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# Compagnie Ivoirienne d'Électricité: Delivering Electricity for All*

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## Abstract

In 2013, Leandre N'Dri, director of general studies and strategic planning at the Compagnie Ivoirienne d'Électricité (CIE), received a request to meet urgently with the energy minister's team to discuss the problem of the lack of electricity access still faced by a huge part of the population in Ivory Coast.

Indeed, despite the fact that the Ivorian power system was one of the most extensive and reliable in sub-Saharan Africa, with more than 74% of the population living in electrified communities, just 23 % of the households were actually connected.

N´Dri has an opportunity to prove that the CIE, a private utility company operating the state-owned electricity grid, could be part of the solution of this historic problem. N´Dri is fully committed to proposing a sustainable plan to bring electricity for all, but to do so he will have to understand the underlying causes of the problem and be creative to overcome the financial limitations of a low-income population and of an indebted power system.

Keywords: Electricity access; public service; Africa; electricity distribution; energy poverty; business at the base of the pyramid; utilities.

*This Occasional Paper was prepared to be used as case, as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. Although mostly inspired by true events and relying on public data, it has been partly fictionalized (dialogue parts). This OP was written under the auspices of the Fuel Freedom Chair for Energy and Social Development to explore the specific challenges of and best practices in reducing energy poverty. The authors would like to thank the Compagnie Ivoirienne d'Électricité (CIE) for its collaboration.



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## Introduction

It was Tuesday, July 2, 2013, and the sun was setting in the valley. Soon the night would surround the 200 modest households in Odienné-Sienso, a rural village in the north of Ivory Coast. It was the perfect landscape to launch a new extension of the national electricity grid, which would finally bring power to the village's 1,100 inhabitants.

Since the end of the postelectoral crisis of 2011, which engulfed the divided country in a period of turmoil, the president of the Republic of Ivory Coast knew the importance of getting closer to the population of rural areas, who had suffered greatly during the long political crisis. Winning their support was critical to guarantee peace and unity in the country, which was still in a fragile state of recovery. To do so, it was of paramount importance to improve the economic and living conditions of rural communities—and the inauguration of new infrastructure was a perfect occasion to strengthen ties.

Under the lights of the recently installed public lamps, the President said that access to electricity was important not just to cover basic needs but also to boost the economic growth and social development that rural areas desperately needed.

"Electricity means more time to study at home at the night, access to better tools at work, safer streets—especially important for woman and children who devote hours every day to collecting water and wood—and healthier indoor air, as it replaces the highly polluting kerosene lamps," the president said, highlighting some of the advantages. Ultimately, "electricity means progress and a better and more productive life, which all Ivorians deserve. Our goal is to become an emerging country by 2020, and this will only be possible if each and every village in this country is electrified. To do that, we are working to rapidly extend the grid to all villages," he concluded.

It was meant to be just another successful day on the presidential tour of the country's rural areas but something did not seem right to the president. As soon as he gave the floor of the improvised stage to a performance by a local church choir, he whispered to his adviser: "Very nice streetlights, but why don´t I see any lights in the houses? Apparently most of the inhabitants are still in the dark!"

The response was devastating: "Despite having the grid at their door, they say the electricity is very expensive. They are poor and can't afford it."

As the president was to discover later, although 74% of the population lived in electrified cities, towns or villages, just 23% of the country's households were connected to the grid. Therefore, a significant part of the population living in electrified areas did not have a grid connection themselves, notwithstanding their proximity to the grid.

Back at his cabinet, the president gave a clear mandate to the Ministry of Petroleum and Energy:

> We are expending valuable resources on making electricity available to rural areas, investing heavily in grid extensions and in power generation, but apparently many families can't afford electricity. We need to understand the extent of this problem and the reasons for it and, most importantly, we need an urgent solution.

More than 500 km away from that rural village, Koffy Leandre N'Dri was having another busy day as director of general studies and strategic planning at the Compagnie Ivoirienne d'Électricité (CIE), at the company's headquarters in Abidjan. He had no idea that the scene

playing out at the cabinet was about to trigger a massive national plan with the potential to change the country's economic landscape.

N'Dri soon received a request to meet urgently with the energy minister's team to discuss the problem of the lack of electricity access still faced by a huge part of the population. He knew that it was now on his shoulders to show that the CIE, the private utility company operating the national grid, could be part of the solution. After all, although several players and institutions formed part of the country's power system, the CIE was in the final part of the supply chain, distributing electricity to households and companies, dealing with the end customers and their concerns.

## The Power System in Ivory Coast at a Glance

Ivory Coast was the first sub-Saharan African nation to open the power sector to private initiative. In 1990, it granted a concession to the CIE to operate the distribution and transmission network. The country also turned to independent power producers to generate electricity to meet its rapidly growing demand.

