USAID
FROM THE AMERICAN PEOPLE

POWER AFRICA

POWER AFRICA TRANSACTIONS AND REFORMS PROGRAM

DJIBOUTI POWER SECTOR ASSESSMENT REPORT

November 2014

This document was prepared by Tetra Tech under USAID Contract No. AID-623-C-14-00003

Prepared by Tetra Tech for the United States Agency for International Development, USAID Contract No. AID-623-C-14-00003, under Power Africa Transactions and Reforms Program ("PATRP").

This report was prepared by:

Tetra Tech
1320 North Courthouse Road, Suite 600
Arlington, VA
22201
Telephone: 703-387-2100
Fax: 703.243.1374

Tetra Tech Contacts:

David Keith Email: David.Keith@tetratech.com

Jim Hogan Email: Jim.Hogan@tetratech.com

DJIBOUTI POWER SECTOR ASSESSMENT REPORT

NOVEMBER 2014

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

Acronyms/Abbreviations	Definition
ADF	African Development Funds
ADDS	Djibouti Social Development Agency (Agence Dijiboutienne de Développement Social)
ADME	Djibouti Agency for Energy Management (Agence Djiboutienne de la Maîtrise de l'Énergie)
AEEP	Africa-EU Energy Partnership
AFD	French Development Agency (Agence Française de Développement)
AfDB	African Development Bank
CCD	Djibouti Chamber of Commerce (Chambre de Commerce de Djibouti)
CPS	Country Partnership Strategy (The World Bank)
CERD	Djibouti Center for Studies and Research (Centre d'Études et de Recherches de Djibouti)
DISED	Directorate for Statistics and Demographic Studies of Djibouti (Direction de la Statistique et des Études Démographiques)
EDD	Djibouti Electricity Company (Électricité de Djibouti)
EIB	European Investment Bank
EU	European Union
EU-Africa ITF	European Union Africa Infrastructure Trust Fund
EUEI PDF	European Union Energy Initiative Partnership Dialogue Facility
FDI	Foreign Direct Investments
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GEF	Global Environment Facility
GWh	Gigawatt hours
HFO	Heavy Fuel Oil
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
Km	Kilometer
kVA	Kilovolt Ampere
kWh	Kilowatt Hours
MERN	Ministry of Energy and Natural Resources (Ministère de l'Énergie et des Ressources Naturelles)
MOF	Ministry of Finance

Acronyms/Abbreviations	Definition
MW	Megawatts
NARUC	National Association of Regulatory Utility Commissioners
ODDEG	Office of Geothermal Energy Development (Office Djiboutien pour le Développement de l'Énergie Geothermique)
OPEC-OIFD	Organization of Petroleum Exporting Countries - OPEC Fund for International Development
PATRP	USAID Power Africa Transactions and Reforms Program
PPA	Power Purchase Agreement
PPIAF	Public-Private Infrastructure Advisory Facility
PPP	Public Private Partnership
PV	Photovoltaics
QPI	Qatar Petroleum International
RECP	Africa-EU Renewable Energy Cooperation Programme
RRA	Renewable Readiness Assessment report
UNEP	United Nations Environment Programme
USAID	US Agency for International Development
WB	The World Bank

MAP OF DJIBOUTI

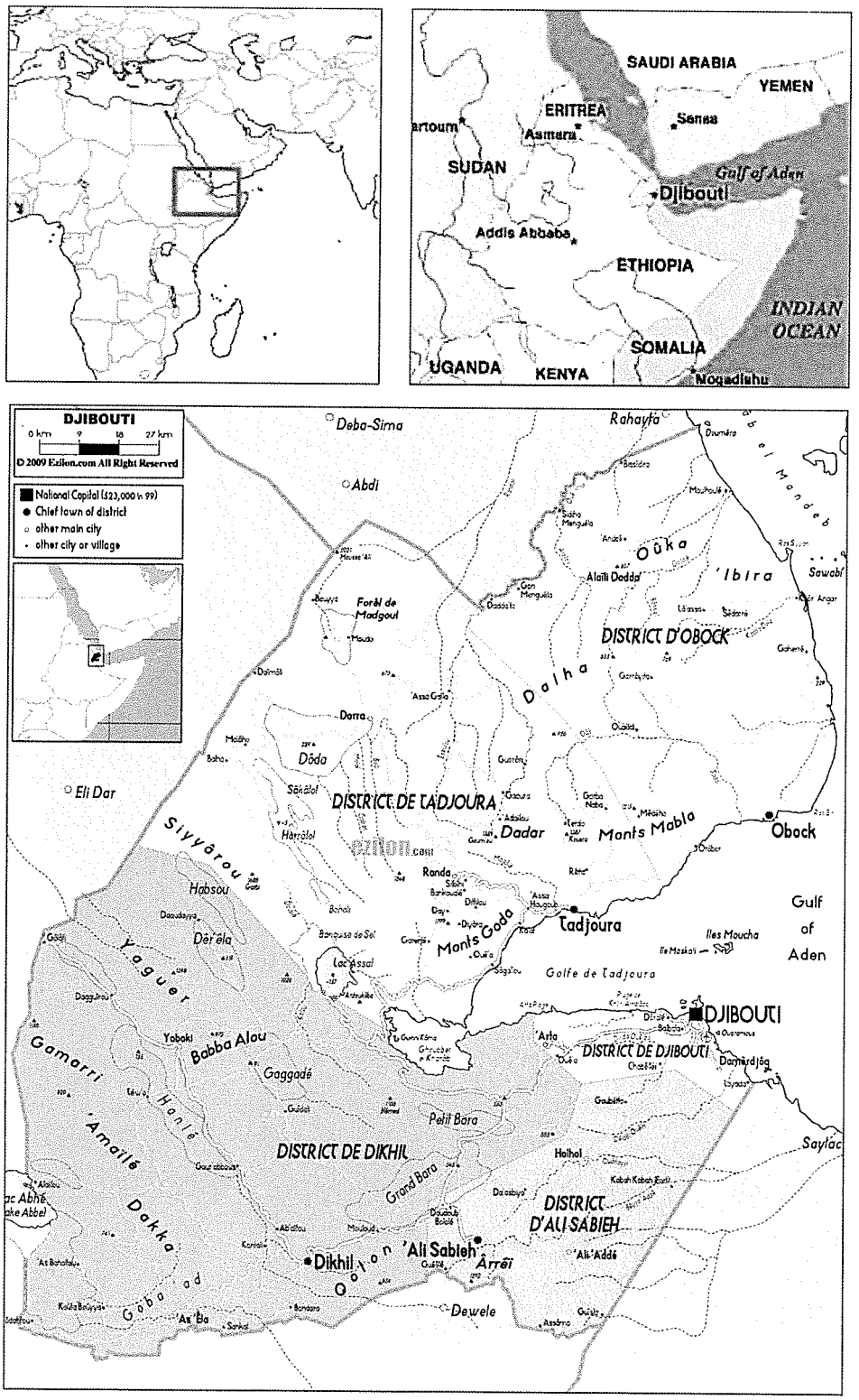


Figure1: Political Map of Djibouti (Source: www.ezilon.com)

EXECUTIVE SUMMARY

Djibouti's strategic location as Africa's gateway to the Red sea offers important opportunities for economic growth and development. The two traditional pillars of economic growth are foreign direct investment and port activity. Even though the economic growth has accelerated in recent years, the country lags behind on human development indicators, ranking 164th out of 187 countries. The economic and social development is severely hampered by the lack of affordable and reliable power and low level of access to energy, water and telecommunication services.

Faced with formidable technical, institutional and financial barriers, Djibouti's energy sector struggles to meet resource constraints due to its dependence on imported electricity, high cost of fossil fuel and weak supply infrastructure. At present, approximately 50% of the population enjoys access to electricity, with lack of access being especially acute in rural areas.

The country is endowed with significant renewable energy resources including geothermal, solar and wind for on-grid and off-grid applications; however, until 2010 it was fully dependent on electricity generated using imported fossil fuel. The high cost and fluctuations in oil prices has for years consumed precious financial resources that would otherwise be used to address pressing social development challenges.

Since 2011, an interconnector between Ethiopia and Djibouti, funded by AfDB, provides the country with low cost energy supply with tariffs ranging between USD 0.06-0.07/kWh. The maximum permitted energy trade level over the period 2012-2015 is 243 GWh per year, increasing to up to 70% of the Djiboutian load by 2019. While this arrangement is advantageous from an economic perspective, the country may be subjected to excessive dependence on imported electricity. As such, the Government of Djibouti is actively promoting the use of its indigenous renewable energy resources. If properly developed, the renewable energy can contribute to improve the country's energy security and to increase electrification rates and reliability of supply while offering lower tariffs. The increase in the share of renewable energy in the country's energy mix has been identified as a key objective of its Visions 2020 and 2035. In both cases, a target of 87-100% share of renewables in the energy mix has been set.

Electrification rates	~50%
Electricity demand	421.73 GWh
Electricity supply	395.7 GWh
Installed capacity	125.96 MW
Power imports	154.97 GWh
Grid losses	16%
Power retail tariffs	$ 30 cent/KWh
Power import tariffs	$ 6-7 cent/KWh
Geothermal potential	650 MW
Wind potential	56.65 MW
Solar potential	55 MW

Table 1: Power statistics of Djibouti (Source AEEP)

While the opportunities are tremendous, this report also informs about a number of critical legislative, institutional, financial and technical challenges facing the energy sector. The Government of Djibouti with the support of the donor community has already launched a number of initiatives to improve the overall performance of the energy sector and harness the country's ample renewable energy resources; yet enormous constraints still remain. The following are some of core areas requiring strengthening, as presented in this report:

Legislative, institutional and regulatory framework

In addition to the national strategy and electricity law that are currently being developed, the following measures will promote strong, functional institutions and regulatory instruments, resulting in conducive investment climate and an increased appetite for private sector participation:

- The current 33% tax on imports is prohibitive for renewable energy. A revised **Commercial Code** and changes in the tax code will provide more incentives for private sector investment;
- A **geothermal law** clarifying the rights to the resource may need to be developed. The viability of using the mining law to issue a concession needs to be evaluated to determine if modifications to the law can be made or if a separate geothermal law is required;
- A **Private Public Participation (PPP) legal framework** is needed to reassure potential private sector investors and other stakeholders about the government's commitment to PPA transactions. A PPP legal framework is likely to be developed with support from the World Bank, AfDB and AFD. For the power sector, specific regulations governing concessions for geothermal fields and IPPs will also be needed to complement a PPP legal and regulatory framework;
- A **regulatory agency** or department for the electricity sector must be envisaged. The regulatory authority will be important to define the rules and the legal norms that will affect all IPPs transmission and distribution companies. Training will need to be provided in topics such as the modern principles of ratemaking, the conduct of cost of service surveys, the implementation and enforcement of utility management policies, development of performance standards and indicators and enforcement policies;
- The creation of a **PPP coordinating unit** should also be considered located in the Ministry of Finance. This unit would serve as a center of knowledge and technical resources on PPPs for the other ministries and agencies. In line with international best practices, it shall be able to provide advisory support in areas such as financial modeling, risk analysis, and enforce planning, procurement and implementation standards for all PPP transactions.

Specific to the Geothermal Project

- There is a need to assess the project development costs for the Fiale Caldera geothermal project using a more **realistic financial model**, to better determine the total costs of the of the project, government fiscal commitments and tariff expectations;
- Associated with the evaluation of the likely cost of the Fiale Calder geothermal project is the need to identify what **credit enhancements** to be put in place to attract private investment and the costs implications of those enhancements on the project.

Other recommendations

- The **technical and financial viability** of the national utility, Énergie de Djibouti as an offtaker, in terms of reducing losses, improving collections and the overall financial management, as well as capacities and risks associated with the transmission and local distribution system must be examined to enhance the company's overall performance. It is important to recognize that Djibouti will need substantial investments for system modernization, as well as for building new generation plants.
- The long-term energy strategy which is currently in preparation, together with **an overarching power master plan** is essential for Djibouti to develop clean, reliable and affordable energy systems and to encourage conservation;
- The capacity of Djibouti to be an active player in the regional power pool of East Africa must be strengthened. EDD staff and MERN technical staff will need to familiarize themselves with key technical and financial aspects of **managing a regionally interconnected power system**.

Specific short and long term actions for USA are provided in the last section of this report.

1 INTRODUCTION

Djibouti's strategic location in a conflict-prone region - with Yemen, Eritrea, Somalia, and Ethiopia at its borders, combined with its commitment to peaceful, moderate views, makes it a unique and strategic partner for the United States. Djibouti is host to Camp Lemonnier, the only permanent U.S. military installation in Africa.[1]

In 2013, the United States of America announced Power Africa - an initiative to provide access to power to 20 million people and commercial entities in Sub-Saharan Africa by adding more than 10,000 megawatts of clean, efficient electricity generation capacity. Though Djibouti is not a Power Africa focus country, United States Agency for International Development (USAID) wishes to assist this strategic country in unlocking its substantial indigenous renewable energy resources through targeted technical assistance.

This assessment of the energy sector of the Republic of Djibouti was undertaken as part of the USAID Power Africa Transactions and Reforms Program (PATRP), funded under contract no. AID-623-C-14-00003.

This report aims to provide an overview of the energy sector of Djibouti and identify capacity gaps, challenges and opportunities to meet the objectives of increased energy security, electrification rates, lower tariffs and reliability in supply. Special attention was given to geothermal and renewable energy opportunities and to the legal and institutional barriers to increased private sector investment in the energy sector in Djibouti. The report also highlights opportunities where the involvement of USAID can facilitate and accelerate the achievement of social and economic development goals, through increased access to low-cost energy.

This report was produced following a two-week mission to Djibouti in October 2014 by a Tetra Tech team comprised of Georges Tadros (renewable energy engineering expert), Jacques Cook (legal expert) and Jay Dick (geothermal expert). During this mission, a two-day training on Public-Private Partnerships focusing on the power sector was provided to government officials, highlighting the legal, financial and technical risk factors involved in planning, developing and implementing successful PPPs. Emphasis was placed on how PPPs and the Build-Operate-Transfer project finance structure affect the lenders' and developers' perceptions of the key risks in IPPs, with a focus on geothermal energy. The mission also allowed for numerous meetings with the Ministry of Energy and Natural Resources (MERN), Énergie de Djibouti (EDD) and other officials to discuss opportunities for the involvements of donors.

This report is comprised of five sections. Section 2 of the report, Country Background, provides an overview of the socio-political landscape and the economy of the country. Section 3 profiles the energy sector of Djibouti, discussing its institutional and organizational framework, energy demand as well as energy supply and the status of the country's electricity generation, transmission and distribution sector. Section 4 of the report focuses on renewable energy resources as well as ongoing and pipeline projects in this sector. Section 5 of the report describes the necessary steps to strengthen the legal, institutional, regulatory as well as technical capacities of the sector, with a focus on encouraging private sector investment. The potential areas for the intervention and contribution of USAID are described in this latter section of this report.

[1] USAID

2 COUNTRY BACKGROUND

2.1 GEOGRAPHY AND SOCIO-POLITICAL LANDSCAPE

Djibouti's strategic location in the Horn of Africa is its most important asset offering opportunities for economic growth and development. This small country of just 23,200 sq km with a population of 906,112[2] (2013) is borded by Eritrea in the north, Ethiopia in the west and south, and Somalia in the southeast. The remainder of the border is formed by the Red Sea and the Gulf of Aden at the east, with 370 kilometers of maritime coastlines. Djibouti forms a bridge between the Middle East and Africa and controls the access to the Red sea.

