

## REPORT

# Models for engaging the private sector in electricity provision in Yemen

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## List of abbreviations

Abbreviation	Meaning
IPP	Independent Power Producer
KPI	Key Performance Indicators
MoEE	Ministry of Electricity and Energy
PEC	Public Electricity Corporation
PPA	Power Purchase Agreement
PPPs	Public-Private Partnerships
PSID	Private Sector Involvement in Distribution
PV	Photovoltaic
SHS	Solar Home Systems

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# About

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## **The Executive Bureau for the Acceleration of Aid Absorption and Support for Policy Reform**

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The Executive Bureau for the Acceleration of Aid Absorption and Support for Policy Reforms (Executive Bureau) was established in 2013 to improve the government of Yemen's absorption of pledges from development partners. The overall objective of the Executive Bureau is to work closely with government institutions to accelerate the absorption levels of foreign funds to implement development projects. The Executive Bureau also has the mandate to improve the government's capacity through technical support provided by donors in the form of consultancies, expertise, and capacity building. The Prime Minister of Yemen heads the Executive Bureau's board of directors.

## **The International Growth Centre**

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The International Growth Centre (IGC) works with policymakers in developing countries to promote inclusive and sustainable growth through pathbreaking research. The IGC is a global research centre with a network of world-leading researchers and a set of country teams and policy initiatives engaged in Africa, South Asia, and the Middle East. Based at London School of Economics and in partnership with the University of Oxford, the IGC is majority funded by the UK Foreign, Commonwealth and Development Office (FCDO).

## **The State Fragility initiative**

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The State Fragility initiative (SFi) is an IGC policy initiative that aims to work with national, regional, and international actors to catalyse new thinking, develop more effective approaches to addressing state fragility, and support collaborative efforts to take emerging consensus into practice. SFi brings together robust evidence and practical insight to produce and promote actionable, policy-focused guidance in the following areas: state legitimacy, state effectiveness, private sector development, and conflict and security. SFi has financial support from the UK Foreign, Commonwealth, and Development Office (FCDO) and The Rockefeller Foundation.

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# 1 Introduction

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In November 2021, the International Growth Centre (IGC) published a report on the electricity sector in Yemen: **Improving electricity services in Yemen: Priorities and options**.<sup>1</sup> The report reviewed the state of the sector and put forward practical recommendations and options for improving fuel supply, electricity generation, governance, transmission, and distribution, as well as off grid electricity provision.

One of the key challenges facing electricity services in Yemen is that the government and the Public Electricity Corporation (PEC) have limited resources for investment in improvements to generation, transmission, and distribution. It is also difficult for the government to move towards cost-reflective tariffs in the current economic situation. Therefore, one of the recommendations of the report was to explore the idea of **encouraging greater engagement of the private sector in the provision of electricity services in specific areas**. This might enable the government to harness new investment from the private sector in generation, as well as distribution and service delivery. Moreover, regulatory innovation could enable differential pricing 'at the margin', so that customers who are willing and able to pay cost-reflective prices can obtain the supply they need without imposing higher tariffs on the entire population.

The private sector is already heavily involved in the provision of electricity in many developing countries. However, in most cases, this has taken the form of private sector involvement in the **generation** of electricity, specifically **contracting independent power producers (IPPs) to produce electricity, which is then sold, often to a government-owned single buyer under terms dictated by a power purchase agreement (PPA)**. This has proved a successful model for expanding investment in generation but is dependent on the single buyer or off taker being able to credibly commit to payment under the terms of the PPA. Often deals are only bankable where an explicit sovereign guarantee is provided by the government to underwrite the PPA.

The war in Yemen has placed the country's public finances under considerable stress. Electricity generation and revenues from oil and gas are much lower than before the war, while costs have dramatically escalated. Consequently, in Yemen, even a sovereign guarantee may not be sufficient to make a PPA bankable since investors or lenders may lack confidence that the government would have the resources to deliver on the guarantee if called

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1 Almohamadi et al, 2021.

upon. Therefore, in addition to exploring feasible models for private investment in generation, it is important to examine mechanisms by which the private sector might engage in the **distribution sector** as well. This matters because, if a bankable model can be found for involving the private sector in distribution, this would generate its own flow of revenues from electricity sales to customers, obviating the need for a guaranteed source of financing from the government.

There are a range of ways in which the private sector can be involved in the distribution sector, including bilateral contracts, management contracts, distribution contracts, distribution concessions, and a full utility concession. All of these models can take place at the same time as private sector involvement in generation (indeed, a utility concession involves this by definition). However, engaging the private sector in distribution involves a set of considerations which are unique to the sector and different from private sector involvement in generation. Therefore, while we briefly discuss the challenges of encouraging private sector investment in generation, our focus, for the reasons given above, is on **how to find a workable model of private sector involvement in distribution** (which, henceforth, we will abbreviate with the term **PSID**).

- **Section 2** describes the methodology of the study.
- **Section 3** provides a brief introduction to the different ways in which the private sector can be involved in electricity distribution.
- **Section 4** provides a review of the literature and international experience with private sector involvement in distribution.
- We then turn to the evidence for Yemen: **Section 5** summarises the legal and regulatory environment governing the electricity sector in the country.
- **Section 6** describes the findings from a series of interviews and a short survey of stakeholders regarding the suitability of different approaches to private sector involvement in the electricity sector in Yemen.
- **Section 7** draws these findings together to provide a possible model for private sector involvement in the electricity distribution sector in Yemen.
- **Section 8** takes this further by outlining the steps that would be needed to implement a pilot programme.
- The final section, **Section 9**, provides overall conclusions and recommendations.



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## 2 Methodology

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The aim of this study is to **assess the feasibility of engaging the private sector in electricity distribution in Yemen** and to try and **identify the advantages and disadvantages of alternative models** of doing so. The methodology used for this study is a **qualitative case study approach**, consisting of four elements:

- 1. A literature review on the introduction of PSID** in developing countries. While there is an extensive literature on power sector reform in developing countries<sup>2</sup>, the literature that looks specifically at the engagement of the private sector in distribution is much more limited. Our review focuses on the distribution literature specifically and on the implications that the few studies in this area have for the feasibility of implementing PSID in Yemen.
- 2. A brief analysis of the legal and regulatory environment for the introduction of PSID.** This reviews the relevance of the existing legislation and suggests areas where laws and regulations would need to be strengthened to accommodate the introduction of PSID.
- 3. Semi-structured interviews with key stakeholders.** Stakeholders interviewed include senior officials in government ministries and PEC, private sector actors that might be interested in running concessions, and relevant intermediaries (e.g., financiers and lawyers). Interviews were also conducted with key development partners to assess their support for the concept and ability and willingness to facilitate implementation. To ensure a broad range of views, a questionnaire was also sent to a wide range of Yemeni stakeholders with extensive knowledge of the sector. The responses from these questionnaires were analysed along with the results from the interviews to gain a deeper understanding of the knowledge, interest, and concerns of sector actors about the introduction of PSID in Yemen.<sup>3</sup>
- 4. Criteria for selecting a concession pilot location.** The implementation of PSID cannot be entirely planned in advance. Rather, it will be necessary to experiment and learn as one goes along. It is therefore recommended that the government consider piloting the concept in one particular area. The report provides a short set of criteria for choosing an appropriate area and proposes a framework for initiating the pilot.

The findings from the above four elements are brought together to provide **a set of conclusions regarding feasibility and recommendations for further action.**

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<sup>2</sup> Foster & Rana, 2020.

<sup>3</sup> Annex A contains a list of interviewees. Annex B contains the semi-structured list of questions asked.

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## 3 Alternative models for PSID

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There are a variety of ways in which the private sector can be involved in distribution, with each approach having certain advantages and disadvantages. It is useful to be clear about which model is being discussed when considering policy options. We outline five different models below.

### 3.1 Management contract

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A **management contract** consists of an arrangement where a **private company is invited by the government to run a utility in return for a fee**. Typically, a management contract lasts for a number of years (often five, but it can be shorter or longer). Performance is assessed based on a set of Key Performance Indicators (KPIs) agreed in advance between the concerned institution and the contractor. Usually, the contractor has complete control over the way in which the utility is run, subject to compliance with existing laws and regulations and the terms of the management contract. Often, the contractor will replace several members (or sometimes all) of the senior management team with experts with experience of turning around utilities. They may also have the authority to change the size and skillset of the workforce of the utility.

The **advantage** of a management contract is that it **provides a way of injecting international expertise into the reform of the existing utility**. Where most expertise in the sector resides within the utility and the utility is genuinely interested in improving performance, reforming the existing utility may be a more reasonable option for improving quality than relying on the existing domestic private sector to provide distribution services where it has little experience of doing so.

The **disadvantage** of a management contract is that it is **not guaranteed to be successful**. While management contracts in some countries have been successful, e.g., in improving financial performance (through better billing and collection and cost reductions), reducing losses, and improving the quality of service, in other countries they have run into difficulties. Typical challenges include:

- **Information about losses** – Often a management contract will specify that the contractor must reduce losses to a certain level based on an initial estimate of losses from the utility. However, contractors, once in position, sometimes discover that the situation is considerably worse than previously thought, making the achievement of their targets more difficult. Successful contracts need to take into consideration the fact that not everything is known in advance so there may need to be flexible about performance indicators when new information comes to light.

- **Tariff changes** – Management contracts frequently specify that the contractor should improve the financial performance of the utility. One way to achieve this is through gradual adjustment of tariffs. However, if the government does not follow through on the adjustment of tariffs in a timely fashion, this can affect the achievement of financial performance indicators.
- **Staffing** – Utilities are sometimes significantly overstaffed. Another way in which contractors may seek to reduce costs is by reducing staffing or requiring staff to take on additional or different tasks. However, these changes are sometimes resisted by existing staff. Where existing (or former) staff have important political connections, they are sometimes able to block moves by the contractor to change the size or composition of the utility workforce.
- **Corruption** – Electricity utilities, like all organisations involved in large-scale public procurement, can be vulnerable to corruption. Management contractors often attempt to reduce costs by introducing processes to mitigate corruption. However, doing so can threaten the interests of those benefiting from such corruption. Where these groups or individuals have political influence, contractors can be prevented from reducing costs by clamping down on corruption.

As a result of these (and other) challenges, contractors sometimes withdraw from their management contract at termination (or before). This can threaten the sustainability of the reforms which they have introduced.

### **3.2 Distribution contract**

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A **distribution services contract** is a more limited version of a management contract. It consists of **the government or a utility giving a contract to a private company to manage the distribution elements of an electricity service**. Typically, a distribution service provider will be responsible for **billing and collection of revenues**, as well as **routine maintenance** of the distribution network and customer service. In return for providing this service, **they are paid a fee** (sometimes linked to performance, e.g., in billing and collection and successful resolution of faults). The ownership of the assets remains with the utility and the private contractor does not invest in the network. Moreover, the revenue that it collects is given to the utility.

This model is currently being employed in Iraq, mainly for bill collection services, where private companies are granted a share of 12.9% of the overall revenue collected. 80% of the private companies' share goes to maintenance employees at the Iraqi Ministry of Electricity within the geographical area of the companies' responsibility. The companies are also required to reduce losses and stop violations, maintain distribution networks, and install meters for citizens, government

departments, shops, and factories.<sup>4</sup> Linking the companies' share to performance is an effective tool to incentivise greater engagement, sustain revenues, and improve collection rates. Additionally, the ministry supplies customers with enhanced services and fewer electricity interruptions compared with other areas to encourage them to pay their bills.

