A Virtuous Circle: scaling up investment in low carbon energy

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christian aid

THE BIG SHIFT GLOBAL

Christian Aid is a member of actalliance

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Big Shift Global: Christian Aid is a member of The Big Shift Global campaign to bring about a complete phase-out of public funding for fossil fuels by 2020, and a scaling up of investment in renewable energy and energy access. See www.bigshiftglobal.org

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Cover: Portable solar panels, carried during a community evacuation drill in Marabut, the Philippines, March 2017.

Reasons for hope

Many global investors and policymakers are unaware of the revolution that has taken place in renewable-energy technology and costs, and the record investment now placed in low and zero carbon energy. Renewable energy is no longer high cost. In an ever-increasing number of settings, it is competitive with fossil fuels. As a result, renewables are disrupting traditional energy business models and creating new investment opportunities. And at the same time, they are seriously calling into question ongoing investment in fossil fuels, especially in the electricity sector.

This revolution coincides with an environment in which certain investors are increasingly allocating capital to long-term infrastructure assets and focusing on more sustainable investments, including those that mitigate the risks of climate change. As renewable energy offers both the returns and the sustainability profiles sought by investors, interest in renewables is at record levels, and rising, while investment in fossil fuels is falling. With the right investment conditions, the increasing affordability of renewables can create a virtuous circle to deliver energy access to the 1.06 billion people who live without electricity and to keep global warming rise below 1.5°C.

The effects of unmitigated climate change are falling hardest on the world's most vulnerable communities – from the devastation caused by extreme weather events such as hurricanes, to slow-onset disasters such as the effect of drought on subsistence farming or rising sea-levels on the displacement of people. This is a humanitarian crisis that has already started to unfold.

Delivering low-carbon energy is also a development challenge. Significant expansion in the provision of energy services will help to meet the 2030 Agenda for Sustainable Development – in particular Sustainable Development Goal 7 to 'ensure access to affordable, reliable, sustainable and modern energy for all'. To achieve such expansion will require higher levels of financing, bolder policy commitments, and the willingness of countries to embrace new technologies on a much wider scale.

Today, there are an estimated 1.06 billion people without access to electricity, of which 612 million are in Africa, overwhelmingly in Sub-Saharan Africa. Some of these households are in urban areas, but the majority live in remote parts of Africa, Asia, and Latin America and the Caribbean.

Civil society, governments, policy makers, and both public and private investors and philanthropists, have a critical role in creating a low carbon future, by making a rapid transition to renewable energy.

For many years, those concerned about the impact of climate change have criticised the delay to embrace low and zero carbon investment, especially the deployment of renewable energy

The Paris climate agreement

The central aim of the Paris climate agreement is to strengthen the global response to the threat of climate change. Its focus is to keep global temperature rise, this century, well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C.

There are substantial challenges to reducing emissions, including financial challenges. To limit climate change to 2°C, the International Energy Agency (IEA) estimates that from 2017 to 2040, $40tn in energy investment and $35tn in energy efficiency investment will need to be diverted from high carbon fossil fuels towards sustainable energy. And more will be required for the 1.5°C preferred Paris Agreement target.[1] But this is no longer an insurmountable challenge.

technologies. But that is changing. This report demonstrates that the time for rapid deployment of renewable energy technologies is now.