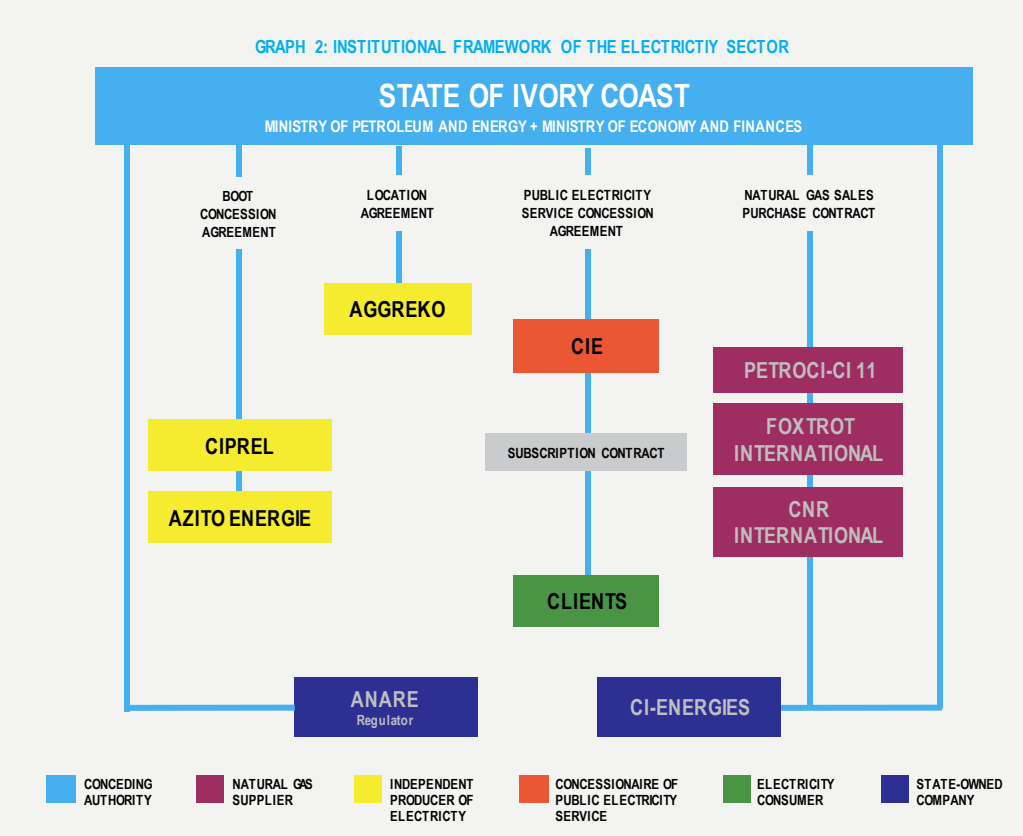
As a consequence, the organization of the Ivorian electricity sector is characterized by the coexistence of public, parastatal and private actors intervening in various ways:

- The state is represented by the Ministry of Petroleum and Energy, whose mission is mainly to define and implement the government's general electricity policy, and the Ministry of the Economy and Finance, in charge of the financial monitoring of the electricity sector.
- CI-Energies is a state-owned company in charge of central planning activities and the expansion of the transmission and distribution network. It also owns facilities such as the distribution grid and numerous hydroelectric and thermal plants (legacy power plants), which are operated by the CIE.
- Anaré (Autorité Nationale de Régulation du Secteur de l'Électricité or National Regulatory Authority for the Electricity Sector) is the independent regulatory agency.
- Private operators:
    - The CIE, the concessionaire of the public service, operates the transmission and distribution network and the state-owned hydroelectric plants.
    - Ciprel, Azito and Aggreko are independent power producers (IPPs), running thermal power plants.
    - Afren CI, Foxtrot and CNR International are gas suppliers, extracting gas from fields near the Ivorian coast and providing it to the IPPs' thermal plants.

Although several private companies operate throughout the sector's whole value chain (natural gas supply, power generation, transmission and distribution), the sector remained heavily regulated and the government retained a central role, owning several strategic assets.

Directly or through the state-owned company CI-Energies, the state is the sector's single buyer—that is, the counterparty of all agreements made with the private investors. (See Figure 1.) Furthermore, the tariffs applied to the end customers are also regulated and therefore determined by the government.

**Figure 1**
**Institutional Framework of the Ivorian Electricity Sector**




Source: Anaré, *Rapport d'activités 2013* (Abidjan: Anaré), 7, accessed September 4, 2018, http://www.anare.ci/index.php?id=34.

Under this configuration, the state is responsible for the network investments (grid reinforcement and extensions) and for setting the electricity tariffs for the end users, leaving private investors in charge of developing new production capacities.

## Power Generation Activities

In Ivory Coast, power production activities are not subject to the state's monopoly.[1] Therefore, the current generation portfolio is formed by a mix of private producers (IPPs) and state-owned facilities (currently under the CIE concession). The IPPs operate through a concession agreement negotiated with the government, under a build, own, operate and transfer (BOOT) scheme. This means that, when the concession term ends, the asset is transferred to the state. The

[1] Ivory Coast's Law 2014-132 of March 24, 2014, introduced the new Electricity Code and aimed to bring more competition to the electricity sector, ending the state's monopoly of network activities.

remuneration is negotiated on a long-term basis, guaranteed through a power purchase agreement (PPA)[2] and take-or-pay clauses.[3]

This setup worked to attract investors to the thermal production segment. In 2012, there were three IPPs operating natural-gas-based thermal plants in Ivory Coast: Azito, Ciprel and Aggreko, accounting for 74% of the electricity produced. In addition, the CIE operated several state-owned hydroelectric power plants, which together produced the remaining 26%. (See Exhibit 1.)

The country produced enough electricity to meet its growing domestic demand and also to export about 10% of the amount generated to neighboring countries, such as Ghana, Togo and Benin to the east and Burkina Faso and Mali to the north.