The **advantage** of a distribution service contract is its **simplicity**. It simply takes a set of functions that would otherwise be handled by the utility and contracts a private company to perform these.

The **disadvantage** of a distribution service contract is that its **success (or failure) depends on the reason that the billing, collection, and service provision was poor in the first place**. For example, if billing and collection was poor because of incentive problems within the utility, then contracting out this service to a private company may shift these incentives in a way that enables a significant improvement. However, if the poor service was the result of security issues outside the control of the utility and contractor, for example, then shifting from a public to a private contractor is unlikely to resolve these issues.

### 3.3 Distribution concession

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A **distribution concession** is like a distribution contract, but where **the entire distribution service is handed over to a private company**. The concessionaire is responsible for billing and collection, but now it keeps all the revenue raised, giving it a strong financial incentive to improve performance. Moreover, it is typically required to **invest in the distribution network** to meet performance targets for loss reduction and service improvement (although the assets remain under the ownership of the utility).

Unlike distribution service providers, where the electricity is provided by the utility, distribution concessions often purchase their electricity from the utility at a contractually agreed price. Either the contract or the regulator usually places limits on the tariffs which can be charged to customers, with these limits being designed so that if the concessionaire meets their targets for billing, collection, and loss reduction, it is able to make a commercial return.

The **advantage** of a distribution concession is that it **significantly sharpens concessionaires' incentives to improve performance**. Because concessionaires keep all the revenue that they collect, they tend to focus on improving billing and collection performance and on loss/cost reduction.

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<sup>4</sup> Kadhim, n.d.

The **disadvantage** of a distribution concession is that, just as with private distribution service providers, they may not have the political authority to bill and collect in highly insecure environments. Also, the financial performance of the concessionaire depends on the regulator keeping to the agreed schedule of tariffs, while the quality of service that they can provide depends on the utility providing them with the electricity that they need.

### 3.4 Utility concession

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A **utility concession** is the same as a distribution concession, except that **the concessionaire is also allowed to generate electricity**. This is an important distinction because it means that the concession effectively runs an **integrated utility** in the concession area. Generation is possible from the concessionaire's own generation capacity or through contracting with private providers of electricity to supply the distribution network, which is then sold onto customers.

Having the ability to contract and purchase electricity from private providers is a major **advantage** for a concessionaire if the electricity supply from the utility is unreliable, as it enables them to **guarantee a given quality of service to customers**. Sometimes, this can be combined with supply from the utility, so that the concessionaire acts as a distribution concession when electricity is available from the utility, but switches to its own generation capacity whenever supply from the utility fails.

This model also has the advantage that it is possible to **combine two different forms of tariff regulation**. Specifically, when electricity is being sourced from the utility, it can be sold at a low or subsidised tariff specified by the regulator. However, when electricity is being sourced from the concessionaire's own generation capacity, the concessionaire can be allowed to charge a higher tariff to reflect the additional costs of generation. In this way, **a higher marginal tariff can be charged** which enables the concession to be profitable while still keeping a low tariff in place for publicly generated electricity. This model has been used to provide an improved electricity service in some cities in Lebanon in an environment where the public utility is only capable of supplying a few hours of electricity each day.<sup>5</sup>

The **disadvantages** of the utility concession are similar to those of the distribution concession, particularly its **reliance on the regulator and the utility**, but it is no longer dependent on the utility for power. However, this brings its own risks. A utility concession holder needs to enter into a PPA with a private power provider. Its ability to provide attractive terms for such a PPA depend on the security and length of its own concession contract. If it has a secure, long-term concession,

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<sup>5</sup> Ahmad et al., 2022.

then it can sign a long-term PPA with private investors for power. This can encourage investors to invest in significant generation capacity, substantially lowering long-run costs. This mitigates the problem of IPPs needing payment guarantees, which is a significant constraint on government, since investors are guaranteed payment by the utility concession based on a track record of collection and payment by customers. However, if the utility concession only has a short-term concession, then it will only be able to sign a short-term PPA with electricity generators which will then typically be diesel generators, since these have low capital costs, despite much higher running cost.

### 3.5 Bilateral contracts and wheeling

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It is worth mentioning a final model that is frequently used in more developed power markets, but which is unlikely to be relevant to Yemen's complex context – bilateral contracts and wheeling.

**Bilateral contracts** exist when **a customer (typically a large business) contracts directly with a generator for electricity**. In Yemen, as in many developing countries, large businesses faced with an unreliable supply from the utility will simply self-provide power using diesel generators. However, this is extremely costly and is not their core business. In an urban area, there may be many such businesses. In theory, allowing businesses to contract directly with private generators who are not located at their location would allow them to outsource electricity supply while still ensuring reliability at an agreed price.

However, for this arrangement to work, **the power utility must be willing to 'wheel' privately generated power across the local distribution network**.<sup>6</sup> They can charge a fee for this service. In addition, **the body responsible for the distribution network** (whether it is a distribution or utility concession or the utility itself) **must ensure that power is supplied to the relevant customers** in accordance with the bilateral contract.

This is the key challenge in the Yemeni context. Wheeling power based on contracts in an environment where there is insufficient overall supply, means reducing supply for all other customers to preserve the supply for customers with bilateral contracts. This is inequitable and probably politically impossible. It is also technically difficult as, since load shedding has to be done at the feeder level, multiple customers may be connected to a single feeder, not only the customer with the bilateral contract. Hence the network operator has to agree to keep that feeder energised to satisfy the requirements of only one large customer attached to that feeder. However, the operator may make

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<sup>6</sup> Wheeling means distributing power across the network from a specific generator to a specific customer.

losses on the other customers attached to the feeder. This will make it reluctant to allow a bilateral contracting arrangement unless the large customer is willing to absorb those losses, something which it is highly unlikely to do. **Until additional investment is made that enables the system to isolate large customers at the feeder level, bilateral contracts and wheeling is unlikely to be consistent with the incentives of all the key actors involved.**

Even if the technical ability to isolate customers is solved, wheeling **depends on the distribution system operator to be willing to wheel power** (and to do so at a reasonable cost), which is not guaranteed. If the distribution operator is the national utility, it may wish to give priority to the electricity that it generates and its own customers. If the distribution operator is a utility concession, then it almost certainly will not wish to prioritise assisting competitors to supply customers using the concession’s infrastructure. Thus, bilateral contracts and wheeling complicates both the technical and contractual management of the distribution network and, at this stage, is not recommended for Yemen.

### 3.6 Summary of pros and cons

**Table 1** below summarises the advantages and disadvantages of alternative models for PSID on the grid.

**Table 1: Advantages and disadvantages of alternative models for PSID**

Model	Advantages	Disadvantages
<b>Management contract</b>	Enables injection of international expertise in the management of the utility	May run into sensitive political challenges, e.g., on tariffs, procurement, and staffing
<b>Distribution contract</b>	Simple contracting out model and can improve the bill collection rate	Few incentives for good performance, particularly where security is poor
<b>Distribution concession</b>	Strong incentive for concessionaire to improve billing and collection	Concessionaire relies on the utility to provide power needed
<b>Utility concession</b>	Provides strong incentives for improved performance and the autonomy to deliver	Requires long-term contractual commitment and potentially a big change of role for – the utility

It should be stressed that all of the above models of PSID can succeed or fail. Much depends on the details of the context in which any given model is implemented, as well as the motivation of the key actors involved.

### 3.7 PSID for off-grid areas

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The above models for PSID are applicable for on-grid areas. However, the majority of Yemeni's are not on the electricity grid. Most live in one of the 35,000 or so small villages in rural areas.<sup>7</sup> For many of these areas, there is little realistic prospect for the grid reaching the villages in the near future. To date, the main way in which such villages have received power is either by privately provided generators, or individuals purchasing solar home systems (SHSs). In theory, the private sector could support providing electricity more generally in such villages through the establishment of mini-grids. That is, a private provider could build a mini-grid for a community, connect the households, and repay the costs of doing so through charging a cost-reflective tariff to the households in the village.

In practice, this rarely happens outside urban areas for three reasons. First, building a mini-grid is a much more significant investment than a SHS. Developers therefore need finance, but finance for such risky projects is extremely difficult to obtain. Second, even if a developer is able to finance the project, they need to be able to recoup their costs. Given the very low electricity demand from the typical rural village, this entails charging high tariff rates. However, there is no regulatory structure in place in the government-controlled areas of Yemen that permits charging such high tariff rates. Finally, even if high tariff for mini-grids were to be approved, developers need to be able to collect the payments from households. However, many households are poor and may not be willing or able to pay such tariffs. Moreover, should households fail to pay, it must be possible to cut off electricity supply. Increasingly, this problem is solved in advance by the use of pre-paid meters, but this still does not guarantee sufficient consumption to justify the investment in the first place.

These problems are not insurmountable, particularly if a well-designed mechanism for subsidising community mini-grids can be put in place. A growing body of literature is exploring how to design subsidies for electricity access that tackle the affordability gap.<sup>8</sup> **Section 7** provides an example of such a program in action.

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<sup>7</sup> See Sufian (2019).

<sup>8</sup> See Nash and Khinmaung-Moore (2020).



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## 4 Literature review and international experience

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Concessions have been implemented in several countries around the world in recent years. However, the experience has been mixed, with some performing well, while others have not. **The effectiveness of a concession is ultimately dependent on its design, which should generate a viable business model that is tailored to specific country needs.** It is important, therefore, to learn the lessons from other countries and to carefully assess the extent to which such a model might be effective in Yemen.

There are a set of guidelines associated with the introduction of private concessions in infrastructure provision in developing countries.<sup>9</sup> However, the guidelines proposed in the 1990s on private concessions followed the 'standard model' of power sector reform. Subsequent work over the last 20 years has shown the weaknesses of that model, particularly when applied in developing countries with inadequate finances and regulatory capacity (see Foster & Rana (2020) for a recent comprehensive review of the performance of the standard model).

A number of authors have explored the performance of rural electricity concessions in Africa.<sup>10</sup> Their findings show that results have been mixed. They find that "[t]he fundamental challenge of rural electrification undertaken through concessions and other PPPs is that **rural electrification is not profitable within the time frames normally considered attractive to the private sector.**" They distinguish between different types of concessions. Specifically, they examine the performance of rural zonal concessions, utility concessions, as well as technology-specific concessions (e.g., mini-grid concessions, solar home systems). After reviewing more than 200 electricity concessions across Africa, they arrive at a differentiated set of conclusions depending on the type of concession.

To date, the only experience with a **rural zonal concession** has been the Programme Prioritaire d'Electrification Rurale (PPER) scheme adopted in Senegal.<sup>11</sup> However, this was not successful, in part because "political connections between regulators, electrification agencies, and the utility, SENELEC, limited the leverage of international companies in negotiating favourable agreements."<sup>12</sup> As a result, there

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<sup>9</sup> Kerf et al., 1998.

<sup>10</sup> Hosier et al., 2017.

<sup>11</sup> Hosier et al., 2017.