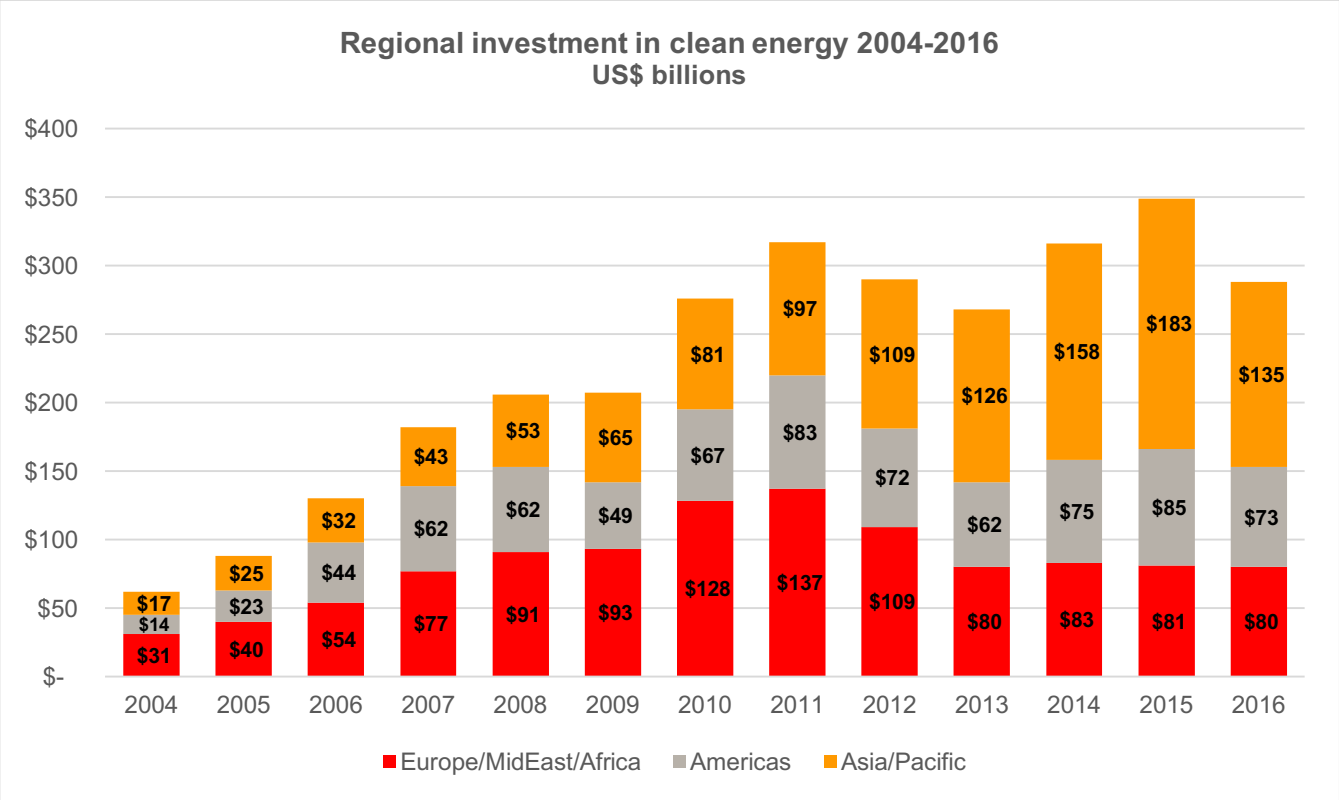
Investability

As renewable energy has become financially competitive, reliable and proven, it has become investible. Today, renewables account for the majority of global electricity sector investment. Substantially more is needed, but capital for clean energy investment is at record levels. Energy experts increasingly believe that wind and solar will be the least-cost sources of new power generation in most of the world by 2020.[2]

Once almost exclusively the domain of a few electric utilities and a handful of specialist infrastructure funds and banks, renewable energy investment has become mainstream. Globally, there are now hundreds of investors backing renewable energy projects: pension funds and insurance companies from Australia, Canada, Europe, Japan, New Zealand and the US; sovereign wealth funds from Europe, Asia and the Middle East; endowments, foundations and family offices from around the world; global banks and multilateral development banks. Figure 1 demonstrates the trend in regional investment in clean energy between 2004 and 2016. This combination of low costs and investor demand for renewables raises serious questions about the soundness of new investment in fossil-fuel-based electricity projects.

‘This combination of low cost and investor demand for renewables raises serious questions about the soundness of new investment in fossil-fuel based electricity supplies’

Figure 1: Global investment in clean energy 2004-2016



Source: Bloomberg New Energy Finance, *Clean Energy Investment, End of Year 2016*, January 2017

Reduced costs

Technological and manufacturing advances have dramatically lowered the cost of renewable power generation. The electricity sector, the largest contributor to CO_2 emissions, can now dramatically reduce emissions and extend carbon-free electricity in developed and developing markets.

The main drivers in cost reduction have been the utility-scale renewables (typically defined as 10MW or larger). But learnings from these large-scale projects, combined with advances in battery technologies and efficient LED lighting, have made small, off-grid energy systems both an affordable and increasingly attractive option for extending electricity grids into developing markets. For example:

- Falling battery costs and photovoltaic (PV) costs (for converting light into electricity), have led to 'plug and play' solar/battery/light systems that are affordable for off-grid communities in Africa, Asia and Latin America. These remove the need for expensive grid extensions. (See case study 1.)
- Major corporate energy users are procuring sustainable energy directly from independent renewable energy generators, taking advantage of regulations that encourage market access and bypassing traditional utility companies. (See Tellenes/Google case study 3.)

Governments and consumers can now make sustainable energy choices that were once available only to wealthy countries and consumers.

Case study 1

A look at off-grid energy use in the world's poorest countries

There is often a perception that the world's poorest people, who frequently lack access to electric grids, do not have energy costs. They do. Charcoal or wood for cooking, kerosene for cooking stoves and lanterns, candles, diesel for small generators, or paying a local store or resident with power to charge cell phones. (In 2016, there were 420 million distinct mobile phone users in sub-Saharan Africa.)

The fuel sources relied upon by those without grid access are highly inefficient, emit high levels of CO_2 and create health risks from smoke and fumes breathed in enclosed spaces. Furthermore, procuring that energy can be time consuming, as people (predominantly women) may have to walk miles for their wood, charcoal or kerosene.

The technological and cost developments that have taken place in both individual photovoltaic (PV) systems and in small 'microgrids' mean that it is now increasingly feasible for the rural and urban poor, without access to grids, to switch some of their energy costs from polluting, carbon fuels to cleaner, more reliable and time-saving electricity.

Defining clean energy

The way investors, including the World Bank and other multilateral development banks (MDBs), define renewable energy is broad. They include large hydropower and bioenergy (biofuels or biomass or both) projects, which can have significant negative environmental and social impacts, contradicting their classification as 'clean' energies.[3] In Brazil, for example, large hydroelectric plants have led to deforestation of the Amazon rainforest and the displacement of indigenous and Afro-descendant communities. Small-scale hydropower facilities, on the other hand, have demonstrably improved living conditions in small, rural communities in the region.

We urge governments, policy makers and investors to keep in mind the following definitions, prepared by Oil Change International, an NGO calling for the transition to clean energy:

Fossil fuel projects: Any project or policies supporting the exploration and extraction of fossil fuels; plus fossil fuel power projects including power transmission using oil, gas or coal.

Clean energy projects: Projects that are both low carbon and have low environmental and social impacts. This includes energy efficiency and renewable energy from the sun, wind, rain, tides and geothermal sources. It also includes any policy reforms that provide incentives for clean energy development and investment.

Other projects: Hydropower and bioenergy (biofuels and biomass), nuclear power and incineration, along with other forms of power that are not fossil fuel but are not 'clean'. Some of these energy sources can have negative impacts on the local environment and on human populations.[4]

Investors embracing clean energy

We have arrived at a tipping point, where not only is clean energy technically and economically viable, it is increasingly embraced by institutional investors who, under the right conditions, are willing to invest at unprecedented levels. This is fuelling a virtuous circle, for as clean energy continues to scale up, costs continue to fall, making clean energy the least-cost choice in an increasing number of applications. But pace of investment, and the speed at which that virtuous circle spins, needs to accelerate rapidly. Despite the tremendous technological and economic achievements, and the fact that the investor community is embracing renewables, all too often governments, policy makers and investors continue to favour fossil fuel power generation. They seem to believe that it is both necessary and economical, when in fact it is not.

Renewable energy is no longer the province of the OECD, Europe and North America. Brazil, Chile, Mexico, Morocco, India and South Africa have emerged as leading renewable energy markets, implementing transparent policies that are attracting global strategic and financial investors to those markets most in need of energy; and the list of countries following suit is growing.

There is now a compelling, evidenced-based case for investing in renewable energy in the developing markets, and as a result a weakening case for further investment in fossil fuels.