In 1977, the Djiboutian people voted for independence from the French Territory of the Afars and the Issas, which officially marked the establishment of the Republic of Djibouti. From 1991 to 1994, Djibouti experienced a civil war with devastating effects on the economy. A power sharing agreement in 2000 between the ruling party and the opposition resulted in relative political stability. The last presidential election was held in 2011, following a change in the constitution that allowed the incumbent president, Ismail Omar Guelleh, to run for a third term. In November 2012, the National Assembly approved a new voting law based on proportional representation. For the first time since 2003, the opposition participated in parliamentary elections in February 2013. According to published results, the opposition won 10 seats in parliament. The opposition contested the results and has boycotted parliamentary sessions in protest against the election results.[3]

Djibouti is a multi-ethnic country; its two main ethnic groups are the Issa of Somali and the Afar of Ethiopian origin. Arabic and French constitute the country's two official languages. About 94% of residents adhere to Islam.

Djibouti had a per capita income of about US$1,430 in 2011, ranking it as a lower-middle-income country. Yet, its Human Development Index lags substantially behind, ranking 164th out of 187 countries (2013). Women and girls face particular challenges given deep-rooted gender inequalities in access to services, educational and employment opportunities, and political representation.

Although poverty figures are difficult to pinpoint due to data limitations, available evidence indicates that poverty is widespread and worsening in the face of the current drought—the worst in 60 years. According to DISED's latest welfare report, the incidence of poverty in Djibouti remains high despite moderate economic growth over the last decade, indicating that recent growth has not translated into reduced poverty or shared prosperity. The report suggests that after dramatic increases in both absolute and relative poverty between 1996 and 2002, absolute poverty has declined only slightly from 42.2 percent in 2002 to 41.9 percent in 2012, while relative poverty has grown from 74 percent to 79.4 percent in the same period. DISED figures suggest that poverty levels vary widely across regions. Outside the capital, seven out of ten Djiboutian fall below the absolute poverty line, and nine out of ten under the relative poverty line.[4]

The statistics on unemployment rates are inconsistent ranging from 40 percent to 59 percent. In 2007, Djibouti was ranked 196th country in the world with unemployment in rural areas being higher than urban areas, and higher among young people, rising above 70 percent for young people under the age of 30.

---

[2] 2013 World Gazetteer estimate

[3] The World Bank (2014)

[4] The World Bank Group -CPS

With nearly 40 percent of Djiboutians under the age of 15, the country's population is relatively young; but their potential to serve as an engine of growth and poverty reduction is severely restrained to due lack of employment. The alarmingly high unemployment has contributed to endemic widespread poverty and has heightened social tensions since 2011.

Over 71 percent of the population of Djibouti lives in urban areas. The capital Djibouti-Ville is home to 58 percent of the country's population. It is estimated that about one-third live in slums, with little access to basic infrastructure.

2.2 ECONOMY

The country's most important economic assets are its strategic location at the mouth of the Red Sear and the Gulf of Aden and its status as free trade zone in the Horn of Africa.

Djibouti is mostly barren, with little development in the agricultural and industrial sectors. The country has a harsh climate, a largely unskilled labor force, and limited natural resources. Djibouti's economy is dominated by the service sector, which constitutes around 79.7% of the GDP, followed by industry at 17.3%, and agriculture at 3%.

The pillars of economic growth and revenue are significant inflows of foreign direct investment (FDI), port activity and rents from foreign countries' military bases. Transport and logistics sector is the backbone of Djibouti's economy, founded on the country's remarkable deep-water state-of-the-art port complex, which has few precedents in Africa.

The facilities of the Port of Djibouti serve as a key refueling and transshipment center, and are the principal maritime port for imports to and exports from landlocked African countries. About 85% of the seaport's activity consists of imports to and exports from neighboring Ethiopia serving its market of 90 million inhabitants. The port contributes substantially to the national economy, generating direct revenues in the range of US$65 million to US$90 million per year (20 to 25 percent of government revenues) and creating about 15,000 direct and indirect jobs (10 percent of the actively employed population)[5].

In 2012, Djibouti began the construction of the Doraleh Container Terminal, its third seaport, to secure its position as a critical transshipment hub in the Horn of Africa. A $396 million project, it has the capacity to accommodate 1.5 million twenty foot container units annually. Trade through Djibouti's port is expected to grow rapidly in parallel with the expanding economy of its main trading partner, Ethiopia. Developing potential trade with South Sudan could further expand port activities.

The strategic location of Djibouti has ensured a steady inflow of foreign aid and military assistance. Owing to its proximity to the Persian Gulf, Djibouti hosts military bases for France, the United States, Japan, and the North Atlantic Treaty Organization (NATO), as well as other foreign forces that are located in the country to support anti-piracy and anti-terrorism efforts in the region.

Following a decade of negative and low growth, Djibouti has seen significant improvement in macroeconomic stability in recent year, with its annual gross domestic product improving at an average of 4.5 percent during 2009-2012. The GDP (purchasing power parity) in 2013 was estimated at US $2.505 billion, with a real growth rate of 5% annually. The GDP based on the official exchange rate was estimated at US $1.459 billion[6]. Approximately 75 percent of the GDP is attributed to the telecommunications, construction, and tourism sectors, which have experienced strong growth in recent

[5] The World Bank Group CPS

[6] Source of data : CIA – The World Factbook

years. Inflation is expected to remain fairly low, with the Consumer Price Index (CPI) falling from an average of 3.7 percent in 2012 to an estimated 2.5 percent in 2013.

The economic growth is further attributed to fiscal adjustment measures aimed at improving public financing, as well as reforms in port management. Fiscal adjustment measures included downsizing the civil service, implementing a pension reform that placed the system on a much stronger financial footing, and strengthening public expenditure institutions. Budgetary discipline and debt management were major challenges. Yet this growth pattern has not alleviated high levels of poverty or unemployment. The small size of Djibouti's economy limits its ability to diversify production and increases its reliance on foreign markets, making it more vulnerable to external market downturns and hampering access to external capital.

The following chart shows the trend of gross domestic product of Djibouti in US dollars estimated by the World Bank. These figures project a favorable outlook for the economy, provided Djibouti is able to address some of the significant structural obstacles to its sustained growth. Access to reliable, affordable energy is a critical barrier to the country's future growth and prosperity.

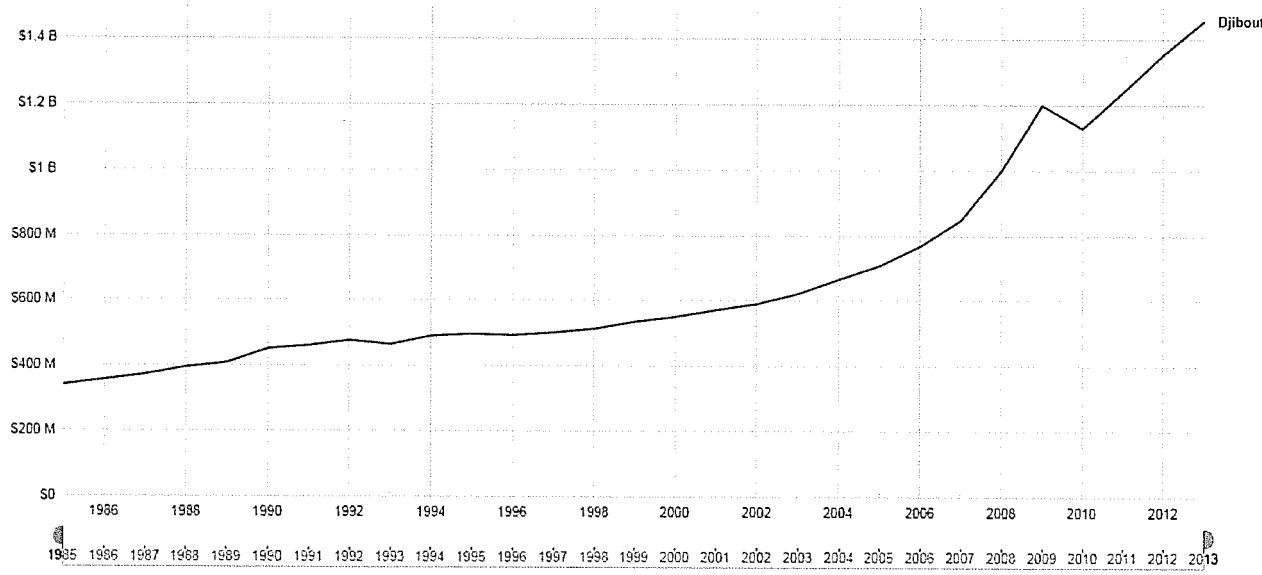


Figure 2: GDP of Djibouti based on Official Exchange Rate (Source: the World Bank)

The following chart provides annual economic indicators.

	2009[a]	2010[a]	2011[a]	2012[a]	2013[b]
GDP at market prices (Dfr bn)	186.5	200.6	220.2	240.6	267.8
GDP (US$ bn)	1.0	1.1	1.2	1.4	1.5
Real GDP growth (%)	5.0	3.5	4.5	4.8	5.5
Consumer price inflation (av; %)	1.8	4.0	5.1	3.8	3.5[a]
Population (m)	0.8	0.8	0.8	0.9	0.9
Exports of goods fob (US$ m)	71.8	78.7	85.0	111.4	114.1
Imports of goods fob (US$ m)	450.7	373.9	510.6	538.1	565.3
Current-account balance (US$ m)	-71.1	50.5	-171.8	-121.7	-123.2
Foreign-exchange reserves excl gold (US$ m)	219.6	230.6	228.3	234.2	410.5[a]
Exchange rate (av) Dfr:US$	177.7	177.7	177.7	177.7	177.7[a]

[a] Actual. [b] Economist Intelligence Unit estimates.

Table 2: Economic statistics (Source: EIU-Country Report 2014)

Less than 0.04 percent of the total land area of Djibouti is arable land. The scant rainfalls limit crop production to small quantities of fruits and vegetables. Djibouti imports practically its entire food supply, causing it to be highly sensitive to external shocks such as spikes in food and fuel prices and natural disasters such as floods and droughts. Djibouti's merchandise trade balance has shown a large deficit; Even though Djibouti runs a substantial surplus in its services balance, the surplus has been smaller than the deficit in the merchandise trade balance.

The current account deficit is estimated to have widened to about 13.1 percent of GDP in 2013 from 5.1 percent in 2010. Imports grew by 18 percent per year on average, in nominal terms, during 2011–2013, as compared to 13 percent for exports. This deficit has been financed in part by significant FDI inflows, which are expected to have risen from 2.4 percent of GDP in 2010 to 18.6 percent in 2013 (USD 277 million). After a marked improvement between 2009 and 2010, the deficit has grown gradually and is estimated to have increased from 2.7 percent of GDP in 2012 to 3.1 percent of GDP in 2013. Financing of the fiscal deficit relies on external sources, with a growing but still limited role for domestic financing. External debt is high, at 49.2 percent of GDP in 2013, and borrowing costs are expected to rise[7].

The Djiboutian franc is the currency of Djibouti. It is issued by the Central Bank of Djibouti, the country's monetary authority. Since the Djiboutian franc is pegged to the U.S. dollar, it is generally stable and the country has a low inflation rate. This has contributed to the growing interest in investment in the country. For purchasing power parity comparisons, the US dollar is exchanged at 76.03 Djiboutian francs. Mean wages were $1.30 per person-hour in 2009.

2.3 OPPORTUNITIES FOR GROWTH

Economic growth has accelerated in recent years, and the country possesses natural assets and geographical advantages that could support more diversified growth in the future. Longer-term, sustainable growth will depend on diversifying the economy beyond the port and the public sector, and on creating jobs. However, sustainable growth will not be possible without an expansion of energy supplies and reductions in the cost of electricity.

According to the World Bank, Djibouti is endowed with natural assets for the development of tourism, untapped marine resources that could support growth in artisanal fishing and a significant infrastructure of undersea telecommunications cables on which it could draw to develop new service industries. Energy trade could also be a source of growth for the country.

The development of energy resources of the country and providing access to cheaper energy in general will increase the access of people to basic infrastructure providing opportunities to diminish poverty and strengthening the business environment.

Effective implementation of deeper institutional reforms also remains critical to sustaining dynamic economic growth and ensuring broad-based economic development. Systemic weaknesses linger in the protection of property rights and the enforcement of anti-corruption measures. The judiciary remains vulnerable to political influence. Weaknesses and flaws in the legal and institutional framework will continue to create obstacles for expanded foreign investment in Djibouti.

A recent report by the World Bank states that to take advantage of opportunities for more diversified economic growth and poverty reduction in Djibouti, the country will need to take action to address key development challenges on two broad fronts. First, Djibouti needs to take steps to address vulnerabilities such as high poverty and unemployment, deficits in human development indicators and social service delivery, limited access to basic infrastructure, and high natural disaster risks. Second, there is a need to

[7] The World Bank Groupe CPS

strengthen the business-enabling environment through better-quality and more affordable energy and telecommunications services as well as improvements to the investment climate and governance framework.

2.3.1 VISION 2035

The government's long-term approach to development is encapsulated in the recently completed Djibouti Vision 2035. In addition to its three cross-cutting themes—promoting women's conditions and reducing gender inequality, supporting youth, and protecting the environment—the vision statement focuses on five pillars representing the country's key development challenges: [8]

- Peace and national unity: social justice, equity, and a culture of peace; a cultural identity and a national conscience; and a defense policy that guarantees the security of people and assets;
- Good governance: strong institutions; a strengthened democracy based on good governance as a social norm; justice system modernization; capacity building in the administration and government; strengthening civil participation and civil society; the media as instruments of good governance; consolidation of the business environment and strengthening of private initiatives; and the prevention and repression of corruption;
- A diversified and competitive economy with the private sector as its engine of growth: diversified growth, with the private sector driving a new growth model; a positive macroeconomic policy; an adequate financing strategy that preserves financial equilibrium; financial market development; supply chain improvements; strategic partnerships; a judicious global and integrated development plan of the national territory; and a global employment policy;
- Consolidation of human capital: ensuring the well-being of the population; reducing poverty through social actions; developing a global sanitation policy; education system improvements; a food security and nutrition strategy; a housing policy adapted to the national socio-cultural environment; defining and implementing a national population policy; and promoting artistic and cultural creativity; and
- Regional integration: capitalizing on Djibouti's strategic location in the Horn of Africa through infrastructure and regional economic initiatives; developing commercial integration and a service platform in the subregion; commercial integration in the Intergovernmental Authority for Development (IGAD), the Common Market for Eastern and Southern Africa (COMESA), and the East African Community (EAC); a regional maritime outlet and service platform; and a stronger national strategy of international cooperation.

Vision 2035 has placed energy access and security at the center piece of its long term economic development plans and objectives. As part of its investment plan, Djibouti intends to transition from a country which depends on fossil fuels for its generation requirements to a country that by the year 2020 will be dependent entirely on renewable energy sources--mainly from geothermal, wind, solar sources, as well as the interconnection with Ethiopia's hydroelectric grid.

2.3.2 OPENNESS TO FOREIGN INVESTMENT

The government of Djibouti publicly welcomes all foreign direct investment. President Ismail Omar Guelleh first elected in 1999, has named privatization, economic reform, and increased foreign investment as top priorities for his government. The president pledged to seek the help of the international private

[8] Text from the World Bank based on the Vision 2035

sector to develop the country's infrastructure. In addition to its strategic location, Djibouti's assets include an open trade regime, a stable currency, substantial tax breaks and other incentives. Potential areas of investment include Djibouti's port, energy and the telecommunications sectors.

In the World Bank Doing Business 2014, Djibouti ranks 160th of 189 economies on the overall ease of doing business (improved from 171st in 2013). Spurring private sector development will require overcoming discouraging structural barriers, including outdated laws and regulations, a complex system for obtaining permits, licenses and registration of new business and heavy taxes and customs duties. Intellectual property rights are also not sufficiently protected by patent and trademark laws.

Although receptive to foreign investment in many sectors, Djibouti still restricts foreign investment and ownership of public utilities such as the transmission and distribution of electricity, which is reserved for the state-owned Électricité de Djibouti. Significantly, conditions of the structural adjustment agreement recently signed by Djibouti and the International Monetary Fund call for increased privatization of parastatal and government-owned monopolies.