<sup>12</sup> Jacquot et al., 2019.

were delays in establishing the concession, insufficient progress was made, and the companies involved experienced financial instability.<sup>13</sup> The Senegal experience underscores the fact that state-owned national utilities can often be an obstacle to achieving the government's private sector rural electrification objectives. As such, it is better to provide electrification agencies with some degree of institutional autonomy from the utility. Zonal concessions are also being attempted in Uganda and Madagascar. Ultimately, zonal or area concessions would be more effective in situations where the utility is weak but bulk supply is available or where big, isolated mini-grids are available with own generation.<sup>14</sup>

In contrast to other types of concessions, **utility concessions** have been more successful. Four national utility-scale concession programmes have been implemented in sub-Saharan Africa and were still in operation in 2015 in Cameroon (ENEO), Côte-d'Ivoire (CIE), Gabon (SEEG), and Uganda (Umeme). The utility concession in Cameroon has been instrumental in driving Cameroon's electrification efforts, extending connections to over 190,000 rural households. Similarly, Umeme in Uganda has served as the primary driver of electrification, responsible for approximately 75% of rural connections (it has connected over 100,000 customers in rural areas). A key reason for success in these countries is that utilities often have a high-level of political support and commitment. This enables them to have **greater negotiation power over public institutions to ensure viability**. The success of these models has improved operational performance, decreased the fiscal burden, enhanced electrification density, and ultimately increased energy access. Thus, a key takeaway from these examples is that national utility concessions can yield positive results and be powerful agents for change even in challenging country contexts with difficult business environments.

Morocco has become a leading example of successful integrated utility-led electrification programmes, whereby solar concessions increased rural electrification rates from 18% to nearly 100% in less than 15 years.<sup>15</sup> In contrast to other African countries, Morocco has adopted a purely utility-driven approach. The national utility, Office National de l'Électricité (ONE), is responsible for the entire energy access programme, including providing electricity to remote communities. The electricity is supplied to these areas using either diesel or renewable-powered mini-grids or photovoltaic kits via a fee-for-service model. Although the programme is coordinated by ONE, private companies operate the service under 10-year concession agreements.<sup>16</sup>

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<sup>13</sup> Diouf & Miezán, 2021.

<sup>14</sup> Ehrhardt, 2015.

<sup>15</sup> Jacquot et al., 2020.

<sup>16</sup> Nygaard et al., 2016.

It must be noted, however, that the success of the electrification plan in Morocco was largely driven by the structure of the market (e.g., large potential for cross-subsidisation between a growing base of urban customers and rural users whose electricity usage remained comparatively limited) and the level of development of the country (which far exceeds that of most sub-Saharan African countries). Nevertheless, key success factors identified by Jacquot et al. (2020) include:

- Strong political support
- Attracting capable international developers based on robust pre-feasibility analyses that match demand estimates
- Leveraging all possible sources of funding available (e.g., cross-subsidies, direct public subsidies, and international debt)

Despite attracting significant external capital from donors, none of the six mini-grid concession examples explored in Africa played a significant role in increasing electrification. This is partly because supplying electricity with mini-grids is expensive and donors typically do not have sufficient volume to launch large-scale sustainable electrification projects using this technology. However, mini-grids can be an optimal solution in areas where extending the main grid would be even more expensive. Mali's bottom-up mini-grid concessions did succeed in electrifying approximately 78,000 rural households since the programme's inception in 2003. The literature suggests that, **for mini-grid concessions to succeed, they will require big subsidies, pricing freedom, minimal red tape, and a transition path to reach utility scale and connect to the transmission grid.**<sup>17</sup> A successful example of mini-grid development is that of Cambodia, where mini-grids (mostly diesel) were developed by rural entrepreneurs after the 1967-75 civil war that destroyed most of the country's electricity system. Private operators became distributors in their zones and received subsidies that allowed them to meet their revenue requirements while customers paid regulated, below-cost tariffs.

Useful lessons can also be drawn from similar reforms in the water sector, which faces many of the same structural, technical, and financial challenges as the power sector.<sup>18</sup> One study of water supply for the poor in several African cities found that near universal access to reliable and affordable water is possible. However, success depends largely on a combination of political economy factors (notably the existence of a secure political lead willing to try new approaches), as well as professional technical leadership able to adapt technical, financial and managerial methods for service improvement in the local context.

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<sup>17</sup> Ehrhardt, 2015.

<sup>18</sup> Heymans et al., 2016.

**Solar home system concessions** have only been tried in one country in Africa – South Africa – where the results were not encouraging and the experiment has since been stopped. The widespread availability of solar home systems (SHSs) through normal commercial channels made a concession model non-viable. Additionally, a lack of fiscal commitment and administrative drive and coordination further impeded the success of the system in South Africa. SHSs are a more expensive supply solution and only affordable for certain segments of the population and can thus not be viewed as a tool to achieve universal electrification without the support of subsidies. Nevertheless, the experience with SHSs in Latin American countries (e.g., Peru) has been relatively more successful. The Luz en Casa initiative in Peru has largely been recognized as a success as it “demonstrates the technical and financial viability of rural electrification using SHS.”<sup>19</sup> The success of the programme has been attributed to increased awareness among rural stakeholders, strengthened dialogue with national actors, improved technical quality of installations and their operation and maintenance, alongside capacity building of users. A similar approach was employed by the PERMER project in Argentina, which supported the installation of renewable energy systems in rural communities not yet reached by the distribution network. However, the PERMER project lacks an efficient subsidisation mechanism, which is needed to ensure the long-term viability of SHSs operations as end-users do not have the financial capacity to maintain products or pay full tariffs. Thus, a major challenge for the future of PERMER will be finding a sustainable source of financing for subsidies.<sup>20</sup>

Thus, international experience demonstrates immense diversity when addressing topics such as assigning responsibility for electrification, revenue criteria, tariff and subsidy setting, and the regulation of different electrification modes. Preparing the policy, legal, and regulatory framework for an appropriate concessions system requires careful consideration of the given country's context (e.g., market structure, business environment, level of socio-economic development, etc.). Ultimately, identifying an appropriate concession model for Yemen requires carefully tailoring the existing evidence base to the realities and specific challenges faced in the country. Nevertheless, by extrapolating from the international literature, some overarching success factors and lessons can be identified and summarised as follows:

- 1. Foster strong political support and commitment.** This enables greater negotiation power over public institutions.
- 2. Appropriate subsidy mechanisms are often required.** Subsidies are necessary to ensure the long-term economic viability of projects as

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<sup>19</sup> Egido et al., 2014

<sup>20</sup> Covarrubias & Reiche, 2000.

customers frequently lack the financial means to maintain products or pay full tariffs.

**3. Leverage all possible sources of funding available.** This includes cross-subsidies, direct public subsidies, and international debt.

**4. Provide electrification agencies with some degree of institutional autonomy.** This will facilitate smoother operations and minimise conflict with incumbents.

**5. Facilitate small-scale innovative solutions by the private sector.**

Enable the private sector to provide solutions in areas where the state is unlikely to be able to provide services in the short-term. Leverage local investors and the diaspora.

**6. Pay close attention to inclusion.** Don't just measure MW or numbers connected – consider *who* is connected and *where*. Ensure that key groups are not left out of the process, including women and those in off-grid and rural areas.

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## 5 The legal and regulatory environment

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### 5.1 Main laws and regulations relating to private investment in electricity

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Electricity Law No.1 of 2009 is the main law that governs the electricity sector in Yemen. The main objective of this law was to **reform the electricity sector and improve performance**. For example, the Electricity Law proposed unbundling the sector into three companies that would be responsible for generation, transmission, and distribution, as well as establishing a regulator who would be responsible for laying down the principles for setting the electricity tariff, among other tasks.

In accordance with the Electricity Law, two Republican decrees were issued, but have not yet been enforced.<sup>21</sup> Decrees No. 113 and 114 of 2011 established (i) The Public Corporation for Distribution of Electric Energy and (ii) The Public Corporation for Generation and Transmission of Electric Energy, respectively.

- The Public Corporation for **Generation and Transmission** of Electric Energy was supposed to be responsible for managing large power plants, substations, transmission lines 132kV and above, and the national control center. Its other tasks include purchasing the electricity, as a single buyer, from licensed electricity providers and selling it to the licensed electricity distributors and large customers. In addition, it may entrust the implementation of any of the services or works entrusted to it to the private sector, or it may exercise these tasks, or some of them, with joint capital with the private sector, permanently or temporarily, through contracts, leasing, management, or franchising.<sup>22</sup>
- The Public Corporation for **Distribution** of Electric Energy was supposed to manage the regional electricity areas as well as substations less than 132kV. It was supposed to purchase electricity from the Public Corporation for Generation and Transmission of Electric Energy and establish companies related to its activities or contribute to joint ventures with foreign or local capital to expand corporate activities.<sup>23</sup>

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<sup>21</sup> In fact, the same ideas were contained in the Power Sector Reform Strategy approved by the government in 2001 (Cabinet Decision 112) but were never implemented – see Sufian (2019).

<sup>22</sup> Republican decrees No. 113 and 114 of 2011.

<sup>23</sup> Republican decrees No. 113 and 114 of 2011.

Unfortunately, many aspects of the law and the decrees issued under it remain unimplemented – in part, due to the upheavals and conflict that have taken place subsequently – and the power utility remains vertically integrated. Moreover, the law also stipulated the establishment of a General Authority for Rural Electrification, as well as an independent regulator preceded by a temporary regulatory board that would last for four years. The General Authority for Rural Electrification and the temporary regulatory board were established, but their activities have been suspended since the war, and the independent regulator has not yet been established.

In principle, the law **encourages private sector participation in the electricity sector and encourages diversification of the energy mix and investment in renewable energy**. The forms of private sector participation permitted by the law include:

- Constructing facilities
- Facilities' rent contracts
- Operating and managing the facilities
- Financing the facilities
- Owning the facilities
- Owning part shares with government

Under each of the above, the following are possible:

- Build-operate-transfer (BOT)
- Build-own-operate-transfer (BOOT)
- Rehabilitation-operate-transfer (ROT)
- Other similar arrangements applied at the international level.

Moreover, private local and foreign investors are encouraged to invest in generation and distribution activities and in wholesale supply, as long as they are licensed. In terms of distribution activities, the law specifically highlights that licensees may measure the supply of electrical power and collect revenues in accordance with meter readings and the regulated tariffs, and they are required to adhere to safety rules and standards.<sup>24</sup> However, in practice, the law has not been implemented nor led to private sector participation along these lines.

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<sup>24</sup> Electricity Law No. 1 of 2009.

The other main law regulating private sector investment is the Investment Law of 2010. Again, in principle, this is a very progressive law. It allows foreign investment in almost all sectors, including electricity. It provides guarantees against expropriation and permits the repatriation of profits. It also mandates the establishment of a General Investment Authority to promote and regulate investment, which is required to set up a One Stop Shop to facilitate investment. The law also provides for the resolution of investment disputes through international arbitration. Unfortunately, as with the Electricity Law, virtually none of these provisions have been implemented in practice.

In 2014, in an attempt to encourage public-private partnerships (PPPs) in infrastructure, the government drafted a law on PPPs.<sup>25</sup> The law aims to:

- Provide a legal framework to organise the partnership process between the public sector and private sector in infrastructure projects on the basis of balance of interests, allocation of risks, equity and ensuring rights, transparency, and fair competition.
- Encourage the private sector to invest in infrastructure projects.
- Attract private funding to fulfill the sustainable funding requirements for infrastructure projects.
- Regulate the monitoring and supervision process over the partnership procedures to ensure their soundness and to protect public funds and interests.
- Create opportunities to bring the most advanced technologies and innovations into infrastructure projects.
- Ensure the reduction of environmental risks according to the regulations of environment protection and enhance sustainable development in planning and implementation of all partnership projects.

