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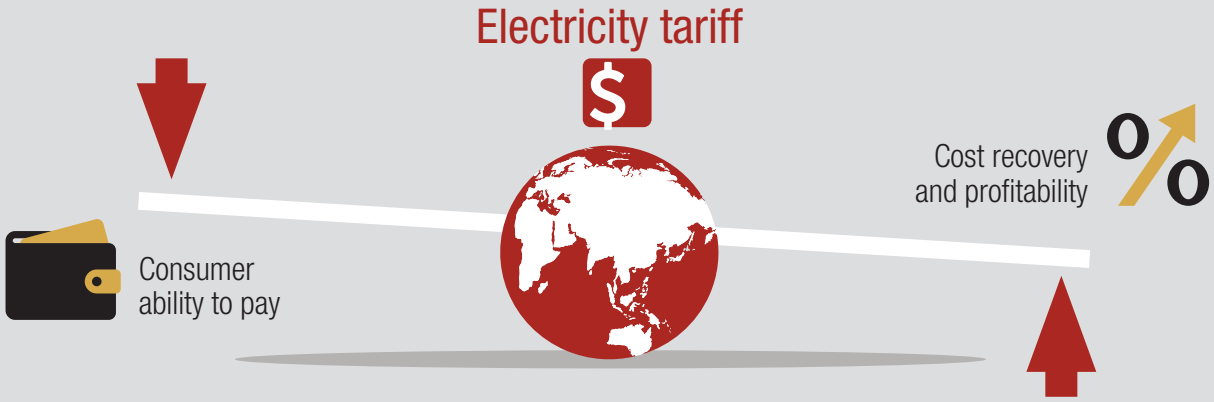
THE LEAST DEVELOPED COUNTRIES REPORT 2017

Transformational energy access

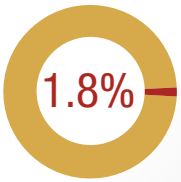
CHAPTER 5

Financing modern electricity provision

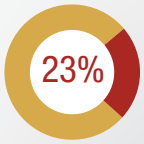
KEY CHALLENGE:
reconciling financial sustainability with affordability



TRENDS IN DEVELOPMENT FINANCE

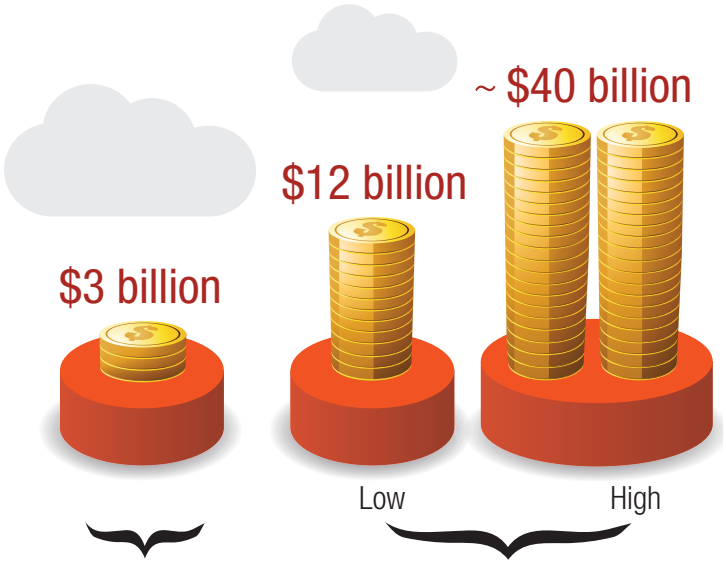


of total official development assistance to LDCs went to the **energy sector** in 2015



of this went to **renewables**

Increasing significance of sovereign borrowing and South–South financing



Official development assistance

Annual estimated cost for basic household needs in LDCs even without transformational energy access

24%–40%
increase in **cost** of commercial finance due to risk and uncertainty

CHAPTER 5
Financing modern electricity provision

A. Introduction

Finance will be a major challenge for the massive expansion and upgrading of the electricity systems of least developed countries (LDCs) necessary to achieve universal access by 2030, and still more so for the greater investment implied by transformational energy access. However, just as the particularities of energy supply have implications for the market structures and governance arrangements appropriate to the sector, so, too, does the nature of investments in the sector give rise to particular issues and challenges in their financing.

This chapter reviews these issues, and the associated tension between the affordability of electricity supply and the financial sustainability of the investments it requires. It also provides indicative estimates of the investment costs of achieving universal access to electricity and transformational energy access in LDCs by 2030, and reviews recent trends in, and prospects for, potential sources of financing for these investments.

B. Electricity fundamentals: Finance

1. The economics of electricity: Intersections with private finance

Infrastructure investments are critically dependent on access to long-term finance. Long-term finance is scare in LDCs, and external public finance has not been at a sufficient scale to cover domestic shortfalls. Recourse to alternative sources of development finance, such as commercial and institutional investors (including pension funds, insurers and sovereign wealth funds), must be explored.

These alternative sources of long-term finance typically have different motives and risk appetites from those of traditional public investors. This presents a number of challenges, since the nature of infrastructure assets has implications for the structure and cost of financing.

Electricity is a special class of infrastructure assets with its own specific challenges. In common with other infrastructure projects it does not lend itself to direct private investment because it typically requires a large amount of financing. In addition, not all electricity projects are likely to generate a dedicated revenue stream for investors, especially in LDCs characterized by a large proportion of the population with constrained ability to pay. The majority of private sector-led, new-build infrastructure projects, including electricity projects, are financed through project finance that is usually syndicated.[1] Project development is subject to significant risks and unknowns while requiring an ongoing investment of time, financial and political resources (Springer, 2013; USAID, 2014).

Some characteristics of electricity investments complicate private financing...

The following characteristics of electricity tend to complicate private financing.

a. Fixed and sunk costs

As with other production processes, generating, transmitting and distributing electricity entails fixed and variable costs. In generation, fixed costs reflect the cost of the land and building the plant and do not change with the amount of electricity produced or used but differ across generation technologies.

The electricity industry faces a substantial front-loading of investments before cost recovery can take place. In particular, the transmission and distribution network is characterized by massive fixed costs and irreversible investments in idiosyncratic (unique) and illiquid assets. These characteristics oblige investors to engage in complex risk analysis and risk allocations. Moreover, any investment decision under these conditions involves the exercising of a call option — the option to invest productively at any time in the future (Kim and Kung, 2013; Pindyck, 2008). When investment is irreversible and the future economic environment is uncertain, market players employ strategies to mitigate the inability to disinvest in adverse economic conditions. This creates an ex ante incentive to delay investment when uncertainty about the future profitability of their investment is high.

Non-hydro renewable generation technologies, such as wind and solar, are also characterized by high fixed costs, although these costs are much lower than those of large-scale centralized fossil fuel-driven plants or other renewable sources, such as nuclear and hydro plants. In common with transmission and distribution in traditional electricity systems, their cost structure is dominated by the cost of land and start-up installation. Relatively low variable costs for operations and maintenance and fuel are their main advantage over traditional fossil fuel-based generation technologies (Borenstein, 2016; IDC, 2012).

Studies estimate that the cost and terms of debt can add between 24 and 40 per cent to the cost of utility-scale wind and solar photovoltaic (PV) projects in developing countries (Nelson and Shrimali, 2014; Waissbein et al., 2013).

… including large upfront costs, irreversible investments, high uncertainty and risks, and carbon lock-in

b. Longevity and risk

Private-sector investors look for safe, long-term investments that will generate a worthwhile return on capital. Infrastructure projects may not generate positive cash flows in the early phases. They tend to have high risks and costs due to lengthy pre-development and construction processes. It is uncommon for countries to maintain portfolios of "shovel-ready" projects already selected, planned and designed, and for which risk assessments have been completed. This poses a significant obstacle and cost impediment for developing countries in particular in securing private infrastructure financing (UNCTAD, 2014d; Sy and Copley, 2017). In addition, economic infrastructure typically has a useful life of 25 years or more. Long project and asset life is fraught with uncertainties and generates substantial financing requirements and the need for dedicated resources on the part of investors to understand and manage project-specific risks. LDCs are additionally disadvantaged in that a significant proportion of their electricity infrastructure needs are likely to require greenfield investments, which are more risky than brownfield projects (OECD, 2015a).

Country-related risks can be highly subjective and ad hoc, difficult to quantify, and therefore difficult to price (OECD, 2015b). Uncertainties and risks are perceived to be especially heightened by the weaker and less stable economic and financial conditions in LDCs. Country-specific risk is typically addressed through an upward adjustment to loan discount rates, which can lead to high costs of capital (Griffith-Jones and Kollatz, 2015; OECD, 2015b; Bekaert et al., 2015; Presbitero et al., 2015).

Commonly assessed risks in LDC electricity sectors are consumers' low ability to pay; absence of frameworks to guide private-sector participation; and perceived regulatory risk from monopoly public utilities subject to social mandates and political uncertainties. Table 5.1 provides a classification of infrastructure asset risks.

Guarantees are the main lever (60 per cent) for private investment in infrastructure but energy projects in middle-income countries benefit the most from such instruments (OECD, 2015b). Between 2012 and 2014, middle-income countries' share of finance mobilized through guarantees, syndicated loans and shares was 72.3 per cent. The LDC share was 8 per cent and other low-income countries' 2 per cent. Developing countries in Africa (29.1 per cent) benefited the most, followed by

Table 5.1

Classification of infrastructure asset risks

<table>
<tr><th>Risk categories</th><th>Development phase</th><th>Construction phase</th><th>Operation phase</th><th>Termination phase</th></tr>
<tr><td rowspan="6">Political and regulatory</td><td>Environmental review</td><td>Cancellation of permits</td><td rowspan="3">Change in tariff regulation</td><td>Contract duration</td></tr>
<tr><td rowspan="2">Rise in pre-construction costs (longer permitting process)</td><td rowspan="2">Contract renegotiation</td><td>Decommission</td></tr>
<tr><td>Asset transfer</td></tr>
<tr><td colspan="3">Currency convertibility</td></tr>
<tr><td colspan="4">Change in taxation</td></tr>
<tr><td colspan="4">Social acceptance</td></tr>
<tr><td colspan="4">Change in regulatory or legal environment</td></tr>
<tr><td rowspan="6">Macroeconomic and business</td><td>Prefunding</td><td></td><td colspan="2">Default of counterparty</td></tr>
<tr><td colspan="2" rowspan="3">Financing availability</td><td colspan="2">Refinancing risk</td></tr>
<tr><td colspan="2">Liquidity</td></tr>
<tr><td colspan="2">Volatility of demand/market risk</td></tr>
<tr><td colspan="4">Inflation</td></tr>
<tr><td colspan="4">Real interest rates</td></tr>
<tr><td colspan="4">Exchange rate fluctuation</td></tr>
<tr><td rowspan="6">Technical</td><td colspan="3">Governance and management of the project</td><td rowspan="4">Termination value different from expected</td></tr>
<tr><td colspan="3">Environmental</td></tr>
<tr><td>Project feasibility</td><td>Construction delays and cost overruns</td><td>Qualitative deficit of the physical structure/ service</td></tr>
<tr><td>Archaeological</td><td></td><td></td></tr>
<tr><td colspan="4">Technology and obsolescence</td></tr>
<tr><td colspan="4">Force majeure</td></tr>
</table>

Source: OECD (2015b), table 1.

those in Asia (27.2 per cent) and the Americas (21.1 per cent) (OECD, 2016a). The current array of risk mitigation instruments used by international finance institutions to crowd in institutional investors has been found to be complex and non-standardized, and thus burdensome and costly for the private sector to use (WEF, 2016).

Measures aimed at improving the institutional environment (including through providing stable long-term infrastructure development plans, enhancing social acceptance for novel approaches to infrastructure development, preparing feasibility studies and bankable infrastructure pipeline projects, and increasing certainty on permits and tariff definition) are the standard prescription through which Governments can influence political and regulatory risk (OECD, 2015b).

c. Opacity

Infrastructure projects generally lack transparency. Commercial secrecy, diverse project structures and differences across a variety of generation technologies increases the financial opacity of projects. No two electricity projects are alike even for the same technology because local conditions influence the performance of the technology. Moreover, the information required by investors to assess project-related risk structures and the market is often non-existent in LDCs, a fact that serves to raise the level of risk.

d. Carbon lock-in

The concept of carbon lock-in or path dependence has been used extensively to explain the persistence of fossil fuel-based technological systems despite their negative environmental impacts (Erickson et al. 2015; Lehmann et al. 2012; SEI 2015; Economic Consulting Associates 2015; Klitkou et al. 2015). Although path dependence is itself judged to be neither good nor bad, the likelihood of policy decisions that serve to diminish or possibly exclude the adoption of alternative technologies is considered to be heightened by path dependence, especially under conditions of uncertainty (Lehmann et al. 2012). Accordingly, insofar as it may dampen private investors' investment appetite or heighten their perception of regulatory risks, carbon lock-in can be a factor in securing commercial credit. It may be particularly relevant in the case of renewables and in a global environment in which fund managers and industry players are increasingly concerned about their green credentials.