Now is the time that governments, policy makers and investors should realise that clean energy and clean energy investments are reliable, cost effective and scalable, and a solution for delivering clean and sustainable energy for all.

The low and zero carbon investment challenge and its opportunities

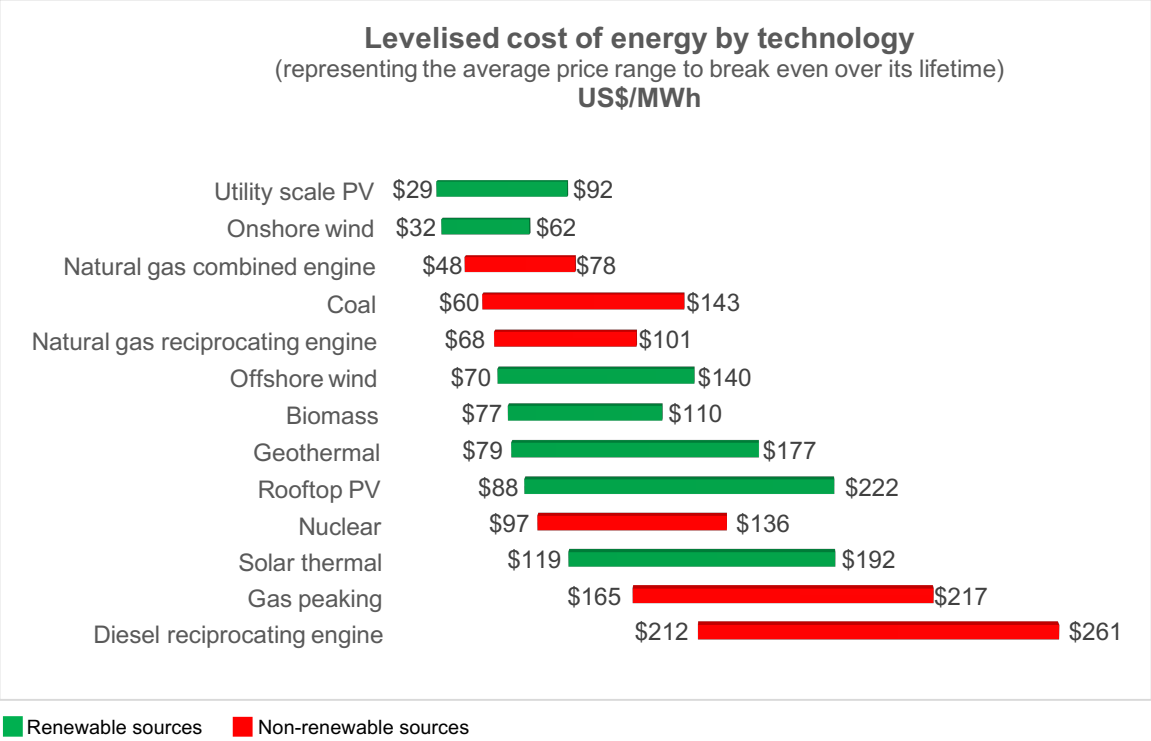
In order to limit global warming to 2°C by 2040, approximately $20tr (about $900bn per year) needs to be invested in renewable power facilities and related transmission and distribution grids. This is triple the current record annual investment in clean energy, which stands at $300bn per year.

Below: Wind farm at Lake Nicaragua, Central America

Following the oil crises of the 1970s, many OECD countries, especially the US and Western Europe, began encouraging renewable energy investment. Following the 1992 United Nations Framework Convention on Climate Change and the 1997 Kyoto Protocol, OECD countries redoubled their efforts to deliver renewable energy – especially in the EU, which became the largest renewable energy market in the early 2000s. In about 2005, China began its big push for renewable energy. This combination of US, EU and China-led growth, albeit at high cost to electric users, allowed the industry to scale up. These countries financed a steep learning curve, through which technology was improved and costs were lowered, now benefiting the entire globe.

The same trend can be seen in the costs of wind energy, especially since 2009 when dramatic technical increases in the efficiency of wind turbines began. The costs below are expressed as the ‘levelised cost of energy’, which reflects the cost of electricity per MWh necessary to pay operating costs and repay capital costs, plus a reasonable rate of return. Figure 2 shows the current levelised cost for a range of energy technologies.

Figure 2: 2017 Levelised cost of energy of renewables by technology



Source: Lazard, Morgan Stanley, Bloomberg New Energy Finance, Two Lights Energy Advisors

These costs do not reflect external costs and benefits, such as pollution and CO_2 emissions from conventional power, back-up power costs for intermittency of renewables, or the costs of building transmission grids in developing markets to accommodate new power. Nevertheless, the data clearly shows that renewables, especially onshore wind and utility-scale solar PV are increasingly the least cost options for new generation power, a position traditionally held by natural gas combined-cycle plants. Also interesting is the competitiveness of renewables vis-à-vis coal and nuclear generation. For developing markets, the cost savings may be even more dramatic.

Historically, diesel piston engines have been a favoured means of power generation for island nations and coastal urban areas, such as the Philippines or West Africa. But when compared to wind and solar, diesel is very expensive. It can also use up hard currency reserves for fuel imports and is obviously highly polluting. The opportunities for displacing fossil fuels in these locations is demonstrably both deliverable and cost effective.

In the past, concerns over cost, reliability, subsidies and absence of investment track records have caused many investors to shun clean energy investment. And despite the revolutionary economic, technical and investment advances made in renewables in recent years, some of these historic perceptions persist today. A fresh look at the current state of renewables demonstrates that these concerns should no longer be obstacles, and further call into question why investment in fossil fuels continues.

Conditions that attract renewable energy investment

Having established that renewable energy has largely overcome past obstacles and is an attractive investment compared to fossil fuels, we will focus on the conditions and mechanisms that have proved successful in attracting renewable energy investment.