It provides an institutional framework for partnership (by requiring the creation of a High Committee for Partnership headed by the Prime Minister) and a Central Unit for Partnership in the Ministry of Planning and International Cooperation. It also allows public entities to establish partnership units for specific projects and lays out the tendering and procurement process that they should follow, as well as how project companies should be established and how they should be monitored and evaluated. The draft law establishes the possibility

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<sup>25</sup> Draft Law for the year 2014 on the partnership between the public sector and the private sector.



of the government providing financial guarantees for infrastructure projects.

Finally, the government has also been keen to increase the use of renewable energy and has developed the Draft Renewable Energy Law, 2009. As stated in the draft law, this legislation aims to:

- Develop the use of electricity generated from renewable energy sources
- Encourage investment in renewable energy by the private sector
- Diversify the energy mix and reduce dependence on imported fuels
- Reduce greenhouse gas emissions and protect the environment
- Develop the country's expertise to achieve these goals
- Establish a fund to support renewable energy applications.

The draft law includes several provisions aimed to develop maps for renewable energy resources, allocate land for investments, and issue certification for the energy produced by renewable energy projects. Additionally, the draft law also highlights how the electricity will be purchased by renewable energy facilities and outlines investment incentives (e.g., tax exemptions, use of public lands, and connecting renewable energy projects for free).<sup>26</sup>

## **5.2 Implications for private sector engagement in electricity distribution**

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The legal environment in Yemen reflects the challenging context that has prevailed in the country, particularly since the start of the war in 2015. In most countries, the legal and regulatory context is of paramount importance because it determines what is and is not possible in a given context. In Yemen's case, the laws that exist are supportive of private investment, including in the electricity sector. However, the very difficult environment facing the country has meant that the laws have not been implemented.

This poses a difficult dilemma for the government, but it can be tackled in two ways. First, the government can attempt to ensure that existing legislation is implemented (and that suitable new legislation is put in place, as is happening with the draft PPP Law and the draft Renewable Energy Law). It can also improve the government's ability to enforce the application of these laws. Second, the government could attempt to make progress in reforming the electricity sector

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<sup>26</sup> Draft Renewable Energy Law, 2009.

by using **'regulation by contract'**. That is, in addition to attempting to pass new legislation and implement existing laws to provide a general framework, the government could attract investment into the sector more rapidly by **tendering for and then negotiating detailed contracts with key private sector actors to provide electricity distribution services**. The detailed, legally binding undertakings of each party can then be written into the contract. As long as the terms of these contracts are compatible with existing laws, there is no need to wait for new legislation before progress can be made. Since the process of drafting and passing legislation is lengthy, and the challenges of implementing existing laws have only worsened in the intervening years, the first option is inevitably a slow one. Thus, pursuing the second option might make more sense in the given context.

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## 6 Stakeholder perspectives

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This study entailed an extensive set of interviews with a wide variety of stakeholders in the sector. These included senior staff from:

- Ministry of Electricity and Energy (MoEE)
- Public Electricity Corporation – both in Aden and in selected governorates
- Private investors
- Lawyers and regulatory experts
- Donors
- International experts and academics.

In addition, a questionnaire was circulated to a larger number of Yemeni actors including senior officials in MoEE and PEC, private sector actors, and relevant intermediaries. The results of this questionnaire were analysed along with the findings from the interviews. Six critical issues emerged from the interviews and questionnaire responses, which are covered below.

### 6.1 The need for a broad approach to private sector engagement

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When asked about their views of private sector involvement in the electricity sector (both generation and distribution), respondents had a wide variety of perspectives (reflecting the wide variety of approaches outlined in **section 3** above). These ranged from hiring a management contractor to run the utility (PEC), a distribution or *affirmage* contract (where the private sector puts in operation costs, but capital is paid by the state), distribution concessions (where the private sector does the distribution but purchases electricity from PEC), and a utility concession (where the private sector are responsible for capital investment as well and own the assets). However, there were some clear preferences from stakeholders:

1. Almost all respondents agreed that private sector engagement was needed. No one believed that continuing with the current, state-run system was satisfactory, not even staff from the PEC.
2. There were two quite distinct views about the nature of private sector involvement. On the one hand, several stakeholders believed that private sector involvement should be focused on **generation**. Their preference was for the government to enter into PPAs with IPPs for large-scale power purchasing to boost the supply of

electricity. On the other hand, numerous stakeholders felt that the focus should be on some type of concession model in **distribution**, with private sector involvement in serving customers.

3. The range of views on private sector involvement in distribution was particularly interesting. While several respondents from MoEE and PEC felt that PSID was important, many believed that the assets should remain in public hands. Some argued for a management contract or distribution contract model. Others recommended a distribution concession in order to encourage stronger investment in rehabilitation of the network.
4. The respondents who were most cautious about a concession model, interestingly, came from the private sector, some of whom felt that this model could not work in the current context (for reasons outlined below). Conversely, those who were most enthusiastic about the adoption of a concession model came from local government. A few respondents pointed out that it is possible to encourage both private involvement in generation as well as a concession type model in distribution.

## 6.2 Security is the top concern

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One of the most striking things that emerged from the interviews and questionnaires is the **importance of security**. Relatively few private sector respondents were interested in the distribution sector because of security challenges around collecting bills. Yet billing and collection are core to any viable system. It is clear that **whoever is responsible for the distribution sector (whether public or private) must have substantive enforcement power over the communities where they operate**. Customers must know that they have to pay their bills and the provider must be able to cut off customers who do not pay, especially if the pre-paid meters are not used. Unfortunately, in many places in the IRG areas, where the public electricity available, this is not currently the case and the collection rate is too low.

A further challenge in a fragile and conflict-affected environment such as Yemen is that the entities that have formal legal power and those that have political power on the ground can be different. This is why, in many conflict situations around the world, the most effective service providers may be local armed groups as, regardless of their formal status, everyone understands that they are the **de facto authority** and do what they say.

The implication of this for Yemen's electricity reforms is that PSID (of any kind) should only be tried in places where the *de facto* authority and the formal authority are well aligned. Supporting a *de facto* authority to deliver services against the wishes of a formal authority would be illegal, whereas supporting a formal authority to deliver services in a place where the *de facto* authority opposes them will simply result in failure. Hence, an essential pre-requisite for effective PSID is that the **locally powerful actors (both formal and informal) must be committed to the enforcement of the contract with the private actor.**

### 6.3 Legal and regulatory environment

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After security, the second most commonly mentioned challenge in introducing greater private sector engagement is the **lack of a suitable legal and regulatory framework**. It is important to recognise that this is not a substitute for the problem of security above as simply changing the law or regulations does not change the *de facto* authority. Having an appropriate legal and regulatory environment is not sufficient for success, but it is probably necessary to give the private sector confidence that their investments are legally secure.<sup>27</sup>

In expressing support for a clear legal framework, some respondents stated a desire for the full implementation of the existing laws and regulations (see **section 5** above). In general, stakeholders felt the MoEE should be responsible for policy, while PEC should be responsible for ensuring the implementation of policy. For PSID, most respondents felt that PEC should issue licenses and supervise and monitor the activities of the private sector to ensure compliance. Some private sector respondents also expressed concern about the capability of the judiciary to enforce the regulatory framework in place.

Some respondents went further, calling for the **creation of an independent regulator** for the sector. It should be noted that the international experience with the creation of independent regulators in developing countries is not encouraging. The 'standard model' of electricity reform promoted in many countries during the 1990s and early 2000s called for the creation of independent regulators.<sup>28</sup> However, reviews of actual practice have shown that most countries fail to create independent regulators precisely because political leaders do not wish to lose control over key decisions affecting the sector.<sup>29</sup>

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<sup>27</sup> Even this is not necessarily true, in many conflict environments, what matters is *de facto* authority. If assurances by that authority are credible, then the private sector can engage even in the absence of a suitable regulatory environment. However, an appropriate legal and regulatory environment can help to institutionalise such informal deals, thereby creating a greater chance of sustainability.

<sup>28</sup> Gratwick & Eberhard, 2008.

<sup>29</sup> Foster & Rana, 2020.

Moreover, where ostensibly independent regulators have been created, they have often been subject to considerable political interference. The key lesson from this literature and experience is that regulating the power sector inherently involves politically contentious decisions. Effective regulation therefore requires the political authorities to commit to a way of 'tying their own hands' to **ensure that decisions in the sector are made with a long-term perspective**. Whether this is done through the creation of an independent regulator or through some other means is a secondary consideration.

The international experience with independent regulators also points to an alternative approach. The experience of PSID in sub-Saharan Africa has been that, while appropriate laws and regulations are important, what matters most **are the terms and enforceability of contracts between the government and the private sector**. International experts interviewed for this study argued that in an environment where legislative change is slow and difficult, it is often possible to use the existing law to enter into a contract with a private actor for a distribution concession, for example. This then provides the opportunity for 'regulation by contract', i.e., all the key rights and responsibilities can be spelled out in detail in the contract between the government and the private actor. If the contract is also made subject to international arbitration, this can provide confidence to the private sector that the terms of the contract will be honoured.

For government, there may be a trade-off between effort invested in improving the broader regulatory environment for investment in the sector (which is still needed) and effort invested in constructing a detailed, legally-enforceable contract with a private actor which ensures that all parties fulfill their agreed roles. Ultimately, it is the latter that matters for actual delivery of service improvements.

## 6.4 Tariffs

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Tariffs in the Internationally Recognised Government (IRG)-controlled areas of Yemen are a tiny fraction of the cost of supply<sup>30</sup>. This makes commercial provision impossible in the short-term and discourages private investment. At the same time, revising tariffs is extremely politically sensitive for two reasons:

1. During a time of war and economic crisis, it is extremely difficult for ordinary citizens to pay more. Raising tariffs may simply result in lower bill collection and reduced revenues, as well as increased resentment towards the authorities for failing to appreciate the difficult circumstances facing ordinary people.

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<sup>30</sup> More than 85% and 60% of the cost of electricity supply for the residential and commercial consumers are subsidised, respectively.

2. People expect (quite reasonably) that any increase in tariffs should be accompanied by an improvement in the quality of service. Hence, there is a sequencing issue – investments to improve quality of services need to be made before any tariff rise. However, this approach imposes a lot of risk on investors as they could invest and then the government fails to deliver the tariff increases.

This is a common problem around the world. Many developing countries have electricity tariffs below the cost of supply. In Africa, there are only two countries whose utilities cover their costs: Uganda and the Seychelles.<sup>31</sup> It is also important to make a distinction between the tariff challenge in off-grid and on-grid areas.

In **off-grid areas**, the issue is finding a tariff that customers are willing and able to pay and which still enables provision to be commercially viable. This is often possible, although it can entail substantial negotiation and dialogue. Typically, subsidies are still needed from the state or a donor to ensure viability.

In **on-grid areas**, there is an expectation that the existing low tariffs will continue, which makes tariff reform much more difficult. The challenge usually entails making credible promises of improvements in service in return for a subsequent rise in tariffs. The challenge is making such promises credible.

Respondents and interviewees in this study raised the issue of tariffs in two ways. First, ensuring a cost-reflective payment for electricity is essential to the viability of a distribution concession. Attracting private investment in such a model is highly unlikely without an assurance that the tariffs charged will enable a reasonable commercial return. (Of course, it is possible to enable PSID through a management contract or a distribution contract simply by paying the contractor to deliver the services through a government contract without changing the tariff. But this does not solve the fundamental challenge of tariffs being well below costs).