Increasing returns to scale and large fixed and sunk costs associated with legacy electricity systems may contribute to carbon lock-in, especially in the presence of abundant and cheap natural resources. For example, large centralized fossil fuel-based generation can be a relatively cheap and stable source of electricity supply and continue to be a favoured avenue for expanding and securing baseload generation capacity. Other contributory factors include the long lifespans of generation technologies and long-term fuel or electricity purchasing contracts common to legacy generation technologies and renewables.

There are tensions in LDCs between affordability and financial viability of electricity systems

In principle, the risk of carbon lock-in may be most limited in LDCs that have nascent, dilapidated and/or outdated electricity systems; those with import-dependent electricity systems that are a major source of macroeconomic instability; and those for which international trade in electricity does not offer a secure option for supplementing domestic generation capacity. Distributed systems may have a natural advantage in island LDCs, for example, as these economies typically lack the economies of scale and contiguous geography needed for centralized generation and transmission.

2. Financial sustainability and affordability

A financially sustainable electricity system is one that recovers operating costs, makes appropriate investments in infrastructure and delivers a secure and reliable service, as well as meeting environmental and social norms. This has long been recognized as a prerequisite for addressing growing electricity demand, particularly in the context of structural transformation, rapid urbanization and growing populations characteristic of LDCs. However, financial sustainability poses major challenges for most LDC electricity systems, as the high cost of expanding access to rural populations, coupled with persistently high levels of poverty and limited purchasing power, gives rise to serious tensions between financial sustainability and affordability.

a. Cost-reflective tariff-setting

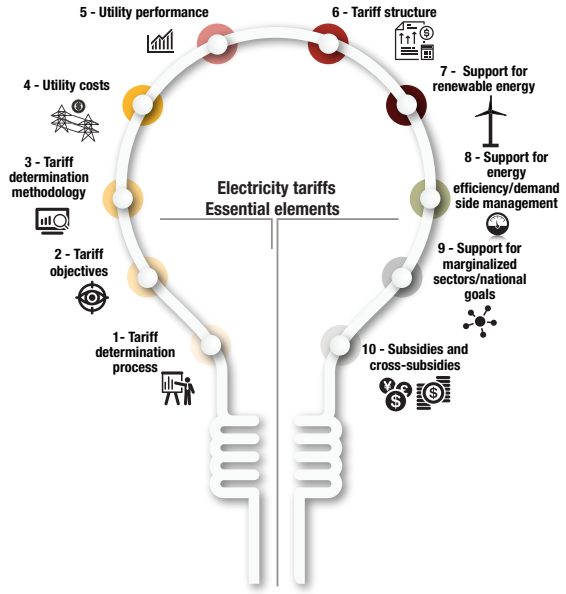
Since sector regulators and utilities in non-competitive markets have historically had an obligation to ensure the affordability of services and a standard national electricity tariff, below-cost regulated tariffs are a common feature of LDC electricity systems. This undermines both the financial viability of utilities and the quality of electricity supplied, and represents an important obstacle to national utilities financing investments to ensure universal electricity access. The result is a serious tension between the multiple

Box 5.1. **Fundamental elements of tariff design**

Globally, electricity tariffs can vary by total usage, consumer type (e.g. residential vs. industrial), time of day and generation source. The unit price per kilowatt-hour (kWh) may follow an increasing or decreasing step-function linked to sequentially defined blocks. It may also follow a linear format such that all units are charged at the same price. Tariff structures evolve over time and commonly reflect multiple national objectives that require a degree of balancing by regulators. For example, the European Union regulatory framework sets only some general standards with regard to the determination of network tariffs, with decisions on design left to member States. Best practice on tariff determination favours a process that is transparent, accountable and participatory. This best practice can sometimes delay or prevent tariff adjustments in developing countries, where utilities are obliged to apply for a tariff increase. Weak institutions and fierce opposition from policymakers and customers concerned about affordability of services can be a significant obstacle.

Box figure 5.1

Essential elements of electricity tariffs



Source: UNCTAD secretariat, based on Dixit et al. (2014).

Tariff design encompasses multiple policy elements in addition to the operational and maintenance costs of an electricity system. It is influenced by the structure of the industry and requires careful planning and effective management, especially in times of transition. Regulators require sufficient expertise and resources to assess, choose and implement appropriate tariff structures given the ramifications of pricing for the financial sustainability of the sector, economic activity and general affordability.

A review of the fundamental assumptions of tariff design may be called for under the new reality of variable renewables, and decentralized and own generation. For instance, in liberalized electricity systems changes are being necessitated by the blurring of the distinction between wholesale and retail electricity markets as consumers increasingly produce to sell to utilities, and with the need to reward consumers for their energy efficiency efforts through time-of-use tariffs. Energy efficiency measures, discounts to low-income customers, incentives for adopting renewable energy and research and development in renewables are costs that LDC utilities will likely confront as they transition to more renewables-based electricity systems. These additional costs will need to be recovered and factored in among the traditionally recognized essential elements and objectives of electricity tariffs.

Source: Bharath Jairaj (2016); Briceño-Garmendia and Shkaratan (2011); Lowry et al. (2015); Schweinsberg et al. (2011); Dixit et al. (2014).

objectives of increasing access, affordability, reliability of supply and the financial viability of investments.

Increased reliance on electricity supply by the private sector requires regulators to ensure commercial returns and protect providers' profitability. This means that cost-reflective tariffs should be set high enough to cover, at a minimum, the full cost of generation and transmission, plus operating and maintenance costs. Pressure on monopoly utilities to demonstrate financial sustainability is heightened when they are offtakers for independent power producers (IPPs), as financial fragility is reflected in higher risk premiums. The pressure for the adoption of cost-reflective tariffs has been further increased by the advent of renewables and distributed generation.[2]

To date, only one LDC (Uganda) has reported the successful adoption of cost-reflective tariffs (boxes 5.1 and 5.2).

Feed-in tariffs provide eligible renewable-power producers with a guaranteed above-market price for the power they generate, thereby reducing market risk to investors by offering an assured rate of return. They are widely used in developed markets, and are increasingly being adopted in developing countries. Almost 60 per cent of LDCs have feed-in tariffs or some other kind of flexible tariff arrangement[3] in place to accommodate private-sector provision (see chapter 4). Where these are indexed to foreign currency, this can give rise to risks of fiscal stress and unsustainability. Flexible pricing mechanisms can also expose customers to price volatility and uncertainty, because electricity prices may change in line with the variability of renewables generation.

Other common policy support instruments targeting power generation are feed-in premiums, and quota schemes (also known as renewable portfolio standards) for different technologies (KPMG International, 2015). Quota obligations are often combined with tradable renewable energy credits or renewable obligation certificates. Quota schemes oblige suppliers to

Box 5.2. **Uganda cost-reflective tariff case study**

In 1999, Uganda became the only LDC to fully restructure and embrace private-sector participation. Nevertheless, the generation mix remained highly concentrated and access very low (chapter 1). By 2011 electricity subsidies accounted for 1.1 per cent of gross domestic product (GDP) due to increasing fuel costs for expensive back-up thermal IPPs for hydro generation that was negatively affected by drought.

The acute fiscal distress brought on by the burden of the subsidies led the Government to default on thermal IPP payments, with resulting severe shortages in electricity and a slowdown in economic activity. With the realization that liberalization and private-sector participation were not sufficient conditions to guarantee favourable outcomes in terms of adequate investments in generation capacity and expansion of access, the Government assumed leadership in electricity infrastructure development and management. Subsidies were abandoned in favour of cost-reflective tariffs. Public funding was redirected to focus on lowering the costs of capital for private-sector investment to meet targets defined by policy, including the diversification of electricity generation sources; improving the quality of supply; and securing the customer base needed to guarantee affordability by rapidly widening and expanding access to unserved populations and areas of the country.

To that end, the Rural Electrification Agency was created, charged with establishing and maintaining a comprehensive database to facilitate informed decision-making on the subsector. A dedicated fund, the Uganda Energy Credit Capitalization Company, was also established with a view to supporting private investment and assuring pro-poor electrification.

The Government further undertook complementary actions to set operational targets that prioritized a systematic loss reduction trajectory and new investment and revenue collection targets as part of the scheduled review of the incumbent distributor concessionaire's licence in 2012. Uganda's main electricity distributor is Umeme Company Limited, wholly owned by Globeleq (initially a consortium formed with South Africa's national utility Eskom), which is a company majority-owned by the United Kingdom's private-equity group Actis.

The investment requirements of the concession agreement between the Government and Umeme were successful insofar as the distributor had exceeded investment targets set for its first five years of operation. Umeme had, in addition, successfully leveraged domestic capital markets by cross listing on the Uganda Stock Exchange to raise capital. However, the company struggled to expand access to rural areas, with the result that new customer numbers rapidly flattened out, thus contributing to a heavy reliance on public subsidies.

Following the withdrawal of subsidies to the sector, tariff determination has been governed by the automatic quarterly adjustment mechanism instituted by the Electricity Regulatory Authority since 2012. Adjustments respond to movements in inflation, exchange rates and the international price of fuel, with the result that current end-user tariffs recover 93 per cent of production costs. The remaining 7 per cent is accounted for by the government financing of standby thermal generation. End-user tariffs were increased immediately by 46 per cent. At the time of the tariff adjustment, government subsidies accounted for over 50 per cent of the end-user tariff.

Time-of-use tariffs and metering (except for residential customers) are now in place and have resulted in a shift of consumption to off-peak periods. The Authority also regulates and approves differentiated tariffs for off-grid distributors and implements a rigorous pre-qualification process for service providers.

Private project developers are contracted on standard 20-year power purchasing agreements (PPAs). They receive 50 per cent of the amortized feed-in tariff payments upfront. These generous capital recovery terms are extended to both domestic and foreign investors and are complemented by other fiscal incentives. The single-buyer model for private-sector participation guarantees a market for the private sector.

Lingering concerns remain with respect to high end-user tariffs that act as a constraint on economic activity and general well-being, even though the introduction of a lifeline tariff for vulnerable customers served to dampen opposition to cost-reflective tariffs. Uganda, together with Rwanda, has the highest end-user tariffs in East Africa.

Fiscal distress was the key motivator for decisive change and subsidy reform in Uganda. Problematic tariff structure, whereby the industrial sector that was responsible for 44 per cent of power consumption shouldered less than a quarter of electricity production, was also a contributory factor.

The Uganda case serves to underline that a change in governance and structure does not guarantee energy security; liberalization does not substitute for regulation and effective government oversight of electricity systems; resource constraints and affordability issues are likely to remain a primary challenge for LDCs into the foreseeable future; a systemic coordinated approach to planning and development of electricity systems is important; the comparative advantages of both public and private actors in the system should be leveraged; and there is a need for Government to balance often-conflicting goals and inherent trade-offs in achieving universal access and development goals.

Government leadership has proved to be a decisive factor in the successful implementation of rural electrification in other developing countries, particularly in the roll-out of renewable solutions to rural access.

Source: Bakkabulindi (2016); ERA (2016); Mawejje et al. (2012, 2013); MEMD (2012); Okoboi and Mawejje (2016); Tumwesigye et al. (2011); http://www.era.or.ug/index.php/statistics-tariffs/113-investment-in-renewable-energy, accessed July 2017.

generate and supply a predetermined percentage of their electricity from renewable sources. Generators or utilities that need certificates are able to comply with regulation by buying excess certificates from others. A key advantage of quota schemes is their potential to reduce the macroeconomic costs associated with expanding renewable energy capacity. Quota schemes can also be an important driver of private-sector investment for renewable energy (UNEP FI, 2012).