Conditions that attract utility-scale renewable energy investment

The conditions necessary to attract companies to develop, sponsor and finance utility-scale renewable energy projects (such as siting, permits, engineering, design, construction) are the same as for any large infrastructure project:

- **A need for the project** – whether it be to fill unmet electricity demand (as in most developing markets) or meet environmental or energy security goals (as in most OECD countries).
- **A stable and transparent regulatory framework** for securing building and operating permits and payment for the electricity produced, and access to ancillary infrastructure such as transmission and distribution grids.
- **Predictable, long-term revenue streams** that repay the upfront costs and give a reasonable profit over a long period of time – whether by contract or tariff. This depends on a creditworthy counterparty.
- **Legal and regulatory frameworks** that allow for the enforcement of contracts, securing mortgages over property and allowing for cross-border repatriation (currency conversion) of profits. Policy makers must also be alert to the potential tension between high levels of profit repatriation and the important role that reinvestment of locally generated profits can play in helping to meet wider economic development goals.
- **National laws or insurance** to protect against expropriation or material long-term regulatory change.
- **Systems and laws** designed to allow installations of renewable technology to secure long-term ‘project finance’.

Conditions that attract distributed renewable energy investment

Globally, there are an estimated 1.06 billion people without access to electricity, a majority of whom live in remote areas of Africa, Asia and Latin America and the Caribbean. The cost of building and building maintenance (earthquake risk, flood risk, vandalism of copper wire, lack of roads and challenging terrain) has been a key obstacle to rural electrification, especially as the consumers in these areas have low incomes.

The advances in renewable technology and cost, especially in solar PV, coupled with advances in battery storage, LED lighting and mobile phone payment systems, have created new options for rural electrification. Businesses supporting the generation of small-scale solar power are now delivering distributed systems at a lower cost

than extending the grid. Today, more than a dozen venture capital backed companies are pursuing this business in Africa alone. (See case study 2.)

The business model is simple. It all comes in a box. The solar panel is mounted on the roof and connected to the battery controller, which can be set up for direct use or to charge the battery for night time use. Customers can buy the system outright, or pay in installments, typically over three years. Payment is most frequently made through mobile phone payment systems, and the SIM-enabled controller allows the provider to both monitor each unit and to shut it down if payment is not made. The cost is typically $10-$15 per month, which consumers can afford by applying savings made from no longer purchasing kerosene or candles or paying to recharge phones. The systems improve quality of life: less smoke and fumes; access to information and entertainment by radio; and light to study by.

Microgrid solar power systems

In addition to these individual systems, advances have been made in community-scale systems and 'microgrids' – in which a jointly owned solar array or wind turbine is attached to a new village grid. Seeing the benefits and savings over traditional grid expansion, some countries are now changing regulation to encourage these small systems. For example, Nigeria is crafting legislation as part of its rural electrification plan to make it easier to establish, finance and operate microgrids based on distributed renewables.

The business model for distributed solar is based on providing a valuable service – energy – to consumers, coupled with providing consumer finance to those customers. The companies that are providing distributed solar are being backed on a venture capital basis by a combination of concessionary or foundation investors comfortable with lower returns and, increasingly, venture capital funds and strategic investors (such as electric utilities) that see value in both the underlying economics and the growth potential.

It is early days for distributed generation companies, as they are still scaling up and reinvesting capital into this growing market. However, in our discussions with several African distributed PV companies (and we believe much of this to be equally applicable to Asia and Latin America and the Caribbean), the following has become clear:

- **Affordability:** Every customer can be served at an affordable price that is profitable to the supplier at appropriate risk return levels.
- **Timely payment:** Customers are paying in a timely manner, providing the basis for reinvestment and for more creative financing opportunities for the PV suppliers.
- **Diverse funding:** Several distributed PV companies, especially in sub-Saharan Africa, have been able to attract both institutional venture capital and private equity funding on commercial terms. This is in addition to strategic funding from international utilities that are realising their long-term strategy for developing markets will require both utility-scale and distributed-scale activities to attract and serve new customers.
- **Customer relationships:** Distributed PV companies are on the front line of developing relationships with future consumers

Case study 2

BBOXX solar power for off-grid communities

Kenya, Nigeria, Rwanda

Customer service, big data and securitisation

BBOXX is the brainchild of three Imperial College London students who saw the need for new clean energy solutions for off-grid communities. Active in Kenya, Nigeria and Rwanda, they are looking to expand to Asia and Latin America. To date, they have sold more than 100,000 distributed solar PV units, consisting of PV panels, battery controllers, lights, radios and TVs. In most countries, more than 90% of their payments have come from mobile phone pay.

BBOXX has secured more than $30bn in venture capital funding from sources including Khosla Impact Fund, ENGIE, and KawiSafi Ventures. Their PV panels and control units are manufactured in China, and are sold through local BBOXX shops in Africa.

BBOXX focuses on maximising sales in defined geographic areas. They train and maintain local service teams so their customers are well-supported. BBOXX see themselves not just as equipment suppliers but as service providers. They also view a focus on service as a way to overcome the history of poor equipment that has affected some consumers.

Finally, BBOXX is aware of the value of the data they are collecting – electricity usage and usage patterns, solar radiation, panel and control box performance and payment history. BBOXX is working to collect and analyse the data, which may prove valuable in the future to be able to offer more products and services in markets where there is currently little consumer data.

Source: Mansoor Hamayun, BBOXX

in the developing markets. Purchasing a distributed PV system will often be a consumer's first major purchase, and payment over a period of time their first experience with credit. Some PV companies are beginning to use payment history to start building credit profiles on consumers that do not have them.

Conditions that attract distributed PV investment

Utility-scale renewables are highly regulated and projects rely on long-term regulatory consistency to ensure investor returns. In contrast, distributed generation is lightly regulated, which makes it easier to execute, but it can lack some of the legal protections of utility-scale projects.