Public policy planning and execution suffer from weak strategic and operational planning instruments in key sectors. This weakness is compounded by the absence of reliable data. Moreover, a lack of clarity in public policies poses challenges for informed, coordinated, and accountable decision making. Djibouti has entered into a number of MOUs with governments and foreign developers which have largely failed for lack of sufficient follow through and efficient implementation. This historical context discourages potential investors who need to see a record of successful achievement before they will commit to major long term projects.[9]

To improve the environment for direct foreign investment, the Djibouti authorities have launched a number of development projects aimed at highlighting the country's commercial potential. The government has also introduced new private sector policies targeting high interest rates, including relaxing the tax burden on enterprises and allowing for exemptions on consumption tax.

2.3.3 ONGOING AND PIPELINE OF PROJECTS

Vision 2035 is a big turning point for Djibouti, whose leaders want to make the country a regional hub for trade and financial services. Major investment is planned to strengthen the country's comparative advantage as a trading and shipping center. The government has been trying in recent years to reduce the structural obstacles to adequate electricity and water supply that handicap growth of the private sector.

The USD 6 billion investment program[10], includes building new ports, railways and roads, an aqueduct, a desalination plant and housing, and will be funded mainly by Chinese investors and the international aid community. The success of this program depends on close monitoring of the government's budget and the national debt. Djibouti must carefully control its overall debt burden. The government fiscal managers will therefore have to balance the need for increased investment in infrastructure projects against the increased levels of indebtedness and government guarantees which will be required to finance these projects.

Djibouti also received funding in late 2012 for the above-mentioned desalination plant to begin address the severe freshwater shortage affecting Djibouti City, and particularly its poorest residents. The Djibouti firm Salt Investment (SIS) began a large-scale operation to industrialize the plentiful salt in Djibouti's Lake Assal region. Operating at an annual capacity of 4 million tons, the desalination project has lifted export revenues, created more job opportunities, and provided more fresh water for the area's residents.

---

[9] The World Bank (2014)
[10] as described in the report on the African Economic Outlook for Djibouti.

In 2012, the Djibouti government also enlisted the services of the China Harbor Engineering Company Ltd for the construction of an ore terminal. Worth $64 million, the project is scheduled to be completed within two years and will enable Djibouti mineral officials to export a further 5 thousand tons of salt per year to markets in Southeast Asia.

Saudi investors are also reportedly exploring the possibility of linking the Horn of Africa with the Arabian Peninsula via an 18-mile (29 km) long oversea bridge through Djibouti referred to as the Bridge of the Horns.

The Djibouti–Ethiopian railroad shut down completely in 2010; construction of a new railway—through a loan from the Exim Bank of China in 2013—should start soon.

The list of energy-related projects is provided in the relevant sections of this report.

3 POWER SECTOR PROFILE

3.1 REVELANCE OF ENERGY TO DJIBOUTI'S DEVELOPMENT

The lack of reliable and affordable energy constitutes a major obstacle for Djibouti in achieving its ambitious economic development plans. Poverty studies have shown a strong correlation between electricity access and poverty in Djibouti. Nearly fifty percent of the country (43 percent of urban households) does not have access to electricity, and 70% of these households are among the poor.

A study undertaken by the World Bank in 2010 underlines that electricity is considered by the majority of companies in Djibouti as the main impediment to private sector development and economic diversification. Electricity tariffs, at US$0.32/KWh, are twice the African average, owing in part to the heavy reliance on expensive imported fossil fuel. Power outages are frequent, requiring the purchase of generators to ensure regular business operations. Electric bills account for approximately 25 percent of business expenses in Djibouti, hindering national competitiveness and industrial development.

The Country Partnership Strategy document by the World Bank has identified the reduction of the costs of electric power through access to geothermal energy, and addressing the financial viability of the energy utility, Électricité de Djibouti as key measures to support the government's efforts to reduce poverty and boost shared prosperity.

Vision 2035 as well as the earlier development programs for Djibouti have highlighted that the country needs to scale-up its energy services, both in quality and quantity, if the country is to meet its social and economic development needs. More specifically, government objectives include the following:[11]

- Increase electrification rates up to 60 percent by 2015;
- Increase share of renewable energy technologies up to 87-100 percent of energy mix;
- Reforms on the level of the electricity utility;
- Refurbish and extend the power grid; and
- Establish new interconnections.

Off-grid rural electrification objectives in rural areas include:

- Solar Water Pumping;
- PV and small wind for Community services (health and education); and
- PV for residential purposes (30 percent of rural electrification from solar PV by 2017).

3.2 LEGAL AND REGULATORY FRAMEWORK

Djibouti does not have a current comprehensive energy policy to address the country's growing energy needs. The most recent document is the "National Energy Policy" issued in 1985 by the Ministry of Energy and ISERT (currently CERD).

In the electricity sector, private investment has also been thwarted by the monopoly enjoyed by Électricité de Djibouti which, under Order no. 83-0171/PR/EDD, has the exclusive authority to produce and

[11] RRA report

distribute electricity in Djibouti city and its suburbs. Even the exclusive rights of the EDD are not reflected clearly in prevailing laws.

The government with the assistance of the EU is now considering a draft electricity law. If enacted this law would among other things:

- Create an Electricity Regulatory body within the Ministry of Energy and Natural Resources
- Authorize IPPs and Self Producers to sell electricity to the EDD
- Establish the legal authority of EDD to be the sole transmitter and distributor of electricity in the national grid
- Authorize the government to grant licenses and concessions to private parties for energy projects
- Authorize IPPs in the renewable energy sector, including geothermal power projects
- Establish norms governing tariffs based on a "normal" Rate of Return
- Establish norms and procedures for the award of licenses and concessions

In light of these reforms, it will be important for the government to fully implement an investor friendly legal and institutional framework that will govern the project cycle of IPPs in the Djibouti from inception through procurement. Accordingly, the draft electricity law will need to be carefully reviewed to determine what complementary legal and institutional reforms may be needed for private investors in the renewable energy sector. This could involve including provisions in the law more directly relevant to solar, geothermal or wind projects, or perhaps even a separate Geothermal Energy statute amending relevant provisions of the Mining Code.

In addition to its work on the draft electricity law, the EUEI Partnership Dialogue Facility is undertaking a *ten-year National Strategy and five-year Action Plan* for the development of the electricity sector This will be based on specific objectives, such as renewable energy penetration rates, maximum power import, peri-urban, rural and decentralized electrification rates, contribution to poverty reduction. The strategy and action plan focuses on the approach, responsibilities and sources of financing for conventional and decentralized electrification and for the promotion of renewable energy sources. Capacity building in the public sector (MERN, EDD, ADDS among others) and the private sector is considered as a central activity in order to ensure a successful implementation of the strategy and action plan.

3.3 ORGANIZATIONAL STRUCTURE

The following figure presents the organizational structure of entities involved in the energy sector:

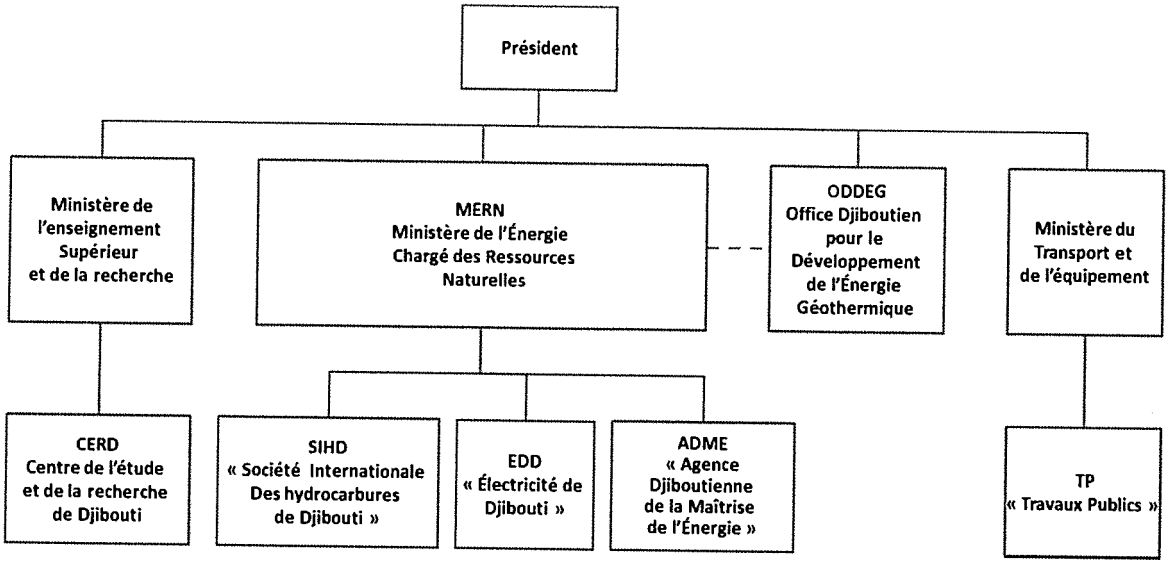


Figure 3: Organizational Structure of the Energy Sector in Djibouti

3.3.1 MINISTERE DE L'ENERGIE CHARGE DES RESSOURCES NATURELLES

Ministry of Energy and Natural Resources (MERN), under the Office of the President, is tasked with the responsibility for the design, definition and development of government policy in the area of energy and natural resources. The ministry defines rules, regulations, statutory instruments and legislation for the energy sector including electricity, petroleum products and renewable energy. Under the authority of MERN are two important government bodies: i) Électricité de Djibouti; and ii) Société Internationale des Hydrocarbures.

The responsibility of MERN, are defined in the Decree No. 97/AN. This is comprised of a General Secretariat and three directorates, including those relating to energy. The latter is divided into two administrative services (conventional and renewable energies).

Djibouti does not have a regulatory body for water and electricity. Creating and staffing such an entity will be needed if the Djibouti moves towards PPPs. This entity, as visualized in the draft Electricity Law will play a critical role in setting tariffs and regulating the privatized suppliers and distributors. It will also reassure consumers, investors and other stakeholders that legitimate private sector interests are aligned with government policies and the public interest.

The National Energy Commission was established by a Presidential Decree No. 11 2009-0218/MERN October 2009 to assist the government in planning, implementation and monitoring of the National Master Plan of Energy Djibouti, and updating the energy map of the country. This is first step towards the creation of a multi-sector regulatory structure for the electricity sector.

3.3.2 ÉLECTRICITÉ DE DJIBOUTI

Electricity of Djibouti (EDD), established in 1960, is a state-owned and operated utility with a monopoly on the generation, transmission, and distribution of electricity within the city of Djibouti and the major towns of the country. The status and duties of EDD are defined in decree no. 83-071/PWEDD of February

2, 1983. Under the auspices of the MERN, EDD is a legal entity with financial and administrative autonomy (Decree 77-079/PR/MRI). According to its creation decree,

- The state has attributed to EDD the exclusive service rights in Djibouti, Arta, Tadjoura, Obock and Dikhil Ali Sabieh;
- The state provides to EDD all existing installations free of charge;
- EDD must cover the costs of constructing new network (in order to meet the increase in consumption), and operation and maintenance and refurbishment to maintain the state of the network;
- The electricity tariffs are set by a resolution of the Board of Directors of EDD and are approved by the Council of Ministers;

Despite high tariff levels, averaging US$ 0.32 per KWh, and fuel subsidies presenting 1.5 percent of the GDP[12] (IMF 2012), the EDD is in a fragile financial situation due to persistently elevated oil prices, weak supply infrastructure and various technical and non-technical inefficiencies of the electric utility. The State of Djibouti is ultimately responsible for EDD's obligations vis-à-vis parties and suppliers. The EDD's net loss for 2008 is estimated at US$4 million, despite close to US$30 million in government subsidies.[13] EDD directly operates in the following regions: Djibouti, Ali-Sabieh, Arta, Dikhil, Obock and Tadjoura. The operations in the other regions are ensured by private operators. The number of electricity customers of EDD has increased from 29,000 in the year 2000 to 43,000 in 2013. EDD is comprised of approximately 950 employees, organized as follows:

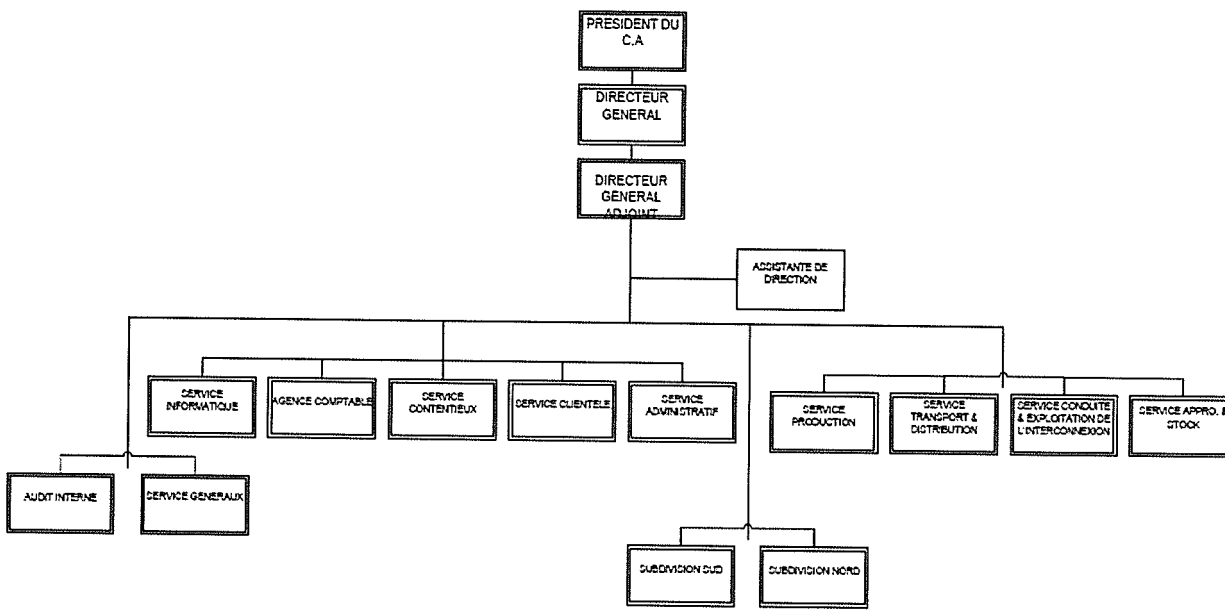


Figure 4: EDD Organizational Chart (Source: EUEI PDF report)

[12] IMF (2012)
[13] The World Bank – Country Assistance Strategy

3.3.3 ADME

Djiboutian Agency for Energy Management (ADME) is a public institution whose mission is to promote energy efficiency and renewable energy in all economic sectors. The mission of the ADME is to implement the state policy in the field of energy efficiency and renewable energy. More specifically, ADME performs the following tasks: disseminate knowledge to develop a policy for rational use of energy; propose solutions to reduce the energy bills of state institutions and homes recommending best practices; assist the industry in energy demand management and integrate energy efficiency into their management systems; encourage scientific research and assistance to reduce energy losses; develop and ensure compliance with the thermal standards for new buildings and renovation of old buildings.

The ADME reports to MERN and is composed of the following services:

- Administrative and financial service;
- Service standards and regulation;
- Department of energy efficiency;
- Department of renewable energy.

The ADME is currently working on an Energy Efficiency program, comprised of energy surveys, creation of energy information database, provision of energy saving solutions and energy efficiency demonstration.

3.3.4 SIHD

Created in 2000, the International Society for Hydrocarbons (SIDH) is legal and autonomous public entity under the supervision of the MERN. It is responsible for hydrocarbon imports, processing, and operations. Imports are dominated by Shell, Total and Oil Libya.