Tendering schemes (for example renewables auctions) have spread rapidly as a means of promoting renewable sources, growing faster than feed-in tariffs and quotas. The potential of auctions to achieve low prices has been a major motivation for their adoption worldwide (IRENA, 2017). For instance, South Africa abandoned costly feed-in tariffs in favour of auctions (Eberhard and Kåberger, 2016) and built local content requirements into the early auctions, which helped grow a local renewables industry (IRENA, 2017). However, while WTO rules give space for a range of renewable-energy incentives, domestic content requirements in the operation of a feed-in tariff are considered problematic (WTO, 2013). There are also concerns that renewables support measures, in general, may distort trade.

Auctions are an attractive approach for LDCs because of their potential for real price discovery. They can also be tailored to a country's economic situation; to the structure of the national energy sector; to the maturity of the national power market; and to the level of renewable-energy deployment (IRENA, 2017). In May 2016, Zambia became the first country to organize solar auctions under the International Finance Corporation (IFC) and World Bank Scaling Solar programme for sub-Saharan Africa. Zambia's auction set a new (low) price record[4] for utility-scale solar on the continent. However, auctions are generally associated with higher transaction costs for smaller providers and a greater degree of complexity for auction organizers than purely tariff-based or purely quota-based schemes. They also carry an attendant risk of underbidding, whereby developers bid too low so as to beat the competition. However, such low bids often cannot secure financing, and developers pressure Governments to raise prices retroactively so that they can actually realize the project (IRENA and CEM, 2015; IRENA, 2013).

Net metering or net billing policies, which allow consumers who generate their own electricity and are connected to the grid to offset their bills against electricity fed into the grid, represent other complementary options in renewable support systems (KPMG International, 2015).

b. Increasing ability to pay

Since rural electrification is rarely self-supporting financially, LDCs increasingly seek to promote microfinance and other forms of credit and offer training to facilitate the growth of micro and small businesses in conjunction with rural electrification schemes and projects. Such efforts are directed at increasing households' disposable income to enable them to meet the high upfront costs of electricity access, and to sustain and grow demand for electricity services. An example is the Nicaragua Off-grid Rural Electrification Project, launched in 2003, the first World Bank operation to link the development of infrastructure services explicitly with the development of micro and small businesses and microfinance institutions (Motta and Reiche, 2001). The project tackled the gap between willingness to pay and electricity access life-cycle costs through subsidies to consumers. It gave grants and short-term subsidies to providers of business development services[5] to innovate and provide adapted solutions for rural clients. Microfinance is also used to accelerate the market penetration of off-grid and sustainable energy products by providing credit to consumers with low purchasing power to cover initial upfront costs of access (Mary Robinson Foundation-Climate Justice, 2015).

In some cases, where the right conditions exist, strategies have evolved beyond mere market creation. For instance, the Electrified Activity Zone in south-east Mali (Béguerie and Pallière, 2016) takes into account the diversity of rural customers and the differences in needs between households and businesses, and between different types of business. These factors not only affect the financial viability of the provider but constitute a responsibility on the part of the provider to respond effectively to customer needs.

c. Redirecting subsidies

Lowering the costs of renewable energy is a major concern of climate policy. The financial return to renewables investments is driven by the costs and performance of different technologies, which vary widely according to local and site conditions, and according to the cost of competing non-renewable sources. In the absence of a systematic accounting of environmental impact in the price of fossil fuel-based generation, the promotion of sustainable electricity from renewables is generally underpinned by a variety of support measures, including subsidies to "level the playing field" for renewables and incentivize adoption.

In this context, the reduction or elimination of subsidies for fossil fuels has increasingly come under the spotlight, both as a means of reducing incentives for fossil-fuel use and as a potential source of funding for renewable energy. Global fossil-fuel subsidies have been estimated at $5.3 trillion (Coady et al., 2015). While sub-global estimates suggest a substantially lower level of subsidies (table 5.2), this at least partly reflects different definitions and methodologies, which

Table 5.2

Fossil-fuel subsidy estimates by country and regional group

Region	Size of subsidy	Year	Source of estimate
Global (projection)	$5.3 trillion	2015	Coady et al. (2015)
OECD, BRICS and Indonesia	$160-$200 billion	Annual (2010-2014)	OECD (2015)
EU	€39 billion	Annual (2010-2014)	OECD (2015)
40 developing countries	$325 billion	2015	IEA (2016b)
APEC	$70 billion	2015	IEA (2017b)
Sub-Saharan Africa	$26 billion	2015	Coady et al. (2015)

Source: UNCTAD secretariat compilation.

Note: BRICs comprise Brazil, China, India, Russian Federation and South Africa. Estimates from different sources are not comparable, due to major differences in definitions and methodologies and to the fact that subsidies may not always be readily identifiable and quantifiable in all jurisdictions.

makes comparison problematic. Subsidies in LDCs are considerably smaller. Even on the same basis as the global estimate, sub-Saharan Africa accounts for only $26 billion, or 0.5 per cent of total global subsidies. If (as an extreme approximation) subsidies are assumed to vary between countries in proportion to their gross national income (GNI), this would suggest total subsidies in African LDCs in the order of $8-$9 billion.[6]

A key strategy of climate policy globally is to reduce and ultimately eliminate direct and indirect subsidies for technologies not aligned with the long-term strategy of environmental sustainability. In this context, fossil-fuel subsidies are considered to favour consumption patterns incompatible with these aims by (i) disincentivizing consumers from actively seeking to adopt energy-saving habits and energy-efficient technologies; and (ii) hindering a proper comparison of fossil-fuel and renewable-energy costs by masking the true cost (including negative externalities) of fossil fuels and conventional electricity technologies. The conventional regime of fossil-fuel subsidies is thus seen as reinforcing carbon lock-in.

International cooperation is supporting national efforts to reform energy subsidies; and a number of developing countries (including a few LDCs), spurred by falling oil prices, have recently made significant progress in reforming subsidies for fossil fuels across a wide range of sectors. However, it is at best questionable whether LDCs could replicate the experience of developed countries, notably in Scandinavia (Merrill et al., 2017), in achieving a fiscally neutral substitution of renewable subsidies for fossil-fuel subsidies.[7] Assessing the potential for such a substitution would require studies adapted to the LDC context. A particular consideration is the limited share of renewable subsidies that is likely to accrue to the domestic private sector, in light of the considerable share of foreign private-sector actors in value added and participation in renewables. The political-economy implications of this approach could be a significant source of opposition.

Energy subsidies in developing countries are particularly criticized as being regressive in nature, so that the ultimate beneficiaries are effectively higher-income consumers rather than the poorest; as reducing the fiscal space available to pursue development goals; and as contributing to unacceptable levels of public debt (Vos and Alarcón, 2016; Vagliasindi, 2013; IMF, 2013). Equally, however, the application of this policy stance, based on the merits of competitive pricing mechanisms in resource allocation, may face challenges in developing countries, where market conditions are typically far from perfectly competitive (World Energy Council, 2001). In many LDCs, by no means all "higher-income" consumers have full access to modern energy, as evidenced by the reliance of many urban residents in LDCs on traditional biomass, and many remain vulnerable to electricity price increases. Since LDCs have particularly high (and in some cases increasing) levels of informality, these consumers, being the most visible, also make up the overwhelming majority of often very small national tax bases. Policies to remove subsidies and allow only targeted safety nets for the extreme poor may thus punish middle- and some low-income groups (Ortiz et al., 2017), and would need to be managed carefully.

Among the standard remedies advocated to address the negative impacts of eliminating subsidies are strengthening social protection, including cash transfers, and instituting targeting mechanisms to channel subsidies to deserving low-income consumers. However, many of these mechanisms are linked to employment and focus on formal social safety nets, and their effectiveness in LDCs is likely to be undermined by the considerable scale of informality, weak institutional capabilities and lack of resources, particularly in a context where the poor constitute a disproportionately high percentage of the population.

d. Demand-side management

Energy demand-side management is a complement to other measures needed to effectively address climate policy objectives while maintaining energy security and expanding access. Demand-side management programmes encourage all end-users (for example households and industry, including

Achieving universal access in LDCs by 2030 might require investment of $12-40 billion per year

electricity utilities) to be more energy-efficient. Specific measures include lighting retrofits; building automation upgrades; recommissioning; and heating, ventilation and air conditioning improvements. Demand-side management thus differs from demand reduction, which seeks to encourage end-users to make short-term reductions in energy demand.

The Least Developed Countries Group announced the launch of its Renewable Energy and Energy Efficiency Initiative (REEEI) to scale up the provision of renewable energy and promote energy efficiency during the 22nd Conference of the Parties (COP22) to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2016. Its initial priorities for the period 2017–2020 include a stocktaking of existing activities and experiences, together with opportunities, and strengthening national policies and regulatory frameworks (Dhital, 2017).

Energy efficiency is a resource possessed by all countries in abundance (IEA, 2016d) and is the quickest and least costly way of addressing energy-security, environmental and economic challenges.[8] Globally, however, two thirds of the economic potential of demand-side management through energy-efficiency interventions remains untapped (IEA, 2014b). Since high prices alone cannot be relied upon to drive investments in energy efficiency, policy plays a central role (IEA, 2016d). Barriers to energy efficiency include lack of information and information asymmetries on energy-efficiency technologies and their benefits and risks to financial stakeholders; knowledge and technical capacity gaps that hinder the development and implementation of energy-efficiency projects; energy subsidies; shortage of affordable financing; and absence of clarity on roles and responsibilities for energy efficiency (IEA and ADB, 2014).

Effective demand-side management requires systematic efforts to reduce energy intensity by encouraging end-users to adopt technological improvements through an optimal mix of incentives. Policy measures include appropriate pricing; legislation, regulations, codes and standards; targeted financial incentives and quantitative energy targets; and knowledge-sharing. Actions typically have to be practical, scalable and replicable on a large scale, as well as having a significant impact. Accordingly, systems should be in place for measurement, reporting and verification of the effects of energy-saving activities (RAP, 2012).

Energy-efficiency obligations are the cornerstone of common schemes with quantitative energy-saving targets. These schemes may be administered by Governments or by independent bodies, or jointly by energy regulators and energy providers. Schemes can also be established principally by Governments, as integral components of government policies (RAP, 2012).

An important constraint to operationalizing meaningful demand-side management schemes in LDCs is the lack of institutional capacities and the knowledge and capability to design and implement such schemes on an economy-wide scale, as effective regulatory oversight, monitoring and evaluation, and verification systems are essential to their effectiveness.

C. Estimating the LDC electricity infrastructure finance gap

The financing needs for Sustainable Development Goal (SDG) 7 are considerable in those LDCs where electricity infrastructure is inadequate to ensure universal access targets. Infrastructure costs are generally high in LDCs, particularly in island LDCs, due to limited economies of scale and in some cases additional costs for climate-proofing. Distribution networks are the costliest segment of the electricity supply chain, and distributed generation and increased reliance on renewables are not expected to obviate the need for future investments in transmission and distribution.

The existing infrastructure is also often in disrepair: it is not uncommon for Governments (including those of developed countries and other developing countries (ODCs)) to prioritize investments in new infrastructure over maintenance of existing facilities, especially under conditions of rising demand and chronic public revenue weaknesses such as those typical of LDCs (WEF, 2014; Branchoux et al., 2017). The degraded state of existing infrastructure in many LDCs necessitates costly reconstruction and repair to allow increases in generation capacity and network efficiency, further increasing investment costs.

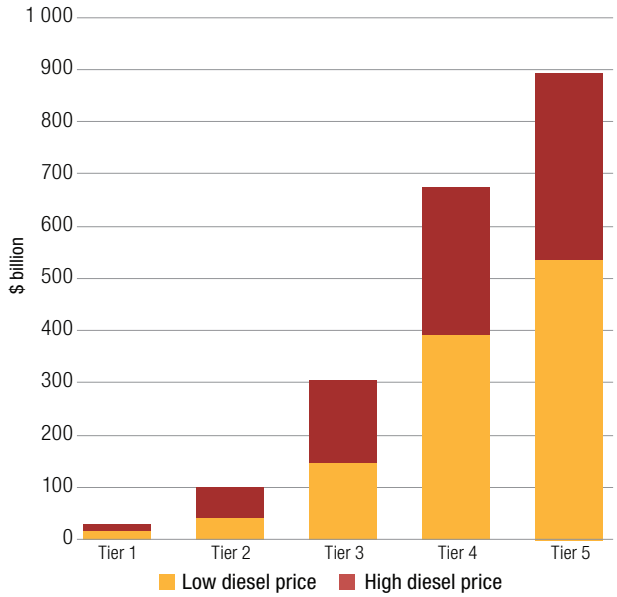
As part of the process of planning infrastructure investments, quantifying infrastructure financing needs helps to focus and direct efforts to mobilize development finance both in terms of the intensity of effort required and in identifying the most appropriate sources of finance. It is particularly important given that different sources of finance are distributed unequally across the segments of the electricity supply chain. For instance, a manifest private-sector bias in favour of generation leaves the transmission and distribution segments largely in the domain of public financing.