Second, respondents pointed out that the tariff issue is likely to be one of the main issues that could result in opposition to the involvement of the private sector in distribution. Customers – whether large commercial or industrial customers or households – who currently have access to electricity at very low tariffs are likely to strongly oppose significant increases in tariffs. In Yemen, as in many other countries, some of the major customers who have access to cheap electricity are government facilities themselves. Thus, not only households and business but also elements of government itself may oppose significant tariff rises. This underlines the importance of developing a reform plan that strikes a balance between the needs of customers and those of investors when deciding on tariff rises.

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<sup>31</sup> Trimble et al., 2016

Moreover, it is critical that tariff rises are accompanied by rapid and tangible service improvements to gain public acceptance for tariff rises that do occur.

## 6.5 Creditworthiness and guarantees

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The issue of creditworthiness (or the lack of it) is central to catalysing private sector involvement. Unfortunately, Yemen's economic crisis means that the IRG and state-owned enterprises, such as PEC, are not regarded by the private sector as creditworthy. As a result, even if the IRG were to provide a sovereign guarantee of repayment to a private investor, many investors would not accept it. This is why private investors are looking to donors and other foreign governments to underwrite any guarantee provided.

In one sense, this issue is even harder in the distribution sector. With generation, a sovereign guarantee assures investors that they will be paid according to the PPA that they sign. But with the distribution sector, there is no PPA. The government can promise to help with security, but if they fail, they cannot guarantee collection. Similarly, the government can promise to increase tariffs, but what if they fail to do so? They can commit to pay the difference between what the tariff should have been (according to the schedule of tariff increases agreed with the private sector) and what is actually levied. However, whether the government is in a position to pay this difference runs into the same creditworthiness problems as before. Furthermore, no donors or foreign governments are likely to guarantee tariff subsidies for any significant period of time.

On the other hand, the distribution sector is the one area of the electricity system where guarantees are less needed if (and only if) security, political cover, and legal certainty can be provided. This is because secure long-term access to the revenue stream from tariff collection is a valuable asset. If investors feel that they have secure control over this revenue stream, then they are much more likely to be willing to invest. Indeed, subject to the conditions above, since this revenue stream is primarily under the control of the investor or concessionaire, it is stronger than the promise of payment of a PPA.

Moreover, the solvency of the distribution sector is linked to the ability of the government to pay PPAs for generation. If the distribution sector improves, then this makes payment of generation PPAs more likely, since a successful distribution concession will be paying PEC for the electricity it supplies, thereby providing a source of cash with which to pay PPAs. Note that the reverse is *not* true, i.e., boosting generation through IPPs and PPAs without solving the problems of the distribution sector makes PPAs more likely to fail. This is because it entails increasing the fiscal obligations of the government (i.e., the required payments under the PPA) without any corresponding improvement in cash flows from customers.



For the above reasons, the issues of creditworthiness and payment guarantees were frequently mentioned by respondents and interviewees for this study. There is a widespread understanding by government and PEC officials that the private sector will only invest in generation if payment guarantees are put in place to ensure that they can recoup their investment. Private sector respondents similarly said that they would only be willing to invest if payment guarantees are established. In some cases, respondents expressed a hope that donors might be able to underwrite such guarantees.

Given the existing challenges with payment for private power in Yemen, it is not surprising that respondents focused on the need for payment guarantees. However, there was less recognition of the linkage between reform of the distribution sector and the ability to provide guarantees for generation contracts with the private sector. International experience suggests that sovereign payment guarantees are only likely to be offered when there is a reasonable likelihood that they will not be called upon. But if the electricity off taker (PEC, in Yemen's case) is insolvent, then it is highly likely that the guarantee will be called upon because the utility does not have the resources to pay the amounts required under the PPA. This will make government extremely reluctant to provide a guarantee. The same is true for any donor.

One international example illustrates this problem well. Nigeria's government provided a sovereign guarantee for the PPA contracted between the Nigerian Bulk Electricity Trader (NBET) and the IPP Azura for electricity from a gas-fired power plant. However, NBET is owned by the government and was insolvent. As a result, the guarantee was called upon and the Nigerian government was compelled to pay Azura the full cost for electricity.<sup>32</sup> The consequence of this is that the Nigerian government now refuses to consider any payment guarantees for PPAs for generation because it believes that they will be called upon. This is significantly hampering private investment in generation.

The key lesson from this experience is that **payment guarantees are generally only feasible where the off taker is solvent**. However, ensuring the solvency of the off taker requires it to have an income from electricity sales that covers its costs, including PPA payments. This is only feasible with reform of the distribution sector. Hence, **there is a direct linkage between the ability of the IRG to provide payment guarantees for private investment in generation and the reforms required in distribution**.

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<sup>32</sup> The Cable, 2020.

## 6.6 The role of PEC

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A key strategic question for any reform is how to engage with the incumbent utility – PEC in Yemen’s case. On the one hand, PEC owns and has control over almost all the assets in the sector. It also has the technical expertise to run the sector effectively, including detailed knowledge of the local context that an outside operator might lack. On the other hand, in some countries, state-owned utilities are extremely inefficient, wasteful, and frequently corrupt (particularly around procurement contracts). In such circumstances, it is either necessary to undertake major internal reform of the utility or to change its role entirely. The choice of how best to engage the incumbent utility in the reform is therefore a key one.

It is helpful in reviewing the role of PEC to consider the four different functions that the utility provides:

- **Regulation** – regulation is a natural monopoly and must be held by government. PEC is the only body in Yemen with the necessary technical skills to monitor and supervise government policy in the sector.
- **Purchase and sale** – the electricity sector in Yemen is far too small to consider a wholesale or retail market for electricity. A government body must therefore be responsible for purchasing electricity from the private sector and, if distribution is also private, selling the electricity to distributors.
- **System operation** – in so far as it is possible to rehabilitate the grid, a central body is needed to manage the electricity system to ensure stability.
- **Generation, transmission, and distribution** – currently, PEC are responsible for around half of all generation, as well as all transmission and distribution. Transmission is a natural monopoly and so it makes sense for this to remain under government control (either through a state-owned company such as PEC or through a regulated private company). However, generation and distribution can both be provided by the private sector. In practice, countries have adopted a wide range of alternative ‘hybrid’ models in which utilities combine different elements of generation, transmission, and distribution.<sup>33</sup>

In the interviews and responses from stakeholders in Yemen, most respondents were clear that they felt that PEC should continue to have a significant role. However, the emphasis was on the **regulatory function** that PEC provides, as well as the **operation of natural**

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<sup>33</sup> Gratwick & Eberhard, 2008.

**monopoly functions** (regulation, transmission, system operation, purchase, and sale). Respondents were much more ambivalent about the need for PEC to continue to be involved in areas where the private sector could more effectively play a role.

However, another key consideration is often decisive, namely the ability of the utility to either support or block progress. Evidence from international experts and the experience from other countries suggests that having the state utility on board with reforms, particularly those involving PSID, can be critical. This was well illustrated by the example of private concessions in Senegal and Uganda. The rural zone concessions in Senegal failed, in part, because of the actions and political connections of the state utility, SENELEC, who saw these concessions as competition.<sup>34</sup> By contrast, in Uganda, the state utility had lost all credibility with key political actors with the result that it was politically feasible to remove its powers and establish the successful private concession, Umeme.

The political power of the utility matters regardless of the form of PSID. For example, creating a private distribution concession might be opposed by existing PEC staff who are concerned about losing their jobs. At the other end of the spectrum of PSID, it is equally true that installing a management contractor to operate PEC might also run into strong opposition. It is therefore essential to understand the incentives, motivations, and influence of PEC and its senior staff. If PEC, as an institution, is well connected and politically influential, it will be important to ensure that reforms are aligned with the interests of PEC. For example, reforms that provide the institution with greater autonomy might enable senior staff to pursue reforms that could strengthen the company and benefit the staff. Conversely, reforms that adversely affect PEC and its staff might be blocked or undermined.

## 6.7 Suitable locations for PSID

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Interviewees and respondents were also asked to consider the type of locations that might be suitable for piloting PSID in Yemen. A clear consensus emerged around two different types of locations:

1. All respondents and interviewees agreed that private distribution concessions are only likely to be commercially feasible in **urban areas (e.g., newly built cities<sup>35</sup>) with a reasonable size and diversity of customers**. This is because it is important for a private concessionaire to be able to internally cross-subsidise between commercial, industrial, and household customers. In smaller and more rural areas, the vast majority of customers are households with limited means to pay, making this a commercially non-viable

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<sup>34</sup> Hosier et al., 2017.

<sup>35</sup> Where well-paid people reside and can afford the actual cost of electricity.

proposition in most cases. Several respondents suggested specific locations that might be appropriate in cities such as Aden and the governorate of Hadramout.

2. A few respondents pointed to the **importance of electrifying rural off-grid areas**. Our previous study on improving electricity services in Yemen also highlighted that the majority of Yemenis do not live in the main urban areas and emphasised the importance of ensuring the **electrification of public facilities and the restoration of livelihoods in such areas**.<sup>36</sup> The private sector can play a major role in supplying such services to rural communities through the creation of mini-grids. However, achieving this requires the establishment of an effective regulatory framework for mini-grids. Moreover, international experience suggests that such mini-grids are rarely commercially viable in rural areas given the low willingness and ability to pay of rural customers. In such areas, it is therefore essential to have in place a **well-managed subsidy mechanism** to enable the participation of the private sector in service provision.

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<sup>36</sup> Almohamadi et al., 2021.

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## 7 A model of PSID for Yemen

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This section draws on the lessons learned from international experience, as well as the findings from interviews and questionnaire responses, to put forward a set of concrete models for PSID in Yemen. However, before doing so, it outlines **the most immediate priority: rehabilitation of generation and network infrastructure**. It analyses approaches with potential to work in Yemen and provides a set of design principles for effective involvement of the private sector in Yemen's electricity sector.

### 7.1 Rehabilitating generation and network infrastructure is the priority

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The focus of this study is on private sector involvement in the electricity distribution sector. However, it is important to note that this is not the immediate priority of the IRG. Yemen is suffering from a crisis of electricity supply. The government is therefore right to focus, in the short-term, on **boosting supply within the existing system**. The fastest way of achieving this is through rehabilitation of existing generation and network assets. In addition, numerous donors and foreign governments are keen to explore ways of encouraging private sector investment in new generation infrastructure through a mix of grants, concessional lending, and guarantee instruments.

Our previous report provided information on priorities for generation and network investments and outlined a set of principles for prioritising action.<sup>37</sup> In particular, it recommended that investments should be prioritised on the basis of a mix of the following criteria:

- The number of customers whose service would be restored as a result of the investment
- The improvement in the quality of service (e.g., hours of supply)
- The impact of the investment on restoring livelihoods and jobs
- Equity across regions and between different groups in society.

In addition, the report recommended that **PEC officials in governorates should be given greater autonomy to experiment and innovate in their local areas with alternative models of supply** and to identify the most important investments to be made. For example, some areas have weak public generation and a weak distribution

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<sup>37</sup> Almohamadi et al., 2021.

performance (e.g., Aden and Hadramout); other areas have good public generation facilities but a weak distribution network (e.g., Marib); other areas have no public generation and a poor distribution network (e.g., Al-Dalea and Taiz); in some areas there is a need to rehabilitate existing, unused power plants (e.g., Ossifera); and in off-grid areas where there is no public infrastructure, mini-grids can be installed to meet local demand. Giving greater authority to local PEC officials allows them to prioritise resources in the most effective manner, while the central government can support by coordinating requests for assistance with donors and other funders.