3.3.5 ADDS

Created in 2007, Djibouti Social Development Agency (ADDS) is tasked with the implementation of the program of the National Development Initiative for poverty reduction. The agency operates under the authority of the Secretary of State for National Solidarity (NSIS), and it is a financially autonomous public legal entity. In this context, ADDS is responsible for the implementation of rural electrification objectives in areas not covered by the EDD grid. The energy component of the ADDS works is managed by the Directorate of rural electrification.[14]

3.3.6 ODDEG

The Government of Djibouti has recently established the Office of Geothermal Energy Development (ODDEG), under the auspices of the Republic's President. The main mission of ODDEG is to identify and quantify geothermal resources by carrying out exploratory work, to exploit geothermal energy and acquire indigenous human and technical capacity.

An inter-ministerial steering committee has also been created to oversee and control at the national level projects relevant to exploiting geothermal energy. This committee will be responsible for providing strategic directions and establish guidelines to develop and implement geothermal energy.

---

[14] RRA Report

3.3.7 CERD

Centre for Studies and Scientific Research of Djibouti (CERD) is a scientific public institution. It is attached to Ministry of Higher Education and Research, and provides an institutional framework for researchers, scientists and academics from all specialism. In terms of energy, it conducts studies to evaluate renewable energy potential in Djibouti, and carries out pilot studies that would feed into energy knowledge system. At present, CERD's solar laboratory (under the authority of the Institute of Earth Sciences and financed by JICA) has installed a grid-connected 300 kW PV plant, which it monitors and conducts scientific experiment. CERD also has a geothermal research unit.

3.3.8 MINISTRY OF FINANCE

Ministry of Economy, Finance and Planning is in charge of industry and planning and sets the electricity tariff and the Directorate of External Finance is responsible for implementing and monitoring new projects. The Ministry is also involved in the regulation and stabilization of oil prices.

3.3.9 PRIVATE SECTOR

There are a few small private sector organizations in Djibouti – suppliers of renewable systems and installers.

The Djibouti Chamber of Commerce (CCD) was established in 1970 at the initiative of a group of local businesses but has since evolved to become the principal representative institution of the private sector at the national level. Its main missions are to defend the perspectives of economic players in the country and present their opinions and proposals that support economic prosperity and poverty reduction, promote development in the Republic of Djibouti. Moreover, the CCD facilitates trade engagements and helps raise awareness that help strengthen domestic markets and communicate these to the relevant private sector actors. It also carries out relevant studies and data collection. The CCD has three operational departments: consulting, technical assistance, and training. All economic sectors are represented in the decision-making body through the General Assembly of forty four (44) elected members and eight executive members who support the president.

The National Investment Promotion Agency was established in 2001 to encourage the promotion of investment in Djibouti through a policy of flexibility in investment operations, and development of enabling regulatory framework and procedures. As part of the investment promotion and development of knowledge of the Djiboutian territory, NIPA is responsible for putting forward the incentive environment of the Republic of Djibouti and investment opportunities. Within its investment focus, NIPA sees renewable energy as an important investment area to boost economic development and create high quality employment for the economy.[15]

3.3.10 DEVELOPMENT PARTNERS

The following is a non-exhaustive list of development partners involved in Djibouti's energy sector:

Agence Française de Développement (AFD), the African Development Bank (AfDB), the European Investment Bank (EIB), the European Union (EU), the European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF) under the Africa-EU Renewable Energy Cooperation Programme (RECP), Japan International Cooperation Agency (JICA), the OPEC Fund for International Development (OFID), the United Nations Environment Programme (UNEP) and the World Bank Group (WB).

[15] RRA Report

3.4 ELECTRICITY DEMAND

In 2012, the total electricity demand represented 421.73 GWh distributed in three different systems, the main grid and two isolated networks. The present per capita electricity consumption of about 330 kWh against an African average of over 575 kWh and a global average of over 2770 kWh, makes the average Djiboutian citizen among the lowest consumers of electricity in the world. In Djibouti, only around 50% of the population has access to electricity, as the demand is constrained by high tariffs, high connection costs and an electricity grid that covers only Djibouti City and its outskirts. The country suffers from regular blackouts and high dependency on energy imports and has one of the highest tariffs in the world.

Approximately 37% of the electricity produced is consumed by the large industries, ports industries such as the sea port, the airport, the free zone and military camps; and residential consumers including social consumer category account for 38%. The remaining 25% is consumed by large shops, public offices and government offices.[16] As a result of the high tariffs and unreliable power supply, the private sector (e.g. Freeport of Djibouti) has developed its own means to produce electricity, but it is not allowed to sell excess power to the grid.

The consequence of the imbalance between supply and demand has been random and scheduled power cuts. For example in 2009 and 2010, between 13 and 14 GWh of the demand could not be served by the grid. This figure has come down to just under 9 GWh in 2011 since the interconnection with Ethiopia, which has enhanced security of electricity supplies.

The economic growth over the past few years has accelerated the country's power demand. Over the past 10 years, consumption of electricity has increased by about 75%, and even with this increase it is judged that effective demand would be significantly higher. Work done by Parsons Brinckerhoff (PB Power) foresees a 5.2 percent yearly increase in electricity demand from now until 2025. The forecasts of PB Power are more conservative than those of EDD as the utility also considers the additional demand that will be induced by large projects currently planned in Djibouti. The EUEI PDF suggests that the Power demand for the main grid is expected to grow by 70-75% in the period 2011-2035, while demand for the isolated networks of Tadjoura and Obock is expected to increase by 62.5% and 49.5% respectively during 2011-2035.

Demand	2012		2035	
	Demand (GWh)	Peak (MW)	Demand (GWh)	Peak (MW)
Main grid	413.5	73.8	1,745.1	311.4
Tadjoura (isol.)	5.2	1.2	14.0	3.2
Obock (isolated)	3	0.7	5.9	1.3

Table 3: Electricity demand in Djibouti (Source: RRA Report)

Clearly, the implications are that Djibouti will need to scale up its efforts to generate more power from domestic sources, preferably from renewable sources while continuing to import power for the time-being from Ethiopia.

[16] World Bank and Parsons Brinckerhoff, 2009

3.5 ELECTRICITY SUPPLY

According to a study by EUEI PDF and Mercados (2013), production levels have been growing at an estimated annual rate of 5.7% over the last 40 years, but more slowly than demand. In 2011, total power supply represented 395.7 GWh. Out of the total power supply, 154.97 GWh were imported from Ethiopia. The following chart describes the energy supply from 2009 to 2011.

Year	Produced Energy (GWh)	Non-supplied energy (GWh)	Imports (GWh)	Total (GWh)
2009	340.16	14.36	-	354.52
2010	372.03	13.24	-	385.27
2011	232.00	8.73	154.97	395.70

Table 4: Energy supply in Djibouti (Source: EDD)

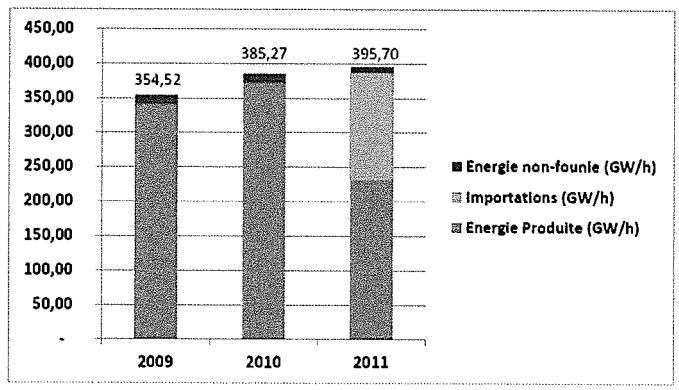


Figure 5: Energy supply in Djibouti (Source: EDD)

Djibouti decreased its power production by 37.64% over the 2010-2011 period as a result of the commissioning of Ethiopia's interconnector which also allowed for a reduction in the non-serve interconnected demand. As a consequence of random and scheduled power cuts, an estimated 8.73 GWh of demand for the main grid could not be served in 2011.

3.5.1 INTERCONNECTION WITH ETHIOPIA

Since 2011, a new interconnector between Addis Ababa, Ethiopia and Djibouti City, funded by AfDB, provides the country with low cost energy supply when the resource is available. Under the terms of the Power Purchase Agreement (PPA), 180 to 300 GWh are to be sold to Djibouti annually. The PPA, which excludes energy sales during Ethiopia's dry season's peak hours, represents 22.35 to 37.24 MW of continuous generation. The supply of electricity is limited by hydrological conditions and the availability of excess energy: the hydro-based generation of Ethiopia is in excess of its demand during the wet season which happens to correlate with Djibouti's high demand summer months.[17]

[17] The World Bank (2014)

The agreed tariffs for 2011 ranged between USD 0.06 and USD 0.07/kWh, depending time of day and season in Ethiopia. The difference in cost between the fossil fuel fired generation in Djibouti and the hydroelectric generation in Ethiopia is so large that Djibouti is likely to import most if not all the energy that is available. EDD sells power to various users at rates ranging between $0.153 to $0.426/kWh depending on the user type. While this arrangement is more than advantageous from an economic point of view in terms of reducing operating costs of EDD, the country may be subjected to excessive dependence on imports from one country; hence power imports from Ethiopia have been regulated by a bilateral contract establishing a maximum energy trading of 243 GWh per year over the period 2012- 2015 and up to 70 percent of the Djiboutian load up to 2019.

The transmission line is routed from Dire Dawa in Ethiopia to Djibouti City. For the majority of the 282-km (175-mile) route, the interconnector runs parallel to the existing Ethiopia-Djibouti railway line, with 202 km (126 miles) in Ethiopia and 80 km (50miles) in Djibouti along national roads No. 1 and No. 5.

Substation construction work included an extension to the existing Dire Dawa substation, involving two 230-kV line bays. One circuit is used to supply Adigala, the principal Ethiopian border town along the 230-kV transmission line route where a 230/33-kV, 20/25-MVA substation has been constructed. The new Adigala substation was constructed to supply another 11 Ethiopian border towns, in the vicinity of Aysha, Dewele and Harewa, through a new network comprising 230 km (143 miles) of 33-kV overhead line and multiple 33/11-kV pole-mounted transformers, including 13 200-kVA units, 33 100-kVA units and 15 50-kVA units.

Adigala substation also includes a 230-kV line bay to supply Djibouti City, where a new 230/63/20-kV substation, equipped with 52/63-MVA transformers, has been built. Another 75 km (47 miles) of 63-kV overhead line was constructed to supply power to the border towns of Ali-Sabieh and Dikhil through a 63/20-kV substation equipped with a single 12-MVA transformer.

The African Development Bank has approved funding to construct a second 230 KV transmission line to Ethiopia, expected to be operational in 2017.

There are three other projects involving energy between Ethiopia and Djibouti:

- Shanghai Electric Group is executing a US $580 Million project for an electric interconnection line for the Ethiopia-Djibouti rail-way with a power output of 70MW.
- The company Black Rhino (USA) will commence performing a feasibility study for an oil terminal and pipeline between the two countries, amounting to US $30 million.
- A Memorandum of Understanding has been signed with the company Poly-GCL (China) for an LNG terminal with a capacity of 150MW and associated pipeline amounting to US $1.2 billion.

3.5.2 GENERATION

The available generating capacity in the country is approximately 126 MW. Currently all electricity produced in Djibouti by the national electricity utility, Électricité de Djibouti (EDD), is generated from thermal generators powered by heavy fuel oil for the main power plants and diesel for the provincial power stations. Despite the country's long term dependence on fossil fuel, Djibouti has no proven oil resources. The volatility of the oil price presents a destabilizing risk for the economy of Djibouti.

The available generating capacity is divided between Djibouti City, Subdivision North (consisting of the towns Tadjoura and Obock) and Subdivision South (consisting of the towns Ali Sabiah and Dikhil). In the 'Subdivision North', there are 6 outlying generators in Tadjoura and a further 5 in Obock providing a total available capacity of approximately 3.4 MW. In 'Subdivision South', there are outlying generators in

Dikhil and Ali Sabieh providing a total available capacity of approximately 2 MW. The principal generating system consists of two power plants in the city of Djibouti. These are the Boulaos Power Station (108.2 MW) and the Marabout Power Station (14.4 MW). Due to unreliability of older generators, EDD's effective generation capacity is limited to 57 MW out of the 126 MW installed.[18]

Supply	Plant	Genset units	Total Cap. (MW)
Main grid	Boulaos	15	108.2
	Marabout	6	14.4
	Tadjoura	6	2.2
Interconnection			
Isolated	Obock	5	1.2
Total			126.0

Table 5: Installed Electricity Generation Capacity in 2011 (Source: AEEP report 2012)

In terms of meeting future electricity generation capacity, Djibouti is currently building the Jaban HFO generation plant with support from the Kuwaiti government. The first phase of an installed capacity of 45 MW is expected in 2015, with plans to grow the capacity of the plant to 140 MW by 2030. This project is expected to be a reserve plant rather than a base load to the system.

3.5.3 TRANSMISSION & DISTRIBUTION

The power transmission system consists of 5 km of 63 kV underground cable connecting the Boulaos and Marabout transformer stations located in the central part of Djibouti and an interconnection line (225 kV) from Ethiopia. The distribution system within the city is at 20 kV. Dikhil and Ali Sabieh are supplied from a diesel plant located in Dikhil via 20 kV distribution lines. The 20 kV network is about 300 km long (240 km in Djibouti and 90 km in and between secondary cities). Energy is supplied to the customers through 300 distribution substations. The Isolated systems' grids are based on low voltage distribution networks. In 2013, EDD managed 43,000 connections.

Regarding those who remain unserved by the grid, the overwhelming majority live in rural villages, large distances away from national grid lines. The cost of transmission lines to connect these communities with low electricity demand to the grid would be prohibitive for the utility at this stage.

3.5.4 ELECTRICITY TARIFFS

Electricity tariffs offered by EDD are defined by a decree of the Ministry of Economy and Finance in charge of planning, and subject to the review of MERN. Electricity tariffs are high and average US$0.32/kWh, mainly as a result of increased oil prices and technical and non-technical inefficiencies. EDD's 2014 tariffs range from a social price of US $0.153/kWh (life-line tariff) to US$0.426/kWh paid by construction sites. Shops and government buildings are charged US$0.397/kWh for electricity.[19] The list of tariffs as of March 2014 obtained from EDD is provided in Appendix 1.

Reductions in tariff and lower connection fees are being envisaged to increase access to electricity by low income households and to support the expansion of the business sector.

[18] The World Bank – Project Appraisal Document
[19] The World Bank Group CSP

4 RENEWABLE ENERGY

4.1 FUTURE OF ENERGY SECTORS

Faced with formidable technical, institutional and financial barriers, Djibouti's energy sector in general continues to struggle to meet resource constraints due to its dependence on imported electricity, high cost of fossil fuel and weak supply infrastructure. The lack of reliable and affordable power is hampering the socio-economic development of Djibouti, affecting the well-being of its people, and limiting investments in industrial and fishery sectors and the private sector in general.

Djibouti has great potential for renewable energy, particularly geothermal, wind and solar power for on-grid and off-grid applications. If properly developed, the renewable energy can contribute to improve its energy security through higher power self-sufficiency, lower the tariffs, increased electrification rates and reliability in the supply. The increase in the share of renewable energies in the country's energy mix has been identified as a key objective of its energy policy as well as of its Visions 2020 and 2035. In both cases, a target of 87-100 percent share of renewables in the energy mix has been set.

To meet its development objectives and a target electrification rate of 60 percent by 2015, the Government of Djibouti intends to reform the electricity sector and create a favorable condition to encourage private investment in these sectors. More specifically, it aims to (i) improve the efficiency and financial performance of the electricity utility; (ii) refurbish and extend the power grid; (iii) and diversify power supply sources through exploration of renewable energy potential and the creation of interconnections.[20]

Over the past few years, a number of the renewable energy technologies are becoming increasingly cost-competitive and their development represents an important opportunity for countries such as Djibouti to capitalize global developments in new energy innovations to diversify their supply options. The use of renewable energy will also contribute to mitigating greenhouse gas emissions.