The likely order of magnitude of the costs of universal access to electricity in LDCs can be derived from estimates of the global cost of universal access to electricity. While there are important issues of comparability (due to variations in definitions, assumptions, levels of access, estimation methods and modelling approaches), recent global estimates mostly lie in a range of $35-$55 billion per year (Sustainable Energy for All, 2015: 66). Since 54 per cent of people without access to electricity globally live in LDCs (chapter 1), assuming equal average costs per person without access in LDCs and ODCs would indicate a range for LDCs in the order of $20-$30 billion per year. Allowing also for variation by a factor of 1.5 in either direction between LDCs and ODCs in average cost per person without access would widen this range to $12-$40 billion.

Country-by-country estimates are available for sub-Saharan Africa, though not for other regions (Mentis et al., 2017).[9] These indicate a cost for universal access in African LDCs of between $18 billion and $900 billion, depending on the tiers of access provided and variations in diesel prices (the latter also affecting the energy mix). The breadth of this range highlights the steep increase in investment costs associated with higher tiers of access: even moving from the minimalist tier 1 (0.1 kWh per household per day) to tier 2 (0.6 kWh) increases costs by a factor of 2.3-3.5, while tiers 3, 4 and 5 require increases in investment by factors in the order of 10, 20 and 30 respectively (figure 5.1).

Figure 5.1

Investment needs for universal access by 2030, African LDCs



Source: Mentis et al. (2017).

Notes: Tiers indicate tiers of access, defined in terms of average electricity use per capita. The range provided for each observation indicates estimates based on low and high prices for diesel fuel.

D. Financing investment in electricity infrastructure: Trends and prospects

1. Recent trends in resource mobilization

a. Domestic public resources

Domestic resource mobilization is a priority area for action in the Istanbul Programme of Action and is recognized by the 2030 Agenda for Sustainable Development as being critical to the ability of LDCs to finance their own development. However, LDC Governments have limited resources to meet financing needs from domestic sources. Many natural resource- and commodity-dependent LDCs, in particular, need to address long-standing and competing gaps in economic infrastructure under constrained revenue conditions while also seeking to maintain a reasonable degree of consumption in their economies.

Tax revenues are lowest in LDCs (IMF, 2016a); few manage levels above 15 per cent (compared with the OECD average of 34.4 per cent in 2014), as they typically have lower levels of tax collection and a narrower tax base. The relevance of the tax-to-GDP ratio as an indicator of domestic resources available to finance infrastructure investments in these countries is undermined by institutional weaknesses in tax collection and low compliance; the presence of large informal sectors; many small-scale firms; and a general dependence on a few natural resources, commodities or foreign aid.

Trends in net revenues (revenues excluding grants) may provide a clearer indication of the ability of LDCs to finance their own investments (figure 5.2). However, data coverage across all LDCs is generally patchy and incomplete. Nevertheless, for the few countries for which data are available for 2015, it is evident that for the majority, net revenues fall below 20 per cent of GDP. Thus, for most LDCs it remains unlikely that public revenues alone can meet electricity investment needs, and ODA will continue to be needed.

b. Public international development finance

In the absence of sufficient domestic resources, LDCs have traditionally relied on ODA[10] to supplement their infrastructure development financing deficits. However, while total ODA flows (figure 5.3) from members of the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD) increased by 8.9 per cent in 2016, preliminary estimates show a reduction of 3.9 per cent in their ODA to LDCs (OECD, 2017c).

Public revenue constraints and limited private financing mean that ODA is needed for electricity investments

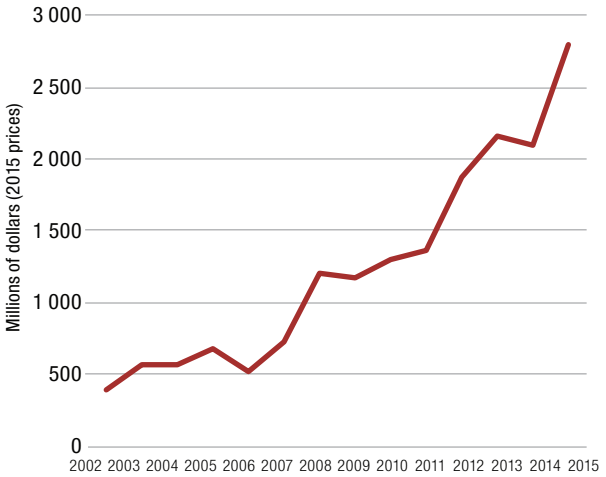
SDG target 17.2 reiterates developed countries' long-standing commitment to provide 0.7 per cent of their GNI in ODA to developing countries, and 0.15-to-0.20 per cent to LDCs, also urging donors "to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries".

In 2015, only four members of OECD-DAC (Luxembourg, Norway, Sweden and the United Kingdom of Great Britain and Northern Ireland) provided 0.20 per cent of their GNI in ODA to LDCs, and three more (Denmark, Finland and Ireland) met the minimum target of 0.15 per cent. Compared with 2014, Belgium fell below the 0.15-per-cent threshold and Finland below the 0.20-per-cent threshold. In 2015, no DAC country allocated half of its total ODA to LDCs, and in only three did the share even reach 40 per cent (Ireland, Luxembourg and Iceland, at 48 per cent, 42 per cent and 41 per cent respectively).

Had all DAC donors met even the 0.15-per-cent target, their total ODA to LDCs would almost have doubled, from $37 billion to $70 billion, providing an additional $33 billion. Had all met the 0.20-per-cent target, this would have generated a further $20 billion. A target of 0.35 per cent would increase ODA to LDCs fourfold to $155 billion, providing additional resources of $118 billion per year (table 5.3).

Figure 5.3

Trends in ODA disbursements to LDC energy sectors, 2002–2015



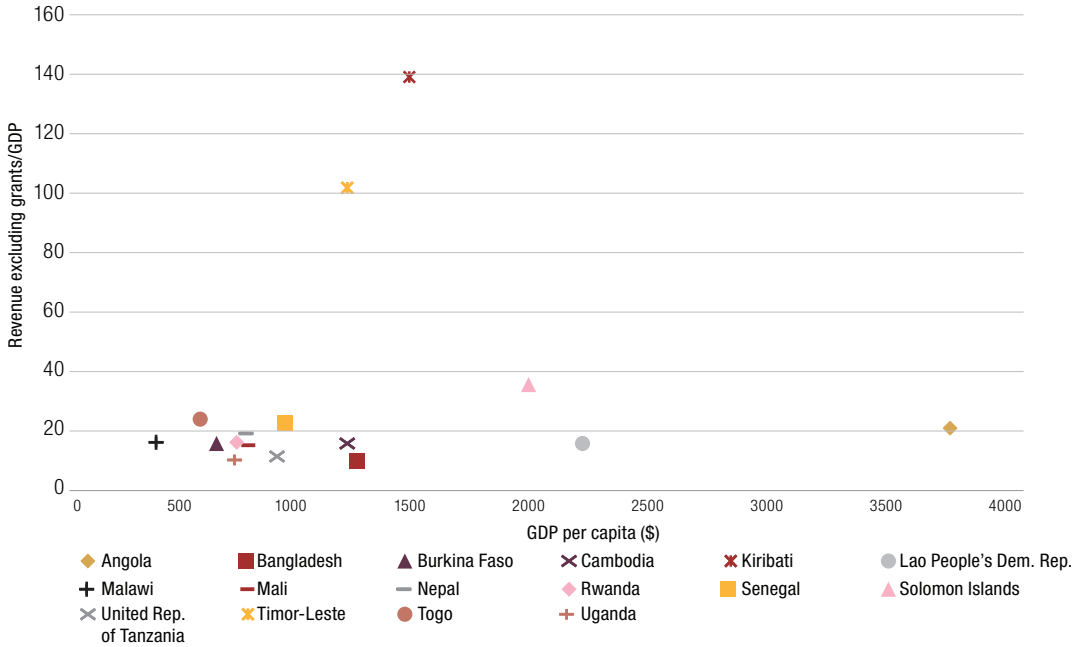
Source: UNCTAD secretariat estimates, based on data from World Bank, World Development Indicators database (accessed May 2017).

Gross ODA disbursements to the energy sector in LDCs have fared better, reflecting an increase in the proportion of disbursements going to the sector from 1.8 per cent in 2002 to 5.7 per cent in 2015 (figure 5.4). However, 43 per cent of funding went to five LDC recipients (figure 5.5). ODA in energy sectors in LDCs is concentrated in a small group of countries, in line with the overall pattern of ODA generally.

There has been an upward trend in disbursements to the energy sector in LDCs since 2006, continuing with a 25-per-cent increase to $2.8 billion in 2015. However, this remains less than half the level of ODA to ODCs ($6.4 billion), and total disbursements to LDCs were exceeded by those to the six largest ODC recipients (Pakistan, India, Viet Nam, Morocco, Indonesia and South Africa), each of which received more than $400 million.

Figure 5.2

Selected LDC revenue excluding grants, 2015 (per cent of GDP)



Source: UNCTAD secretariat estimates, based on World Bank, World Development Indicators database (accessed August 2017).

Table 5.3

ODA to LDCs and additional amounts generated by meeting targets, DAC member countries, 2015

(million dollars)

	Actual (2015)	Target amount			Increase from 2015		
		Percentage of GNI:	0.15	0.20	0.35	0.15	0.20	0.35
Australia	931		1 976	2 635	4 611	1 045	1 704	3 680
Austria	222		562	750	1 312	340	528	1 090
Belgium	610		683	911	1 593	73	301	984
Canada	1 561		2 293	3 058	5 351	732	1 497	3 790
Czech Republic	41		259	346	605	218	305	564
Denmark	610		610	623	1 090	0	13	480
Finland	429		429	469	820	0	39	391
France	2 378		3 687	4 916	8 604	1 310	2 539	6 226
Germany	2 596		5 155	6 874	12 029	2 560	4 278	9 433
Greece	38		293	391	684	255	353	646
Iceland	16		25	33	58	9	17	42
Ireland	345		345	452	791	0	108	447
Italy	870		2 722	3 630	6 352	1 852	2 759	5 481
Japan	3 659		6 823	9 098	15 921	3 164	5 439	12 262
Rep. of Korea	728		2 080	2 773	4 853	1 351	2 045	4 125
Luxembourg	154		154	154	154	0	0	0
Netherlands	1 036		1 121	1 495	2 617	85	459	1 580
New Zealand	138		254	339	593	116	200	454
Norway	1 098		1 098	1 098	1 421	0	0	323
Poland	125		689	919	1 608	564	794	1 483
Portugal	90		290	387	677	200	296	587
Slovak Republic	19		129	172	300	110	153	282
Slovenia	10		63	84	146	53	74	137
Spain	314		1 788	2 384	4 172	1 474	2 070	3 858
Sweden	1 473		1 473	1 473	1 762	0	0	288
Switzerland	928		1 029	1 372	2 402	101	444	1 474
United Kingdom	6 117		6 117	6 117	9 876	0	0	3 759
United States	10 737		27 744	36 992	64 736	17 007	26 255	53 999
TOTAL DAC	**37 274**		**69 894**	**89 943**	**155 140**	**32 619**	**52 669**	**117 865**

Source: OECD, Statistics on resource flows to developing countries (http://www.oecd.org/dac/financing-sustainable-development/development-finance-data/statisticsonresourceflowstodevelopingcountries.htm), table 31, accessed July 2017, and UNCTAD secretariat estimates, based on GNI data from World Bank, World Development Indicators database (accessed July 2017).