The installed capacity had increased by 221 MW since 2000 (from 1,200 MW to 1,421 MW), and there was still a good reserve compared with the peak demand of 1,006 MW in 2012. (See Exhibit 2.)

## The CIE and Network Activities

In Ivory Coast, the network assets for transmission (high voltage) and distribution (medium and low voltage) are state-owned, and the state has the monopoly over these network activities.[4] Before 1990, the grid was operated by the vertically integrated and state-owned company Energie Électrique de Côte d'Ivoire (EECI). In 1990, the government granted the CIE a 15-year concession to operate the grid. The concession was renewed in 2005 for an additional 15 years.

Since 1990, two different organizations have carried out the two main activities of (1) long-term planning and investment, and (2) the operations and maintenance of facilities and the delivery of the service:

- CI-Energies[5], the state-owned company, is in charge of the assets, central planning and investments, and
- The CIE, the concessionaire, receives a fee to operate the assets, maintaining the grid and managing the retail activities and customer relationships such as electricity connections, customer service, metering and billing. The CIE's remuneration is variable,

[2] "A power purchase agreement (PPA) is a legal contract between an electricity generator (provider) and a power purchaser (buyer, typically a utility or large power buyer/trader). […] The PPA defines all of the commercial terms for the sale of electricity between the two parties, including when the project will begin commercial operation, schedule for delivery of electricity, penalties for underdelivery, payment terms, and termination. […] Such agreements play a key role in the financing of independently owned (i.e. not owned by a utility) electricity generating assets. The seller under the PPA is typically an independent power producer, or 'IPP.'" (Source: Wikipedia, s.v. "Power Purchase Agreement," accessed September 20, 2018, https://en.wikipedia.org/wiki/Power_purchase_agreement.)

[3] Take-or-pay clauses, when inserted into a PPA, usually mean that the buyer (offtaker) will have to pay the provider (producer) for a certain minimum amount of energy even if the offtaker does not need that amount.

[4] In Ivory Coast, the state used to have, by law, a monopoly over electricity network activities (transport and distribution), exports and imports. Therefore, CIE has a concession to operate an state´s monopoly. This situation changed in 2014 with the introduction of the new Electricity Code. At the time this case was written, the code was still in the process of being implemented and it has had a limited impact on the sector's setup so far. The code aims to bring more competitiveness to the electricity distribution segment (a natural monopoly by definition), potentially allowing other companies to enter this market from 2020, when CIE concession agreement expires.

[5] CI-ENERGIES, was created in 2011, as result of the third reform of the electricity sector undertaken by the State, from the dissolution and the merger of the previous asset management company of the electricity sector (SOGEPE) and the electricity operating company (SOPIE), State companies resulting from the second reform of the electricity sector in 1998 (http://www.cinergies.ci/historique.html)

based on a contractually fixed amount (a management fee) per unit of electricity (kilowatt-hour) sold.

The CIE has more than 4,500 employees, and 54% of the company is owned by Eranove Group. The government holds a share of 15%. Eranove is one of the few utility players focused on Africa, particularly West Africa (Ivory Coast, Senegal, the Democratic Republic of Congo and Mali), where it runs several companies in the electricity and water sector. In Côte d'Ivoire, besides controlling CIE, Eranove also has a majority stake in Ciprel (power generation), SODECI (water distribution) and AWALE (telecommunications). The group had 8,575 employees in 2016, generating revenue of €575 million. Eranove is itself mostly owned by Emerging Capital Partners (ECP), a private equity firm based in Washington, DC, that holds 55% of the shares. AXA, the international insurance company, has 15%.

## Access to Electricity: A Widespread Problem in Sub-Saharan Africa

The problem of limited access to modern energy sources, such as electricity, was not exclusive to Ivory Coast. It is a major problem in most low-income economies. It is estimated that 1.1 billion people in the world are still living off-grid. The highest incidence is found in sub-Saharan Africa, where it is estimated that just 42.8% of the population has access to electricity, leaving more than 600 million in the dark.[6] Rural areas are especially affected, and this exacerbates the economic and social development gap between rural and urban areas.

In most of the countries struggling to make electricity available to the population, the main problem is that the grid is outdated and normally does not extend beyond the capital and a few major urban centers. This is due to a lack of financial resources to invest in power generation, reinforcements and grid extensions. Furthermore, the tariffs are usually too high for a significant part of the population but too low to cover the system costs. This in turn generates an unsustainable situation where there is a financial deficit that does not help to attract investors or secure access to international funding.

In addition, strong demographic growth in the region—around 2.7%—can put extra pressure on development goals. Sub-Saharan Africa is the only region in the world where the number of inhabitants without electricity increases every year—even with an electrification growth rate that is higher than the population growth rate and despite the efforts and investments put in. (See Exhibit 3.)

Notwithstanding the progress of the past decades and despite it having one of the best electricity systems in the region, in 2013 Ivory Coast still faced several challenges. Electricity consumption per capita was more than 13 times lower than the world average,[7] while its penetration ratio was also poor as just 34% of localities had electricity. Technical and commercial electricity losses[8] were around 20% (more than twice the world average) due to an obsolete grid and a high incidence of fraud. On top of that, the sector had been suffering significant financial losses for the previous six years[9] as the tariffs applied were not enough to recover the system

[6] Data from the World Bank database for the year 2016. See the references section.

[7] Calculation based on data from the World Bank database. See the references section.