In a study performed by EUEI PDF and AF Mercados in 2013, four scenarios with an energy mix of fossil fuel, imports from Ethiopia and renewable energy were studied:

- Scenario 1 energy supply was assumed to be composed of conventional power generation (fossil fuel) and imports from Ethiopia without the introduction of renewable energy.
- Scenario 2, geothermal competed with conventional energy sources and imports from Ethiopia.
- Scenario 3 was similar to scenario 2 but with lower fossil fuel costs
- Scenario 4, geothermal energy was no longer an alternative, but other renewable sources such as wind and solar competed with conventional sources.

The analysis suggested that renewable energy can be developed with a degree of confidence to address the energy challenges of Djibouti. The total cost between the various scenarios are similar with the exception of scenario 1 (conventional methods) where the costs are somewhat higher. Scenario 3 provided the lowest cost. In conclusion, the development of renewable energy, particularly geothermal in Djibouti is a solid and viable solution taking into account the assumptions of costs and technical parameters used in the modeling.

---

[20] REEGLE

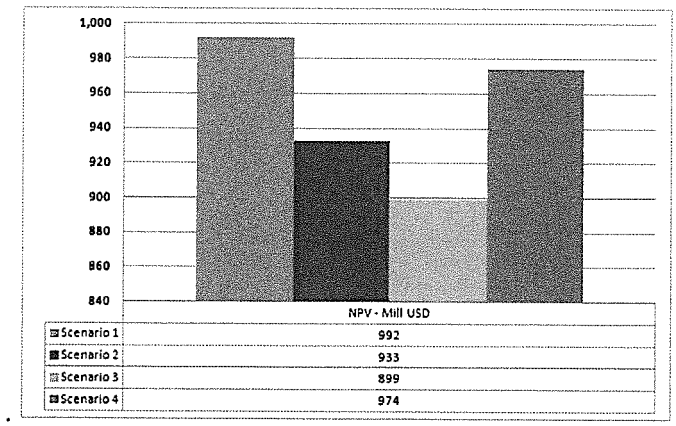


Figure 6: Net Present Value of costs for various energy supply scenarios (Source: AF Mercados)

There are a number of renewable power projects proposed or under development in Djibouti. The following sections will address the key projects individually.

4.2 GEOTHERMAL

The main renewable source of the Republic of Djibouti is geothermal, which also the only energy source available in the country that has firm capacity. The country is located within the Afar Depression; a geologic triple junction structure formed by the intersection of the Red Sea, the Gulf of Aden and the East African rifts[21]. Volcanic and tectonic activity at this intersection has been occurring for 30 million years. One important advantage of developing the geothermal energy is that provides a secure base-load power, whereas other sources of renewable energy are intermittent in nature and thus need to be paired with other technologies. A number of countries such Kenya and Ethiopia are exploring geothermal energy as an option to meet their energy requirements.

Geothermal energy has been investigated since the 1970s with approximately twelve geothermal provinces being identified based on locations of surface hydrothermal manifestations. At the level of the geothermal energy, the technically exploitable potential is estimated between 350 and 650 MWe, and the economically exploitable potential for the only region of Assal-Ghoubbet is higher than 150 MWe.[22] Lake Abbec has also a potential capacity of 150 MW.

An analysis, undertaken by Reykjavik Energy Invest (2008) shows that geothermal power plans could reduce significantly the cost of generation by a margin of nearly USD 0.20/kWh, compared to conventional oil (heavy fuel and diesel) currently in use in Djibouti.

In addition to its low environmental impact compared to other base load power sources and its low cost relative to fossil fuel generated energy, geothermal energy has a number of other attributes that make it an attractive energy option. Its high capacity value and capacity factor display a high level of reliability, and its history of successful exploitation demonstrate both the longevity of the resource and the dependability of the technology. Further, it contributes to the labor market, not just by creating jobs directly, but also indirectly affecting employment in a variety of supporting industries such as service personnel, security

[21] World Bank
[22] Ahmed Aye, 2009

guards, lawyers, and government regulators. Geothermal power production creates a variety of jobs across the project value chain.

Improving its self-generation capability would enable Djibouti to enter the regional power market as a seller of power, strengthening its strategic position. Development of geothermal and other renewable energy resources could provide an avenue for Djibouti to sell base load geothermal power to Ethiopia during the dry season when Ethiopia's hydro generation is curtailed and thermal generation may be required to meet dry season power demands.

In 1987, the World Bank (along with the Government of Italy, the African Development Bank, UNDP, USAID and the OPEC Fund) carried out exploratory drilling with follow-up plans to develop and construct the geothermal power plant. Unfortunately, disbursement was delayed amid donor disagreement concerning additional quantification of the geothermal reservoir.[23]

Lac Assal Field – Fiale Caldera Geothermal Drilling Project.
The Geothermal Exploration Project in Lake Assal is structured as a Public Private Partnership to be executed in three phases: (i) Phase 1 comprises the exploration of Lake Assal geothermal vapor field and confirmation of the characteristics of the fields geothermal resources; (ii) Phase 2 involves the development of the geothermal field and construction of a geothermal power station with an installed capacity of 20 MW; (iii) Phase 3 will involve expanding the power plant to 50 MW.

The exploratory part of the project (Phase 1) will support Djibouti in assessing the commercial viability of geothermal resources in the Fiale Caldera within the Lake Assal region. Grants and soft loans by donor agencies amounting to US$31.23 million[24] will be used to execute phase I, which is the most risky part of the field development. This validation would be performed through a predefined testing protocol after which an international tender offer would be used to attract private Independent Power Producers (IPP) that would finance, engineer, procure and construct a geothermal power plant as public-private partnership (PPP) investment.

The PPP would recoup its capital investment and associated profit under a predefined tariff structure that the initial studies anticipated to have a 90 percent capacity take or pay requirement. The assumption of this structure is that the IPP will be bankable at the agreed tariff provided the cost of Phase 1 is borne by the government and donor agencies. The assumptions used by the World Bank to undertake the financial analysis are provided in the following table:

Activities	Costs and assumptions
Exploratory drilling implementation over the time frame of 3 years	USD 31.2 million
Capital expenditures for geothermal field development for a 50 MW plant (i.e., US$3.62 million per MW installed).Includes expenditures	USD 181 million

[23] RRA report

[24] The World Bank will finance US$6 million. The Global Environment Facility (GEF) will provide US$6.10 million of which US$6.04 million will directly support the total project cost, while US$0.6 million will cover the agency's fee. The OPEC Fund for International Development (OFID) will fund US$7 million. The African Development Bank (AfDB) will fund US$5 million through the African Development Fund and EUR 1.8 million through one of the trust funds it manages. Agence Française de Développement (AFD) will fund EUR 2.5 million. Energy Sector Management Assistance Program (ESMAP) will fund US$1.1 million4 through the Africa Renewable Energy Access II program budget as part of the newly created Global Geothermal Plan. Finally, the Government of Djibouti will make an in kind contribution of US$0.5 million and will be financed by the World Bank

for the first 3 years of exploration.	
Capital structure of the IPP: base case Interest on the debt portion	70:30 debt-equity ratio 6%/year over 15 years
Required rate of return on equity (Re)	Range from 15% to 25%, with the main case for the prospective IPP project being 20%.
Geothermal plant capacity factor	90% capacity factor = 394.2GWh
Operation and Maintenance costs	USD 9,172,500/year
Depreciation of capital assets	30 years
Initial working capital	USD 5,400,000
Taxes	10-year tax holiday, and a corporate income tax of 25% applying in subsequent years
IPP to break even at an electricity tariff	USD 0.0875/kWh to USD 0.0910/kWh

Table 6: Costs and assumptions for financial analysis (Source: RRA Report)

The Phase 1 of the project is divided into three components: The first component is drilling program. This component includes the provision of works, goods and consultants' services for: (i) civil engineering preparatory works necessary for the execution of the drilling program (financed by African Development Bank (AfDB); (ii) execution of the drilling program as designed by the geothermal consulting company (jointly co-financed by Global Environment Facility (GEF), International Development Association (IDA) and OPEC Fund for International Development (OFID); (iii) steel material needed during the execution of the drilling program; (financed by French Development Agency (AFD); and (iv) for the inspection and testing of reservoir flow rates (financed by Energy Sector Management Assistance Program (ESMAP). The second component is technical assistance for the drilling program. This component comprises the provision of goods and consultants' services to: (i) design the drilling program and well test protocol; (ii) execute the well test protocol and ensure third party certification of the results of the drilling program; and (iii) preparation of a technical feasibility study for the geothermal power plant provided that the geothermal resource is suitable for power generation. The third component is project management. This component involves the provision of goods, consultants' services, including audit and training, and operational costs for the purposes of project management and implementation, including monitoring and evaluation. It will be jointly co-financed by Government of Djibouti and AfDB.[25]

The following is a realistic time line for the World Bank/AfDB drilling project:

- January/February 2015 - Proposals for the Project Management and Geothermal Consulting tenders are due
- April/May 2015 – Project Management and Geothermal Consulting tenders are awarded
- September 2015 – The Geothermal Consulting team completes its review and confirmation of the previous resource exploration data, well design and drilling engineering protocols

[25] The World Bank project appraisal document

- September 2015 – Solicitation from short list of drilling contractors and the acquisition of materials, tubulars, consumables, etc. to drill the wells.
- First Quarter of 2016 – Drilling begins at Fiale Caldera

4.2.1 FEASIBILITY ISSUES

(1) Technical

Stakeholders are concerned whether or not the geothermal resource, which is proven to exist, is of sufficient quantity and quality for large-scale power generation. A factor affecting the quality of the geothermal resource and its commercial viability is its level of salinity. Assal 1 drilled in 1975 produced excessively high brine super saturated geothermal resource with dissolved solids that ended up plugging the well. Another concern could be fluid acidity given proximity of magma. There are reportedly technological advances in the tubing to be used that mitigate the salinity risk and now make this project technically feasible.

(2) Risk Profile in geothermal projects

According to the World Bank project document, the Geothermal Power Generation Project is a high-risk high-reward project due to the fact that it finances primarily exploration with a probability of success of 80 percent. Some of the identified risks in the project document are as follows:

- Capacity: The lack of capacity is an issue in Djibouti and constitutes a substantial risk that needs proper mitigation measures. This is all the more important in the case of this project since it will be operating with a newly created Project Team with no experience in donors operations.
- Governance: Any disruption of the Team in implementing the project would have a negative impact, e.g. suspension of staff salaries, change in key staff, etc. The severity of the impact would depend on the nature and length of the disruption.
- Design: Successful completion of the project is dependent on accurately compiling the results of well test data to provide information necessary for IPPs to confidently propose geothermal electric tariff pricing.
- Social and environmental: The proposed operation will include building access roads and drill pads, water supply arrangements and drilling of four deep geothermal exploration wells. Drilling of the wells will be followed by a testing period of approximately three months per well in order to evaluate the characteristics and geothermal potential of the reservoir. In case the results from the proposed operation are negative, the drill pads will be reshaped to blend in with the landscape and all wellheads be minimized.
- Program and Donor: The project is jointly financed by GEF, OFID, AfDB and AFD and therefore comes with a significant coordination risk at implementation.
- Delivery Monitoring and Sustainability: Possible implementation delays due to procurement or technical challenges.

In the event that the well test data and feasibility study demonstrate the technical viability of the project, institutional and regulatory risks still remain. As addressed in Section 5 of this report, there is no regulatory framework for PPPs under current government laws and regulations.

(3) Tariffs and risk allocation issues –potential returns

The prospective IPP would require a 20% return on equity in the scenario yielding the break-even tariff indicated above. The analysis assumes debt is available for a geothermal energy project in Djibouti at an interest rate of just 6%. However, the required rate of return on equity (Re) is market driven and depends on several factors including the general perception of the business climate in Djibouti, the quality of the legal and regulatory PPP framework, as well as project specific factors such as the residual resource risk involved in further development of the geothermal field. All of these factors would contribute to the determination of the required rate of return and ultimately the tariff specified in the Power Purchase Agreement (PPA) with the IPP.[26]

The World Bank model which anticipates a Tariff of $0.09 is very optimistic at best; the tariffs may be too low for the first IPP in the country considering the risks. The IRR will also be a function of the debt/equity ratio and interest rate, which will depend on lender appetite for risk-taking in Djibouti geothermal risk.

It is clear that the Project will be a challenging undertaking by a government with limited experience managing a private sector transaction in the energy sector. There are still many unknowns which could affect the viability of the financing scheme, the implementation schedule and ultimately the expected economic benefits for the country.

4.3 SOLAR ENERGY

Djibouti has outstanding solar resource conditions. Irradiation levels in Djibouti have been studied since the 1980s proving high potential all over the country (5-6.5 kWh/m2/day). Djibouti has two peak periods of insolation (Mar-April, and Sept-Oct) when the diurnal variation between the minimum and maximum radiation values is small. The lowest radiation values are observed from June to August, which coincide with the hot and humid season, but even during this period the solar radiation received by the country are good enough for energy application. According to Pillot et al. (2013), about 82% of the country receives annual mean global radiation of over 2000 kWh/m^2, which amounts to 4.84x1013 kWh or about 20,000 times Djibouti's annual energy consumption[27]. According to the Centre des Études et la Recherche de Djibouti (CERD), the South-West region particularly Dikhil enjoys the highest irradiation levels.

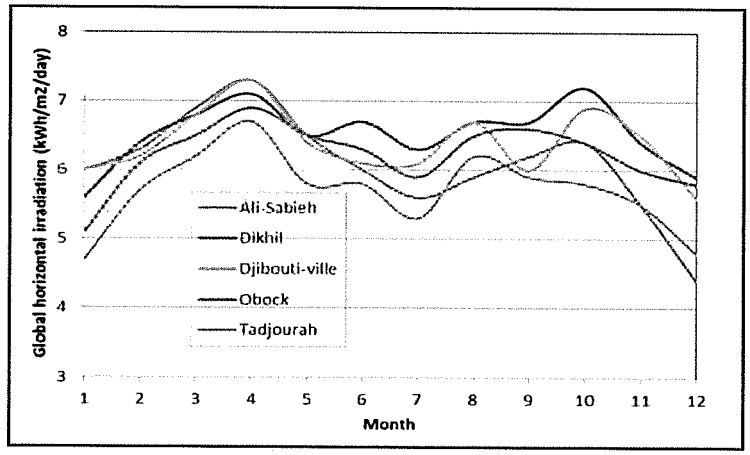


Figure 7: Global horizontal irradiation for 5 stations in Djibouti (KWh/m^2/day) Source: ISERST (1984)

[26] The World Bank project appraisal document (geothermal)
[27] RRA report

There has been a rapid fall in the cost of PV technology globally, enabling grid-based PV to achieve grid parity in a number of markets, and is fast becoming a genuine alternative for countries faced with the twin challenges of energy access and energy security. More recently, PV systems are subject of considerable interest in Djibouti, both for off-grid and on-grid applications. Djibouti's high electricity generation cost offers an important incentive for investors to play a role in grid-based PV. However, it is important to recognize that grid PV remains a capital intensive venture that will require government intervention.

Though the number of shops in Djibouti-ville selling PV components are increasing, the private sector in general is little active in the solar PV sector, as commercial markets are yet to develop due to the size of the country and the lack of governmental policies to stimulate the market. The sector is also constrained by high taxes of more than 33% (import tariff and VAT). Furthermore, the market is unregulated and may be flooded with lower quality products.

Solar energy applications currently in use in Djibouti include a pilot 300 kW grid-connected PV system described below as well as off-grid applications in rural lighting, communications, refrigeration, water pumping. Off-grid PV systems have been in use in Djibouti for over 30 years. Government and donors have funded most of Djibouti's PV investments.