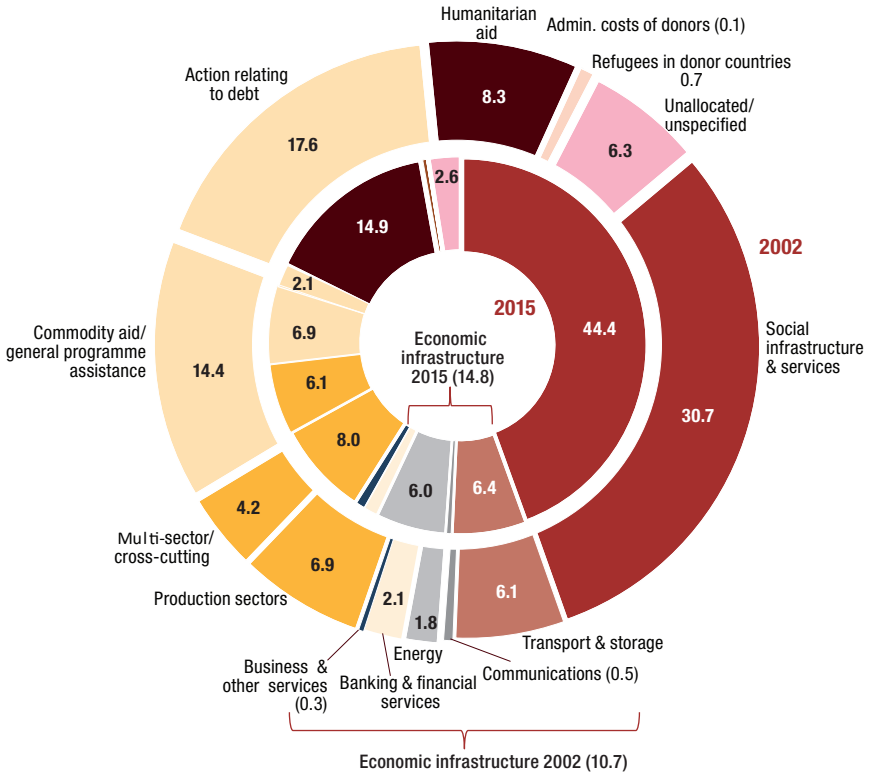
On average, 53 per cent of disbursements to LDCs between 2002 and 2015 were in the form of loans rather than grants (figure 5.6). Non-DAC donors, followed by the World Bank Group, disburse the highest shares of grant funding. OECD-DAC countries record the lowest share (figure 5.7).

A substantial part of the increase in ODA to LDC energy sectors since 2006 is accounted for by the entry of new non-DAC donors, such as the OPEC and Arab Funds, whose share in multilateral ODA in the LDC energy sector has increased rapidly (figure 5.8 and table 5.4), and by the growing role of regional development banks in LDC energy sectors. It is notable that the OPEC Fund shows a low level of concentration in terms of coverage of LDCs. The impact of multilateral funds linked to climate change, such as the Global Environmental Facility (GEF) and the Climate Investment Funds (CIFs), remains very small at present, partly because expanding electricity infrastructure is not a central part of their roles, and partly because both have been more active in ODCs than in LDCs.

Figure 5.4

ODA disbursements to LDCs by sector, 2002 and 2015

(2015 dollar prices)

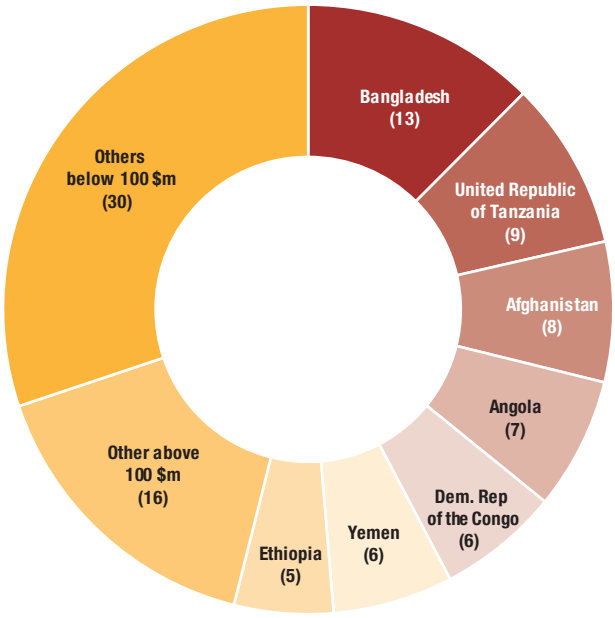


Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed May 2017).

Figure 5.5

Top LDC recipients of energy ODA, 2015

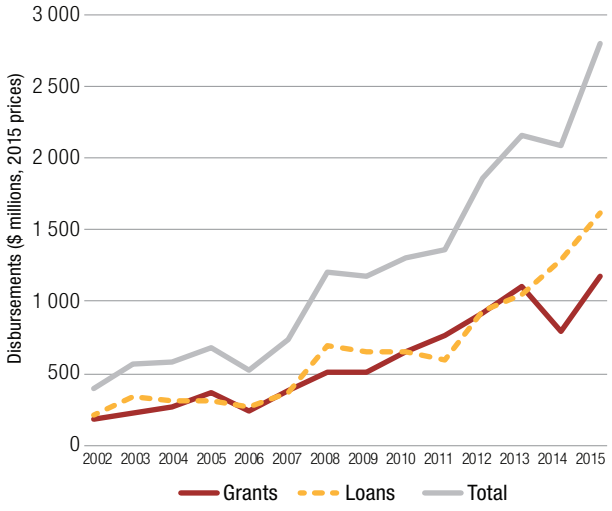
(per cent of total disbursements)



Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed July 2017).

Figure 5.6

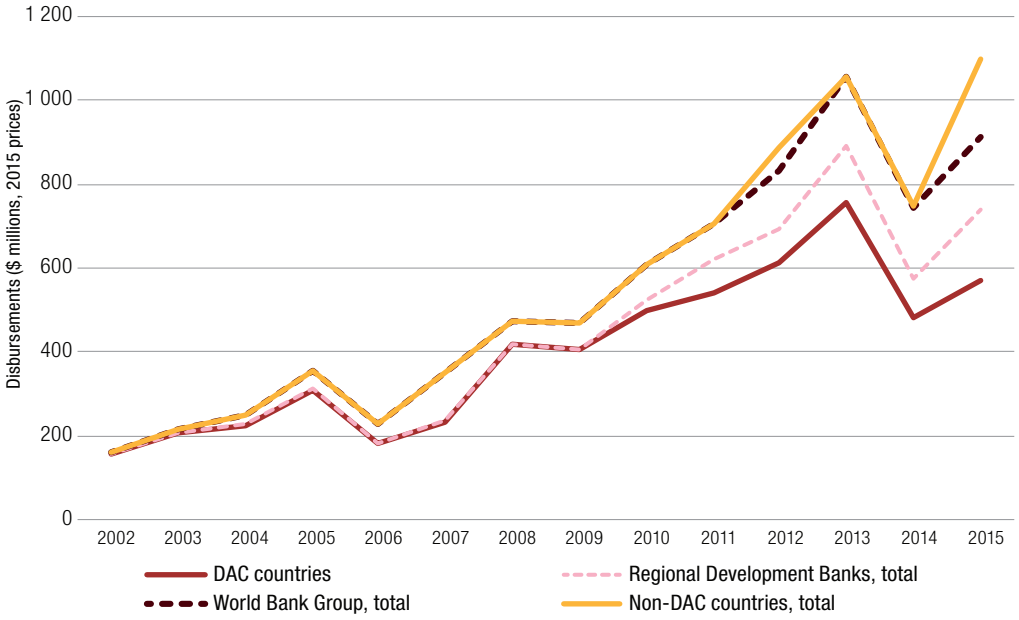
ODA disbursements to LDC energy sectors by type, 2002–2015



Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed May 2017).

Figure 5.7

ODA grants to LDC energy sectors by donor, 2002–2015

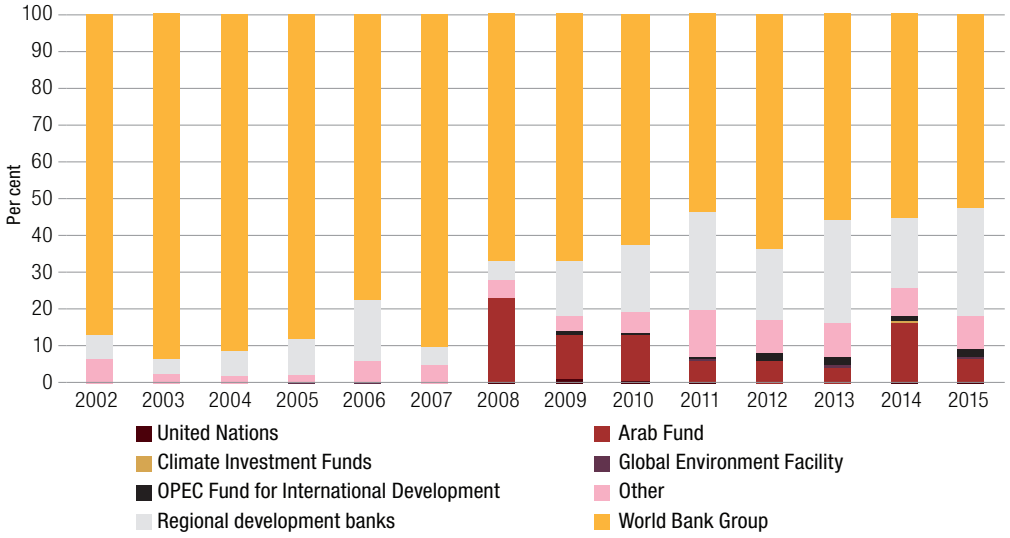


Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed May 2017).

Figure 5.8

Evolution of energy ODA disbursements by multilateral bodies to LDCs, 2002–2015

(2015 prices)



Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed May 2017).

Table 5.4

Non-DAC and regional banks' shares in multilateral ODA

(2015 prices)

Fund	First year	Average share in multilateral ODA 2008–2015 (%)
Arab Fund	2008	8.8
CIF	2013	0.01
GEF	2005	1.4
OPEC Fund	2009	5.5
Regional development banks	2002	25.4

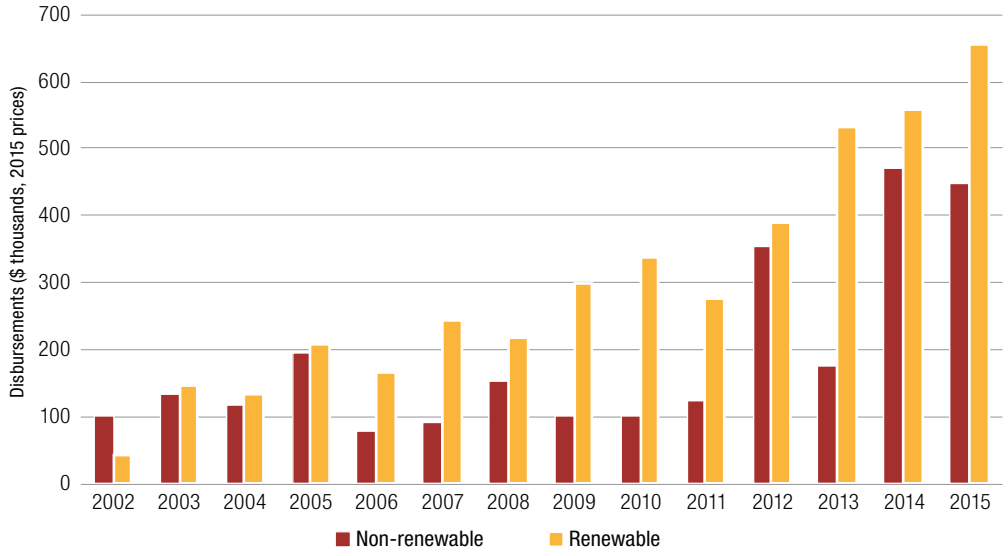
Source: UNCTAD secretariat, based on OECD, OECD.Stat Creditor Reporting System database (accessed May 2017).
Notes: Regional development banks comprise the African Development Bank and the Asian Development Bank.

Since 2003, disbursements directed at renewable sources of electricity generation have surpassed those destined for the non-renewables subsector (figure 5.9). OECD-DAC countries and various multilateral donors have all been equally active in this category. The trends in the distribution of ODA disbursements between generation and network segments of the electricity industry are less clearcut, however (figure 5.10).

An important issue in ODA allocations is the lack of support to energy-sector planning, administration and regulation, which are recorded as having received zero disbursements between 2002 and 2015.[11]

Figure 5.9

Distribution of ODA between renewable and non-renewable sources of energy, 2002–2015



Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed June 2017).

Figure 5.10

Distribution in ODA between network and generation segments, 2002–2015

Source: UNCTAD secretariat estimates, based on data from OECD, OECD.Stat Creditor Reporting System database (accessed June 2017).

Other official flows (public financing flows that do not meet the concessionality criteria for classification as ODA)[12] into LDC energy sectors averaged $173 million annually over the period 2005–2015 (figure 5.11). The majority of these funds were allocated to energy policy and administrative management (mainly funds from regional development banks) and electricity transmission and distribution (figure 5.12). Similar to ODA, zero disbursements were reported for the energy regulation subcategory.

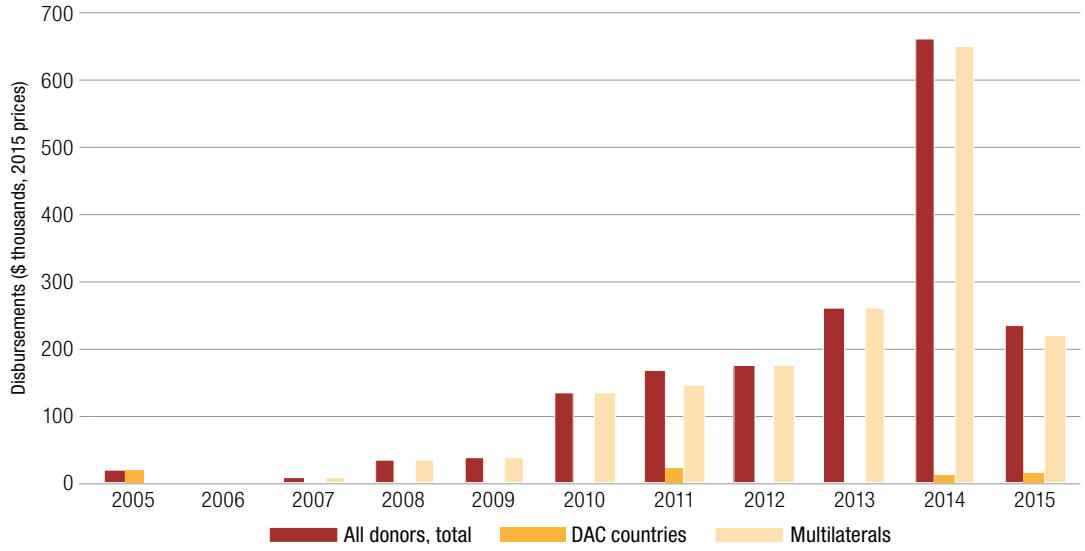
c. Public-private finance

Public-private partnerships (PPPs)[13] typically make up only about 5-10 per cent of overall investment in economic infrastructure (Mckinsey Global Institute, 2016); and the proportion of ODA disbursed through PPPs or equity in LDC energy sectors is minimal.

Financing for PPPs comes from a combination of private and public sources, including development finance institutions and other multilateral agencies. While only 5 per cent of global private infrastructure investment goes to lower-middle-income and low-income countries, some developing countries rely on PPPs for up to a quarter of their total financing. Regionally, across developing countries as a whole, the East Asia and Pacific region had the highest financing for PPPs from the private sector (83 per cent) in 2015, while Latin America and the Caribbean had the highest public share (39 per cent) (IFC, 2017a; World Bank, 2017a).

Figure 5.11

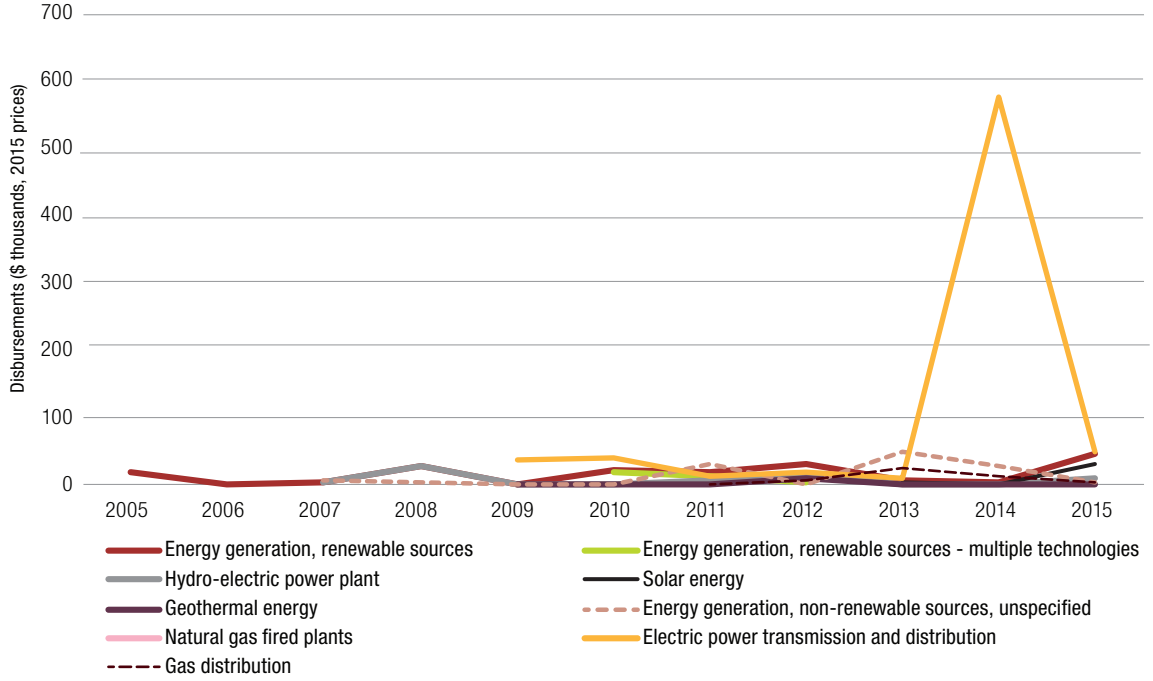
Trends in other official flows, 2005–2015



Source: UNCTAD secretariat estimates, based on data from OECD, Stat Creditor Reporting System (CRS) database (accessed June 2017).

Figure 5.12

Distribution of other official flows by generation source, 2005–2015



Source: UNCTAD secretariat estimates, based on data from OECD, Stat Creditor Reporting System (CRS) database (accessed June 2017).
Note: The spike in 2014 is explained by other official flows from the African Development Bank (AfDB) to Angola.

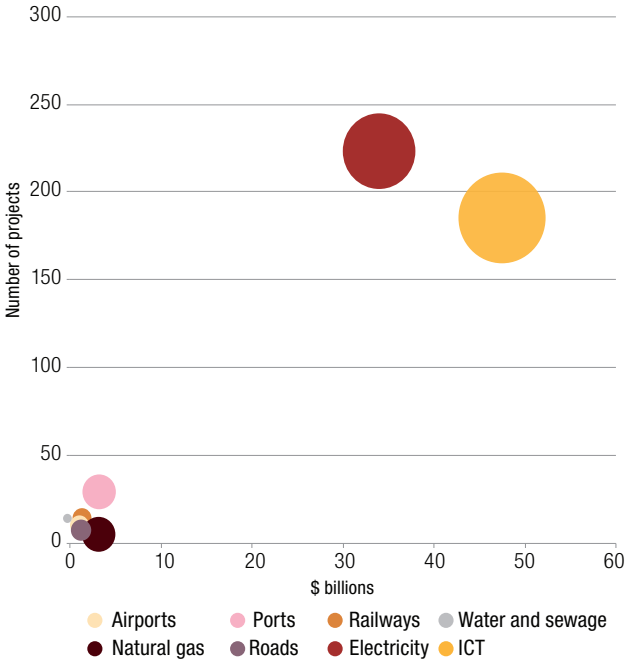
It should be noted, however, that PPPs do not necessarily liberate public funds, and that national Governments can generally raise finance at a lower cost than developers via concessional debt and aid (Nelson and Shrimali, 2014).

Since 1990, there have been 488 recorded PPP project investments in LDCs, amounting to $91.3 billion. More than half of these projects by value ($47.5 billion) were in the information, communications and telecommunications (ICT) sector; but a greater number of projects (223 projects totalling $34 billion) have been in the electricity sector (figure 5.13). This compares with $2.23 billion (5,971 projects) over the same period in ODCs, of which the electricity sector accounted for $748 billion (2,726 projects).

The total value of PPP energy projects in LDCs has increased rapidly since 2004, peaking at $14.1 billion (179 projects) in 2012, but has fallen dramatically since, to $6.9 billion (148 projects) in 2013, and a low of six projects ($0.8 billion) in 2016. Among the LDCs, the

Figure 5.13

Private participation in infrastructure in LDCs, 1990–2016



Source: UNCTAD calculations based on World Bank Private Participation in Infrastructure database accessed May 2017

Note: No information is available for Equatorial Guinea, Solomon Islands and Tuvalu.

country with the highest value of investments over the period was Lao People's Democratic Republic, with investments of almost $16 billion in electricity (table 5.5).

Chinese investments in LDC energy projects are estimated to be in excess of $9.4 billion, and its construction contracts (not involving ownership of infrastructure) in excess of $55.3 billion between 2005 and 2016 (table 5.6).[14] However, LDC energy markets accounted for only 0.2 per cent of Chinese investments worldwide between 2005 and 2016.

d. Sovereign borrowing

Rising commodity prices, high economic growth rates, and low interest rates in developed markets have encouraged some LDCs, particularly in Africa, to increase their issuance of international bonds to finance infrastructure development (UNCTAD, 2016a; WEF, 2016). Between 2006 and 2015, at least seven African LDCs have tapped Eurobond markets (Angola, Ethiopia, Mozambique, Rwanda, Senegal and Zambia). Demand for such bonds appears to remain strong, despite Mozambique's default on a coupon payment in January 2017: Senegal's fourth Eurobond, issued in May 2017, was eight times oversubscribed (Bloomberg 2017).

Table 5.5

Top four recipient countries of private participation in electricity and ICT

Country	Electricity		Country	ICT	
	Investment ($ billion)	No. of projects		Investment ($ billion)	No. of projects
Lao People's Democratic Republic	15.9	25	Bangladesh	8.2	12
Bangladesh	4.4	49	Sudan	4.2	5
Uganda	1.4	22	United Rep. of Tanzania	4.0	12
Nepal	1.9	29	Senegal	3.1	3

Source: World Bank Private Participation in Infrastructure database (accessed May 2017).

Table 5.6

Investment by Chinese companies in LDC energy

Year	Investor	Amount ($ millions)	Investor share (%)	Subsector	Country	Type
2008	Huadian	580		Hydro	Cambodia	
2010	Sinohydro	1 030		Hydro	Lao PDR	Greenfield
2011	Sinohydro	140	90	Hydro	Nepal	
2013	China Energy Engineering	130		Hydro	Nepal	Greenfield
2013	CNPC	4 210	29	Gas	Mozambique	
2013	Power Construction Corp	120	90	Hydro	Nepal	Greenfield
2013	Norinco	180	85	Hydro	Lao PDR	Greenfield
2013	Huaneng	410		Hydro	Cambodia	Greenfield
2015	Three Gorges	1 200	75	Hydro	Nepal	Greenfield
2016	Power Construction Corp	1 360		Hydro	Laos	Greenfield

Source: World Bank Private Participation in Infrastructure database (accessed May 2017).

Some LDCs use their natural resources as collateral to overcome barriers to accessing conventional bank lending and capital markets. Natural resource- or commodity-backed finance is a form of lending used by banks from a number of jurisdictions, including China (table 5.7), Brazil, France, Germany and Republic of Korea (Halland and Canuto, 2013).

2. Prospects for external financing

The need for massive injections of capital into LDC energy sectors comes at a time when the international development finance landscape is undergoing its own disruptions, and these countries may be facing a less supportive environment in which to raise additional funding. Shifts in that landscape have created new opportunities and options to access external finance, but also significant new challenges (box 5.3).

Changes in the international development finance landscape are creating new opportunities and new challenges

a. Public international development finance: A shrinking space?

