund and Ghana's Social Security and National Insurance Trust, which has taken over a power plant in Tema as part of its drive towards more active investments.

African savings levels are lower than other continents', but they are growing and many analysts see scope for the massive mobilisation of savings. As well as tapping into residents' savings, Africa's large diaspora populations offer a potential source of investment funds. Ethiopia understood this when it developed financial instruments for diaspora investors to raise financing for the Grand Millennium Dam.

Deepening markets

Greater recourse to local currency financing will do more than most things to accelerate the pace of power plant construction, distribution networks or efficiency-related projects. Utilities and other distributors are generally paid in local currencies by the clients; having to raise Euro or dollar financing greatly adds to the cost and complexity of developing projects. Therefore, as much of the project cost that can be met by their national currency is to be welcomed.

Projects such as wind farms in Morocco and solar schemes in South Africa have benefitted from these economies' ability to raise dirham- and rand-denominated finance. Nigeria's electricity sector privatisation really took off when, in mid-2013, Lagos banks played a leading role in providing finance for investors to purchase generation and distribution companies.

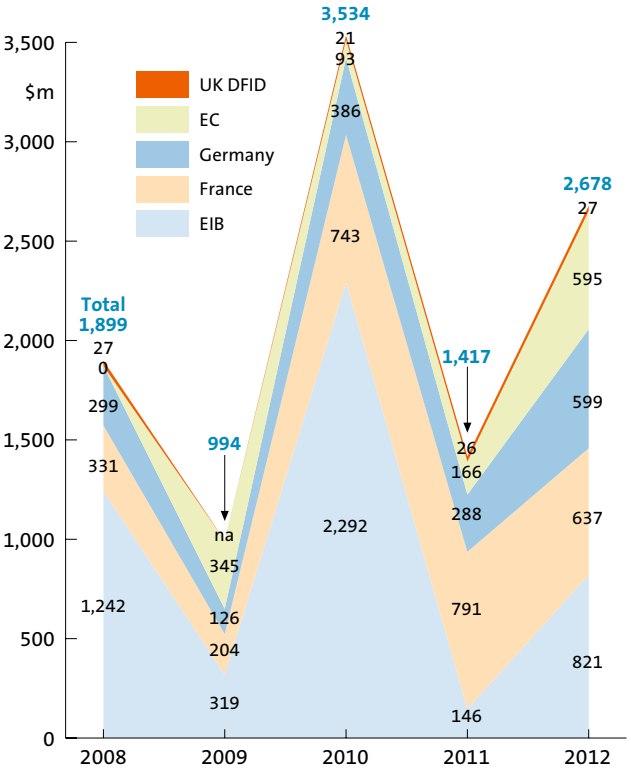
In 2012, the World Bank Group's International Finance Corporation and Standard Chartered Bank, launched a Pan-African Medium-Term Note Programme to boost local currency lending, with an initial focus on Botswana, Ghana, Kenya, South Africa, Uganda and Zambia. In September 2013, the IFC issued its first local currency-denominated bond in Zambia; the 'Zambezi' bond made it the first non-resident domestic capital markets issuer. Other institutions, including the AfDB, are also providing support to build up local currency markets.

Africa50 beckons

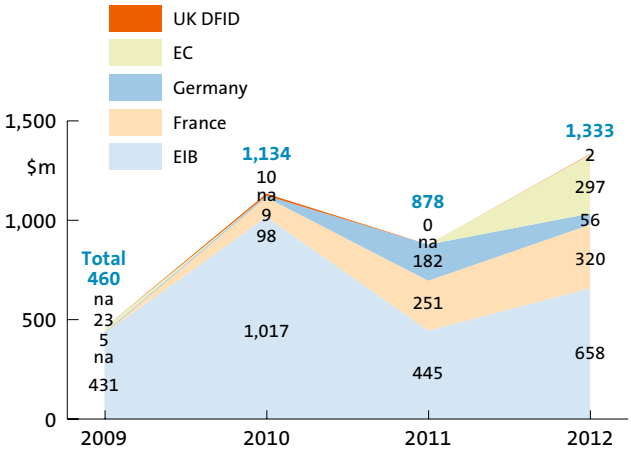
Potentially the biggest facility of all is a public sector initiative to leverage private sector investment: the AfDB's creation of the Africa50 Infrastructure Fund, which aims to mobilise private financing for high-impact national and regional projects in the energy, transport, ICT and water sectors, by contributing to early-stage funding to push projects towards bankability. Africa50 aims to reduce the project time span, between conception and financial close, from an average of seven years now, to three years.