[8] Technical losses are caused by the overheating of the conductors and losses of iron in the transformers. Commercial losses, also called nontechnical losses, are caused mainly by metering problems (poorly calibrated meters, incorrect readings, etc.), invoicing errors and fraud (direct connections, meter manipulation, etc.).

[9] For example, in 2011, the losses registered by the sector were 64.60 trillion CFA francs, with revenues of 303.13 trillion CFA francs (Anaré, *Rapport d'activités 2012*, http://www.anare.ci/assets/files/pdf/rapport/RA2012_reduit.pdf).

costs. (See Exhibits 4 and 5.) The IPPs, being the last companies to be paid in the cash-flow cascade, were carrying the burden of the arrears.

On the generation side, the sector was still very concentrated in terms of players and technologies. In years of drought, hydropower production was compromised, and there was a threat of shortages in the supply of domestic natural gas (the main fuel to generate electricity in the country). In 2010 and 2011, for instance, the thermal power plants had to resort to heavy vacuum gas oil—an expensive and polluting fossil fuel used as a backup—to produce electricity. This increased the system's costs significantly and caused the fragile financial balance to deteriorate further.

## Access to Electricity: What Is the Real Problem in Ivory Coast?

Despite these problems, in terms of electricity access the problem in Ivory Coast seemed different in nature compared to that in other countries in the region. At the meeting with N'Dri and other representatives of the sector's main companies and institutions, the adviser of the energy ministry's team summed up the situation:

> Our power system is one of the most extensive and reliable in sub-Saharan Africa. We have spent and are spending thousands of billions of CFA francs[10] on power generation, reinforcements and grid extension. We are producing enough electricity for ourselves and even exporting a surplus. Our electricity access rate[11] is more than 74%, probably the highest in the region. We are keeping electricity prices as low as possible. In fact, the tariffs are lower than the system costs. We are offering a very low social tariff to the poorest families. How is it possible that the connection rate[12] was just 23% at the end of 2012? Why are people in the electrified areas not getting a connection?

"Was this question for me?" N'Dri thought. He noticed the frustration in the adviser's words, a frustration that he shared. N'Dri knew that the underlying causes of the problem could not be attributed to the CIE's performance. He was sure that the CIE was following all the relevant procedures to connect households as quickly as possible and giving customers the easiest access possible, always within the regulatory framework for the activities of a concessionaire. However, he also knew that a considerable part of the population and a few politicians blamed the utility for most of the problems that the sector faced. In such a complex and regulated sector, where the operations of all the players were strongly interdependent, it was usual to attribute problems to the system's visible face—the utility in charge of the final part of an intricate supply chain. Furthermore, the fact that the CIE was carrying out a natural monopoly activity did not help, as people tended to see a problem in the lack of competition itself, afraid that companies could take undue advantage of their dominant position.

Different opinions about the reasons for the problem were soon heard in the room. Some people attributed the problem to high electricity prices due to the extensive use of the thermal plants (instead of using more hydro resources). Others blamed the delay in extending the network to

[10] The West African CFA franc (ISO currency code XOF) is used in eight countries: Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal and Togo. "CFA" stands for "Communauté Financière Africaine" (African Financial Community). In July 2013, €1 was worth 656 CFA francs (fixed exchange rate) and $1 was worth 503 CFA francs.

[11] The meaning of the term "access rate" and the calculation of the rate vary from source to source. In the case of Ivory Coast, it refers to the ratio of the total population living in electrified localities to the total population of the country.

[12] The connection rate refers to the number of households actually connected to the grid, divided by the total number of households in the country.

all rural areas and someone said that part of the population simply felt no need to get a connection as they were not accustomed to it or could not afford electrical appliances to use with it. The fact that many people lived in very crudely built or precarious houses that could not be connected safely was also mentioned. It was quite common for several households to share the same connection point and meter, an informal and dangerous practice that in theory was not allowed.

N'Dri emerged from his thoughts and sought to bring some consensus to the room:

> We all agree that we have a huge challenge to solve. Right now, around 1.1 million households have an electricity connection out of the 4.2 million households in the country. We at the CIE receive an average of 50,000 connection requests per year. At this pace, the access rate will reach only 28.4% in 2020, the period when our country is expected to become an emerging economy according to the government's plan. We need to speed up our efforts or we will never catch up. We should remind ourselves that this problem is not new and that the government and the CIE have tried several plans before. We should review what worked in the past and what did not work.

As N'Dri noticed he had the attention of everyone in the room, he continued:

> Based on my experience at the CIE, I think that several problems are contributing to this situation. For example, the indoor installation and connection costs—to connect the household to the grid—requires clients to pay up front, which is a significant barriers for such a low-income population. [See Exhibit 6.] In addition, the process of acquiring certification for the indoor installation is complex and expensive. And when a house is finally connected, after one or two months of consuming electricity, the first ordinary bill arrives and the family does not have enough savings to afford it. Most low-income households have irregular incomes and unstable jobs. I mean, we need to think of a comprehensive solution that works this time.

N'Dri left the meeting with a clear mandate, direct from the Ministry of Petroleum and Energy: the CIE should come up with a proposal that could solve the problem, as soon as possible.

## Looking for the Answers

For the first time, the government was asking for the CIE to draw up a plan, and N'Dri knew that the company should not waste the chance. Tired of the previous programs that started and then stopped and had a limited impact, he saw the ultimate opportunity for the CIE to show its commitment to solving a historical and complex problem—and maybe even change the perception of the company being part of the problem. With genuine interest and support from the government, maybe the company could solve the situation once and for all.