New uncertainties have arisen around future levels of ODA that may serve to narrow LDCs' financing options. Political developments and continued economic stress in major donor economies are prompting some donors to rethink their ODA commitments, including possibly abandoning the commitment to provide 0.7 per cent of GNI in ODA and reducing contributions to multilateral bodies such as the World Bank.

Table 5.7

China energy finance to selected LDCs 2000–2016

Country	Borrower	Lender	Energy source	Energy subsector	($ billions)
Zambia	Government	Ex-Im Bank	Hydropower	Power generation	2.00
Cambodia	Government	Ex-Im Bank	Hydropower	Power generation	1.50
Democratic Republic of Congo	Government	Ex-Im Bank	Hydropower	Power generation	1.00
Sudan	Government	Ex-Im Bank	Hydropower	Multipurpose	0.61
Benin	Government	Ex-Im Bank	Hydropower	Power generation	0.55
Lao People's Democratic Republic	Government	Ex-Im Bank	Hydropower	Transmission and distribution	0.55
Uganda	Government	Ex-Im Bank	Hydropower	Power generation	0.50
Mali	Government	Ex-Im Bank	Hydropower	Power generation	0.44
Ethiopia	Government	Ex-Im Bank	Hydropower	Power generation	0.44
Guinea	Government	Ex-Im Bank	Hydropower	Power generation	0.34
Equatorial Guinea	Government	Ex-Im Bank	Hydropower	Power generation	0.26
Nepal	Government	Ex-Im Bank	Hydropower	Power generation	0.20
Myanmar	Government	Ex-Im Bank	Hydropower	Power generation	0.20

Source: China Global Investment Tracker, data compiled by the American Enterprise Institute and the Heritage Foundation.

Box 5.3. **New vocabulary in development finance explained**

Innovative finance encompasses a range of new or non-traditional funding mechanisms that seek to achieve specific results, such as raising additional funds, improving the efficiency of funding or linking finance to specific developmental impacts. The same or similar mechanisms may be labelled differently in different regions or sectors. The lack of common definitions and policy frameworks, including for monitoring and evaluating their efficacy and impact, constrains the sound assessment of these new forms of development finance, even as they gain prominence.

Blended finance/capital occurs when public development finance is used to attract or leverage commercial finance into developing countries. It is thus a means to mobilize additional development finance from the private sector. The World Bank Group incorporates this strategy as part of its cascade approach to assessing how best to fund development projects in order to improve the efficiency of Bank funding. OECD has also adopted blended finance as a means to bring together public and private investors to achieve the SDGs.

Impact investing is undertaken by companies, organizations or funds seeking to generate social and/or environmental impact alongside financial returns. Investors may target market-rate returns or seek only to recoup capital. Impact investors are not necessarily the same as social investors.

Social investment or socially responsible/green/ethical investing encompasses investment strategies that seek to bring about social change. However, unlike impact investors, social investors consciously avoid investments that do not meet their ethical standard, over and above an investment's potential social impact.

Source: Mohieldin (2017); OECD (2017a, 2017b); Saldinger (2017).

The Addis Ababa Action Agenda (adopted in 2015 at the Third International Conference on Financing for Development) presents catalysing resources from other public and private sources as an important use of ODA and other international public finance. This may be an opportunity for LDCs, if it effectively broadens their options for development finance. However, the current array of risk mitigation instruments used by international finance institutions to crowd in institutional investors has been found to be complex and non-standardized, and thus burdensome and costly for the private sector to use (WEF, 2016). Guarantees are[15] the main lever by which international official financing is used to leverage private investment in infrastructure, accounting for 60 per cent of the total amount; but guarantees for energy projects benefit mostly ODCs (OECD, 2015b). Between 2012 and 2014, LDCs received only 8 per cent of finance mobilized through guarantees, syndicated loans and shares. Overall, developing countries in Africa (29.1 per cent) benefited the most, followed by Asia (27.2 per cent) and the Americas (21.1 per cent) (OECD, 2016a).

Changes are also under consideration in multilateral development financing institutions. Specifically, the World Bank Group is considering the adoption of a cascade approach to financing infrastructure projects (Mohieldin, 2017). This approach would prescribe that support for public-sector solutions to development financing, including concessional lending, could only be considered if private-sector solutions (first priority) and public-private partnerships (second priority) were deemed not to be feasible. If adopted, this approach is expected to apply equally to the International Development Association (IDA) fund for the poorest countries, which was replenished by $75 billion (50 per cent) in December 2016. The "blended finance" approach of OECD and the Addis Ababa Agenda follows a similar logic.

b. New global financial sector rules

Stricter liquidity and capital adequacy requirements under Basel III[16] implementation are expected to increase the price of long-term debt and reduce its supply.[17] Basel III is also expected to induce changes in the way that project financing is structured and documented (OECD, 2015a; IRSG, 2015). As a consequence, banks in developed countries have become more reluctant to take on the risks associated with infrastructure project finance. This emerging gap in long-term bank financing contributes to a widening frontier of vulnerability in the development finance landscape for LDCs and developing countries generally.

The volume of private participation in financing infrastructure projects in lower-income countries remains modest (OECD, 2015b). There is evidence that institutional investors, estimated to account for assets in the trillions of dollars, may be gradually increasing their exposure to infrastructure and other real assets. However, the vast majority of their investments are still concentrated in their home OECD economies and in traditional financial instruments (Inderst and Stewart, 2014). For instance, pension funds continued to invest mainly (75 per cent) in equities and bonds in 2016 (OECD, 2017d).

The challenge is to channel institutional investment towards developmental purposes. The infrastructure push associated with the 2030 Agenda is widely expected to encourage institutional investors to further diversify their portfolios and turn their attention to developing countries. However, in the Basel III environment, these investors are showing signs of being increasingly wary of large investments that require the bespoke due diligence which typically characterizes infrastructure projects (Kharas, 2015). First-mover risks linked to ongoing technological disruption in energy markets could also be viewed as a potential source of systemic risk by investors (Ma, 2016).

A further challenge is that changes in institutional investors' own rules may be necessary to allow them to invest in development-oriented projects (UNCTAD, 2012). Developments in climate policy have so far not stimulated any discernible change in this context. For instance, sovereign wealth fund mandates do not typically include green finance (OECD, 2016b), and related actions in this area have been taken with a view to reducing the portfolio exposure to fossil fuels (Halland, 2017) in the debt and equity of listed corporations. Willingness to invest in any given country is also heavily influenced by perceptions in areas in which LDCs tend to be at a disadvantage, such as sovereign risk, investment climate, policy settings and institutional quality (OECD, 2016b; Inderst and Stewart, 2014).

c. The rise of infrastructure and energy-related funds

Notwithstanding an uncertain future for development finance generally, infrastructure, including the electricity sector, has increasingly been the focus of considerable interest from donors, the private sector and multilateral development finance institutions. There has been a proliferation of infrastructure- and energy-specific development finance and impact investment funds (box 5.4), and of climate and green financing facilities, at the bilateral, regional and multilateral levels. Such initiatives are often linked to climate-change policy or sustainable development and may or may not target energy infrastructure and/or access. Many are led by regional development banks or fall under the rubric

of South-South or bilateral cooperation, often with a regional or country focus, but a specific LDC focus is rare. In the new development finance paradigm, the blending of public and private finance is transforming the profile of fund investors to include development finance institutions, private equity managers, impact investors and institutional investors. This contributes to an interlaced web of interests, motivations and flow of development finance.

These initiatives are important because they are increasingly successful in marshalling large financing commitments that have the potential to contribute to development alongside public spending and ODA.

The European Sustainable Development Fund, proposed in September 2016, is expected to raise up to €44 billion for investment in Africa and in countries neighbouring the European Union. A minimum of 28 per cent of that fund will be earmarked for investments in climate action, renewable energy and resource efficiency. The proposed fund aims primarily at creating jobs and addressing root causes of migration (European Council, 2017). At the multilateral level, the Green Climate Fund had mobilized $10.3 billion in pledges as at July 2017, and 13 of its 43 active projects, amounting to only $2.2 million in commitments, are in LDCs. The Africa Hub of the Sustainable Development Investment Partnership (SDIP) for infrastructure investment was launched in 2016, and a hub for ASEAN is planned. The partnership is a collaborative initiative comprising public, private and philanthropic institutions from around the world, coordinated by the World Economic Forum with support from OECD, and aims to mobilize $100 billion using blended finance by 2020.

The explosive growth of such initiatives is illustrated by the mapping of (a conservative list of) 58 multi-country energy-related initiatives and programmes targeting Africa, shown in table 5.8. Multilateral donors are involved in 77 per cent and bilateral donors in 65 per cent of the Africa initiatives and programmes. Almost all of them focus on the promotion of renewable energy and the vast majority address the electricity sector, 74 per cent supporting grid-connected electricity generation (AEEP, 2016).

However, this proliferation of energy initiatives could exacerbate the already skewed nature of development finance flows amongst LDCs as a group and between regions. It also highlights the persistent challenges around tracking, measuring and understanding the motivations and nature of non-traditional sources of development finance. The large volume of often non-comparable and opaque data associated in particular with initiatives involving the private sector, South-South cooperation and impact investment makes it increasingly difficult to assess fully how much funding is available, its coverage, additionality and impact. Furthermore, official estimates of the activities of private entities (e.g. philanthropic foundations, corporate philanthropy) that aim primarily to support national or international development rather than making a profit and that involve a transfer of resources to developing countries are generally lacking or provide insufficient sectoral and country detail (United Nations, 2016). Changes in the global development finance landscape have thus created an information scarcity problem while also contributing to an increasingly complex and fragmented development finance architecture for LDCs and other developing countries to navigate (UNCTAD, 2016b).

Impact investors are also seen as potential sources of financing, in particular for medium-scale renewable and hybrid projects on larger grids capable of supporting

Box 5.4. **The impact investment industry**

Impact investments are considered to have complementary and significant potential for the realization of the SDGs alongside public spending and ODA, and were initially driven in large part by bilateral donors and philanthropic communities. Impact investors invest in private-sector companies, organizations and funds, primarily in developing countries. Their key selling point is a perceived ability to drive inclusive and green business through catalytic investment in small and medium-sized enterprises and reach bottom-of-the-pyramid populations using innovative new business models.

By September 2016, the Global Impact Investing Network's database included more than 400 impact investment funds, 60 per cent of which had been in existence for less than three years, with committed capital amounting to $31.2 billion. Major emphases are rural and urban areas; bottom-of-the-pyramid; community/local investing; women; minorities/previously excluded populations; fair trade; human rights; and faith-based themes. Access to finance and access to basic services were by far the two most important focus areas, followed by employment generation and green technology. Private equity and venture capital account for more than 50 per cent of funds' investment vehicles, especially in emerging markets. Funds predominantly (79 per cent) pursue risk-adjusted market returns.

Challenges faced by fund investors include the limited number of sustainable social enterprises or impact investees that meet their criteria for investment in their target markets; a lack of innovative fund and deal structures that match investor risk and return profiles; a lack of visibility; an unclear regulatory environment in target markets; and limited possibilities to dispose of investments profitably. The development of standard social-impact measurement systems remains a significant challenge for the industry.

Source: GIIN (2015); UNDP (2015); Wilson (2016).