## **7.2 The need for a financially sustainable system**

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Although measures to boost supply are essential, they are only affordable with ongoing support from donors and international allies governments. Therefore, in addition to seeking immediate support for essential rehabilitation and restoration of electricity supply and network infrastructure, it is important to build a system which will be financially sustainable for the medium and long-run. Eventually, this must entail a customer-focused system that delivers good quality service and, in return, collects sufficient tariff revenue to provide a commercial return on the assets deployed.

However, in transitioning to such a system, the government faces a major constraint. It is simply impossible, politically, for the government to increase tariffs by enough to cover the current cost of supply. For households, this would entail a 10-fold increase. Any attempt to introduce such a change would be met by strong opposition. In any case, the economic crisis induced by the war has resulted in households being unable to pay such high tariffs, even if the government were able to apply them. Although it is a good idea for the government to signal to citizens that, over time, some tariff increases will be necessary (and that they will be linked to improved quality of services), there is no realistic prospect of moving tariffs to a cost-recovery level in the near future.

Fortunately, there is a (partial) solution to this conundrum. It is possible to start moving Yemen's electricity system to a more financially sustainable, long-term footing because there are some customers – mostly large businesses and industries – who are currently paying extremely high prices for self-provided diesel power. It is likely that these customers would be very content with paying commercial rates for power, as long as they are lower than the cost of supplying power themselves. Since such customers consume a relatively large amount of electricity (compared to households), it may be possible to design a financially sustainable system that serves these customers and which uses the surplus from doing so to cross-subsidise households.

The feasibility of such a model will vary from location to location, depending on the distribution and type of customers in the service area. A detailed feasibility study will be needed in any region that wishes to pilot such an approach (as discussed in greater detail in [section 8](#)).

### 7.3 Design principles for effective PSID in Yemen

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To have a chance of success, the model for PSID adopted in Yemen should draw on the lessons from the interviews and questionnaire responses described in [section 6](#) above. This report identifies four key issues that have a major influence on the design of the system:

- 1. Security** – if security is paramount for the success of PSID, then it is essential that any local reform has the **backing of both the de facto and formal authorities** of the area.
- 2. Regulation** – since changing legislation and regulation is complex and time-consuming, it may be best to consider **regulation by contract**, at least in the first instance.
- 3. PEC** – the dominant position of PEC and its deep contextual knowledge of the sector means that **reforms should be complementary to the work of PEC** and should benefit it as an organisation. Reforms which threaten the interests of PEC are unlikely to be successful.
- 4. Tariff** – Commercial viability (and therefore private investment) is only **possible if it is possible to reform tariffs 'at the margin'**, i.e., if it is possible to charge a higher tariff for customers who are able to pay for a greatly improved service when public subsidized electricity is not available.

The evidence from the literature review, interviews, and questionnaires also suggests approaches that are *unlikely* to be successful. Looking back at the five models described in [section 3](#) (and summarised in [Table 1](#)), four of these are unlikely to work in the Yemeni context. The reasons for discounting the use of bilateral contracts and wheeling have already been described. In addition:

- A **management contract** is unlikely to be effective in Yemen because such contracts require an **external management team to take over the national utility and run it**. This is effective if the national utility has relatively little political power, so that the government can impose an external management team upon it. Therefore, attempting to reform PEC by removing the existing management and replacing them with outsiders would result in **substantial opposition to the reform** which will likely cause the intervention to fail. It would be more effective to work *with* PEC to achieve commonly agreed goals.

- A **distribution services contract** (i.e., contracting the private sector for bill collection) is only likely to be effective if **the contractor has the backing of the political authority in each region**. Even then, distribution contracts sometimes disappoint, because the contractor does not keep the revenue. As a result, the contractor has little incentive to innovate around billing and collection or to ensure that collection is done in the most efficient and effective manner.

A **distribution concession** would have an incentive to improve billing and collection and, with local backing, could be effective. However, it is likely to struggle in the Yemeni context because of **shortages of power**. If it relies on PEC to supply it with power, and PEC fails to do so, then service quality will be poor, regardless of how well the concessionaire performs on other things. Customers who do not receive power will be reluctant to pay, and the concessionaire will not be willing to pay PEC if power is not delivered, running the risk of a collapse in payments and service provision.

## 7.4 Four models of PSID for Yemen

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Fortunately, there are four potential avenues for private sector engagement in the distribution sector in a manner that would be both commercially viable and beneficial to the sector as a whole.

### 1 Advisory services within PEC and internal management contracts

While a full management contract may not work, **PEC could benefit from an injection of external expertise**. The task of rehabilitating generation and the transmission and distribution network is an immense one. A lot of technical expertise is needed to identify the failings of the existing capacity and the least-cost technical solutions and to write the necessary specification for restorative work or for new investments that can be presented to potential funders. Donors are well placed to fund such expertise, which could be drawn from other Arab countries with similar electricity challenges. Embedding such individuals in an advisory role within PEC could support PEC to implement their own reform plans in a constructive way.

For example, donors could support PEC to obtain expertise to deal with the chronic issues that threaten the sector's financial sustainability, especially those relating to bill collection and electricity losses. They could also help to re-establish the expertise that was provided by the central PEC in Sana'a before the war to better manage generation and transmission activities. Such expertise could be hired to work either in the central PEC or in regional PEC branches.



An alternative approach to improving the performance of PEC can be drawn from the example of Uganda's water utility mentioned above. A key part of the reform to this utility was the introduction of Internally Delegated Management Contracts. Instead of replacing senior management in the utility with external advisors and experts, the head of the Ugandan water utility designed a set of contracts for senior area managers that incentivised them to improve key indicators of utility performance. These contracts were competitively awarded and included significant additional benefits for the individuals concerned. This mechanism was part of a series of efforts to build internal capabilities and create a culture of performance and is credited as a critical part of the significant improvements achieved by the utility over a relatively short period of time. The MoEE could learn from this approach and consider ways of restructuring PEC to build capabilities and provide stronger incentives and accountability for improved performance.

In addition to supporting PEC, international expertise is also needed to help formulate electricity sector reforms, including on establishing competitive procurement processes (for both traditional and renewable energy projects), better engaging the private sector in electricity sector activities, and improving the financial management and governance of the sector.

## **2 Utility concession – the Zahle model**

A more ambitious approach would be to **pilot a utility concession in a designated area**. Unlike a distribution concession, a utility concession would enable a private sector company to both generate and distribute electricity within a license area. For such an approach to work, several factors need to be considered:

- 1.** The area must have strong demand with a variety of different types of customers, including major businesses.
- 2.** The concessionaire must be allowed to use the existing PEC infrastructure and be compensated for investments and improvements that it makes to such infrastructure.
- 3.** The concessionaire must be allowed to invest in generation (or purchase from other providers). This means that the concession must have a reasonably long-term horizon to ensure that the concessionaire has a reasonable prospect of recouping its investment during the period of the concession.
- 4.** The concessionaire should be allowed to operate as distribution concession when PEC electricity is available. For this to be viable, the electricity from PEC must be provided to the concession at a rate *below* the regulated tariff, so that the concessionaire can still make a small margin from the distribution of PEC power.

5. When PEC is not producing power, the concessionaire must be allowed to provide power from its own generators (or power that it purchases from IPPs) at a commercial tariff that reflects the cost of supply.

The model outlined above is similar to that deployed in the city of Zahle in Lebanon (see **Box 1**) and has been shown to be effective in providing electricity to a city in an environment where the ability of the state utility to provide power is limited.<sup>38</sup>

### **BOX 1: THE ZAHLE MODEL**<sup>39</sup>

Zahle is a city of approximately 150,000 inhabitants in the Beqaa region of Lebanon. The local electricity concession for the city and surrounding area, Electricité du Zahle (EDZ), was established in 1923 under the Ottoman era, and provides the concessionaire (an influential local businessman) with the right to use the transmission and distribution networks on behalf of the national utility, Electricité du Liban (EDL).

After the civil war of 1975-1989, EDZ effectively operated as a distribution company for EDL, with virtually no generation of its own. Because of the deteriorating performance of the national utility, a set of private diesel generator owners expanded their own neighbourhood-level networks in the city, reaching around 120 generators, operated by 50-60 owners. This cartel of diesel generator owners earned large profits by imposing high flat tariffs on subscribers for a generally poor quality of service.

This situation led the management of EDZ to get involved in power generation. In late 2014, EDZ struck a deal with Aggreko, a UK-based company that specialises in temporary power rentals, to install a diesel-based generator with initial capacity of 35 MW. EDZ leveraged the terms in its concession contract and its historic role in power generation to justify its move. The power plant supplies EDZ with electricity during EDL outages. It is owned and operated by Aggreko with EDZ acting as an off taker and distributor. By September 2020, the total installed capacity of Aggreko was 59.4 MW. This additional capacity enabled EDZ to provide uninterrupted electricity to those in its concession area, displacing almost all of the small private generators who had been providing back-up power.

EDZ's model was profitable for two reasons. First, when EDL was supplying power, it was allowed to purchase power from the utility for a discounted rate and distribute it at the low, nationally regulated tariff rate. Second, when EDL failed to deliver power, Aggreko would run its diesel generators. EDZ would sell this electricity to customers at a much higher, commercially

<sup>38</sup> Ahmad et al., 2022.

<sup>39</sup> Ahmad et al., 2022; Ayoub et al., 2022.

competitive tariff rate. This enabled EDZ to pay Aggreko according to the terms of its PPA with the company.

While successful for over five years, the Zahle model has, more recently, suffered from the consequences of the economic collapse in Lebanon. The collapsing currency and the removal of fuel subsidies has made accessing diesel difficult and expensive, thereby reducing the quality of the electricity service provided and dramatically raising costs and prices. Ironically, the Beqaa valley is one of the best locations for solar irradiation and had EDZ invested in a solar power station, it would have been much less affected by the rising price of diesel. However, doing this would have required it to enter into a long-term PPA with a provider to cover the high up-front capital costs of the solar power plant. Regulatory uncertainty regarding the future of EDZ's concession made entering into a long-term PPA unviable.

### 3 Approaches to electricity provision elsewhere in Yemen

There is another approach to the engagement of the private sector in delivering electricity which is commonplace in the central and northern areas of the country, notably in Sana'a and other areas including Taiz.

After the war broke out in 2015, a significant part of the electricity infrastructure in Sana'a was damaged or destroyed. A large number of private actors immediately set up generators and started to supply households within neighborhoods (or squares) nearby. Initially, these private actors were able to charge whatever tariff they chose, thereby ensuring that tariffs covered the full commercial cost of operation.

After fuel subsidies were abolished, the costs of electricity provision were extremely high. As a result, there was a dramatic boom in the provision of solar power, particularly solar home systems (SHSs).<sup>40</sup> It is estimated that the household penetration of solar PV systems was 75% in urban areas, and 50% in rural areas with around USD 1 billion spent on solar energy systems in the 2014-2017 period by citizens and communities.<sup>41</sup>

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<sup>40</sup> Ansari et al., 2019.

<sup>41</sup> Mahmoud et al., 2017.