Back at the office, N'Dri organized his restless thoughts:

> We need to start with an accurate diagnosis of the real problems, then find a solution for each of these barriers. And finally, if we really want no one to be left behind, the plan must be sustainable—which means that we should not rely on subsidies that the country cannot afford.

To help clarify his ideas, he made a list of the essential conditions needed for a would-be consumer to get and keep a connection:

1. The electrification of the locality where the future consumer is, with the power system able to produce, transmit and distribute enough electricity: Although nowadays just 34% of the villages and towns were electrified, electrification was one of the government's priorities. In the Rural Electrification Program (PRONER), the government made a commitment to electrify all localities with more than 500 inhabitants between 2013 and 2016 and continue to electrify 500 localities per year up to 2020. Furthermore, the government and the private sector had ambitious plans to increase the generation capacity even more, including the construction of a new hydro plant in Soubré by a Chinese consortium and an increase in the capacity of the existing thermal plants of Azito and Ciprel.

2. Indoor installation and certification process: Households wishing to benefit from domestic electricity services must first have the electrical installation inside the house. The installation has to be done by an accredited professional. Would-be consumers must also obtain, at their own expense, a certificate to show that the indoor installation complies with technical standards.

3. The next requirement is to connect the consumer's residence to the distribution network. The CIE provides this service but the would-be consumers are responsible for paying the connection costs, which should be paid in advance. These costs vary according to the distance from the network and include the costs of the materials (such as cables, a circuit breaker and accessories), the manpower to install them plus an access fee.

4. The final condition consists of subscribing to a tariff and paying monthly for the energy consumed.

If the CIE wanted to propose an effective plan, N'Dri now needed to find answers to two main questions: What were the problems and barriers during these four stages? And what were the alternatives to reach a sustainable solution?

## Learning From the Past

As N'Dri had been involved in most of the previous programs to facilitate electricity access, he decided that it was time for a recap of those initiatives, with an assessment of what did and did not work before.

### *Program to Subsidize Connections and Circuit Breakers, 1994–2001: 100,000-Household Electrification Program*

To promote access to electricity for more households, this program subsidized part of the connection costs or the acquisition of circuit breakers in villages and suburbs that were already electrified. It was announced in 1994 and came into effect in 1996. Both the government and the electricity sector funded the program.

Approximately 332,000 circuit breakers and 213,000 connections were subsidized (at a total cost of 7 billion CFA francs and 9 billion CFA francs respectively). This meant that around 31% of all connections during that period were subsidized. At the time, connection costs could range from

$150 to $1,000, with an average cost of between $300 and $400. In the beginning, the subsidies covered 50% of the connection costs. Later, the subsidies were reduced to about 25%, which enabled the program to be extended to more households. The program was suspended in 2001 as a consequence of the financial difficulties faced by the state and the private sector. This resulted in a significant drop in the average number of regular connections made per year and an increase in irregular connections, especially in peri-urban areas.

### *CIE Promotional Campaigns*

The growing incidence of illegal multiple connections was a cause for concern for the CIE. In addition to the fraud associated with this practice as many consumers were not paying for the electricity used, it caused technical problems (such as overloads and short circuits) and these affected the grid operation and the quality of the service. Even worse, such connections threatened the safety of CIE technicians and the population at large.

The company was aware that the main trigger of this situation was a lack of financial resources on the part of poor families to pay the up-front costs to get their own connection. To mitigate the problem, the CIE regularly ran promotional campaigns to facilitate and finance the payment of these charges, giving people three to six months to pay. Even then, the poorest families could not afford it. For example, for a family on the official minimum wage of 60,000 CFA francs per month, spending around 120,000 CFA francs (the minimum connection costs, including indoor installation and fees) would represent two full months of income.

The CIE also used similar campaigns to promote the payment of overdue bills.

### *Revolving Fund of the World Bank*

In 2013, the World Bank and the Republic of Ivory Coast created a revolving fund to finance the connection of households that benefitted from the grid extensions that had recently been built with the financial support of the World Bank or European Union. The CIE gave customers a substantial discount on the connection costs. A new customer would pay an initial fee of 20,000 CFA francs and the balance would be spread over up to 13 payments of 5,000 CFA francs every two months.

Since the start of the project, more than 14,000 households had benefitted, and about 60,000 more households were expected to be connected in 2014. It was estimated that the funds from this program would enable about 120,000 households to secure access to electricity.

At the time, this mechanism was working well but its overall impact would be insufficient in terms of the number of connections due to the limited amount of funding.

## Designing the Electricity for All Program

With all this in mind, N'Dri felt the pressure that came with the opportunity. This time, he realized, the CIE could finally help to design a plan to act in those areas where the previous projects had failed, an ambitious project with the potential to bring electricity to all. However, it would also be his responsibility to anticipate the risks and the impact of such a proposal. Any failure could compromise not just the access to electricity that the population deserved but also the company's business relationship with the government.