A 300 kWp grid-connected PV plant has been installed with the support of the Japanese government, costing an estimated USD 5.9 million (610 million yen). The solar park occupies an area of 5200 m^2 (1440 PV panels) and provides energy to the CERD campus and feeds the surplus to the grid. The plant became operational in January 2012, and started to provide power to meet the energy needs of the CERD campus. Surplus power is fed into the EDD network. During the first year of operation, the plant produced 508 MWh (10% more than initially planned) of electrical energy with output peaking in October 2012 at about 47 MWh. About 158 MWh of the produced energy is consumed by the CERD buildings and the surplus 350 MWh is fed to the EDD network. Reduced energy output was recorded for the months of June, July and August due to relatively high ambient temperatures and incidence of high levels of hot dry wind.

With funding from the World Bank's Public- Private Infrastructure Advisory Facility (PPIAF) a PV rural electrification study was undertaken to assess rural electrification based on PV with a view to evaluate the opportunities and barriers to launch a program of mini-grids and stand-alone PV kits for 25 villages (19 villages were eventually selected). The study employed two economic models: non-concessional market for PV products and PPP for mini-grids; and delivered the main guidelines for the implementation of solar electrification program through renewable energy.[28]

The Government plans to build a manufacturing facility of PV modules, and two grid-connected PV plants near Djibouti Ville, one of 10 MW (expandable to 25 MW) and another of 20 MW. The construction of a solar thermal plant with a 10 MW capacity is also being studied. The Djibouti Social Development Agency (ADDS) is currently developing an off-grid solar project aimed at achieving the targets set by the Solar Development Program. Although not yet studied, hybridization of the thermal plants of Tadjoura and Obock isolated systems could also be evaluated.[29]

The utility EDD is currently evaluating an unsolicited proposal from the Spanish Company Fotovatios Renewable Ventures (FRV) for a 50 MW Solar park (the Francolin project). In April 2014, a Memorandum of Understanding was between FRV and the MERN to design, build and operate a 50 MW Solar Plant to be connected to the grid along the Electrical line between Djibouti and Ali Sabieh. It is envisaged that a Power Purchase Agreement (PPA) will be signed in 2014 for a period of 25 years. The price of electricity will be 130 $ / MWh levelized (cap) with the aim to reach 120 if some improvements on the main assumptions of the project are obtained, specifically the financial cost. A Tax Free Zone

[28] RRA Report
[29] AEEP report

treatment will allow having a full tax exemption for the project. The plant will be located Petit Bara on a 200 hectares of land owned by the Government.

4.3.1 COST ISSUES

The cost of the pilot solar plant built by the Japanese equates to about USD 20,000/kW, which is very expensive. Today, solar PV installed costs in non-OECD regions for utility scale projects are in the range of $2000-7000 kW. If these figures are applied, cost competitive costs could be obtained for PV in Djibouti, especially for larger PV systems where the economy scale benefits can be significant.

The cost of the above system has been re-calculated, using market data on wind systems and real economic data from Djibouti. The levelized cost results showed a wide variation depending on the capital cost of the system, ranging from about $1.1 million to over $2.5 million over the duration of system lifetime (Figure 8). When viewed in terms of the levelized costs in terms of kWh, generations cost of between $0.11/kWh and $0.25/kWh is obtained (Figure 9).

Of course, there are other important considerations such as the fact that PV systems are associated with high initial costs while fossil-based systems have higher recurrent costs over the duration of system lifetime. However, as the cost of PV systems continues to fall, their value as reliable and cost-effective option for power generation is increasingly enhanced, particularly for periods of peak electricity demand during the day[30].

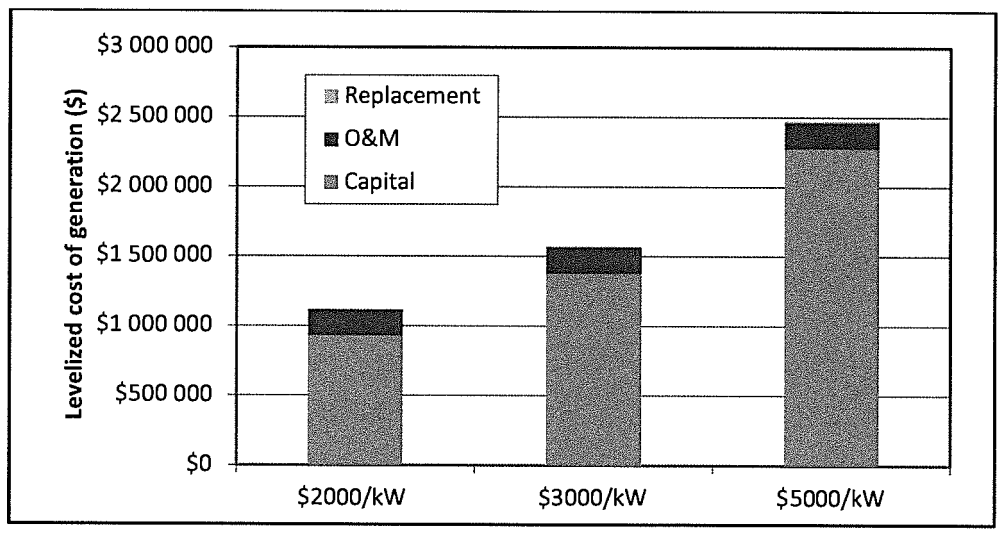


Figure 8: Levelized cost of generation with PV (Comparison at different system costs)

[30] Analysis obtained from RRA report

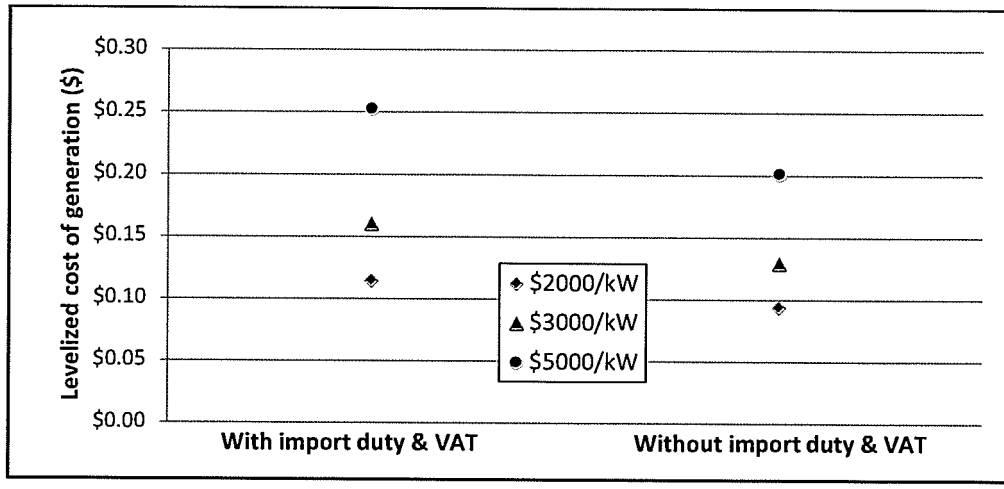


Figure 9 - Levelized cost of generation of different import duty levels in Djibouti

4.3.2 TAX ISSUES

The country has high import taxes amounting to 33%, comprised of an import tariff of 26% and VAT of 7 percent. This rate also applies to PV systems. As demonstrated in the Figure above, the tariffs decrease substantially when important taxes are not included in the financial analysis. If the provision of affordable electricity is an important goal, then the regulation would need to reflect this desirable goal. Exempting PV systems from import duties would increase interest while decreasing capital investments required to harness this indigenous source of energy in Djibouti.

4.3.3 SUBSIDIES- BREAKEVEN

An important feature with respect to financial viability of grid-based PV relates to the agreed selling price of electricity to EDD, which is the distributor. The following table from the RRA report provides tariffs and pay back periods for a range of system costs for the 300 kW system if electricity was delivered to EDD. It shows that the selling price of electricity would need to be at least $0.15/kWh if the payback period for the system is to be within the project timeframe of 20 years. This indicates that for PV options the introduction of enabling instruments such as a feed-in-tariff may be necessary for investors to be motivated to invest.

System size / Selling price	$2000/kW (w/o import duty & Vat)	$2000/kW (with import duty & Vat)	$3000/kW (w/o import duty & Vat)	$3000/kW (with import duty & Vat)	$5000/kW (w/o import duty & Vat)	$5000/kW (with import duty & Vat)
$0.30/kWh						
$0.20/kWh						
$0.15/kWh						
$0.07/kWh						

Table 7: Payback years for 300 kW PV system, using different system cost and tariff figures (Source: RRA Report)

Note: The colors represent the following: Yellow (7 years and under); Light green (7 to 10 years); Dark greed (11 to 15 years); Purple (16 to 20 years); Grey (above 20 years)

4.3.4 TECHNICAL—DUST STORMS AND O&M CHALLENGES

While Djibouti enjoys excellent solar radiation conditions, a technical challenge for PV Panels in Djibouti is the amount of sand and dust accumulation, which will require frequent cleaning. It is estimated that 4 grams of dust per square meter can reduce a solar panel's efficiency by 40%.[31] This is especially problematic during the Khamsin months between June and August. The CERD plant undergoes daily dry cleaning (wiping dust with dry cloth) every month except the rainy month, and distilled water is used for cleaning 2 months of the year. Manual cleaning of large solar panels is labor extensive and also expensive, if using distilled water. Research and development on measures such as advanced surface coatings and artificial cleaning techniques must be studied for countries such as Djibouti to fully benefit from innovations in this field.

4.4 WIND ENERGY

Since 2000, the Government of Djibouti has explored the potential of wind energy resources in Djibouti. In 2002, CERN undertook a wind resource assessment by performing feasibility studies in 14 sites, of which most of them have revealed average wind speeds above 5 meter per second (m/s). Ghoubet, Gali Maaba and Day gave results close to 9 m/s. According to AF Mercados, the site of Ghoubet remains the most interesting. The following Figure shows the wind resource distribution across Djibouti, confirming that Djibouti hosts some excellent sites to harness wind energy resources.

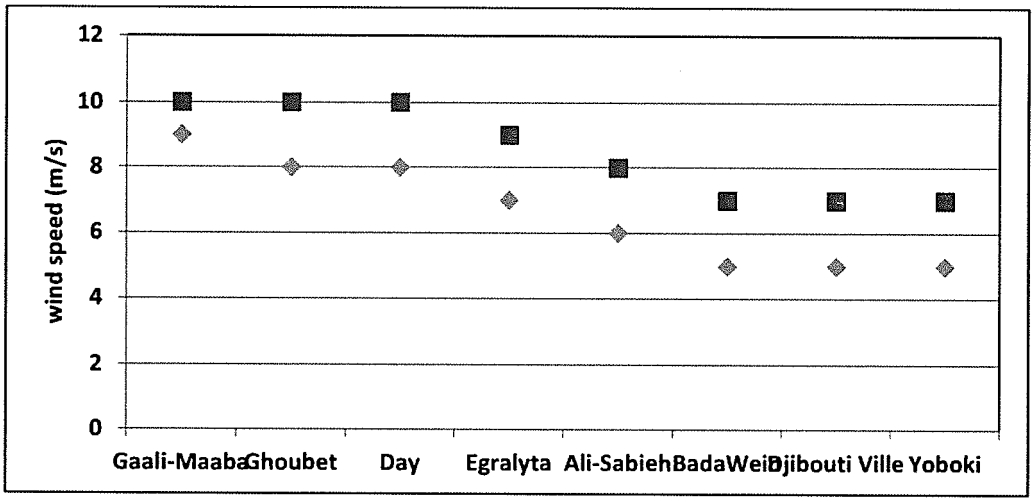


Figure 10: Average wind speed of various sites in Djibouti at 40m (CERD, 2006)

Much of the limited experience of Djibouti in wind energy is in water pumping at a pilot level or for private use, resulting in low O&M capacity. Currently there are no grid-connected wind power generators in Djibouti.

Wind power in Djibouti can be harnessed to drive a range of productive activities such as fishing, which remains underdeveloped in Djibouti – largely for lack of energy services for cooling and processing. Ice-making and chilling process at the fisheries is energy intensive, but Djibouti has the energy resources to kick start an industry that could generate much needed employment opportunities and significant economic benefits. Employment factors for wind plants at manufacturing, construction & installation (C&I) and O&M are 6.1 job-years/MW; 2.5 job-years/MW; and 0.20 jobs/MW respectively. Using these

[31] Gastli and Charabi, 2011

factors and regional multiplier for Africa (at 4.3), a 20 MW wind plant can generate as much as 540 job-years in C&I and 43 jobs in O&M32 in Djibouti.[33] Ghoubet is identified as a location to wind farms with a capacity of 20 MW. Possible sites such as Ali Sabieh, Bada Wein, Egralyta and Djibouti ville could generate a capacity above 5 MW; and Day, Hol-Hol and Yoboki could generate below 1 MW.

In recent years, wind energy for electricity generation has generated some interest in the Djiboutian government, donors, and private investors. Several projects are in the pipeline:

Qatar Petroleum International (QPI) has signed a memorandum of understanding in 2013 with the EDD to evaluate plans to build a 60 MW (2 x 30 MW) wind farm, near Lake Assal. Tractabell Engineering - GDF Suez won the RFP to conduct the feasibility study. Upon completing the feasibility study and wind regime assessment, Tractabell will prepare a tender document for an EPC contractor to erect the wind turbines. This project will be owned and operated by the government of Djibouti.

The Projet d'eau potable et de l'énergie renouvelable (PEPER; Producing Safe Drinking Water with Renewable Energy) relates to the agreement for the EU to provide 90% funding for a €46m (USD 55m) wind energy and water desalination plant in Djibouti. The plant will initially have a capacity of 22,500m³/day, which will be expanded to 45,000 m³/day during the follow-up phase. The new plant should provide sufficient water for 200,000 people, over one-quarter of the population. From an energy standpoint, the construction of a 20 MW wind park in Ghoubet is being considered by the European Commission for the provision of power supply to seawater desalinization. A pre-feasibility analysis was carried out by the project developers for grid-connected wind power generation with a reference capacity of 20 MW (63 kVA) with an annual generation rate of 82 GWh and system cost of USD 2500/kW. The analysis showed a payback period of about 10.7 years for a system that will operate over a 20 year period, feeding the grid at the cost of USD 0.075/kWh, but the payback period varies significantly according to the selling price of power. It could be as low as 3 years, if the tariff is the same as the current tariff for fossil fuel (USD 0.30/kWh). The levelized cost result was also encouraging at USD 0.056/kWh, illustrating that the large wind system can generate electricity at a rate which is competitive with the incumbent generation system. Other scenarios are also being studied.[34]

China has also signed an agreement with the Djiboutian government to develop the wind resources in Ghoubet. Nonetheless, being located close to Lake Abbec, the Ghoubet project faces serious challenges due its remoteness. If the geothermal plant of the Lake Abbec is built, both projects could share the same interconnection line. The American-affiliated company, Maple Indian Ocean Resources is also pursuing a 40 MW wind power plant.

As indicated earlier, Djibouti experiences strong dust and sandstorms during the summer months. Dust, sand, and temperatures extremes can cause failures and increase the frequency of repairs and maintenance of wind turbines.[35] However, it is also known that at heights above 50 meters, the amount of dust reduces, implying that larger wind turbines are likely to withstand sandstorms better than smaller turbines.[36] Furthermore, turbines exposed to prolonged sunshine may also undergo faster wear-and-tear, particularly to the exposed plastic and rubber parts. The effect of local weather conditions on wind turbines should therefore be carefully considered when deciding on the size of systems and type of wind turbines.