Deploying systems profitably depends on economies of scale when purchasing systems; setting up marketing, service and billing; and when supporting purchasing, management and financing structures. In our research, we identified the following factors leading to profitability in distributed PV operations:

- **A pro-renewable regulatory environment:** Countries that have a good understanding of climate change risks and that promote renewable energy investment (even if only subsidised at utility scale), are more attractive, creating an overall more stable and predictable regulatory environment – which in turn encourages investment.
- **An addressable customer base, within an appropriate geographic area:** There must be a sufficient concentration of potential customers within a defined geographical area. There must be energy demand and sufficient income to pay for it (by shifting current energy costs to clean energy costs). Until costs reduce further, the smallest and remotest populations that lack access will not be the focus of entrepreneurial companies.
- **The ability to achieve significant penetration in a community.** This encourages more sales, and because in close knit communities non-payment and loss of service can be embarrassing, some companies believe it improves the payment profile.
- **Appropriate tax barriers.** Many developing markets have high import duties. These may be appropriate for some items but can make the distributed systems, which are dependent on solar panels and related equipment, too expensive. Similarly, VAT rates can be too high, discouraging adoption.[5]
- **Favourable finance regulation.** Providing customers with financing is integral to installing systems, as most potential customers are unable to pay the upfront costs. The companies are aware of their obligations to deal fairly with consumers, but jurisdictions that might seek to impose banking regulations on distributed PV businesses are likely to add costs that make distributed PV uncompetitive.

'Until costs reduce further, the smallest and remotest populations that lack access will not be the focus of these entrepreneurial companies'

Case study 3

Tellenes onshore wind

Norway

Low cost renewables at scale, supported by Sustainable Corporate Power Purchase Agreements

In recent years, an increasing number of corporations with substantial energy usage have supported new wind farm projects. They have directly purchased electricity for their own consumption, outside traditional tariffs or utility power purchase agreements (PPA). This drive has been spearheaded by high-tech firms such as Amazon and Facebook. But Google is the undisputed leader, and in 2016 it announced that it would reach 100% renewable energy for its global operations in 2017.[6] This substantial demand is supported by operations such as the (160MW) Tellenes wind project in Norway.

The Tellenes wind farm, located in southern Norway, will generate in excess of 500GWh per year of electricity, enough to power 31,000 Norwegian homes. It was developed by a local joint venture of several Norwegian municipal utilities.

As noted above, investors in long-term energy projects seek to mitigate their exposure to electricity pricing risk. Historically, in the Nordic market power prices could only be fixed for about five years, which has created issues for many wind investors. However, at the same time the Nordic region offers some of the world's best wind resource and the opportunity to deploy the latest wind technology at scale, reducing costs and making Nordic wind some of the cheapest wind energy in the world. Despite the low costs, the investors in the project – an institutional investor fund managed by BlackRock, the world's largest asset manager, required power pricing certainty for longer than the five years generally available in the Nordic market. The solution was provided by Google.

In 2015, Google announced that they would seek to meet all their substantial electricity needs, including those of their data centres, by purchasing renewable energy from projects around the world.

In the Tellenes project, Google agreed to buy all the electricity produced by the wind farm for 12 years at a fixed price. The removal of electricity pricing risk allowed BlackRock to invest substantial equity and secure long-term project financing from the Danish Export Credit Agency and two European commercial banks. Google will use the power to meet part of the electricity demand for four data centres that it operates in Scandinavia and Northern Europe. The power price is fixed, but reflects market rates and insulates Google from market price risk for 12 years.

The combination of Google's strong credit, high wind speed and low capital costs means that the project's levelised cost of energy is less than $45 MWh, making Tellenes one of the lowest-cost wind projects in all of Europe.

In addition to selling power to Google, the project will generate green certificates under the joint Norwegian/Swedish renewable energy regime.

The conditions that allowed this deal to proceed included:

- A liquid and open power market in which private companies can contract for power, bypassing historic monopoly utilities.
- Non-discriminatory access to the electric grid, allowing corporate purchasers to transmit power from renewable generation sites to the point of consumption.
- Good wind resources and the ability to invest at scale, reducing both operating and financing costs.
- A creditworthy customer in Google to support bank debt.
- Enforceable contracts.

In the traditional model, renewable projects sell power under tariffs or long-term contracts with utilities. This project represents a substantial collaboration between industry and financiers outside this model. It also shows the cost effectiveness of renewables.

This corporate PPA model is an increasing trend. In 2014 and 2016 more than 25% of US wind and solar projects were built and financed based on corporate PPAs rather than traditional utility PPAs. This trend is expected to continue.

Source: BlackRock Real Assets website

Related conditions that help attract renewable energy investment – utility and distributed scale

Above, we examined the main conditions for investment for both utility-scale and distributed renewables. There are additional supporting investment conditions that can enhance the chances of attracting investment at both the large and small scale, especially in developing markets:

- **Multilateral development bank (MDB) 'A/B' loan structures:** The MDBs have created what are referred to as A/B loan structures. Under the A/B structure, the MDB is the grantor who makes the 'A loan' and is the direct creditor and administrator. Private sector lenders hold 'B loans', which are similar to a syndication. The private sector lenders benefit from the MDBs' preferred position and more favourable capital reserve rules (under the Basel II accord).[7]
- **Political-risk insurance:** Political risk insurance, whether from private markets or governmental entities such as OPIC and the World Bank, help protect investments from nationalisation or expropriation, either directly or indirectly, through regulation.
- **First loss provisions:** Several entities, such as OPIC and the EIB, have pioneered first loss provisions, whereby the governmental organisation agrees to be repaid after private investors, taking the 'first loss', if need be.
- **Green Banks:** Green Banks are a recent phenomenon. They started in the UK, where the UK Green Investment Bank spearheaded investment in offshore wind, waste to energy, and energy efficiency; and in moving into areas where private investors had concerns. Their sector expertise allowed them to attract about £3 for every £1 of Green Bank money, and in so doing made offshore wind an investable asset class. Malaysia, Japan, Australia and the US states of New York and Connecticut have established Green Banks to catalyse private capital.