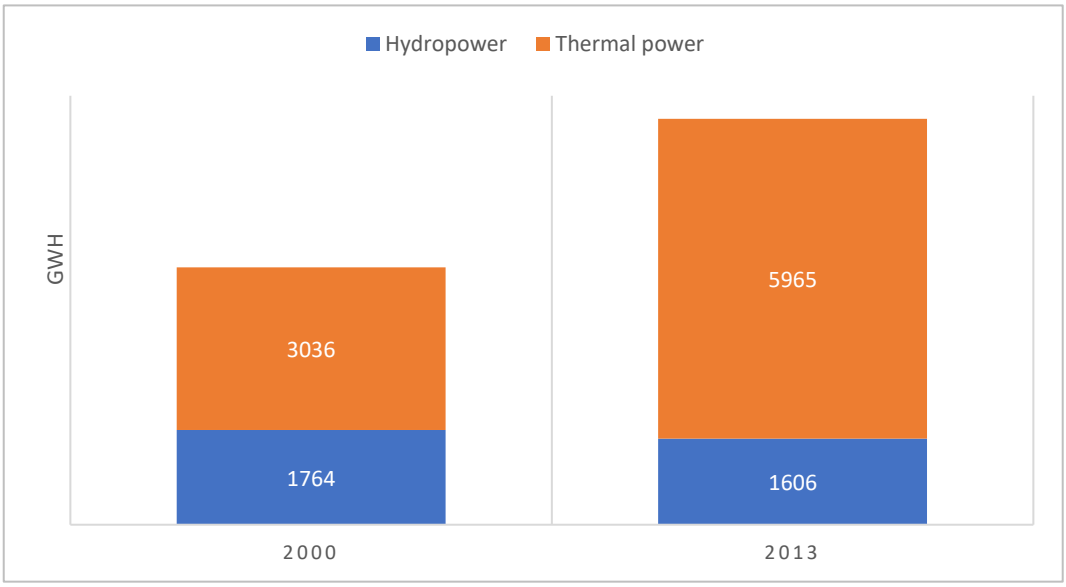
He had some clear ideas of what to include in the proposal. First, to really speed up the connection rate, the company should aim to connect 200,000 households per year. Maybe there would be fewer in the first years of the program but ultimately the target should be to connect at least 1.2 million new households in the following four to six years. This would require unprecedented efforts by the sector and unprecedented financial resources. Was the plan too ambitious?

Second, he was convinced that financing the up-front costs—including even the indoor installation, for the first time ever—would be key to the success of the plan. Using a revolving fund to finance the connection costs seemed to him to be a good mechanism to make the program sustainable. The customers would pay the up-front costs in small fixed installments and, with the money received, the company could keep financing new connections. However, he had some doubts about how to structure and operate the fund. How much money would need to be raised to cover 200,000 connections per year at an average cost of 150,000 CFA francs per connection, with a repayment scheme spread over 10 years and an annual interest rate of 8% (commercial rate + default risk rate)? Who should be in charge of raising and managing the funds? The CIE, the Ministry of Petroleum and Energy, CI-Energies, maybe the regulatory agency or even an independent institution?

N'Dri also believed that establishing a prepayment method for electricity consumed by new customers would be better than using the classic scheme of paying for electricity already consumed. Ideally, customers should be able to top up their accounts with the amount they wanted and then use electricity (paying a tariff per kilowatt-hour) until they ran out of credit. This would reduce drastically the problems related to unpaid bills, and families using electricity for the first time would be able to manage and limit their electricity expenses effectively. However, this would bring an additional challenge: without an electricity bill to be paid at the end of the month, how and where could the company collect installment payments to recover the connection costs? Should it issue a separate bill periodically and ask customers to pay it at their nearest payment facility? Another option was to split the installment and include it in the tariff per kilowatt-hour, which would mean that the price paid per kilowatt-hour would be slightly higher. What were the risks of both options?

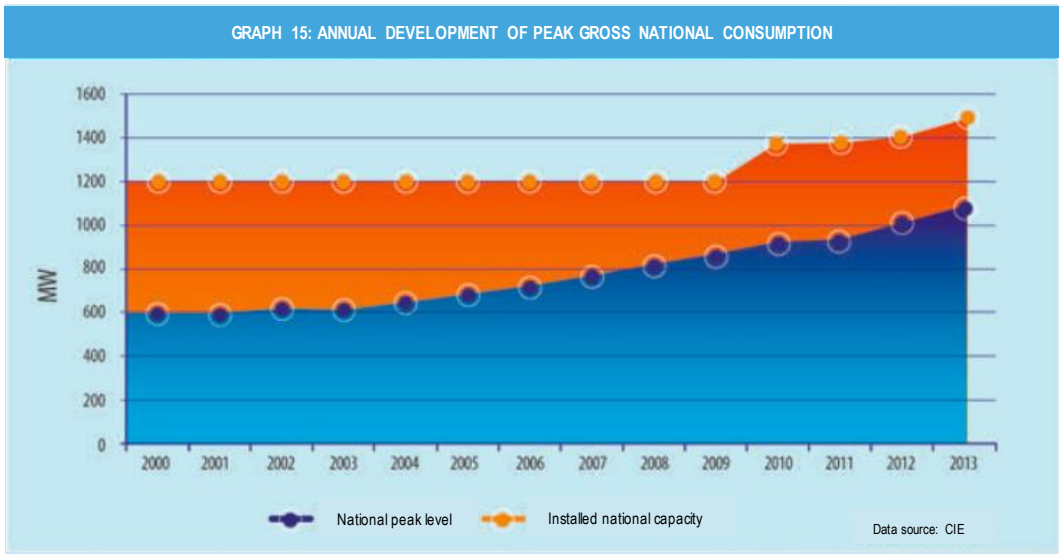
He was also concerned that, once the program had been launched, the demand might be overwhelming. Who should prioritize which customers should be dealt with first and how could the potential pent-up demand be managed? Using which criteria? And finally, how could such a massive plan affect the sector's financial balance?