In addition, the authorities recognised the need to regulate the sector more effectively. In 2018, the MoEE in Sana'a issued a decree aimed at regulating private electricity producers and distributors. The decree provided for:

- Granting licenses for private producers to supply electricity in specific geographical locations. An annual fee is charged which varies depending on the capacity of the generators used.
- The PEC is entitled to 10% of electricity sales, after deducting 7% as standard electricity losses rate. This charge covers the use of PEC electricity poles and the cost of regulation.
- The PEC is entitled to charge a fee for renting PEC infrastructure (e.g., poles) as per a contract between the private producers and PEC.
- The PEC is supposed to provide energy meters and install them at the location of private diesel generators to measure the electricity sold. The private sector is supposed to pay the cost of the meter and installation.
- The private producers are not allowed to use the networks and energy meters already installed by the PEC before the war.
- The tariff is supposed to be regulated and adjusted regularly (every three months or as needed) by the Regulatory Board for Electricity Activities.

The result is a complex, costly, hybrid system of provision. There are over 200 licensees in Sana'a alone. Most run diesel generators and serve one or more local neighborhoods, although some larger operators serve several areas. In some cases, where public PEC generators are functioning, operators purchase electricity from PEC. In other cases, operators pay for using PEC infrastructure to distribute electricity to customers. Notwithstanding the earlier boom in SHSs, generation from diesel generators has a relatively high demand, although it is very costly. Although maximum tariffs are now regulated, tariffs still cover supply costs, making the sector financially sustainable.

The model adopted in these parts of the country is interesting because it is taking place within Yemen and therefore faces very similar challenges to other parts of the country. By liberalising the sector entirely, the authorities have ensured widespread provision of electricity and that the sector no longer represents a financial burden on the authorities. Regulation of private sector activities is beginning to rationalise the use of public infrastructure while attempting to protect customers. The result is a system that sustainably supplies electricity to the population, but does so at great cost, making electricity unaffordable for many. For example, residential tariffs in Sana'a are more than 300 YER/kWh compared to less than 30 YER/

kWh in Aden<sup>42</sup>. A key challenge going forward will be to encourage investment in lower cost generation – including using heavy fuel oil and renewables – to reduce the financial burden on the population.

#### 4 Rural off-grid concessions – the Mali model<sup>43</sup>

The above three models for PSID focus on the on-grid sector. However, as noted in the section on off-grid electrification in Yemen in our previous report,<sup>44</sup> the majority of Yemenis live in rural areas and are not connected to the grid. It is therefore worth considering models of PSID that might be applicable for **rural, off-grid areas**. Here the experience of Mali is of particular relevance. Mali set up a powerful rural electrification agency (Agence Malienne pour le Développement de l'énergie Domestique et de l'Electrification Rurale, or AMADER), which instituted a programme to support the development of rural mini-grids. Mali initially attempted to institute zonal concessions, but this was unsuccessful due to conflicts between the concessionaire and the national utility. In its place, the government introduced the Projets de Candidatures Spontanées d'Electrification Rurale (PCASER), which attracted significant interest from small, local entrepreneurs who developed hundreds of projects between 2004 and 2015.

Under this bottom-up approach to concessions, interested parties can approach AMADER with proposals to build out projects with a capacity smaller than 250 kW. There are now more than 250 mini-grids in the country operated by around 68 private operators and the state-owned vertically-integrated utility Energie du Mali (EDM). The majority of projects are powered by diesel-fired generators, but some are in the process of converting to hybrid solar-diesel generators. The private operators usually manage between one and four mini-grids each, although the largest manages 15 mini-grids covering 31 municipalities.

There are four aspects to the PCASER model that were key to success:

1. Proposals for individual projects came to AMADER unsolicited from private operators, contrary to generally regarded good practice. Generally, unsolicited proposals can be problematic as they can encourage fragmentation and expansion of the system in way that may be inconsistent with least-cost or government policy objectives. However, the major advantage of unsolicited bids is that it **allows private companies to propose projects that they themselves believe to be viable**, rather than be driven by the government's desire to provide services in areas that may not be commercially viable.

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<sup>42</sup> MoEE, 2022.

<sup>43</sup> For more information on the Mali model see Castalia (2015).

<sup>44</sup> Almohamadi et al, 2021.

2. Proposals were not competitively tendered, again contrary to generally regarded good practice. Rather, after an opportunity for others to put in alternative proposals, proposals were evaluated by AMADER and, if deemed acceptable, authorised to continue. The disadvantage of this approach is the possibility of collusion, which would raise prices. However, the advantage was that it was **considerably faster than the lengthy tendering process.**
3. Rather than relying on national laws and regulations to determine the performance of the concessionaires, the key details (including the tariff rate) were set as part of the typically 15-year concession agreement (following a 'regulation by contract' approach). This enabled **agreement on a tariff that would cover costs, as well as a mechanism for adjusting tariffs based on objective criteria.**
4. Critically, mini-grids in rural Mali, as in most rural areas of the world, are not financially viable if they have to cover their full costs. The government therefore **drew on a World Bank project to provide substantial capital grants** (around 80% of capital costs) to concessionaires. This meant that tariffs and collections were primarily designed to simply cover the operational costs and not to repay the capital cost of the system development. As a result, most of these mini-grids were profitable.

The government of Yemen could discuss the feasibility of piloting such an arrangement for mini-grids in rural areas with development financial institutions and multilateral lenders, such as the World Bank. Through its existing projects, the World Bank is currently planning to access the mini-grids sector in Yemen. As it has done in Mali and other countries<sup>45</sup>, providing a loan to catalyse private sector investment in mini-grids would enable private providers and communities to put together proposals and achieve implementation on a far more rapid timescale than could be achieved by waiting for public funds to deliver such systems.

The evidence from this study suggests that these four models of PSID could potentially work in Yemen. The next section lays out how the government might assess the feasibility of introducing a concession model in a pilot location.

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<sup>45</sup> For work in Nigeria see ESMAP, 2017.

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## 8 Assessing feasibility in a pilot location

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**Section 7** described a set of theoretical options for electricity provision that might be suited to the Yemeni context. However, to move from theory to practice, it is important to do a **pilot**. Conducting a pilot programme is important because, given the huge uncertainty of the current context, it is not possible to know in advance precisely what approach will be successful in Yemen. There is a wide range of economic, political, and social factors that might make implementation of any particular model for electricity provision more (or less) difficult, and these are not predictable in advance. The only way to know if the innovative models proposed above will work is to test them.

At the same time, it would be foolhardy to implement a single new model across the entire country without good evidence that it is likely to be effective. Hence, the best approach is to conduct a pilot programme in a **clearly designated area**. The evidence from this pilot programme can then inform whether it makes sense to expand it to other areas. It also provides an opportunity to learn lessons which can be applied rolling out a program more broadly.

There are **two key criteria for the selection of a pilot area**:

1. As noted in the design principles above, the area chosen must have **good security**. This means both physical security (i.e., no conflict and the application of the rule of law) but also political security, in the sense that the political leadership of the region must be reasonably stable so that decisions made by the local government are enforced.
2. It is important that the area or region chosen for the pilot has a **political leadership that is willing to experiment, innovate, and solve problems as they arise**. If the local leadership is merely implementing the pilot because they have been requested to do so by the central government, then they may wish to abandon it when difficulties and problems arise. However, difficulties and problems always arise in the implementation of new ways of working. To be successful, the local government must have a strong sense of ownership of the pilot and a desire to put in whatever effort is needed to safeguard its success.

If an area that fulfils these criteria can be identified, then there are **five practical steps that need to be undertaken to implement a pilot programme**:

### **1 Undertake detailed baseline studies of the pilot area**

Any potential bidder for a utility concession will require detailed information about three things:

- **Asset survey** – bidders will need **detailed information about all the generation and distribution assets** that they will be taking over. This not only includes a list of all generation capacity (with technical details of precisely the location and type of each unit and the fuel needed), but also information about its performance and state of repair, including costing (if available) of repair work needed. A detailed map of distribution assets is also needed, showing the distribution architecture and assets, their performance and state of repair.
- **Demand information** – bidders need to know the **scale and nature of demand for electricity**. Information needs to be collated and provided about the amount of electricity consumed by different types of customers (industrial, commercial, government, households at different levels). Where possible, the information should be spatially disaggregated (at the feeder level if possible) and broken down by time of day (if possible). This information can give a sense of the size and variability of demand in the pilot area.
- **Billing, collection, payment and willingness to pay** – detailed information needs to be collected about **billing, collection and payment**, again disaggregated by type of customer and spatially, if possible. This is vitally important for a concessionaire to identify potential improvements in billing and collection. In addition, since existing consumption is based on the existing tariff structure, it will be important to undertake a **willingness to pay survey** with key customer groups to get a sense of what potential demand might exist for a higher quality service at higher levels of tariff. Equally, such a survey should sensitively assess where challenges to collection might arise so that these can be discussed with the political leadership and a suitable solution identified.



## 2 Prepare a prospectus for bidders for the concession

Once the above information has been collected, it is then possible to prepare a **prospectus for potential bidders** for the concession. This prospectus would include all of the information from the baseline studies above, so that all bidders have access to the same information.

In addition, the prospectus should lay out the **government's priorities and key performance indicators for the concessionaire**. Specifically, the government needs to state how it will evaluate bids and, in particular, the relative weight that it will place on improvements in hours/quality of service, increasing access for those currently without access, and ensuring a reasonable tariff. Experience from other concessions reveals that the **top priority should be on improving the quality of service to existing customers**, rather than extending access immediately. Thus, the prospectus/tender should invite bidders to put forward a detailed set of proposals regarding:

- The investments that they will make in improving existing or adding new generation and distribution infrastructure.
- How many additional hours of service (or other quality improvements) such investments will yield.
- What tariff schedule would be required over the period of the concession to allow the concessionaire to implement these investments.

It is recommended that the tender asks bidders to put forward two, or perhaps three, different scenarios of investment, quality improvement, and tariff (e.g., a low, medium, and high option), so that the government can negotiate with the winning bidder the optimal place along the spectrum of investment, quality improvement, and tariff schedule that it feels is most appropriate.

The tender must also make a clear choice about whether there are any assets to be *excluded* from the concession. In particular, the government should decide whether it wishes to retain PEC generation assets in the pilot area under the control of PEC or whether these would be managed and maintained by the concessionaire. Relatedly, the government should decide in advance whether the concession is only responsible for providing 'additional' electricity, when PEC generation is not available (the Zahle model), or whether it should plan to cover the generation requirements of the area at all times. Moreover, the government should indicate whether it requires the concessionaire to pay for the investments itself (and be reimbursed through the tariff that it charges) or whether the government will reimburse the concessionaire for investments made in public generation and distribution facilities. These key decisions will have major bearings on the scale and nature of the investment that bidders will need to undertake and the level of tariffs that they are likely to require.

### 3 Manage the procurement process

After a prospectus has been produced, the government will need to prepare a **detailed tender document**. This tender document will be different from normal procurement for the design and construction of infrastructure. As noted above, a tender for a concession allows the bidder to put forward a set of proposals about the investments that would be made, the quality performance indicators to which the bidder will be held, and the price (tariff) which they will require for different levels of investment. Bidders are therefore putting forward a 'package' that they believe will be most appropriate for the given context and which will best meet the priorities spelled out by the government in the tender documents.

To ensure that the government gets good value for money, it is extremely important that the procurement process is **managed in a transparent and competitive way**. To ensure this, it is strongly recommended that **independent, external advisers are involved in the procurement process**. For example, IFC or World Bank support for the procurement process would provide confidence to external bidders that the process will be transparent and fair. This, in turn, increases the competitiveness of the bids received, enhancing the value for money for the government.