Advances in distributed renewables

There have also been enormous advances in distributed renewables, especially solar PV, both for community and individual rooftop application. The fall in PV panel prices has made this a competitive market, especially where distribution grids are limited or non-existent. Falling PV costs have been accompanied by falling battery costs and improved storage density, especially for lithium ion batteries (See case study 4). This has enabled a growing market for 'pay as you go' home solar systems. These systems consist of a solar panel mounted on a roof and connected to a battery/charger. The system generates sufficient electricity to charge a mobile phone and a radio, and to power highly efficient LED lights. It displaces kerosene as a lighting source. Consumers pay monthly. More than 700,000 systems have been installed in Africa alone.[8]

'There have also been enormous advances in distributed renewables, especially PV, both for community and individual rooftop application'

Clean energy investment is mainstream

In 2004, there were less than 10 active institutional investors providing equity for EU renewable energy projects. They were mostly specialist, unlisted investment funds and accounted for less than 2% of capital invested. By 2010, with costs coming down and investments getting larger, institutional equity investors increased in number and in the capital they committed. They are now among the largest sources of capital for EU renewable energy projects, and many of those investors are starting to move to developing markets.

Evidence increasingly demonstrates that the historic barriers to large-scale renewable energy investment – technology, cost and investor inexperience – have been largely overcome. The trend suggests that cost objections should be eliminated in three-to-five years, making renewables the least cost alternative. This means that the obstacles facing renewables will be no different to those affecting conventional power deployment, especially for utility-scale renewables.

Those remaining obstacles are primarily regulatory, ancillary infrastructure and country macro-economic risks, which are common not only to renewable and fossil fuel investments, but to infrastructure investments in general. Governments and policy makers that address the risks, outlined below, should see greater investment. With the falling cost of renewables and increasing investor appetite, there is no reason that investment should not flow to renewables.

- **Regulatory risks**
  - **Siting and permitting:** Renewable and conventional plants are subject to stringent permitting requirements for siting, health and safety, environmental and social impact, and the like. Valid local concerns must be addressed, but in many places siting becomes a local political issue and national and global needs are not adequately considered.
  - **Grid connection:** Most renewable and conventional projects need to connect to grids to deliver power. Grid connection rules, regulations and costs can vary.
  - **Protection of incumbent energy sector players.** In the recent past, most electric utilities were national or regional monopolies, with an obligation to serve, but with the sole right to provide electricity. Despite deregulation in many OECD countries in the 1990s, monopolies are hard to break. However, the new business models – self generation and direct corporate purchases – are a threat to their traditional business.[9]

Case study 4

Wind and solar with battery storage

Graciosa, Portuguese Azores

Renewables replacing diesel generation, reducing costs and CO_2 emissions

Graciosa is an island in the Portuguese Azores. It has 4,500 residents and has been dependent for decades on diesel generation to meet its electricity needs. In 2016, it began construction on an innovative integrated renewable energy and electricity storage project delivered by Younicos, a German project developer and microgrid specialist, and Leclanché, a Swiss manufacturer of utility-scale battery storage and associated integration software.

The battery storage maintains power quality during wind and solar fluctuations, and stores power for when wind and sun resources are not producing. The diesel generator remains for backup. The project is paid an overall price for the power generated (which is less than the cost of diesel operations), reducing costs for local consumers and providing an attractive return for the project investors. This will substantially reduce the Island's CO_2 footprint, while reducing consumer costs and providing attractive returns to investors.

Although the project does not fully eliminate diesel usage and emissions, it provides a platform for that to happen in the future. It also shows how areas that are considering diesel can use the new developing and complementary renewable and storage technologies to reduce diesel usage in new projects.

Sources: Younicos and Leclanché websites

- **Ancillary infrastructure**
  - **Grid:** An electric grid is needed for utility-scale projects. If the grid does not exist or there is no certainty that it will be delivered, a project, conventional or renewable, will not be built.
  - **Roads, ports:** The necessary port, road, rail or other transport infrastructure to deliver equipment and materials to a designated site may not exist in some developing markets.
- **Country macroeconomic and political risks**
  - **Governance, transparency, corruption:** Countries with poor governance (governmental and corporate), that lack transparency and have high levels of corruption, will struggle to get investment for their power needs, whether renewable or conventional.
  - **Ability to pay:** Renewable and conventional energy projects are large capital investments, which need to be repaid over long periods of time for power to be affordable (consider the monthly cost of a 5-year mortgage versus a 25-year mortgage). Investors need assurance of adequate payment: who is bearing the cost – government or consumers or both? And how strong is their credit? In developing markets, equipment, foreign loans and equity are likely to be in US dollars, euros or another foreign currency. Yet payments for power delivered may be in local currency, creating currency risk for investors.

Many, if not all, of these risks are manageable or can be mitigated through effective policy and regulation – clear siting rules, fair and timely grid access rules, better governance and the use of country credit risk to support projects. Case study 5 provides an example of renewable energy auctioning programmes overcoming these risks in Mexico.

New business models and favourable regulation can drive more renewable energy.

‘New business models and favourable regulation can drive more renewable energy’

Case study 5

Electric market reform and renewable energy auction programme

Mexico

Market liberalisation, lower costs, private investment

Between 1994 and 2014, Mexican electricity demand doubled. In 2016, Mexico had approximately 68GW of installed power-generation capacity. Of the power generated, 80% came from fossil fuels, 10% from hydro, 6% from wind and solar, and 4% from nuclear. The electricity sector was heavily regulated, with the Federal Commission on Electricity (CFE) operating as a vertically integrated monopoly owning the supply chain (ie generation, transmission, supply and distribution). Independent power producers and industrial self-generators had a very limited role and consumers had to buy their electricity from CFE.

In 2013, Mexico embarked on a series of reforms to liberalise the sector and deliver on its clean energy goal of 50% by 2050. The reforms were designed to lower costs, increase competition, deliver renewable energy targets and attract private investment both in Mexico and abroad.

In 2016, Mexico had two renewable energy auctions, with a third in November 2017. The 2016 auctions attracted investors from around the world. About one-third of the solar capacity was won by the Italian utility Enel, whose bid price at $35MWh is one of the lowest prices for solar globally. Both wind and solar prices were substantially below those anticipated by Mexico, and were lower than fossil fuel prices. Overall, contracts were awarded to 40 wind and solar, 2 hydro and 1 geothermal projects.