# Exhibit 1
## Change in the Electricity Mix, 2000–2013 (GWh)



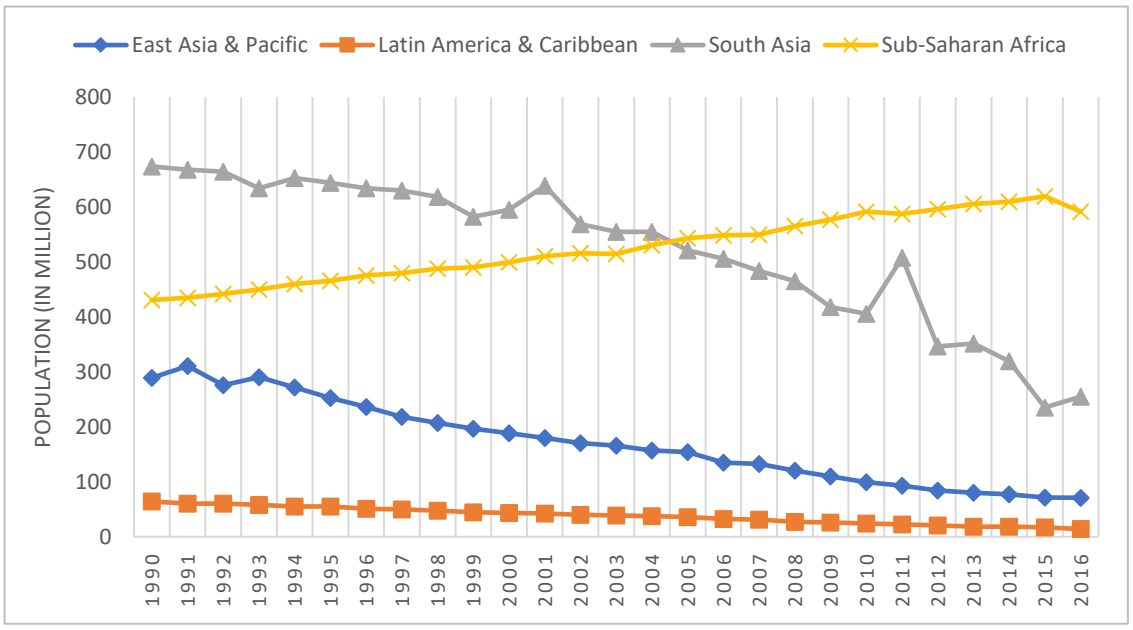

Source: Prepared by the authors, based on data Anaré, *Rapport d'activités 2013* (Abidjan: Anaré), Graphique 5 (Figure 5), p. 15.

# Exhibit 2
## Installed Capacity and Peak Demand



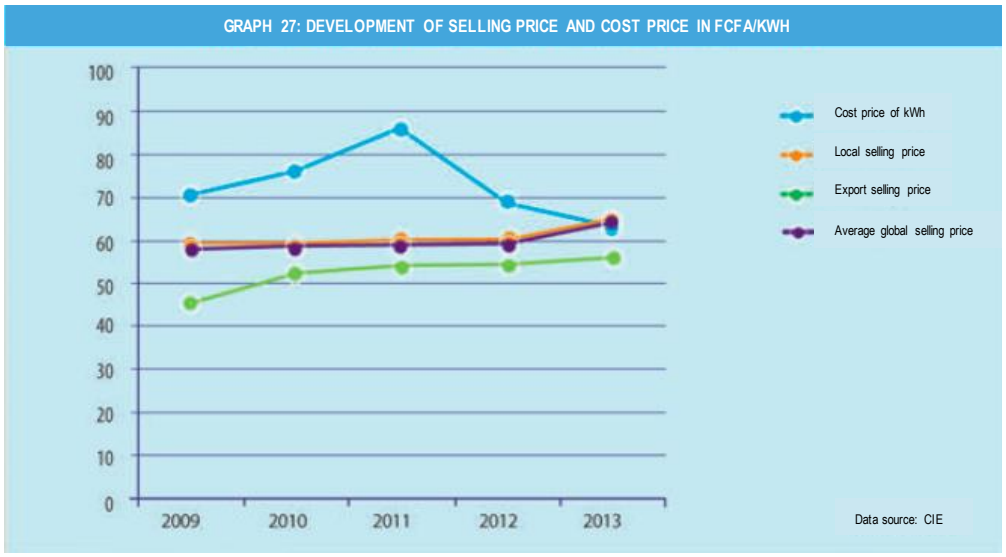

Source: Anaré, *Rapport d'activités 2013* (Abidjan: Anaré), Graphique 15 (Figure 15), p. 21.

# Exhibit 3
## Population Without Access to Electricity (in Millions)




Source: Prepared by the authors, using World Bank data. (See the references section.)

# Exhibit 4
## Evolution of the Selling Price and Cost Price of the Electricity Tariff




The review of the evolution of selling prices and cost prices from 2009 to 2012 in the graph above shows that the cost of a kilowatt-hour is higher than the average total sales price over the period as a whole, reflecting an operating deficit in the sector. In 2012, however, the difference between the cost price and the average selling price per kilowatt-hour fell sharply and, in 2013, the average selling price per kilowatt-hour became higher than the cost price per kilowatt-hour. The result is a return to the sector's operating equilibrium in 2013.