It will offer financial instruments, including short-term bridge equity, senior secured loans, refinancing and secondary transactions, as well as other risk mitigating activities. In this way, Africa50 hopes to boost investment, sharing costs with host governments and developers, and recovering its contribution at financial close. The AfDB hopes that its target of $10 bn will attract a further $100 bn in investment in projects, which will make a big contribution to delivering projects included in the Programme for Infrastructure Development in Africa. Africa50's ambitions are underlined by its target of $3 bn for initial fund-raising.

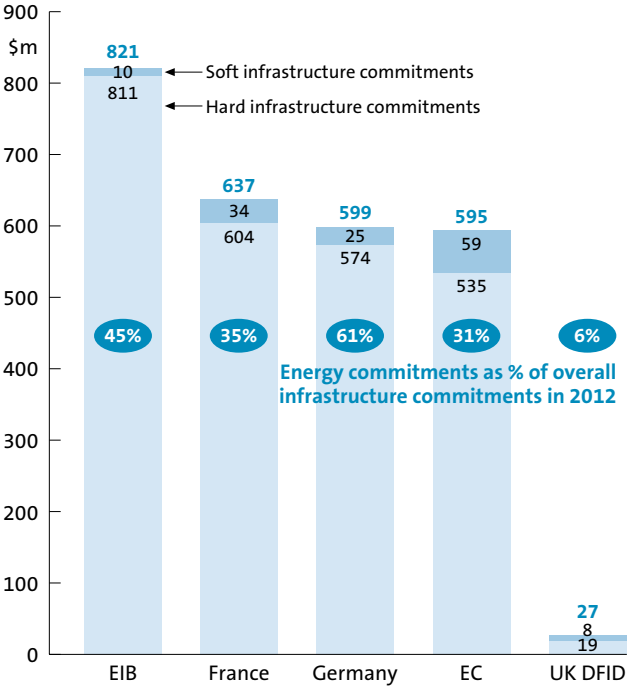
European energy commitments to Africa, 2008–12



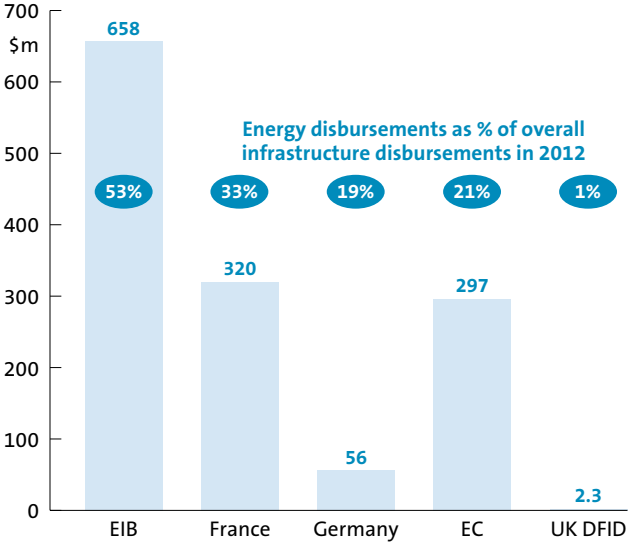
European energy disbursements to Africa, 2009–12



European energy commitments to Africa, 2012



European energy disbursements to Africa, 2012



Case Study

European financing is set for further expansion

Increased flows of European official and private sector finance for African energy projects are expected in the next cycle of European Union funding, from institutions such as the European Investment Bank (EIB) and several instruments including the European Development Fund and EU-Africa Infrastructure Trust Fund (ITF). Other multilaterals are also increasing their support, including the World Bank Group and African Development Bank Group – both of which have a large European shareholding.

A number of leading European development finance institutions are also planning to increase support, including some of those already most active, such as the Netherlands' FMO and Germany's KfW. One example among several of how African energy has risen up the international agenda since the AEEP's creation, FMO's 2013–16 strategy, focused on becoming a "leading impact investor" that leverages private sector deals to drive sustainable economic development, envisages another big increase in the Dutch Development Finance Company's already substantial African energy portfolio.

ITF offers leverage

The EIB-managed ITF offers one example of the impact European funding can have on African projects: it has supported €385 m-worth of projects since it was set up by the European Commission (EC) and EU Member States in October 2007. More than half of this (almost €196 m) has been directed towards the energy sector. This is an effective contribution: every euro the ITF offers in project support is estimated to generate €13 of investment. Further expansion is likely when the EU puts new funding in place. The EC has designated ITF as its main instrument to support the United Nations-led Sustainable Energy for All (SE4 All) initiative. Backed by a €329 m EC commitment, ITF will provide grants through a SE4 All envelope that supports energy projects that qualify under SE4 All eligibility criteria.