Some elements that have contributed to the success of the Mexican reform and auctions:

- Mexico created the National Center for Energy Control (CENACE) – a new, independent, transparent agency – to administer the new wholesale market and renewable energy auctions on a fair and transparent basis.
- High quality documentation, including financeable long-term contracts, with price certainty, for the sale of renewable energy, were prepared in consultation with the industry and designed to attract project finance.
- Breaking the monopoly utility-supply model – allowing large energy users to contract for power directly with independent power producers, including renewables.
- Winners secured a 15-year, fixed-price power purchase agreement for electricity (denominated on Pesos) and 20-year contracts for green certificate sales. The purchaser is CFE, the state-owned utility, which provides strong credit backing.
- Unlike other systems, winners are only paid the contract price for a nominated annual quantity, with penalties for under generation and compensation for over generation at prevailing market prices rather than the contract price, but nevertheless providing a stable revenue base.
- Open access to the tenders by international utilities and investors.
- High level political support and a business-friendly stance.

Source: IRENA, Mayer Brown website, US Energy Information Agency, CENACE website

The expanding global sources of clean energy investment

Not only has the annual volume of clean energy investment grown six-fold since 2004, so too have the sources of clean energy investment, with hundreds of global investors now active. The renewables technological and cost revolution coincides with increased demand for ethical and sustainable investments. This is creating new investment vehicles, such as green bonds and renewable energy 'Yieldcos' – increasing the amounts of capital across the capital spectrum. Despite this increase, momentum needs to be nurtured.

Below: Solar panels providing energy access to communities in the Bolivian Amazon.

Since 2010, there have been remarkable, indeed unprecedented advances in renewable energy finance. Alongside the overall increase in investment, there has been a tremendous growth in institutional investment – pension funds, insurance companies, endowments, sovereign wealth funds – committing more and more capital to the sector. And new investment vehicles have emerged. This growth in investment appetite has been greatest in utility-scale renewable energy projects, which account for the majority of institutional debt and equity investment.

This growth, especially growth in equity investment, is the result of three factors:

1. The increased reliability and cost competitiveness of renewables, already described, reducing the need for government subsidies.

2. The increase in demand for sustainable and environmentally friendly investments, as part of the larger Environmental, Social and Governance (ESG) sustainability and fossil fuel divestment movements.
3. The low-interest-rate market, which has spurred global demand by institutional investors for long-dated infrastructure assets. These provide risk profiles similar to government bonds, providing long-term stable cash flows that pension funds and insurance companies look for to match against their long-term liabilities.

The search for cash-yielding investment coincides with the rise of sustainable and ethical investment objectives, including the growing fossil fuel divestment movement. The confluence of these two trends has dramatically increased investor appetite for clean energy investment.

In the US, Europe and less developed markets like Brazil, Chile, Morocco and South Africa, there are adequate investors and investor appetite for capital for development, construction and operation.

In other developing markets, however, development and construction capital can be difficult to secure; although capital for operating projects is usually achievable, other than in the most difficult countries. The key to unlocking development and construction state capital earlier is to focus on the overall conditions for investment, as examined above.

‘The search for cash-yielding investment coincides with the rise of sustainable and ethical investment objectives, including the growing fossil fuel divestment movement. The confluence of these two trends has dramatically increased investor appetite for clean energy investment’

Case study 6

Financial innovation supporting renewable energy investment

Unlisted general and renewable infrastructure funds

For the last few years, renewable energy investments have accounted for more infrastructure investments than any other global infrastructure sector.[10] The principal investors in these funds are pension funds, insurance companies, family offices, endowments, foundations and sovereign wealth funds. But their commitments to funds are only part of the story. Many of those same institutional investors are bypassing funds and making direct investments in renewable projects and companies. For example:

- Allianz and Munich RE have established dedicated renewable investment teams and collectively committed more than $5bn to EU and US renewable energy projects.
- Dutch pension fund APG has made direct investments in more than $1bn of EU renewable energy projects.
- Danish pension funds PKA Pension and PensionDanmark have invested more than $1bn in EU offshore wind and biomass projects.
- Canadian Pension Funds CDPQ, PSP, OMERS and several others have collectively invested more than $1bn in investments in US and EU renewable projects.

Green bonds: Although most green bond issuances are refinancing existing debt of renewable projects and companies rather than financing new installations, their rapid growth demonstrates a growing appetite for sustainable investments by many global institutional investors. Some of the capital released by green bond refinancing is being reinvested in new renewable energy projects. 2017 green bond issuance is expected to exceed $100bn.[11]

Project finance: Project finance consists mainly of long-term loans from commercial banks, and increasingly from pension fund and insurance companies. There are more than 50 global commercial banks, such as Mitsubishi UFJ, Barclays Bank, Bank of America, KFW Bank, Rabobank, NordLB, DNB Nor, BNP Paribas, Deutsche Bank, Key Bank, HSBC, Mizuhu, Sumitomo, Investec and Rabobank, actively lending to renewable projects. Like equity investors, they are attracted to renewables because of the proven technology and low risk.

Yieldcos: Yieldcos sprang onto the scene in 2013. The Yieldco concept was modelled on listed real estate investment trusts (REITs) and master limited partnerships (publicly traded partnerships), which are used in the US to hold low risk infrastructure assets. They were conceived as low risk, income producing investment vehicles that pay an annual dividend from operating renewable energy assets. For now, the US market is closed to new Yieldcos, but the more conservative UK market has proved to be durable, and continues to bring renewable energy investment to listed retail investors.

Multilateral development banks (MDBs): The multilateral and national development banks (NDBs) are increasing investments in renewables. Private investors particularly value the participation of the MDBs and NDBs because of their local connections and the reliance on them for other national funding. There is a strong belief that developing countries will not default on MDB and NDB loans, and the private sector participants benefit from their ‘umbrella’ protection.[12]

Conclusions

Governments, policy makers and investors can join the wave of investors who are confidently moving to a clean future by investing in clean, renewable energy. By joining forces, they can contribute to the global ambition to limit global warming to 1.5°C or 2°C. At the same time, they will be bringing energy access to many of the 1.06 billion people on the planet currently living without modern energy services.

There is no doubt that there is work to do, and more capital needs to be raised, but we are optimistic. Clean, renewable energy works. In many parts of the world, it is already a cost-effective choice, both technologically and economically, and within just a few years it is poised to be the cost-effective choice almost everywhere. Complimentary technologies, such as battery storage, are developing fast, which will further cement the competitive advantages of renewables.