### 4 Analyses the bids and decide on a preferred bidder

**Analysing bids for a concession is significantly more complex** than the analysis normally done for a simple infrastructure procurement. Typically, infrastructure procurement establishes a technical performance threshold and bids that meet that threshold are ranked by price with the cheapest bidder winning. For a concession, however, each bid will need to be analysed according to:

- **Understanding of the investments needed and the value for money of the costs**

Bidders should have the freedom to propose how they would rehabilitate the generation and distribution assets to maximise quality and improve performance at least-cost. The government will therefore need to **evaluate the technical realism** of the investments proposed to determine whether they will deliver the quality improvements suggested. They should also assess whether the costs proposed for the investments are **realistic** and represent **good value for money**.

- **Ambition but also realism of the performance indicators**

One approach to preparing the bid would be to provide a set of performance indicators in advance to all bidders and ask them to propose a least-cost way to meet these. However, for a complex concession where rehabilitation and investments are likely to be required over several years, it may be better to **ask bidders to propose performance indicators** against which they are willing to be held accountable. Evaluators can then consider whether these are sufficiently ambitious, but also whether they are realistic. If payment (or reimbursement) for investments is dependent on meeting key performance indicators, then this provides an incentive for the bidder to suggest quite easy indicators. However, if the ambition of the proposed indicators is a criterion for winning the bid, then they are likely to be more ambitious about the improvements that can be made and more willing to risk capital to achieve them.

- **Level and reasonableness of the tariffs proposed**

A key criterion for winning the bid should be willingness to undertake investments while still **maintaining a reasonable level of tariff**. At the same time, bidders may claim that they only require low levels of tariff to win the bid and then hold up service at a later stage if they are not allowed to charge significantly higher tariffs. Therefore, the tariffs proposed by bidders should be judged not only on their level but also on their reasonableness (i.e., the extent to which they are consistent with the proposed investments). Bids that are clearly loss-making should be rejected as non-viable.

## **5 Negotiate and agree on a concession contract**

Once a preferred bidder has been identified, the government should then enter into detailed negotiations with that bidder regarding the nature of the concession contract. The final contract does not need to follow the options provided in the bid precisely as the government may wish to make adjustments. For example, the government may have a preference that investments in certain generation or distribution assets should be prioritised. This may have cost implications and so bidders, through negotiation with the government, should be allowed to adjust their bids to satisfy such requirements.

A key part of the concession contract will be the incorporation of mechanisms for **remedies** (e.g., through tariff adjustment) to deal with shocks, such as an outbreak of violence, natural disaster, sudden sharp escalation in international prices of key fuels or other inputs, or changes in the law that have a material impact on the costs or revenues obtained by the concessionaire. In this way, when shocks do occur, there are clearly defined processes that should be followed to make the adjustments needed to **ensure that the concession remains viable**.

Similarly, the contract should spell out what happens if either party fails to honour their obligations under the contract. The appropriate remedies should be built into the contract and be subject to international arbitration with a bond placed by both parties in escrow providing for automatic compensation for the wronged party depending on arbitrator's decision. The contract should also spell out exit options, both for the concessionaire and the government, and the costs associated for each party.

Finally, it is strongly recommended that the government **obtain international assistance in implementing the pilot**. There are several areas where development partners are likely to be able to provide useful assistance:

- Funding baseline studies
- Preparation of the prospectus
- Ensuring transparency of the procurement process
- Support with analysis of bids
- Supporting negotiations with the preferred bidder to ensure the best deal
- Legal support in drawing up the concession contract.

In addition, given the one-off nature of rehabilitation costs, some development partners may be willing to provide capital to cover the costs of approved rehabilitations as part of the concession pilot. If bidders know that this resource is available, this can dramatically reduce the tariff which they will need to cover their costs to a level that may be more politically acceptable.

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## 9 Conclusions and recommendations

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The overall conclusion to be drawn about how best to involve the private sector in the electricity distribution sector in Yemen is a challenging one – it will be difficult. There are numerous obstacles that make private actors reluctant to invest in the sector, with the most important being the fragile security situation, regulatory uncertainty, the lack of payment guarantees, and the very low tariffs currently applied.

Nonetheless, this study suggests that PSID in Yemen is **not impossible**. Indeed, we argue that the long-term sustainability of the sector requires it, since only a functioning and profitable distribution sector can generate the revenues needed to ensure the financial sustainability of the rest of the electricity system. Moreover, international experience provides some valuable lessons about the kinds of approach which are most likely to be successful (and those which are not). Specifically, the evidence suggests that **a utility concession could be an effective approach in Yemen and should be piloted in a specific city or region to assess its suitability**. If such a concession is to work, it will require strong political support from the central government, as well as from the political leadership in the area of the pilot. It will also require a spirit of collaboration between PEC and the concessionaire and a willingness to experiment and to do things differently. Finding the right approach will take time and flexibility from all those involved.

If such a concession is to work, it will require strong political support from the central government, as well as from the political leadership in the area of the pilot. It will also require a spirit of collaboration between PEC and the concessionaire and a willingness to experiment and to do things differently. Finding the right approach will take time and flexibility from all those involved.

Key recommendations on how to proceed:

### 1. Communicate the idea and agree on the approach

Introducing the private sector into distribution is a new concept and a new approach for Yemen. It is important that the idea is well explained and comprehensively discussed among all key stakeholders, including regional actors, so that any decision does not come as a surprise. If it is felt that PSID is an appropriate approach to pilot, this decision must be a formal one made at the highest level, so that there is no ambiguity.

## 2. Identify potential locations for a pilot and choose the most suitable one

As noted above, suitable locations for a pilot of the approach require the support of both formal and informal authorities in the chosen region. The government should therefore enter into discussions with potential regions, assess their suitability both from a political and a technical perspective, and agree a final choice on the selected area.

## 3. Prepare for implementation of the pilot

**Section 8** provided a detailed description of how to prepare for the pilot concession following these steps: baseline assessments, preparing a prospectus, procurement, analyses of bids, and negotiation of a contract. These can start immediately after a pilot area has been selected and agreed. Donors can be invited to support this process.

## 4. Separately study models of mini-grid concession for off-grid areas

The above model is suitable for a **utility concession serving a diverse urban area**. But many Yemenis live far from the grid and will not benefit from this approach. The current approach of **electrifying key public facilities with donor support** is a good one. However, it would be useful to study the viability of mini-grid concessions in off-grid areas to explore whether the reach of the private sector can support electrification in such areas as well.

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# Annex A

## Semi-structured interview questions

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### Core questions

**Preamble:** Yemen's electricity system desperately needs investment. However, the government's resources are limited, even with support from outside. One option, therefore, is to encourage the private sector to invest in the sector, not only in generation, but also in managing local distribution of electricity through concessions. We are conducting a set of interviews to find out the perspective of key knowledgeable people such as yourself on this topic.

1. What is your view of the idea of electricity concessions?
2. What sort of model for private sector engagement do you think would make most sense in Yemen?

It may be worth giving examples e.g.:

- Full privatisation
  - Concession (assets are publicly owned, but a private company runs the service, collects bills, and keeps the revenue)
  - Management contract (company is paid to deliver the service for a fee, but revenue goes to PEC)
3. What areas would be suitable for a private concession? What are the criteria that should determine the scope of a concession (e.g., administrative region, size, grid architecture)?
  4. How should concessions interact with PEC/government? Who should be responsible for what?
  5. How should concessions be regulated? By whom?
  6. Are there companies that would be able to run a concession in Yemen? If so, who? Are there international companies that might be interested in such a concession? Who?
  7. What are the most significant barriers to introducing a concession system in Yemen? How might they be overcome?
  8. Are there particular groups or people that will oppose the introduction of concessions? Why? Are there particular groups or people that will support it? Why?
  9. What might the benefits of a concession system be in Yemen? How could they be maximised?
  10. What would be the best way of moving forward/piloting such a model in Yemen?

In addition to the above core questions, we may wish to ask specific questions to the following respondents as follows:

### **Questions for Ministries/PEC**

- Do you think that the concession idea is a good one or a bad one? Why? Would you be supportive of such a move? Why?
- If the government was to adopt such a model, how would it affect your organisation? What would need to be done by your organisation to implement it?
- Can you supply us with data on:
  - Generation capacity and functioning in the concession area
  - Demand in the concession area (number of customers, level of demand)
  - Levels of income of customers
  - Current legal documents that define roles of relevant institutions

### **Questions for regional political leaders and also regional officials e.g., in PEC**

- Are there private sector groups already involved in supplying electricity in your area?
  - Who?
  - What do they do? (e.g., how much do they supply to who many people at what cost?)
  - What is your view of them? (useful/not)
- Do you think that greater involvement of the private sector in electricity would be a good thing or a bad thing? Why?
- What is your view of the concession model (explain it)? Is it a good idea or a bad one? Why?
- If the central government was to adopt such a model, how would it affect your region? What would need to be done by your local government to implement it?
- Can you supply us with data on: [they may not have this, but could put us in touch with the local PEC to get it]
  - Generation capacity and functioning in your area
  - Demand in the concession area (number of customers, level of demand)
  - Levels of income of customers

### **Questions for potential concession providers/private investors**

- Do you currently provide electricity to any regions/areas in Yemen? (If so, where, how much, who is the client?)
- Have you any experience of running distribution concessions? (If so, where? What size? For how long? What was the model used? Did it work well/badly? Why?)
- If the IRG were to introduce a concession system in Yemen, would you be interested in investing or running a concession? If so :
  - What would preconditions be for investing?
  - What criteria would you use for deciding whether to invest?
  - What kind of model do you think would be most appropriate?
- Are there other firms that you are aware of that would also be interested in this? Who?
- Can you give us some basic information about your company (e.g. size, where registered, ownership)

### **Questions for lawyers that set up concessions**

#### **For international lawyers**

- Do you have experience of setting up electricity distribution concessions? If so, where?
- What are the key legal pre-requisites for setting up a concession?
- What are the key legal challenges associated with setting up concessions?

#### **For Yemeni lawyers/Legal Affairs**

- What are the key laws/regulations that determine who is allowed/required to do what in the electricity sector in Yemen?
- What are the laws/restrictions/rules about private sector engagement in the electricity sector in Yemen?
- If the government was to introduce private concessions for electricity distribution, which laws/regulations would have to be amended and how?

### Questions for donors

- How are you supporting private sector engagement in the electricity sector in Yemen at the moment?
- Do you have experience of helping to set up electricity distribution concessions in other countries? If so, where? What were the key lessons from that experience?
- What are the key challenges associated with setting up concessions in your experience?
- Do you think that a private concession model would be a good idea in Yemen?
- A concession model would require investment/payment guarantees – is that something that your organization has considered supporting?

# State Fragility initiative

The State Fragility initiative (SFi) is an International Growth Centre (IGC) initiative that aims to work with national, regional, and international actors to catalyse new thinking, develop more effective approaches to addressing state fragility, and support collaborative efforts to take emerging consensus into practice. SFi brings together robust evidence and practical insight to produce and promote actionable, policy-focused guidance in the following areas: state legitimacy, state effectiveness, private sector development, and conflict and security. SFi has financial support from the UK Foreign, Commonwealth, and Development Office (FCDO) and The Rockefeller Foundation.

[www.theigc.org/statefragilityinitiative](http://www.theigc.org/statefragilityinitiative)

# IGC