ITF grants provide interest rate subsidies (IRS) for long-term loans, technical assistance (TA) for feasibility studies, oneoff grants and financial instruments. In 2012, it approved €17.6 m-worth of IRS and €600,000 of TA for Zambia's 120 MW Itezhi-Tezhi hydroelectric plant.

ITF also provided a total of €22.5 m in IRS and one-off grants to the Cote d'Ivoire-Liberia-Sierra Leone-Guinea Interconnection project, and committed €8 m to the Africa Sustainable Energy Facility, which aims to encourage local commercial banks to finance renewable energy and energy efficiency projects. ITF is also supporting the new Africa Energy Guarantee Fund (AEGF), created to address a lack of adequate risk-mitigation (insurance) products. The EC has thus far contributed €637.7 m to ITF. Other major donors include the United Kingdom which has committed €64.7 m, Spain and France (both €10 m), and Germany (both €5 m). Germany and the United Kingdom are among those considering new commitments.

EU commitments are rising

The ICA's data for selected EU commitments to Africa for energy in 2012 amounted to $2.7 bn, or 40 % of total commitments to infrastructure, which also includes the transport, water and sanitation, and ICT sectors. Germany dedicated the largest proportion to energy investment (61 % of its total infrastructure commitment), followed by the EIB (45 %). Commitments are broadly divided into official development assistance (ODA) and non-concessional funding (non-ODA). The EIB and France committed about 60 % and 28 % respectively of non-ODA investment in 2012; the German, EC and UK contributions were entirely classified as ODA.

The data shows that EU energy commitments fluctuated considerably between 2008 and 2012. The poorest performance was in 2009, when the global financial crisis hit, while commitments surged in 2010, driven by $1.4 bn of non-ODA committed by the EIB to North Africa. The general trend over these five years shows that EU funds committed to energy have grown by an average 9 %/yr. And selected EU disbursements show a similar pattern, if exhibiting significant variations. The compound average growth rate stands at an impressive 43 %, but needs to be put into perspective considering the very low 2009 baseline.

In 2012, overall EU disbursements stood at $1.3 bn, with the EIB accounting for the largest share (as a contribution to overall EU disbursements and as the share disbursed on energy relative to overall infrastructure). It is also notable that EC disbursements have increased significantly when available data for 2009–12 is compared.

The ICA data show that around 5 % of total energy commitments were made to 'soft infrastructure projects' that support the realisation of physical infrastructure outputs. In 2012, the UK directed the highest share (30 %) towards soft infrastructure measures such as capacity-building, enabling legislation, and project preparation, followed by Germany and the EC (10 % each).

Targets to 2020 and beyond

The Africa-EU Energy Partnership has established a dynamic framework in which policies and projects that can significantly improve the lives of millions can be implemented with high levels of delivery, sustainability and stakeholder buy-in. That improvement will become a reality if Africa, strongly supported by Europe, can meet the AEEP's 2020 Political Targets. Progress is measured through a monitoring process by which the AEEP continuously reviews the available data to ascertain which targets best meet the goals of governments and peoples. These targets must be both challenging and realistic.

The 2020 Targets are far from being the exclusive domain of Europe: many other players are involved, from the Americas, Asia, Europe beyond the EU and other regions. But, as this AEEP Status Report establishes, the EU and its member states are first among equals in helping Africa to meet, and even exceed, the 2020 Targets.

The data suggests Africa can rise above some of the targets decided by the AEEP in2010. Major renewable power procurement programmes in Morocco and South Africa should comfortably meet the targets for solar and wind power. A few large dam projects will determine whether the hydroelectric target is met: the push to implement PIDA should make this a reality. Access targets could largely be met were a large, under-served country – such as Africa's most populous economy, Nigeria – implement changes to its policy environment. This is the promise of Nigeria's ambitious distribution and generation privatisation programme.

Major progress is being made on several fronts, but it is not necessarily evenly spread among Africa's diverse economies and societies. In future monitoring, tailored regional targets might help address this issue, to take into account regional differences in the resource base and demographics, while encouraging a better spread of outcomes across Africa. AEEP's promotion of off-grid solutions, as well as mega-projects with transnational impacts, is promoting more broadly-based development.