---

[32] Manufacturing has been omitted from this calculation given that much of the technology is likely to be imported, at least in the short-run.
[33] RRA Report
[34] RRA report
[35] Zgou and El Thalji, 2011
[36] Awaleh, 2014

4.5 OTHER RENEWABLE ENERGY OPTIONS

The overwhelming majority of those who are or will remain unserved by the grid live in rural villages located large distances away from national grid lines. The electrification for rural communities through small-scale off–grid electricity production using renewable energy can boost the social and economic conditions of poorest of the poor in Djibouti. Given the dispersed nature of settlements and the type of economic activities, decentralized systems are part of the solution to Djibouti's energy access dilemma.

4.5.1 SMALL-SCALE GEOTHERMAL POWER GENERATION

There are over 50 geothermal power plants in the world with electrical outputs at or below 5 MW. Small-scale geothermal power plants have the potential for widespread application, but achieving cost effectiveness in small plant sizes presents a number of challenges. Still, a number of studies have shown that the cost of electricity, ranging from USD 0.06/kWh to USD 0.10/kWh have been obtained in the US.[37] More recently, Japanese engineers have been pioneering small-scale geothermal plants for community energy use with a view to create a new energy source while revitalizing local communities. The modularity of geothermal plants can be attractive for Djibouti given some settlements are likely to remain away from the grid line.[38]

4.5.2 OFF-GRID PV ELECTRICITY

The main decentralized renewable energy system being promoted in Djibouti is PV solar, either as stand-alone or mini grid systems. As previously mentioned, a PPIAF grant Feasibility Assessment for Solar Rural Electrification was signed in February 2012. The objective of the grant is to assess the most viable and sustainable rollout option available to electrify 25 villages in both peri-urban and rural areas. The study has determined the following:

- Individual solar kits for village within 10 kms to the grid network are deemed appropriate as an interim solution before extending the network to these villages.
- Only four out of the 12 villages that qualified for mini-grid system installation had a diesel mini-grid (though not always working) installed.
- The Regions of Obock and Tadjourah are proposed to be the first non-concessional areas to offers stand-alone PV systems.
- Services to charge portable batteries is largely reserved for less affluent households that cannot afford a connection fee. In this option, the solar system is treated as a 'power station', used to charge small batteries that can be easily transported to a charging station located in a central location.

As regards rural electrification, the government has set a solar development plan with the following targets: (i) equipping 70 rural boreholes and 100 other wells with solar pumps, (ii) equipping all rural health centers and 100 rural schools with solar arrays, (iii) increasing rural electrification up to 30% by 2017 with the installation of solar PV systems in 5,000 households.[39]

In Djibouti, groundwater sources account for about 95% of the potable water needs, hence energy use for pumping water is a critical input in water access and in determining the associated costs. With lowering PV technologies prices and considering the volatility of the fossil fuel costs, PV pumps are rapidly

[37] DiPippo, 1999; Gawlik and Kutscher, 2000
[38] RRA Report
[39] REEGLE

becoming increasingly attractive options. However, technology specific cost analysis must be carried out to assess the viability of different technologies in different parts of Djibouti. In some areas where the wind speed is favorable, mechanical wind turbine could be attractive options.

4.5.3 OFF-GRID WIND ELECTRICITY

Wind power using stand-alone and mini-grid delivery systems can provide much needed power for rural communities on a decentralized scale. However, it is also important to recognize that Djibouti's experience in wind energy is limited to a few cases of wind pumping, and much work awaits the policy makers in order to prepare the institutional, regulatory and policy environment for investment in distributed wind energy systems.

4.6 FINANCING RENEWABLE ENERGY

International negotiations on climate change now open up new funding opportunities through the new concept of "Nationally appropriate Mitigation Actions" (NAMA).

NAMA is defined by the roadmap Bali (COP 13) as any mitigation of greenhouse gas measures at national level but must be measurable, verifiable and Notifiable (MVR). In this context, developed countries are required to support developing countries in the implementation of NAMAs through its financial support, technical assistance and technology transfer.

Negotiations at COP 17 in Cancun confirmed the political agreement in Bali and Copenhagen. Developed countries are committed to the provision of funds, primarily the Green Fund (Green Fund) which should be the main instrument for the funding of NAMA. This fund, to be managed by the World Bank, will mobilize 100 billion US dollars per year from 2013 to 2020.

Djibouti is most probably eligible and could benefit from this fund for the implementation of its policy to develop renewable energy sources for electricity production. The Government of Djibouti must submit a document NAMA describing its objectives, its institutional structure, its impact in terms of CO2 reduction and sustainable development, the need for funding and technical assistance as well as MRV (Measurement, Reporting and Verification) set up for monitoring impacts.[40]

[40] Obtained from the EUEI PDF and AF Mercados report on energy mix scenarios.

5 NEXT STEPS

The power sector of the Djibouti faces critical barriers that affect the ability of Djibouti to meet the twin concerns of energy self-sufficiency and energy access. There is a long list of measures that the government need to undertake on legislative, institutional and regulatory fronts as well as technical and management capacity building to attract private investors and developers for IPPs and form public-private partnerships.

5.1 FIALE CALDERA PROJECT SPECIFIC TASKS

While the World Bank/AfDB sponsored drilling program at the Fiale Caldera field is cumbersome and will likely take two years to complete, the following actions will serve to facilitate international competitive tender for the project, and to expedite the release of a general notice of the project, a request for an expression of Interest (EOI) and the pre-qualification of bidders for the geothermal project before all of the wells are drilled.

- ***Assessment of the potential Fiale Caldera geothermal project development costs with more realistic finance model.*** The World Bank model which anticipates a tariff of $0.09 may need to be reviewed and confirmed. It will be important to educate the different ministries in the government on what the likely costs will be and ways in which the government can reduce those costs. Similar to our work with the GDC in Kenya and GreenMax Capital USAID is well positioned to help the government to canvas the international development and finance community to assess what their investment expectations would be in Djibouti and what terms they would be willing to invest in the sector.

- ***Review credit enhancements and their cost implications on the project.*** Associated with the evaluation of the likely cost of the Fiale Calder geothermal project, is the need to identify what credit enhancements can be put in place to attract private investment and the costs implications of those enhancements on the project. This is also related to the offtaker issue. These credit enhancements will likely involve government of Djibouti guarantees which would add to the cost of the project to the government and relative benefit they expect to receive from private sector participation in the sector.

5.2 LEGAL AND INSTUTIONAL FRAMEWORK

As previously indicated, Djibouti lacks a comprehensive legal and institutional framework for attracting and implementing public private partnership transactions in the infrastructure sectors. This creates both uncertainty and ambiguity about the rules of game and complicates government efforts to attract serious investors in the key infrastructure sectors. However, the French Development Agency, the World Bank and PPIAF have indicated that they will be supporting efforts to develop laws and regulations for PPPs.

- ***Develop a national electricity law:*** EUEI Partnership Dialogue Plan is developing a draft Electricity Law that covers the regulatory framework, tariff setting, granting of licenses, incentive measures to attract private sector investments, technical requirements and renewable energy sources framework, and the roles and responsibilities of different stakeholders. The Law would provide a much needed reassurance to private investors because there is currently no clear legal basis for private sector investment in the energy sector.
- ***Revise the tax code:*** The current 33% tax on imports is prohibitive. The government is currently revising its Commercial Code and eventually the tax code to provide more incentives for private sector investment.

- *Develop a geothermal law clarifying the rights to the resource:* The viability of using the mining law to issue a concession needs to be evaluated to determine if modifications to the law can be made or if a separate geothermal law is required.

5.3 IMPROVING REGULATORY FRAMEWORK

The lack of a regulatory instrument in power provision is a major impediment, especially in constraining the participation of non-State actors such as independent producers (IPPs). The key regulatory function involves striking the right balance among financial sustainability, customer service quality politically and socially acceptable tariffs. Strong off-take agreements enable IPPs to generate enough revenue to operate their system, service their debt, and even invest in upgrades and expansions, while the tariffs must be affordable enough to satisfy the needs of the general public and to stimulate private sector economy, while enticing operators to be as efficient as possible. Other functions include allocating subsidies (especially important in rural areas), addressing public complaints and resolving possible conflicts between the government and the IPPs.

- *Establish regulatory instrument for the energy sector:* An appropriate regulatory instrument goes some way to gaining the interest of more private sector players in Djibouti. Regulatory functions are best implemented when the regulatory entity, permanent or ad-hoc, is independent from severe government influence. If the government of Djibouti decides to assign this EDD as the principal off-take for new IPPs, then the capacity of EDD must be developed to undertake these important tasks. It will therefore need to upgrade the performance of its key staff and equip them with tools to undertake the negotiation, procurement and oversight of PPAs. Its internal regulatory staff will need to be trained in modern principles of ratemaking, the conduct of cost of service surveys and the implementation and enforcement of utility management policies. These training programs will serve to create a pro-business culture within EDD which will enhance its ability to attract major international IPP developers and contractors. EDD, along with the staff of the MERN, will also need training PPA negotiation and drafting techniques and as well as training on structuring concessions for natural resources.
- *Streamline the regulatory process for permits.* Numerous permits will be required for the development of a geothermal project. The inter-ministerial geothermal working group under ODEG will need to develop a process for streamlining such permits.

5.4 PUBLIC-PRIVATE PARTNERSHIPS

As indicated in this and numerous other reports, Djibouti must build its technical and regulatory capacity to meet the challenge of engaging in transactions with private sector developers. The current level of experience, technical knowledge and managerial expertise of key staff in the energy agencies is not adequate and must be upgraded to meet the needs of structuring PPP projects in renewable energy power projects.

- *Develop a national PPP framework:* A PPP legal framework is needed in order to issue a concession. A higher level PPP legal framework likely to be developed with support from the World Bank, AfDB and AFR. A more specific framework may be required for the power sector.

- *Create a PPP unit:* The Ministry of Economy, Finance and Planning is the entity that will most likely be the home of the inter-ministerial coordinating committee for PPPs. To build up a public sector institutional capacity for PPPs, the Ministry will need to create a unit which will serve as a center of knowledge and technical resource for the other ministries and agencies on PPPs. A PPP unit working across several ministries and departments will also need to develop PPP procurement

and policy guidelines to ensure that all PPPs are carried out in line with international best practices. It will also need to be able to enforce planning, procurement and implementation standards for all PPP transactions. Specialized training will be needed along with outside PPP advisory support to implement these reforms and train the Ministry staff. These trainings will cover all of the relevant aspects of PPP project development including financial modeling, fiscal risk analysis, legal documentation and negotiation and project risk monitoring and supervision techniques.

Additional consultations with the World Bank and IFC are needed to better understand their planned support for Djibouti's PPP legal and regulatory framework as well as the eventual public procurement of the Fiale Caldera geothermal energy project.

5.5 TRAINING IN PPP & REGULATION

Tetra Tech organized a workshop in October 2014 on Public-Private Partnerships for representatives from the Ministry of Energy, the utility EDD, the research institute CERD, the new geothermal development unit ODDEG and the Ministry of Economy and Finance. The workshop was well received and participants actively participated in discussions. Nonetheless, a two day course is only an introduction to PPP and additional training on specific areas of PPP, such as financial modeling, procurement, negotiating and structuring PPAs and institutional mechanisms for managing the procurement and supervision of PPP projects, is required to build indigenous capacity.

The following presents a preliminary assessment of the training programs that should be considered for the Djibouti energy sector to build strengthen institutions and build capacity to meet the challenges of resource diversification through private sector participation. The two main components of the training are PPP and Regulation. The PPP training shall cover in depth the issues touched upon superficially during the PPP training workshop. Enhanced Regulation will be needed to support the development of new regulatory body within the MERN and the implementation of the new Electricity Law. A broader training program will be needed on regulation once the entity is created and its internal processes are more precisely defined.

I. Component 1: Public Private Partnership
   a. **PPP Policy and Regulatory Framework**—a program focusing on the policy guidance and regulatory framework for PPPs in infrastructure. This course will examine:
      i. Review of different legislative models for regulating PPPs,
      ii. The role of PPP Units and sector nodes and risk management offices
      iii. PPP project cycle—creating and enforcing a PPP project cycle with gateway reviews to ensure high level technical and political oversight and support

   b. **PPP Project Appraisal Techniques**—a program focusing on the identification and quantification of risks in PPP projects and strategies for allocating and mitigating risks to achieve Value for Money. This training will focus on the following themes:
      i. Value for Money—what does it mean and how does it apply in the appraisal and identification of viable PPPs
      ii. Risk analysis—what are the key risks and how are they quantified and used to structure a financially bankable PPP project
      iii. The Risk Matrix and Risk Register in a PPP project—how can the risks be categorized and tracked throughout the PPP project cycle

iv. Financial Modeling in the PPP project—how to manage and develop a financial model for a PPP project to measure project sensitivities, potential IRRs and fiscal impact
v. Economic Cost Benefit Analysis in a PPP project with special focus on energy projects—how to determine the least cost option and most viable economic project

c. **Project Management Techniques**—a program to train project managers in the latest techniques and processes for efficiently managing and supervising the implementation of PPP projects including IPPs. It will examine the following major themes:
   i. The institutional models for tracking and measuring project performance with the aid of Key Performance Indicators—survey techniques for stakeholders, use of auditors etc.
   ii. Enforcing the PPP contract—contract management and supervision within the public sector, use of penalties and incentives to optimize performance
   iii. Management techniques for a partnership—governance models and processes to enhance communication and problem solving
   iv. Fiscal Risk management techniques—review of the techniques applied to quantify and account for the fiscal risks embedded in PPP contracts and government credit enhancements
   v. Controlling and managing the construction and operational risks—role of independent engineers, insurance advisors and technical experts in the execution of PPP projects

d. **Project Procurement and Transaction Negotiation Techniques**—a program focusing on processes for procurement, preparation of the RFQ and RFP, Project Finance and term sheet negotiation. The training will be aimed at the following topics and themes:
   i. Procurement of the PPP contract—techniques for drafting and structuring the RFP to secure optimum investor interest; how to structure selection criteria for prequalification and award of the contract;
   ii. Regulating unsolicited bids and examination of international best practices for managing and controlling direct negotiations; designing procurement guidelines for PPPs

e. **Project Finance**—examination of the principles of project finance as a financial and legal model of allocating risks in PPPs. The program will cover the following issues:
   i. Understanding the core financial drivers of private sector investment and financing in PPPs (IRRs, DSCRs, D/E), negotiating the term sheets and role of the lenders and financiers in PPP projects; inter-creditor issues and role of security and credit enhancements in project finance
   ii. Examination of the project finance terms sheet for a BOT power plant closing—key terms; negotiating parties and their role
   iii. Inter-creditor issues—understanding the perspective of different lenders and their tolerance for risks; political risk insurers and their roles

f. **Preparation of PPP contracts for energy projects**—a program designed to instruct on how to structure and bankable BOT contract. Key provisions in IPPs

for hydro, geothermal, solar, wind and thermal power projects. The topics covered will be the following:

i. Key financial clauses in the BOT/ BOO power project—review of sample contracts and their key provisions governing contract effectiveness, construction milestones, tariff clauses and capacity charges, penalty provisions; transmission obligations, pass through of fuel and energy costs, early termination payouts
ii. Key legal issues in the BOT—review of enforcement issues and role of arbitration, mediation and alternative dispute resolution mechanisms in PPP contracts, benefits and costs of litigation; lender step in rights and obligations
iii. Transmission Regimes and power pools—regional mechanisms and contracts for sharing electricity across geographic and political boundaries; review of governance provisions and cost allocation regimes. Wheeling agreements and role of the Independent System Operators.

II. **Regulation in the Energy Sector**

a. **Tariff Regulation**—a program to examine different systems of tariff regulation. The course should introduce the participants to the tariff policies that will need to be developed to complement the introduction of IPPs into the Djiboutian power grid. The program will examine the following key themes:
   i. Price Cap and Rate of Return systems of tariff regulation—pros and cons of each system and their impact on the bankability and risks to the IPP.
   ii. Tariff design issues will also be considered
   iii. Feed in Tariff regimes to subsidize renewable energy projects
b. **Regulatory Impact Analysis**—examination of the principles and techniques for conducting regulatory impact analysis in the energy sector
c. **Quality of Service Regulation in the energy sector**—how quality of service can be factored into the regulations in the power sector from production through transmission and distribution.