Renewable investment has become mainstream. This is happening for both large-scale and distributed-scale renewables. So, in this environment, it is hard to justify a reason for new investment in primary fossil fuels for power generation – either by governments seeking to meet the energy needs of their citizens, or from investors. One only need look at the declining value of coal producers and electric utilities dependent on coal to see that these are, or soon will be, stranded, loss-making investments. In many cases, they are already.

From where we stand today, investors and governments only need to create the same permitting, regulatory, finance and other frameworks for renewables as they have used for decades for fossil fuels. They need only to open their eyes and act on the opportunities that create a virtuous circle of clean energy.

Recommendations to national governments of developing countries

Based on a few examples of successful renewable energy investment in countries still working to make their renewable energy investment regimes more attractive, we suggest incorporating the following factors:

1. **Study the auction methods**, including contractual structures, of South Africa, Brazil, Mexico, the UK and others.
2. **Understand the global developing appetite of corporations to contract directly with renewable projects to purchase their electricity needs.** This means allowing such purchasers non-discriminatory access to grids, so as to move power from the project to the facilities, and the ability to enforce long-term contracts.

3. **Consult with experienced project finance law firms** in designing policies and tariffs. These will range from whether revenues should be brought in by contract or tariff to how renewable installations will be taxed to how contracts for construction are enforced and how security is enforced.
4. **Focus on minimising risks to long-term investors:**
   - Develop policies and support that provide stable, long-dated revenues that are largely insulated from change, removing the commodity price risk.
   - Develop policies that expressly reject retroactive pricing changes for projects that are under construction and operation. As the market develops, the rules can change for new projects.
   - Create and maintain legal systems that allow for mortgages and security interests on the tangible and intangible property of projects, and provide an effective system for enforcement of that security.
   - Create and maintain legal systems that respect the underlying contracts that make project financing work, and the enforcement of those contracts.

Recommendations to investors

To take advantage of the clean energy revolution, we strongly encourage investors to:

- **get ahead of the curve** – join the virtuous circle to help meet the Paris Agreement goals and the Sustainable Development Goals. As clean energy continues to scale up, it continues to become more and more affordable
- **be part of the solution** – recognise that renewable energy is competitive, reliable, proven and investible
- **invest in opportunity** – wind and solar will be the cheapest sources of new power generation in most of the world by 2020. Now is the time to move out of fossil fuels and into renewables
- **be part of a growing universe of investors** – more capital is available for clean energy investment globally, and at a lower cost than at any time in history
- **catch the tide of institutional investors** who are willing, under the right conditions, to invest at unprecedented levels.

‘The pace of investment, and the speed at which that virtuous circle spins, needs to accelerate rapidly’

End notes

[1] Energy Agency, *World Energy Outlook 2016*, Executive Summary, pp 2, 4.

[2] Morgan Stanley Research, *What Cheap, Clean Energy Means for Global Utilities*, July 2017.

[3] Oil Change International, *Shift the Subsidies: Public Energy Finance Still Funding Fossils*, http://priceofoil.org/shift-the-subsidies/#methodology

[4] overview: World Bank and energy, 2015, Bretton Woods Project, http://www.brettonwoodsproject.org/2015/08/issue-overview-world-bank-and-energy/

'World Bank call for hydropower to combat climate change challenged', 2016, Bretton Woods Project, brettonwoodsproject.org/2016/02/worldbank-call-for-hydropower-to-combatclimate-change-challenged/

Bioenergy Out: Why bioenergy should not be included in the next EU Renewable Energy Directive, Biofuelwatch, 2015, biofuelwatch.org.uk/wpcontent/ uploads/EU-Bioenergy-Briefing2.pdf

[5] In the absence of effective direct taxation systems, many developing countries rely on indirect taxation systems such as VAT and import duties. Broader, more progressive tax reform could help to maintain tax revenues while removing the need for high tax on distributed energy systems and other goods on which people depend. Developing countries need the policy space to make the choices that are right for their needs.

[6] https://static.googleusercontent.com/media/environment.google/en//pdf/google-2017-environmental-report.pdf

[7] It is fundamental that public finance is channelled to the companies and sectors that have least access to private capital markets, hence ensuring that scarce public resources are genuinely additional to private finance. They must also be channelled to firms and sectors that can deliver the best outcomes for the poor, thus ensuring that public development monies are used for their intended purposes. *Private profit for public good? Can investing in private companies deliver for the poor?*, Eurodad, eurodad.org/files/pdf/520a35cb666a7.pdf

[8] Two Lights Energy Advisors, Thomas Murley, 2017.

[9] A good example comes from the US electric utility think tank and industry association, the Edison Electric Institute (EEI). In a 2013 paper, *Disruptive Challenges: financial implications and strategic responses to a changing retail electric business*, the EEI presented arguments that distributed solar was changing the electric business to the financial detriment of incumbent utilities, and that utilities should argue against certain renewable support mechanisms. The loss of customers to self-generation was summarised as follows: 'When customers have the opportunity to reduce their use of a product or find another provider of such service, utility earnings growth is threatened. As this threat to growth becomes more evident, investors will become less attracted to investments in the utility sector. This will be manifested via a higher cost of capital and less capital available to be allocated to the sector'.

[10] Preqin online infrastructure database https://www.preqin.com/

[11] The NGO BankTrack call for green bonds to ensure high standards of transparency and disclosure for bond issuances they underwrite, reference clear and science-based definitions and criteria of what constitutes 'green' under the Principle; commit unambiguously to third party, independent verification of the information on sustainability and use of proceeds reported by Green Bond issuers. See https://www.climatebonds.net/2014/05/green-bond-principles-banktrack-ngo-group-cautiously-welcome-call-transparency-science

[12] Christian Aid is part of a multi-stakeholder campaign towards the World Bank and multilateral development banks, to bring about a complete phase-out of public funding for fossil fuels by 2020, and a scaling up of investment in renewable energy and energy access. See www.bigshiftglobal.org