Ambitions for access

The data is sketchy, but it is nevertheless expected that access to electricity and non-solid cooking fuel targets will be met. Over the decade 2000–10 an estimated 140 million Africans gained access to electricity and 78 million to non-solid cooking fuel. The historical trends suggest that a target of 100 million people gaining access in the decade to 2020 is achievable. With initiatives such as Sustainable Energy for All (SE4 All) coupled with the more focused policies being applied by many governments, a more ambitious performance might be possible. But statistics rarely tell the whole story: population increases mean that, even if access targets are met in 2020 (and through to 2030, within the SE4 All framework), there could still be more African citizens requiring access than there are now.

Among other indicators, energy security targets are expected to be missed if current trends persist. The AEEP estimates that exports were 78.9 bcm in 2010, meaning that the target of doubling exports is likely to be missed. A similar picture applies to gas consumption. The 2020 electrical interconnection target will also be missed if the recent trend maintains, but project implementation, backed by increased investment and urgency in the sector, make this an achievable target.

Longer term targets

The AEEP Secretariat has undertaken analysis and consulted stakeholders on whether the AEEP political targets should be extended to 2030. This might allow for more long-term strategic thinking, and would coincide with the longer period factored into SE4 All, PIDA and other initiatives that will help Africa to overcome its access, energy security and other challenges. Many African countries have signed up to SE4 All, and the EU has also aligned with the global initiative. While the issue of access is critical to driving forward the African economic and social development agenda, it should be remembered that global success hinges on improving access in India (which suffers by far the biggest shortfall in numbers) and other countries.

Working together, the AEEP and partners such as the African Union Commission, African Development Bank (SE4 All's African hub) and European Commission can promote a continental agenda within the global initiative to improve access over the years to come.

An important step along the way will be meeting the AEEP's 2020 Political Targets. These remain an essential element of the AEEP framework, defining medium-term goals towards which work is already under way. They provide a robust framework in which to bring a diversity of stakeholders together, and structure Europe's support for a more dynamic, broad-based and sustainable African energy infrastructure.

Africa-EU
Energy Partnership

Imprint

Published by

European Union Energy Initiative –
Partnership Dialogue Facility (EUEI PDF)

On behalf of the stakeholders of the
Africa-EU Energy Partnership

c/o Deutsche Gesellschaft für Internationale
Zusammenarbeit (GIZ) GmbH
Dag-Hammarskjöld-Weg 1–5
65760 Eschborn
Germany

www.euei-pdf.org/aeep
aeep@euei-pdf.org

Authors

EUEI PDF on behalf of the stakeholders of the
Africa-EU Energy Partnership

Produced by Cross-border Information (London) Ltd.

www.crossborderinformation.com

Design & Layout

Schumacher. Visuelle Kommunikation, Germany

www.schumacher-visuell.de

Picture credits

Front cover Sia Kambou, AFP via Getty Images

Page 2 EUEI PDF

Page 8 Thomas Koehler/Photothek via Getty Images

Page 12 EUEI PDF

Page 19 GIZ

Page 21 Energy Coordination Office, Ethiopia

Page 25 Thomas Koehler / Photothek via Getty Images

Page 27 Jenny Vaughan / AFP via Getty Images

Page 30 BP

Page 31 Globeleq/Songas

Page 33 eleQtra (InfraCo) Ltd

Page 34 Antonio Gomes

Page 38 Othmane Dilami

Page 41 DigitalGlobe via Getty Images.

Page 42 Thomas Koehler/Photothek via Getty Images

Page 43 GIZ, Rwanda/Energy, Water and Sanitation Authority (EWSA)

Page 48 AFP via Getty Images

Page 51 Eskom

Page 53 GIZ

Page 54 Sia Kambou, AFP/GettyImages

Page 63 EUEI PDF

Maps and graphics were drawn by David Burles, Cross-border Information (London) Ltd

Federal Ministry
for Economic Cooperation
and Development

Ministero degli Affari Esteri
e della Cooperazione Internazionale

European
Commission

The AEEP is one of eight Joint Africa-EU Strategic Partnerships. It provides a long-term framework for structured political dialogue and co-operation between Africa and the EU on energy issues of mutual strategic importance. Through it, Africa and Europe work together to develop a shared vision, common policy approaches and actions.

The AEEP's overall objective is to improve access to reliable, secure, affordableand sustainable energy services for both continents, with the aim of achieving the Millennium Development Goals in Africa. The AEEP's efforts are focused on meeting a series of concrete, realistic and visible targets by 2020, as agreed by the Partnership's First High Level Meeting, held in Vienna on 14–15 September 2010.

The aim of this report is to describe the AEEP's efforts to set benchmarks and monitor progress in achieving those goals, and to point to directions for continued action.