Source: Anaré, *Rapport d'activités 2013* (Abidjan: Anaré), Graphique 27 (Figure 27), p. 32, using CIE data.

# Exhibit 5
## Financial Performance of the Power Sector, 2010–2012

| | 2010 | | 2011 | | 2012 | |
|---|---|---|---|---|---|---|
| | Amount (GWh) | Millions of CFA francs | Amount (GWh) | Millions of CFA francs | Amount (GWh) | Millions of CFA francs |
| **SALES** | | | | | | |
| **Revenue** | — | 310,517.79 | — | 303,131.78 | — | 364,412.76 |
| National electricity sales | 4,432.58 | 310,517.79 | 4,301.41 | 303,131.78 | 5,178.82 | 364,412.76 |
| Local sales | *3,961.88* | *285,763.53* | *3,705.40* | *270,781.75* | *4,513.64* | *329,320.17* |
| Export sales | *470.7* | *24,754.26* | *596.01* | *32,350.03* | *665.18* | *35,092.59* |
| **EXPENSES** | | | | | | |
| **Expenses of category A** | | | | | | |
| Remuneration of CIE | | 92,448.00 | | 86,470.00 | | 99,834.00 |
| **Expenses of category B** | | **265,171.20** | | **276,123.00** | | **251,591.43** |
| Production, of which | 6,040.60 | 265,171.20 | 6,235.43 | 276,123.00 | 6,940.33 | 251,591.43 |
| Thermal, of which: | 4,286.17 | 60,470.26 | 4,453.66 | 61,969.61 | 5,117.08 | 64,630.50 |
| Azito | *1,732.95* | *20,190.70* | *1,791.52* | *16,997.87* | *2,112.80* | *16,878.10* |
| Ciprel | *2,154.00* | *33,736.33* | *2,134.00* | *33,802.72* | *2,190.90* | *34,747.50* |
| Vridi | *142.76* | | *101.90* | | *228.88* | |
| Aggreko | *256.46* | *6,543.24* | *426.24* | *11,169.02* | *584.5* | *13,004.90* |
| Hydraulic | 1,618.37 | | 1,773.60 | | 1,788.59 | |
| Other producers | 136.06 | 21,015.50 | 8.17 | 129.43 | 34.66 | 2,099.57 |
| Purchase of gas and fuels | | 183,685.44 | | 214,023.97 | | 184,861.36 |
| Natural gas | | 171,799.00 | | 209,655.67 | | 182,952.46 |
| Fuels | | 11,886.44 | | 4,368.30 | | 1,908.90 |
| **Expenses of category C** | | **8,352.00** | | **5,137.00** | | **4,092.00** |
| Renewal and major revisions of facilities | | 3,822.00 | | 2,548.00 | | 2,430.00 |
| Extension and reinforcement | | 4,530.00 | | 2,589.00 | | 1,662.00 |
| **Expenses of categories A, B and C** | | 365,971.20 | | 367,730.00 | | 355,517.43 |
| **OPERATING BALANCE** | | **(55,453.41)** | | **(64,598.22)** | | **8,895.33** |

Source: Prepared by the authors based on figures from Anaré, *Rapport d'activités 2012* and Anaré, *Rapport d'activités 2011*.

# Exhibit 6

Costs to Obtain a Connection and Comparison With Income, in Local Currency (CFA Franc)

| UPFRONT COSTS TO THE ACCESS TO ELECTRICITY | | Type 1 (5A) | Type 2 (10A) | Type 3 (15A) |
|---|---|---|---|---|
| Indoor Installations (*) | | 45,000 | 45,000 | 45,000 |
| Compliance Control Fee (Certification fee) | | 12,000 | 30,000 | 63,000 |
| Connection cost (20m-30m), of which: | | 96,212 | 96,212 | 96,212 |
| *Cost of the circuit breaker* | | *21,356* | *24,102* | *41,186* |
| Cost of subscription with standard electricity meter, of which: | | 6,745 | 32,350 | 47,800 |
| *Including Advance on consumption* | | *5,300* | *30,905* | *46,355* |
| *Cost of subscription with prepayment meter* | | *1,445* | *1,445* | *1,445* |
| Total with standard electricity meter | | 159,957 | 203,562 | 252,012 |
| Total with prepayment meter | | 153,212 | 171,212 | 204,212 |
| **ANNUAL AVERAGE INCOME** | | | | |
| BASE 1 - Income classes | ENV 2008 | 315,927 | 772,089 | 1,376,397 |
| BASE 2 | ANNUAL SMIG (60000*12) | 720,000 | 720,000 | 720,000 |
| **SHARE OF THE COST OF ACCESS TO ELECTRICITY OF ANNUAL AVERAGE INCOME** | | | | |
| BASE 1 : ENV 2008 | | 51% | 26% | 18% |
| BASE 2 : SMIG ANNUEL (60000*12) | | 22% | 28% | 35% |

(*) Fixed rate for one installation type for one building with 2 rooms (3 points of light, 2 plugs)

ENV 2008: Quality of life-househld survey of Institut National de la Statistique de Côte d'Ivoire (INS) 2008

SMIG: Salaire minimum interprofessionnel garanti (guaranteed minimum wage)

Source: CIE, Programme Electricité Pour Tous (PEPT: Electricity for All) brochure, privately published, 2014, translated by the authors.

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