Alternative sources of development finance include South-South finance, diaspora investment and domestic capital markets

semi-industrial and industrial productive activities (box 5.4). Securing commercial financing for larger decentralized grids is problematic in many developing countries because of their intermediate size, greater complexity and need for formal institutional and legal frameworks. In most instances public financing, which can be as high as 80 per cent, comes in the form of a capital subsidy (IFC, 2012). Larger decentralized systems designed with business rather than household customers in mind are able to exploit economies of scope to provide more reliable and differentiated services, such as peak and off-peak services, and to cater for different loads. Inadequate policy frameworks, periodic adjustment costs necessitated by rising demand, long-term management and maintenance, and lack of funding at the intermediate scale have contributed to the concentration of private-sector interventions in household and off-grid solutions.

d. South-South financing

Chinese policy banks have emerged as global leaders in finance for energy projects in developing countries (table 5.7), and it is estimated that China's banks and funds have doubled the availability of global development finance and hold more assets than the

Table 5.8

Overview of major energy initiatives and programmes targeting Africa

High-level initiatives	
Africa Clean Energy Corridor	Africa Renewable Energy Initiative (AREI)
Africa Energy Leaders Group (AELG)	Presidential Infrastructure Champion Initiative (PICI)
Africa-EU Energy Partnership (AEEP)	Program for Infrastructure Development in Africa (PIDA)
Africa Power Vision	SE4ALL (Africa Hub)
High-level initiatives with an operative programme	
Africa 50	New Deal on Energy for Africa
Africa Renewable Energy Access Program (AFREA I & II) – ESMAP	Power Africa
ElectriFi	Public Private Infrastructure Advisory Facility (PPIAF)
Energies pour l'Afrique	World Bank Guarantee Program
Global Alliance for Clean Cookstoves	
Operative programmes and delivery mechanisms	
ACP-EU Energy Facility	GET FiT Uganda
AFREA Gender and Energy Program	Global Energy Efficiency and Renewable Energy Fund (GEEREF)
Africa Clean Cooking Energy Solutions Initiative (ACCES)	Green Mini-Grids Africa Regional Facility
Africa Energy Guarantee Facility (AEGF)	IRENA/ADFD Project Facility
Africa Enterprise Challenge Fund (AECF)	Lighting Africa
Africa-EU Renewable Energy Cooperation Program (RECP)	Mediterranean Solar Plan (MSP)
African Development Bank Partial Risk Guarantee (PRG)	NEPAD Bioenergy Programme for Africa
Africa Renewable Energy Fund (AREF)	NEPAD Continental Business Network (CBN)
Biofuels Programme for Household and Transport Energy Use	NEPAD Infrastructure Project Preparation Facility (NEPAD-IPPF)
Carbon Initiative for Development (Ci-Dev)	PIDA Service Delivery Mechanism (SDM)
Clean Technology Fund (CTF)	Private Infrastructure Development Group
EEP Africa – Energy and Environment Partnership	Regional Energy Project for Poverty Reduction
Energising Development (EnDev)	Regional Technical Assistance Program (RTAP)
Energy Access Ventures	Renewable Energy Performance Platform (REPP)
Energy Africa Campaign	Renewable for Poverty Reduction Program (REPoR)
EREF ECOWAS Renewable Energy Facility	Renewable Energy Solutions for Africa (RES4Africa)
EU-Africa Infrastructure Trust Fund (ITF) / Africa Investment Facility (AfIF)	Scaling Solar
EU Development Finance Institutions (EDFIs) Private Sector Development Facility	Strategic Climate Fund – Scaling Renewable Energy Program (SREP)
EU Energy Partnership Dialogue Facility (EUEI PDF)	Sustainable Development Investment Partnership (SDIP)
European Union's Technical Assistance Facility (TAF)	Sustainable Energy Fund for Africa (SEFA)
Geothermal Risk Mitigation Facility	

Source: AEEP (2016), table 1.

major multilateral development banks operating in developing countries. In Africa, China has become the major bilateral source of infrastructure financing (Sy and Copley, 2017). Between 2007 and 2014, Chinese banks added $117.5 billion in energy finance, which doubled globally available energy financing (Gallagher et al., 2016). Loans extended by China have sometimes been found to meet the OECD-DAC and World Bank concessionality criteria, but even when they do not, their disbursement processes and lack of conditionality are key selling points (Bhattacharya and Rashmin, 2016). The diversity of LDCs receiving credit from China is significantly greater than that of recipients of direct investment.

China's dominance in infrastructure finance is expected to continue. It played a major role in capitalizing the New Development Bank[18] and the Asian Infrastructure Investment Bank.[19] Among the latter's list of projects approved in 2016 is a $20-million electricity generation project in Myanmar and a $165-million project in electricity distribution in Bangladesh. The Asian Infrastructure Investment Bank, which became operational in January 2016, is projected to provide $10 billion to $15 billion in loans annually over the next 15 years. It is estimated that the New Development Bank has the ability to reach an annual lending capacity of $3.4 billion by 2024 and almost $9 billion by 2034 (United Nations, 2016).

China's Belt and Road Initiative, which calls for massive investments in infrastructure, is also expected to boost Chinese lending, including in the electricity sector in Asia. The establishment of the China South-South Climate Cooperation Fund, announced in 2015, is also relevant to the electricity sector.

Other South-South finance is also set to increase. For instance, India announced in 2015 a $10-billion concessional credit to African countries over five years, along with $600 million in grant assistance, augmenting existing lines of credit to the continent.

e. Domestic financing

LDC Governments and international donors are now focused — albeit from different perspectives — on alternative investment sources that can help bridge funding gaps as pressures mount in some traditional donor countries to reduce public sources of international development finance. Increasing attention is directed to three potential financing sources that are seen as exceeding ODA and as being relatively stable and resilient during periods of economic downturn: illicit financial outflows (in particular from Africa but also from other jurisdictions); resources that could be liberated through the reform or elimination of inefficient support for the consumption or production of fossil fuels; and personal remittances. The last of these is not a source of development finance or of long-term capital, but rather a flow of private money between households, largely for consumption expenditure. However, there may be some potential for direct investment in development-related activities by diaspora members.

A prerequisite for tapping alternative sources of development finance in LDCs is the development of domestic instruments for infrastructure-related debt. Underdeveloped capital markets in LDCs result in an unavailability of typical infrastructure debt instruments, such as corporate bonds and project bonds, including municipal bonds, that can be rated and traded and are normally allowed in institutional-investor portfolios (Inderst and Stewart, 2014; IFC, 2016). The generally insufficient level or outright unavailability of such instruments hampers investors' ability to diversify risk. It also constrains the development of a local investor base. For example, the importance of pension funds relative to the size of the economy in some LDCs (e.g. Lesotho) is significant (OECD, 2014) and could be better exploited if the domestic capital market were more developed.

Notable developments are signs that national development banks are assuming a more prominent role in financing regional and subregional infrastructure (United Nations, 2016), and the growing number of initiatives aimed at assisting developing countries to develop nascent domestic capital markets and tap new breeds of investors.

Some international initiatives are under way to support domestic resource mobilization. At the multilateral level, IFC promotes local currency bonds (IFC, 2017b). At the regional and continental levels, a "Big Bond for Africa" has been mooted;[20] and a number of initiatives already exist in Asia, such as the Asian Bond Fund initiative of the Executives' Meeting of East Asia Pacific Central Banks (EMEAP), launched in 2003,[21] and the Credit Guarantee and Investment Facility (CGIF), which provides bond guarantees in the Association of Southeast Asian Nations (ASEAN)+3 region.[22] Examples at the bilateral level include the African Local Currency Bond Fund established by Germany's KfW Development Bank in 2012.[23] National examples include Ethiopia's diaspora bond and Bangladesh's migrants' bonds (Guichard, 2016).

However, the LDC coverage of these initiatives is variable. For instance, IFC bonds have largely benefited ODCs — including the BRICS countries — perhaps underlining the acute difficulties in LDC contexts, while only Zambia and Rwanda have so far benefited from the IFC initiative and LDC members of the EMEAP initiative have not yet participated. Impacts may also be constrained where listing is confined to national markets, as is the case for Bangladesh's migrants' bonds.

E. Conclusion

The costs of achieving universal access to electricity in LDCs, and still more of transformational access, are very considerable, and much greater than existing financial flows to the sector. Estimates presented in this chapter suggest the total investment cost for basic universal access by 2030 to be in the order of $12-$40 billion per year across LDCs as a whole; and increasing supply to fulfil the needs of transformational access would increase these costs significantly. However, the prospects for an increase on the scale required are clouded by a number of current and impending challenges.

Current trends in development finance, notably as expressed in the Addis Ababa Action Agenda, highlight the potential role of private financing for development-oriented infrastructure investment and of official flows in catalysing such financing. However, the role of private infrastructure financing remains limited in LDCs, and there are substantial obstacles to its deployment to achieve universal access. This approach also presents the challenge of balancing the drivers of private finance with the very different motivations of public finance. Together with the high cost of private finance, these considerations strongly indicate a continuing central role for public investment and ODA. An increase in ODA to LDCs is critical in the context of the internationally recognized principle of common but differentiated responsibility with respect to climate-change mitigation.

The particular circumstances of LDCs, with high costs of electrification and very limited purchasing power, give rise to potentially serious tensions between the multiple objectives of increasing access, affordability, reliability of supply and financial sustainability. These tensions may be further heightened to the extent that LDCs seek to increase the share of renewables in their electricity generation mix significantly through private-sector participation, as this is likely to require consideration of renewable energy support schemes that involve above-market prices. Further constraints arise from the limited availability of planning and regulatory capacities, which need to be taken into account in the design and choice of support mechanisms, and also highlight the need for proactive efforts to build the requisite capacities to broaden policy options in the future.

Notes

1 A syndicated loan is financed by a group of lenders rather than a single borrower.

2 Whereas for developed countries the pressures revolve around the inequities among residential customers created by the emergence of distributed generation, for LDCs (and other developing countries) the drivers are linked to structural weaknesses exposed by increased private-sector participation in the sector.

3 For example, tariffs differentiated by technology and site location, or tariffs exempt from regulation and set by operators in consultation with communities, as in the United Republic of Tanzania (IRENA, 2016b).

4 Bearing in mind that renewables' costs differ by locality, auction prices are not comparable within or across countries.

5 Business development services often mean the difference between the success and failure of entrepreneur credit schemes and the successful uptake of credit, as the availability of credit does not in and of itself lead to an increase in entrepreneurs or borrowing (Molenaar, 2006; Naidoo and Hilton, 2006).

6 While LDCs represent 60 per cent of the population of sub-Saharan Africa, they account for only one third of the region's GDP, reflecting their lower GDP per capita and the substantial shares attributable to South Africa and Nigeria.

7 During 2010–2015, 22 climate-related official development assistance-funded projects were aimed directly at fossil-fuel subsidy reform (Merrill et al., 2017).

8 https://www.iea.org/topics/energyefficiency/.

9 An online repository of supplementary materials to this study, including the modelling tool used (developed by the United Nations Department of Economic and Social Affairs), is available at https://github.com/UN-DESA-Modelling/electrification-paths-supplementary.

10 Official development assistance (ODA) remains a unique and important driver of development cooperation and is the only form of international public finance that is explicitly targeted at promoting the development and welfare of developing countries (United Nations, 2016).

11 The OECD-DAC database subdivides ODA for energy data into six thematic areas: energy policy and administrative management; energy sector policy, planning and administration; energy regulation; energy education/training; energy research; and energy conservation. Disbursements to LDCs in the first two categories are recorded as zero between 2002 and 2015.

12 Other official flows include bilateral financing for commercial purposes, such as direct export credits; subsidies to the private sector to soften its credits to developing countries; and funds in support of private investment. The data reported here exclude export credits.

13 Public-private partnership (PPP) contracts have emerged as a major legal structure to define project finance investment. They have few standardized structures and are often project-specific (OECD, 2015a).

14 China Global Investment Tracker database (http://www.aei.org/china-global-investment-tracker/). The database excludes deals with a value of less than $100 million.

15 At least up until the cascade/blending arrangements are fully effective.

16 The introduction of Basel III is to be completed in 2019 and is expected to be in operation worldwide.

17 The European Commission and European Investment Bank have established the Europe 2020 Project Bond Initiative as a means to attract alternative financing for individual infrastructure projects (http://www.eib.org/products/blending/project-bonds/).

18 The New Development Bank was founded by the BRICS countries (Brazil, Russian Federation, India, China and South Africa) in 2015 with a particular focus on lending for sustainable development and sustainable infrastructure (it targets 60 per cent of lending to renewable energy) in the BRICS, other emerging-market economies and developing countries (http://www.ndb.int/about-us/essence/history/).

19 The China-led Asian Infrastructure Investment Bank is a multilateral development bank that came into existence at the end of 2015 with the aim of addressing infrastructure needs across Asia. As of May 2017, five Asian LDCs (Bangladesh, Cambodia, Lao People's Democratic Republic, Myanmar and Nepal) and one African LDC (Ethiopia) were members. Prospective LDC members listed on the Bank's website in May 2017 include Afghanistan and Timor-Leste.

20 Proposed by Ngozi Okonjo-Iweala, former Finance Minister of Nigeria and Managing Director of the World Bank, and Nancy Birdsall, President Emeritus and senior fellow at the Center for Global Development (Birdsall and Okonjo-Iweala, 2017).

21 https://aric.adb.org.

22 http://www.cgif-abmi.org/. ASEAN and EMEAP LDC members comprise Cambodia, Lao People's Democratic Republic and Myanmar.

23 http://www.alcbfund.com/.