5.6 CAPACITY BUILDING OF EDD

The viability of the national utility EDD, in terms of reducing losses, improving collections and the overall financial management, as well as capacities and risks associated the transmission and local distribution system must be examined to enhance its overall performance.

- ***Assess the technical and financial viability of the utility.*** Ormat has already indicated that it will not invest in Djibouti unless it had a viable offtaker such as the US military base. The French Development Agency (AFD) also expressed its concern with how to make EDD financially viable. The AFD plans to undertake a financial analysis of EDD and the power sector. In addition, the EU has committed $12 million Euros to finance a new control center for EDD. Substantial investment will be needed to modernize the nation's transmission and distribution system in the coming years.

5.7 NATIONAL STRATEGY AND POWER MASTER PLAN

As previously mentioned, there are a number of donor efforts underway to strengthen the planning of the energy sector in Djibouti. The EUEI Partnership Dialogue Plan is assisting the Djiboutian authorities to formulate a ten-year National Strategy and a five-year Action Plan for the development of the electricity sector. It is envisaged that the National Strategy will embrace renewable energy as a key component of a

longer-term energy vision, and provide a systematic roadmap for delivery. The strategy is further expected to present a robust rural electrification strategy, necessary to bring into sharp focus the needs and demands of rural communities and to provide clear guidance on how to achieve progress in this sector. The French development agency is also developing a master plan for the country's transmission lines.

- *Need for a long term power sector master plan*: Djibouti needs to move away from the current ad hoc approach to developing its power sector where it responds to unsolicited proposals. This long-term energy plan is essential for Djibouti to help develop clean, reliable and affordable energy systems and to encourage conservation, taking into account the timeline required for each energy source to be developed. An overarching power master plan is a pre-requisite for a well-planned energy sectors with ambitious objectives. This is an area where greater coordination among donors and their implementing consultants is required. A national dialogue is also needed for the government to settle on what generation options and mixes it wants to pursue and how much power it plans to import from Ethiopia.

- *Support implementation of National Strategy and Master Plan:* Once the National Strategy has been completed, good implementation mechanisms will be required to deliver meaningful results. The Djiboutian authorities will need support to implement the various aspects of the strategy and more importantly to monitor their performance with regard to their objectives. By moving away from ad hoc projects, Djibouti will need a program management and monitoring system to enable coordinating programs with various donors and encouraging investors. It furthermore will need to monitor its performance in attaining the objectives set-out in the Action plan.

5.8 MANAGEMENT OF REGIONALLY INTERCONNECTED POWER SYSTEM

In addition to the broad area of IPPs and project finance transaction analysis, Djibouti will also increasingly rely on regional interconnections with Ethiopia and other countries of the region to supplement its power supply and to provide an outlet for excess energy exports.

- *Strengthen the capacity of Djibouti to be an active player in the regional power pool of East Africa:* EDD staff and MERN technical staff will need to familiarize themselves with key technical and financial aspects of managing a regionally interconnected power system, establishing a governance structure for a System Operator, congestion management, financial transmission rights, nodal pricing and other market elements. Such training should also expose Djiboutian authorities to interconnection systems used in other parts of Africa and outside the region. Furthermore, Djibouti's strategic location as a gateway from Africa to the Middle-East creates significant opportunities for energy trade. Djibouti could position itself as a transcontinental transmission hub and place itself at the heart of the $22 billion African Union backed project to develop a pan-continental electricity transmission grid by 2020. Local capacity building would be important to capitalize on this opportunity and become a visible player in the regional power pool of East Africa.

5.9 IMPROVING BUSINESS ENVIRONMENT

As mentioned early in the report, Djibouti is ranked very low in terms of the 'World Bank doing business' index, with entrepreneurs facing higher labor and production costs, problem of access to resources such as energy, water and telecommunications. The role of the State is vital in encouraging the private players, protecting the public interest and setting in place transparent processes. In fact, the World Bank Group's Country Partnership Strategy (CPS) placed improving business environment as one of the two broad pillars of a diversified economic growth and poverty reduction objectives. The report states: 'there is a need to strengthen the business-enabling environment through better-quality and more affordable energy

and telecommunications services as well as improvements to the investment climate and governance framework.'

In collaboration with the World Bank, USAID could provide various supports in achieving this important objective which will directly encourage the participation of IPPs in the renewable energy sector.

5.10 AVAILABILITY OF DATA

Data and information on two fronts, energy consumption and energy supply using renewable energy resources, is non-existent, irregular or inconsistent. Furthermore, no one entity is in charge of collecting, processing and storing data. Without reliable information, planning and implementing effective energy efficiency measures, as well as project planning for resource development is very difficult.

According to the RRA, the Government of Djibouti should take the following steps: i) collect & centralize energy demand and consumption data in a single institution to serve as a port of call for those requiring energy data. This would need to be updated regularly; ii) install, monitor and maintain solar and wind measuring stations in additional areas; iii) build a national inventory on renewable energy resources. In taking this forward, an institution such as CERD could play a pivotal role in serving as the data center. This would also allow CERD to build the required human and technical capacity to undertake regular energy demand surveys and renewable energy assessments, both at the service of the government and other clients. Development partners and organizations could play a critical role in facilitating and providing technical support and training to CERD or a relevant institution that can play the role of becoming hub for energy data and information.

5.11 TECHNICAL EXPERTISE

Djibouti suffers from a major capacity deficit in the energy sector in general. To better manage PPPs, the technical expertise of the country in terms of knowledge of the available technologies, environmental phenomena which affect the performance of the resources, the capitals costs versus life cycle costs and the appropriateness for domestic conditions must be enhanced.

For the foreseeable future, Djibouti will rely on sourcing technologies, and to some degree, technical expertise from abroad. This will need to continue in parallel with efforts to upgrade innovation systems that will support domestic technology adoption and development. Here, the role of tertiary education institutions and research centers such as CERD in skilling people, undertaking country-specific research and carrying out technical seminars will contribute considerably to knowledge generation and sharing in the energy field.[41]

5.12 USAID CONTRIBUTION

The following section identifies short term and long term actions that USAID could undertake in an effort to contribute to universal electrification, energy sufficiency and energy security of Djibouti. The list of actions is not presented in any order of priority, and the list of actions is unlikely to be exhaustive.

USAID NEXT STEPS (6-12 MONTHS)

- Mobilize in-country Power Africa transaction advisor and attend the November 19 PPP workshop in Djibouti;

[41] RRA report

- Work with EDD to evaluate PPAs and project documents for the proposed solar, wind and transmission projects and assess their viability;
- Include EDD in CDLP's next East Africa PPA training and provide follow-up advisory assistance through the embedded advisor;
- Provide CERD and ODDEG with third party technical expertise to assist in the review and validation of resource findings and the location of the Fiale Caldera wells in the next six months;
- Work with the World Bank drilling advisor to help set up the ODDEG led inter-ministerial working group for the development of the Fiale Caldera geothermal energy project;
- Provide training in geothermal energy project development, the roles and responsibilities of the ODDEG led inter-ministerial working group and establishment of a project development timeline and strategy for developing and implementing a bankable Fiale Caldera project;
- In collaboration with the World Bank, provide training in financial modeling and work with the ODDEG inter-governmental geothermal working group to develop a more realistic financial model of the Fiale Caldera project including the evaluation of different credit enhancements and project structures required for a bankable project. This might also include a market assessment similar to the work with GreenMax capital with the Geothermal Development Company (GDC) in Kenya;
- Include EDD and Ministry of Finance representatives in the regional Power Africa transmission cross border trade working group and regional NARUC regulatory workshops;
- Collect copies of the mining and water law and provide an initial evaluation of the need for a separate geothermal energy law;
- Together with the World Bank, explore additional capacity building to facilitate the development of a legal PPP framework in Djibouti;
- Through the country Transaction Advisor, assist in facilitating greater collaboration among donors on energy issues and in particular ongoing efforts to develop an up-to-date power sector development plan.

LONGER TERM SUPPORT (12-24 MONTHS)

- Enter into a utility partnership between E3's US Energy Association Utility Partnership and EDD;
- Provide training on tariff analysis and development;
- Assist in developing a geothermal energy law;
- Develop energy specific PPP implementing and procurement regulations and provide training for their implementation;
- Collaborate with the World Bank to develop the project structure for the competitive solicitation of the Fiale Caldera project, assist in developing the notice of the project, a request for an Expression of Interest (EOI) and the pre-qualification of bidders;
- Provide training in the development of tenders, technical and financial review of proposals, project management, and oversight;

- Support a national dialogue on the development of a long term power sector and transmission plan.

The World Bank recently hired a finance consultant and an independent drilling consultant for six months to help move the Geothermal Consulting Contract and PIU forward. An Engineering Manager at Geothermal Resource Group in Reno, he will serve as a geothermal drilling advisor and is due to arrive in country in November. He will help move the two solicitations forward but will also help ODDEG set up its inter-ministerial geothermal working group. It will be important for USAID's advisors to coordinate with this advisor to get a better understanding of his work and how USAID can provide follow-on support when his consultancy is over next spring.

APPENDIX 1: ENERGIE DE DJIBOUTI TARIFFS

The following rates are in effect as of March 31, 2014 (Source: EDD)

			Code	Prix Unitaire par Tranche 1°	Prix Unitaire par Tranche 2°	Epaisseur des Tranches par Mois 1°	Epaisseur des Tranches par Mois 2°	Prime fixe par Mois	Avance sur Consommation	Maintenance
				FD	FD	KWh	KWh	FD	FD	FD
BASSE TENSION	DOMESTIQUE SOCIAL 1	PS=1 KVA	1	27	62	200	le surplus	544	3668	
	DOMESTIQUE SOCIAL 2	PS = 3 KVA	17	40	58	200	le surplus	951	18574	
		PS = 6 KVA		40	58	200	le surplus	1069	37148	
	DOMESTIQUE	PS = 9 KVA	2	48	55	210	le surplus	1308	55721	
		PS > 9 KVA		48	55	105+ (5 x PS)	le surplus	1494	18574 par Tr. de 3 KVA	
	GENERAL	PS < ou = 36 KVA	3	62	-	Conso.Totale	-	605	3668 pour 1 kVa	
	NON DOMESTIQUE	PS > 36 KVA		62	-	Conso.Totale	-	66 x PS	18574 par Tr. de 3 KVA	
		avec ind P max		62	-	Conso.Totale	-	80 x PS	7715/kVa	
	PAIN POPULAIRE		4	48	-	Conso.Totale	-	1520	18574 par Tr. de 3 KVA	
	DEGRESSIF	PS < 08 KVA	5	62	54	180 x PS	le surplus	519	7715/kVa	
	(av./ind/max.)	PS > 08 KVA		62	54	180 x PS		1900 x (PS-8)		
	PETITE ET MOYENNE ENTREPRISE		16	50	-	Conso.Totale	-	1520	18574 par Tr. de 3 KVA	
	ECLAIRAGE PUBLIC		8	59	-	Conso.Totale	-	-	-	
	CHANTIER		9	62	-	Conso.Totale	-	7756/18kVa	192841/18kVa	
MOYENNE TENSION	DJIBOUTI		11	50	40	de 0 à 500 KVA: 220 x PS de 501 à 1300 KVA: 200 x PS plus de 1300 KVA: 175 x PS	le surplus le surplus le surplus	1931 x PS 1738 x PS 1642 x PS		
	REGIONS DE L'INTERIEUR		12	60	50	de 0 à 500 KVA: 220 x PS de 501 à 1300 KVA: 200 x PS plus de 1300 KVA: 175 x PS	le surplus le surplus le surplus	1931 x PS 1738 x PS 1642 x PS	<u>De 0 à 36 KVA</u> 15950 DJF par tranche de 3 KVA	19214 jusqu'à 40 kVa
	INDUSTRIEL 1	PS > ou = 250 KVA	13	37	41	de 0 à 500 KVA: 220 x PS de 501 à 1300 KVA: 200 x PS plus de 1300 KVA: 175 x PS	le surplus le surplus le surplus	1931 x PS 1738 x PS 1642 x PS	<u>Le reste:</u> 6625 DJF par KVA	<u>Le reste:</u> 4425 DJF tranche de 20kVA
	INDUSTRIEL II	PS > ou = 250 KVA		33	-	Conso.Totale	-	1642 x PS		

REFERENCES

International Renewable Energy Agency, 'Renewable Readiness Assessment for Djibouti - Country Report', April 2014

Africa-EU Energy Partnership, 'Country Power Market Brief: Djibouti'

The World Bank, 'Project Appraisal Document for Geothermal Power Generation Project' Report No: 68254-DJ, May 2013

The World Bank, 'Country Assistance Strategy for the Republic of Djibouti', March 2009

The World Bank Group, 'Country Partnership Strategy for the Republic of Djibouti, FY2014-2017', March 13, 2014

EUEI PDF and AF Mercados, 'Élaboration d'une Stratégie Nationale et d'un Plan d'Action pour le Développement du Secteur Électrique à Djibouti – rapport Scénarios', December 2013.

EUEI PDF and AF Mercados, 'Elaboration d'un Cadre Réglementaire et d'une Stratégie pour le Développement du Secteur Électrique à Djibouti', April 2013.

European Commission, 'Élaboration de l'Étude de Faisabilité du projet d'investissement de production d'eau potable par dessalement d'eau de mer approvisionné en énergie renouvelable – Volet : Montage financier et structure de Gestion', March 2012.

Audrey Emmanuelle Vergnes (AfDB, OECD, UNDP 2014), 'Djibouti 2014 – African Economic Outlook.org', 2014

World Bank and Fichtner, 'Projet d'Évaluation des Ressources Géothermiques', Project n. 610-1175, November 2012.

World Bank, 'Restructuring paper on a proposed project the Power Access and Diversification Project', Project No. 68191-DJ, March 2012.

World Bank and Parsons Brinckerhoff, 'Least Cost Electricity Master Plan, Djibouti', Project n.. 69203, August 2009.

USAID, 'Leveraging Partnerships to Increase Access to Power in Sub-Saharan Africa'

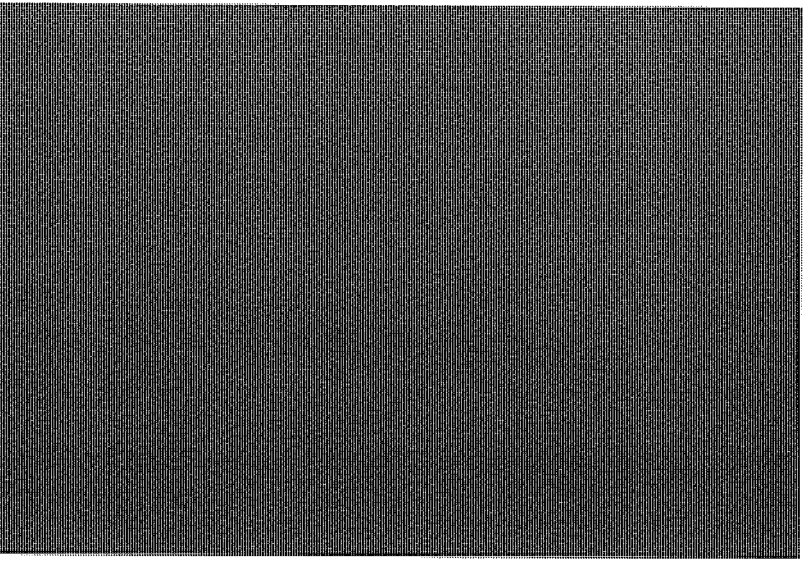
http://en.wikipedia.org/wiki/Economy_of_Djibouti

http://en.wikipedia.org/wiki/Djibouti

http://www.reegle.info/

https://www.cia.gov/library/publications/the-world-factbook/geos/dj.html

http://www.edd.dj/



U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov