



Work programme

# Increasing Financial Flows for Urban Sanitation

Case study

Marrakech, Morocco

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## I. BACKGROUND

### I.1. Political and constitutional context

Over the last few years the Kingdom of Morocco has seen drastic changes, particularly in political and institutional areas: the new Constitution of 2011 introduced institutional changes relating to the management of public utilities with a view to wider decentralization. Local public services managed by communes (municipalities) include drinking water, electricity, collection and treatment of wastewater, sewerage, solid waste, public lighting, public transport, road signalling and parking, ambulance services, slaughter houses and funeral homes. Municipalities are also responsible for local economic development and for a range of functions related to hygiene, health and the environment, as well as social and cultural services.

The Constitution of 2011 reinforced the role of communes and regions and created an environment to speed up decentralization. It introduced two essential principles: free administration of territorial authorities and subsidiarity; the latter implies that the central government will only intervene in cases where projects vital for citizens could not be carried out by regions and municipalities.

The process of transferring responsibilities from the central level to regional and local levels was implemented through a legal and institutional framework that transferred resources for decentralization. Implementation was introduced by revising the Law of Territorial Authorities into three laws: law on regions, law on prefectures and law on communes. The revision constitutes a breakthrough towards a legally decentralized system of government.

### I.2. Demographic, economic and social evolution

According to the 2014 census, the population of the Kingdom of Morocco was 33.8 million, an average annual increase of 1.25 per cent since the previous census in 2004. The rate of population growth is not high since the growth rate declined from 2.61 per cent between 1971 and 1982 to 1.25 per cent between 2004 and 2014 (Table 1).

Table 1. Population of Morocco 1960–2014

Year of census	Population	% annual average growth
1960	11,626,470	-
1971	15,379,259	2.58
1982	20,419,555	2.61
1994	26,073,717	2.06
2004	29,891,708	1.38
2014	33,848,242	1.25

According to estimates by the Economic Advisory Committee, the Moroccan population is now 34.9 million, an increase of 3.1 per cent compared to the census of 2014; the average annual increase is 1.03%, confirming the trend between 2004 and 2014.

Disaggregating the population by sex shows a slight dominance of females in the Moroccan population in 2014 (Figure 1).

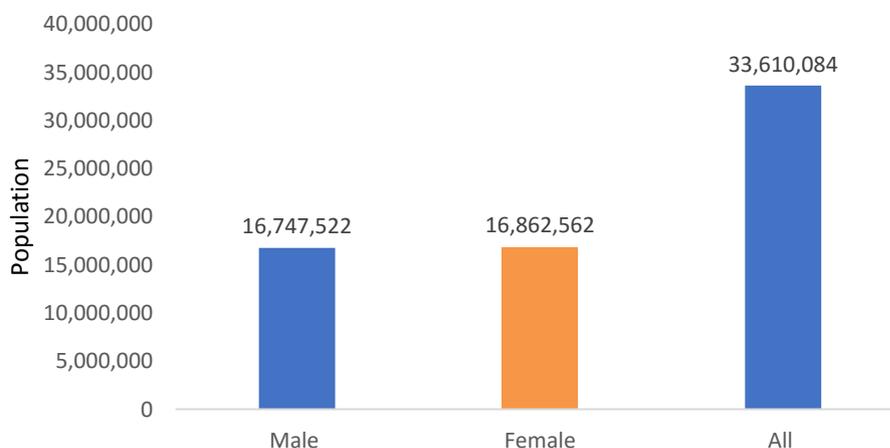


Figure 1. Population in Morocco by gender 2014

The demographic split between urban and rural areas shows a very strong structural variation; the percentage of the population living in

urban areas is 60.4 per cent and the percentage living in rural areas is 39.6 per cent. The number of inhabitants in urban areas has increased on average by 5 per cent between every census since 1994. The population of rural areas decreased from 70.8 per cent to 39.6 per cent between 1960 and 2014 (Figure 2) and led to a structural transformation in local public services, particularly urban public transport, drinking water and sanitation.

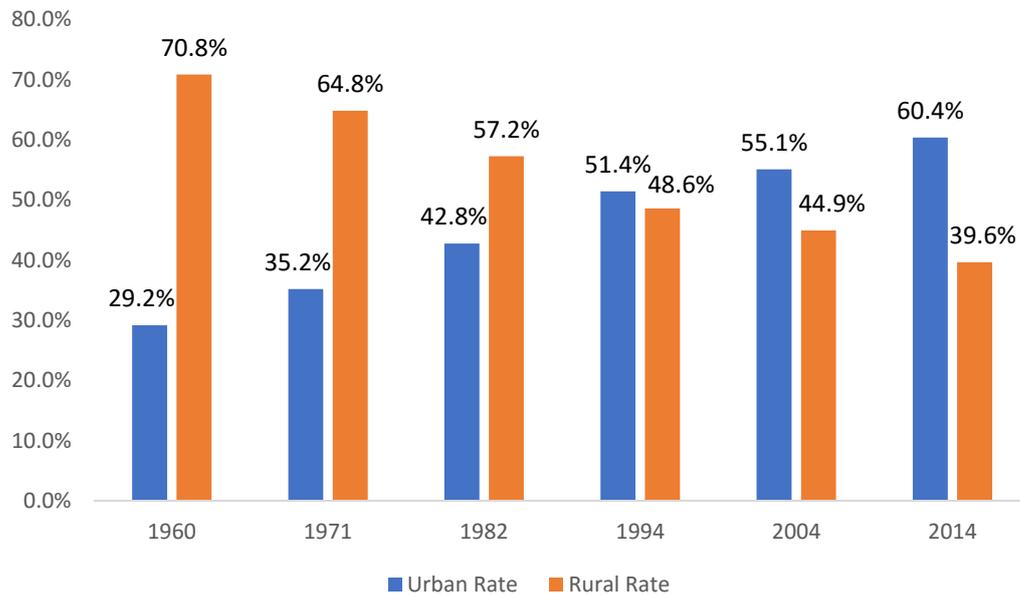


Figure 2. Urbanization in Morocco 1960–2014

In 2016, the gross domestic product (GDP) of the Kingdom of Morocco reached Moroccan dirham (MAD)914 billion (USD91 billion). The economy of the country is becoming more and more diversified; the agricultural sector now represents only 12 per cent of GDP

against over 30 per cent in the 1990s. The evolution of the Moroccan economy is due to the emergence of new sectors, notably the car industry, aeronautics and services (Figure 3).

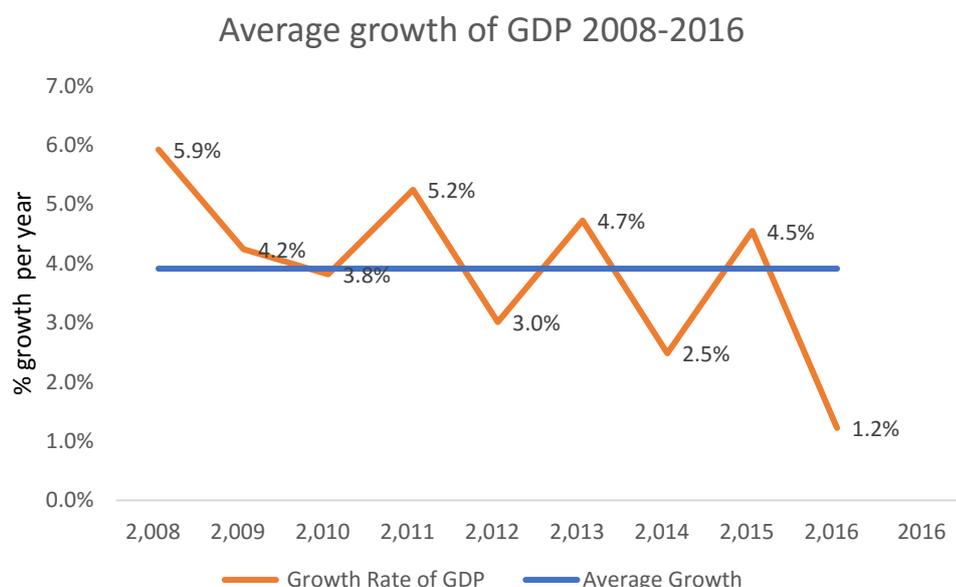


Figure 3. Gross domestic product (GDP) in Morocco 2007–2016

Like other countries, Morocco faces the scourge of youth unemployment. At the end of 2016, the national unemployment rate was 9.4 per cent and the urban unemployment rate was 13.9 per cent. The unemployment rate in rural areas is estimated to be 4.2 per cent. For young people aged from 15 to 24 years, unemployment is particularly high in towns, where the rate reached 41 per cent in 2016.

### I.3. Water supply and wastewater treatment

The 2014 census brought to light data concerning access to drinking water and sanitation (Table 2):

- 73 per cent of the population has access to the public distribution network of drinking water, 91 per cent in urban areas and 37.8 per cent in rural areas.
- In rural areas, access to sanitation is relatively poor compared to access to water. The rate of connectivity to sanitation in urban areas is 88.2 per cent and 2.9 per cent in rural areas, an overall national rate of 58.9 per cent.

Table 2. Urban and rural access to water and sanitation

Access to public networks	Urban (%)	Rural (%)	Total (%)
Water	91.3	37.8	73
Sanitation	88.2	2.9	58.9

Table 3. Disposal of wastewater

Disposal of wastewater	National (%)	Urban (%)	Rural (%)
Public sewerage network	58.9	88.2	2.9
Septic tank	23.2	9.6	49.2
Other	17.9	2.2	47.9

The public sewerage network is the main method of disposing of wastewater, used by 58.9 per cent of the Moroccan population (Table 3). Septic tanks are the second most common method of wastewater disposal, with 23.2 per cent. Septic tanks predominate in rural

areas; 88.2 per cent of the urban population has access to the public sewerage network for disposal of wastewater compared to 2.9 per cent in rural areas.

Institutionally, the management of sanitation is the responsibility of municipalities (communes) in accordance with the law on communes (113-14 enacted July 7 2015 section II article 83). This article specifies that municipalities should manage sanitation, wastewater treatment and water treatment plants. The management methods recommended by the law are:

- Direct management — municipal control or control supervised by municipalities
- Delegated management — entrusting the management of public services for treatment of wastewater and the development and management of water treatment plants to private entities (concessionaires)
- Management by local development societies — these are limited liability companies with at least 34 per cent municipal ownership.

Morocco specifies that, according to the needs of each municipality, operators are to manage at least two activities: drinking water and sanitation. In some situations, notably in large urban centres, operators manage electricity, drinking water and sanitation.

There are three categories of urban sanitation service providers in Morocco:

- Autonomous state-owned companies such as Regie Autonome de Distribution d'Eau et d'Electricité de Marrakech (RADEEMA) in Marrakech, Regie Autonome de Distribution d'eau et d'electricite de Fès (RADEEDF) in Fès, etc.
- Private concessionaires. Lydec, subsidiary company of Suez Environnement, REDAL subsidiary company of Veolia Environnement
- National public company. Office National de l'Electricité et de l'Eau Potable (ONEE), which operates mainly in rural zones and small townships.

The first two categories of operator manage sanitation operations and investment in large urban centres. According to official data provided by the Directorate of State-owned Company and Conceded Services (DRSC), the population served by networks managed by big state-owned companies and contract holders increased by 80 per cent between 2001 and 2015.

Currently these operators serve 44 per cent of the national population and 73 per cent of the urban population (Table 4).

Table 4. Management of water, sanitation and electricity services by state-owned companies in Morocco

	Served population	Management method	Services managed		
			Sanitation	Drinking water	Electricity
Grand Casablanca	4,078,633	Private concessionaire	Yes	Yes	Yes
Rabat-Salé-Temara	2,183,940	Private concessionaire	Yes	Yes	Yes
Fès	1,191,661	Municipal utility	Yes	Yes	Yes
Tanger	1,064,633	Private concessionaire	Yes	Yes	Yes
Marrakech	932,135	Municipal utility	Yes	Yes	Yes
Grand Agadir	879,892	Municipal utility	Yes	Yes	No
Meknès	710,395	Municipal utility	Yes	Yes	Yes
Tétouan	658,592	Private concessionaire	Yes	Yes	Yes
El Jadida	620,317	Municipal utility	Yes	Yes	Yes
Oujda	511,400	Municipal utility	Yes	Yes	No
Kénitra	469,300	Municipal utility	Yes	Yes	Yes
Safi	311,600	Municipal utility	Yes	Yes	Yes
Larache	260,077	Municipal utility	Yes	Yes	Yes
ChYesa	275,970	Municipal utility	Yes	Yes	No
Tadla-Beni-Mellal	196,572	Municipal utility	Yes	Yes	No
Taza	149,362	Municipal utility	Yes	Yes	No
Total	14,494,479				

Access to sanitation in urban areas was one of the biggest challenges Morocco faced. In fact, it was more important to connect people to the sanitation network than to the drinking water network: the population connected to the drinking water network grew from 9.7 million to 14.8 million, a 52.6 per cent increase between 2001 and 2015 whereas the population connected to the sanitation network increased from 7.5 million in 2001 to 13.5 million, an 80 per cent increase (Figure 4).

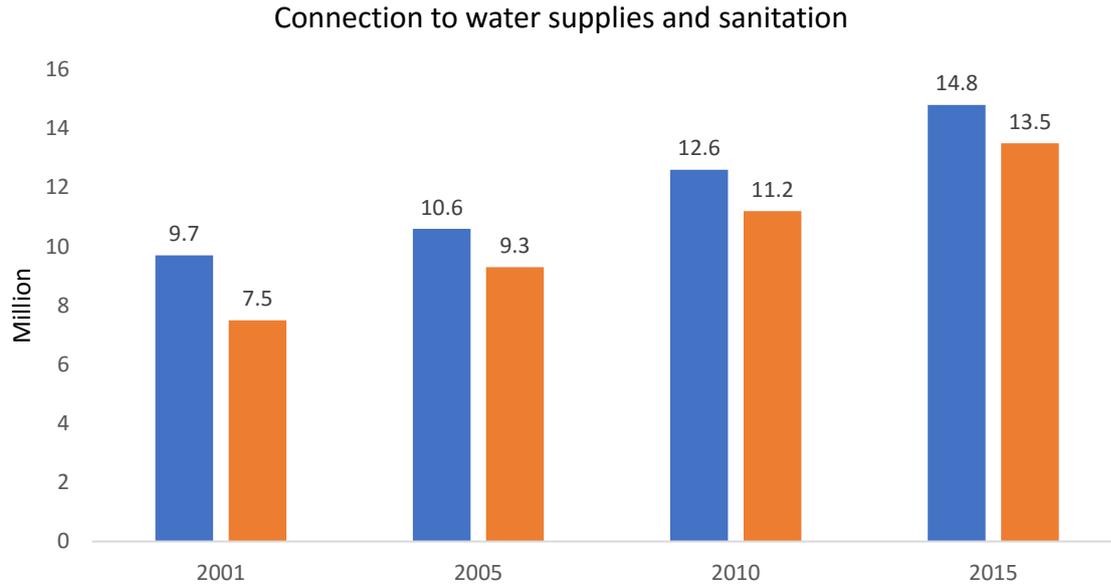


Figure 4. Population (million) connected to sanitation and drinking water networks 2001–2015

With 13.5 million users, the population connected to sanitation networks was 92.6 per cent in 2015 compared to 75 per cent in 2001, while the population connected to the drinking water network grew from 82 per cent to 97.8 per cent (Figure 5).

The two levels of connection are very important even though they only relate to 73 per cent of the population in urban zones.

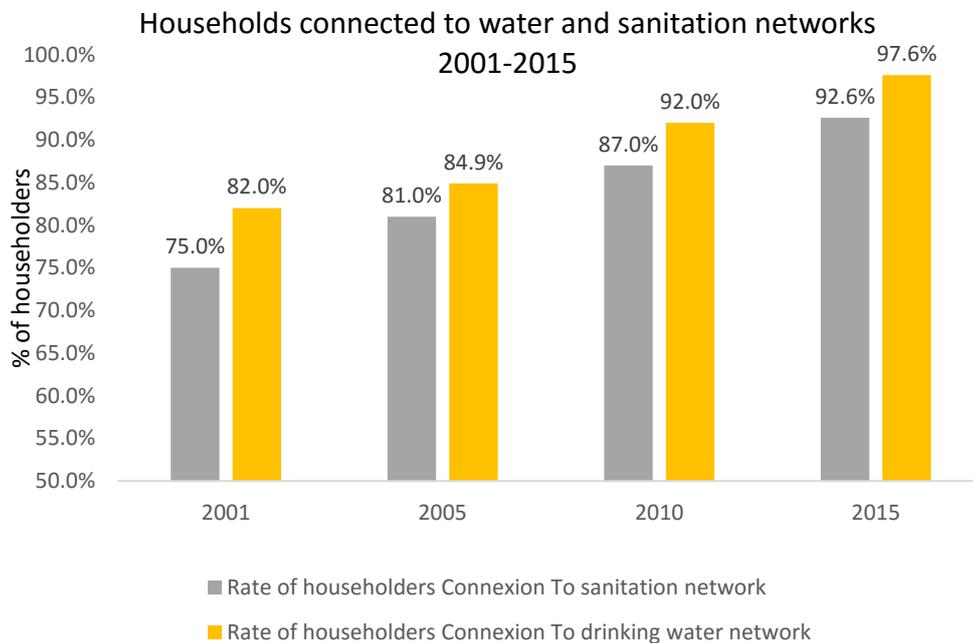


Figure 5. Households (%) connected to drinking water and sanitation networks

With regard to the cost, achieving connections to the sanitation network required an investment of MAD20.4 billion (USD2 billion) over the last ten years, or an average of MAD2 billion a year, compared to only MAD850 million a year on average over the period 2001 to 2005. Over the period 2001 to 2015, investments in sanitation totalled MAD24.6 billion (Figure 6).

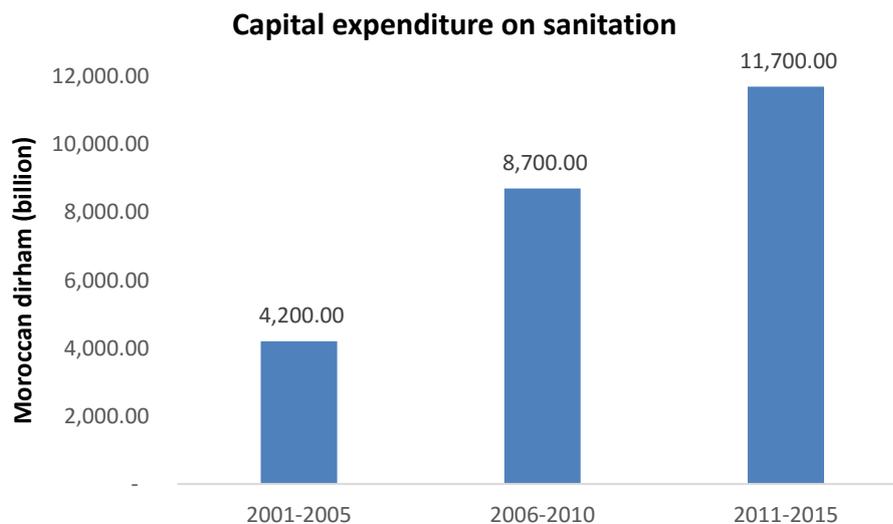


Figure 6. Capital expenditure (Moroccan dirham) on the sanitation network 2001–2015

Thanks to these investments and policies implemented by authorities at national and local levels, treatment of wastewater saw a significant improvement between 2001 and 2015. Before 2005 there was a lack of basic facilities for treatment and purification: each year out of 500 million cubic metres (m<sup>3</sup>) wastewater, barely 10 per cent underwent adequate treatment. This situation incurred costs of MAD15 billion just to remedy the environmental damage from pollution.

State policy, to be implemented mainly by municipal utilities, concessionaires and the ONEE, recommended prioritizing projects for treating wastewater and reducing pollution of the natural environment (water and sea) by eliminating untreated liquid waste. This policy has paid off; 63 per cent of wastewater currently undergoes adequate treatment.

Municipal utilities and concessionaires installed a significant number of treatment and pre-treatment works to implement the national policy and protect the population against health and epidemiological risks (Table 5).

Table 5. Wastewater treatment facilities implemented 2001–2015

Work	Number	Throughput a year (m <sup>3</sup> )
Treatment works	19	232 million
Pre-treatment works	6	973 million
Maritime emissaries	5	

At the end of 2015, the wastewater amounted to 510 million m<sup>3</sup>, of which 410 million m<sup>3</sup> was discharged into the sea and 100 million m<sup>3</sup> into rivers and lakes (Table 6). The rate of treatment and pre-treatment was 63 per cent, 70 per cent of which was wastewater discharged into rivers and lakes and 61 per cent discharged into the sea.

Table 6. Treated and untreated urban wastewater discharged 2015

	Treated or pre-treated (million m <sup>3</sup> )	Part discharged without treatment (million m <sup>3</sup> )	Wastewater discharged (million m <sup>3</sup> )	Rate of treatment (%)
To the sea	250	160	410	61%
To the water environment	70	30	100	70%
Total	320	190	510	63%

As for rural areas and small towns—where municipal authorities and concessionaires are absent—the treatment and distribution of drinking water is the responsibility of the national public operator ONEE. The ONEE manages sanitation in more than 100 townships, serving a population of 4.3 million inhabitants (Table 7).

Table 7. Sanitation managed by ONEE 2015

	2015
Number of townships (communes)	100
Number of treatment works	81
Beneficiary population	4,300,000
Treatment capacity (m <sup>3</sup> /day)	332,000
Treatment rate %	67

In terms of national coordination, sanitation management is the responsibility of two entities:

- The Ministry of Interior controls and coordinates the activities of municipal utilities and concessionaire (approved) services. It is in charge of controlling, monitoring and regulating sanitation (Decree n°2-64-394 of September 29, 1964). This mission is realized under the Directorate des Régies et Services Concédés (DRSC). The main responsibilities are:
  - Developing state strategic policies for sanitation and wastewater;
  - Directing and coordinating local operators; assisting communes in decisions concerning management of public services (drinking water, sanitation and electricity);
  - Participating (DRSC) in studies and directing large projects at a national or sectoral level; and
  - Controlling and following up (DRSC) on the quality of services and fixing rates.
- The Ministry of Water through the national public operator ONEE. The ONEE coordinates sanitation and drinking water services in rural areas and small towns—where municipal services and concessionaires are absent. ONEE manages sanitation in more than 100 townships, serving a population of 4.3 million inhabitants.

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## II. MARRAKECH

The city of Marrakech was chosen as a case study as it is one of the biggest cities in the Kingdom of Morocco, demographically and economically. With a population of 1.32 million it is the second largest urban centre in the kingdom after Casablanca. Since the census of 2004, the population of the city has grown by 24 per cent, that is an annual increase of 2.4 per cent, compared to population growth of 1.3 per cent nationally. It must be noted that the city of Casablanca, the biggest agglomeration in the kingdom, saw its population grow by only 14 per cent. The city of Marrakech experienced significant growth between 2004 and 2014 (Table 8).

Table 8. Population growth in Morocco and the city of Marrakech 2004 and 2014

	2004	2014	Variation %
Marrakech	1,063,415	1,323,005	24
Kingdom of Morocco	29,891,708	33,848,242	13
Share Marrakech/national	3.6%	3.9%	0.004

The city covers an area of 230 km<sup>2</sup>, with a density of 5,739 inhabitants per km<sup>2</sup>. Marrakech is one of the most densely populated cities in Morocco. In comparison, the city of Casablanca, which is the most populated city and which accounts for most of the national wealth

with 30 per cent of national GDP, has a density of 4,253 inhabitants per km<sup>2</sup>. The population density in Marrakech is 35 per cent higher than that of Casablanca (table 9).

Table 9. Population of major cities in Morocco

	Male	Female	Total
Casablanca	1,647,986	1,695,656	3,343,642
Marrakech	654,865	668,140	1,323,005
Fès	567,132	578,956	1,146,088
Tanger	540,280	519,981	1,060,261
Salé	483,382	490,036	973,418
Rabat	277,348	295,369	572,717

The city of Marrakech is the most important urban area in the Marrakech-Safi Region, accounting for 69 per cent of the region's urban population and 29 per cent of the overall population of the region (Table 10). The fact that the city is the most important urban centre in the region has led to an influx of the rural population in search of jobs and better living conditions.

Table 10. Population of Marrakech and the Marrakech-Safi Region

	Indicator
Marrakech	1,323,005
Region-Marrakech-Safi	4,504,767
Urban population of Marrakech-Safi Region	1,928,525
Share Marrakech/Marrakech-Safi Region	29%
Share Marrakech/urban population of Marrakech-Safi Region	69%

Marrakech is the hub of the Marrakech-Safi region and is the city in fifth place in terms of income and income per head: the GDP per capita in 2015 was USD1,930.31 compared to USD4,527.91 for Casablanca (Table 11). The difference can be accounted for by the poor diversification of the city's economy which is principally based on tourism, trade and the craft industry.

Table 11. Gross domestic product in Moroccan regions

Region	GDP 2015 (million USD)	Population 2014	GDP/person (USD)
Casablanca-Settat	30,911.00	6,826,773	4,527.91
Rabat-Salé-Kénitra	15,543.80	4,552,585	3,414.28
Tanger Tétouan Al Hoceima	9,800.70	3,540,012	2,768.55
Fès Meknès	8,761.00	4,216,957	2,077.56
Marrakech Safe	8,695.60	4,504,767	1,930.31

The city of Marrakech has low unemployment compared with other urban agglomerations (Table 12).

Table 12. Unemployment in Morocco and Moroccan cities

	Unemployment rate (%)
Morocco	16.2
Marrakech	15.9
Casablanca	18.9
Fès	19.6
Rabat-Salé	16.9

The city of Marrakech is known for attracting large events and international conferences. In 2016, the United Nations Climate Change Conference (COP22) was held in Marrakech.

### III. MARRAKECH SANITATION

At the end of 2016 the area of Marrakech mostly served by Regie Autonome de Distribution d'Eau et d'Electricite de Marrakech (RADEEMA) had 968,263 inhabitants, an increase of 9 per cent between 2011 and 2016 (Figure 7). The area comprises both urban and rural districts. The urban districts are the most important with 98.2 per cent of the population.

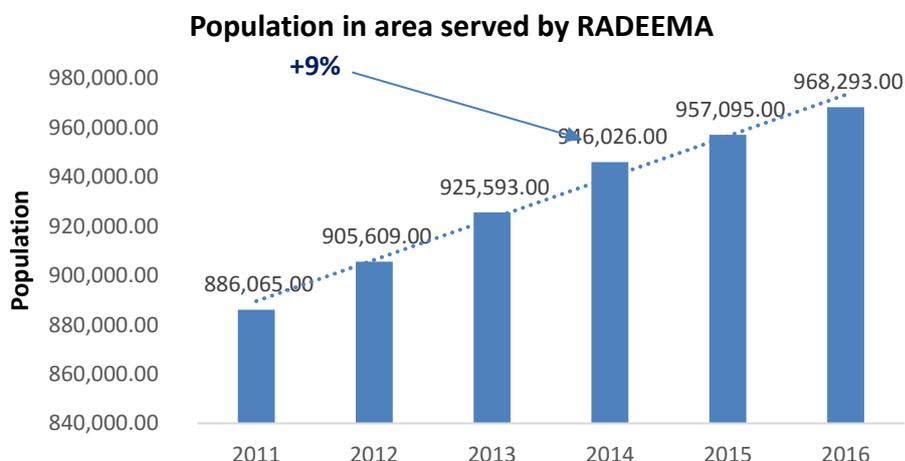


Figure 7. Population in the area covered by Regie Autonome de Distribution d'Eau et d'Electricité de Marrakech (RADEEMA) operations 2011–2016

According to the 2014 census, the population of the city of Marrakech (most of which is covered by RADEEMA) had access to the following (Table 13):

Table 13. Access to sanitation in Marrakech and nationally 2014

Sanitation type	Population of province of Marrakech (%)	National level (%)
Public sewerage network	75.8	58.9
Septic tank	17.5	23.2
Other	6.7	17.9

The public sewerage network managed by RADEEMA, or ONEE in some parts of the Marrakech prefecture, shows that 75.8 per cent of the population has access to a public network. Of the 1.323 million inhabitants of the province, the number of inhabitants with access to a public network is 968,293 in the urban area of the City of Marrakech managed by RADEEMA whereas, 17.5 per cent of the province's population flushes wastewater mainly into unregulated septic tanks. Septic tanks are mostly used in rural townships not managed by RADEEMA.

### III.1. Rate of connection and length of network

In the city of Marrakech, the population served by the sanitation network (connected to the network) was 93.4 per cent in 2016 compared to 86 per cent in 2006, an 8 per cent increase overall (Figure 8).

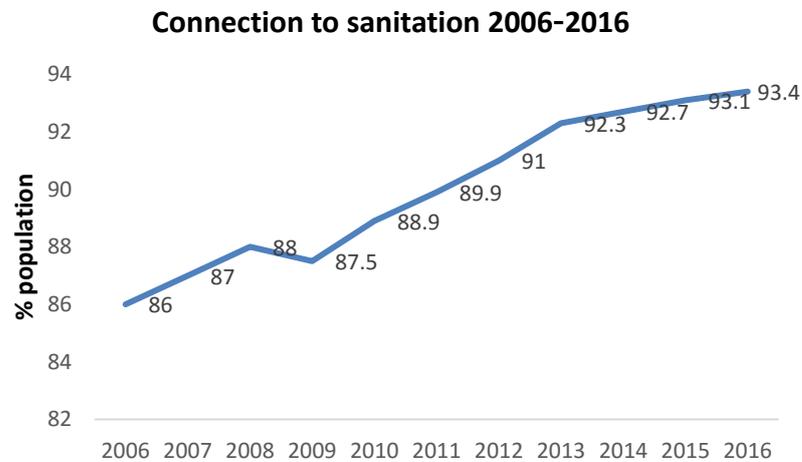


Figure 8. Population served by the sanitation network in Marrakech 2006–2016

The improvement in the service rate was accompanied by an expansion of the sanitation network, which grew from 1,635 km in 2007 to 2,778 km in 2016, a 70 per cent increase. Urban development and the significant growth of the population explain the increase of the length of the sanitation network (Figure 9).

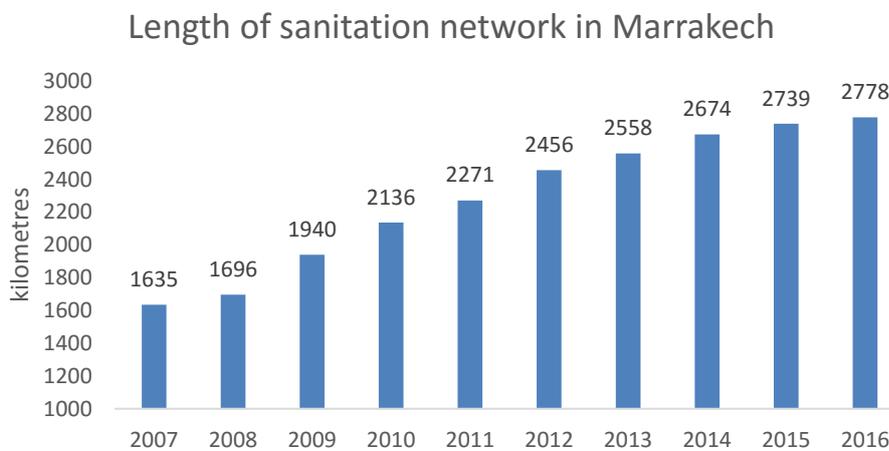


Figure 9. Length of the sanitation network (km) in Marrakech 2007–2016

### III.2. Treatment of wastewater

Since 2009 wastewater has been treated in the wastewater treatment plant, one of the most important investments in the life of RADEEMA:

- In 2009: the first stage of purification, consisting of primary treatment of wastewater (screening, degreasing and primary settling) and processing of primary sludge (gravitational thickening, digestion dehydration) was brought into service;
- In 2011: the second stage of purification, consisting of secondary treatment of wastewater (biological treatment with activated sludge, secondary decantation and, according to the need, treatment by filtering through sand, disinfection in ultra-violet light and chlorine) and a second processing with activated sludge (gravitational thickening, digestion dehydration), was brought into service.

Collection and transportation of wastewater is by gravity. However, some zones are equipped with lifting or pumping stations. The sewerage network in Marrakech works in three modes:

- Pseudo-separated system: runoff from roads and impermeable areas is separated from wastewater. This mode is adopted in the zone of M'hamid and in some housing estates in the Targa zone.

- Separated system: separation of wastewater from rainwater. This mode is adopted in the industrial zone of Sidi Ghanem, the tourist zone of Agdal and the Kasbah Resort.
- Combined system: this mode is adopted in the rest of the city.

RADEEMA treats on average 90 per cent of wastewater discharged into the public network (Figure 10). The median volume (2011–2016) treated at primary level is 39.1 million cubic meters. Water treated currently represents 94 per cent of station throughput. The available capacity is 6 per cent for an untreated volume of 10 per cent.



Figure 10. Volume treated 2012–2016

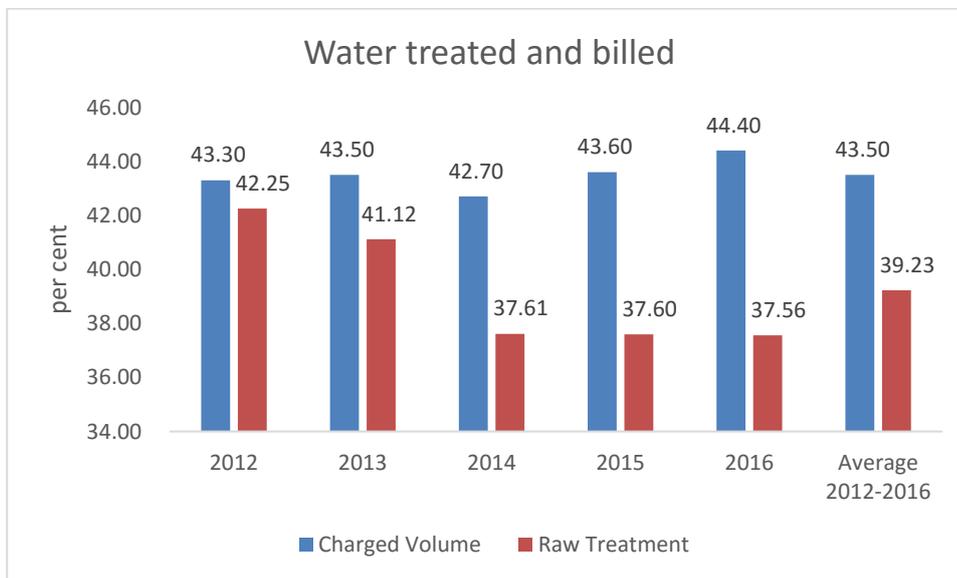


Figure 11. Volume of water billed and volume treated at primary level by RADEEMA 2012–2016 (%)

Over the period 2011–2016 the water treated at secondary level represented on average 90 per cent of the raw water received by the purification station (Figure 11).

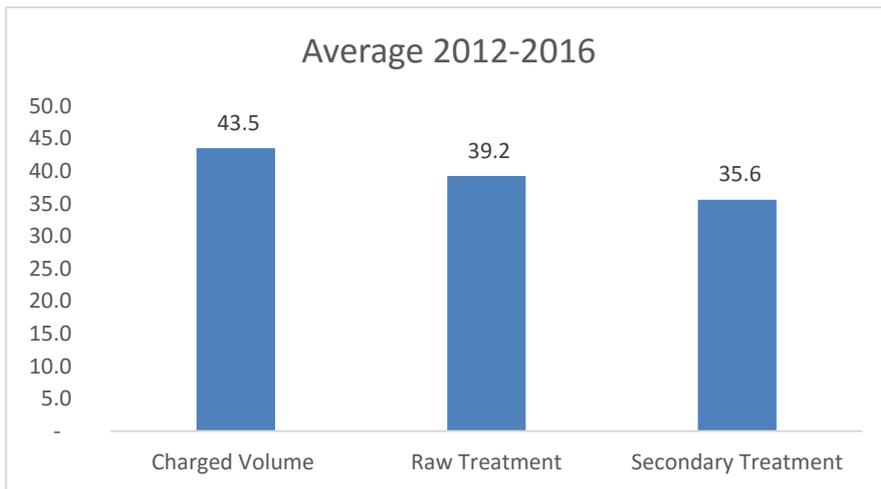


Figure 12. Volume of water billed, primary and secondary treated 2012–2016

The volume of wastewater receiving secondary treatment compared to the volume receiving primary treatment increased between 2012 and 2016; secondary treatment was 95.5 per cent in 2016 against 82.4 per cent in 2012, a 13.1 per cent increase (Figure 13).

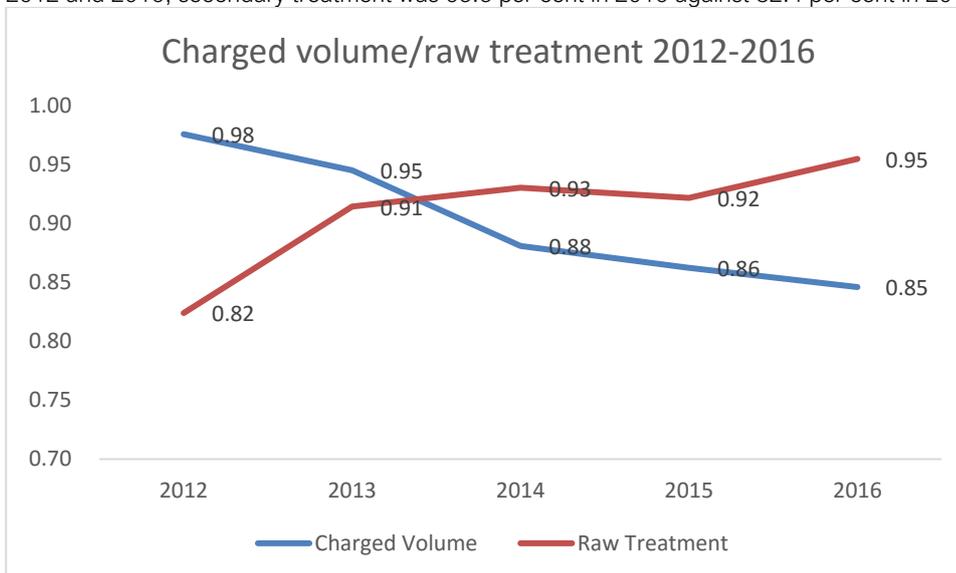


Figure 13. Ratio of treated/discharged water and secondary treated/gross volume 2012–2016

RADEEMA also treats some wastewater at tertiary level in order to re-use it for irrigating golf courses. In 2012, the percentage of water treated at tertiary level was 19 per cent compared to 10 per cent at secondary level (Figure 14) and the average volume was 5.21 million cubic metres. Water to be re-used is distributed through pipes (between 250 cm and 1100 cm in diameter) stretching over about 80 km and five pumping stations ranging from 800 kW to 2,500 kW in capacity.

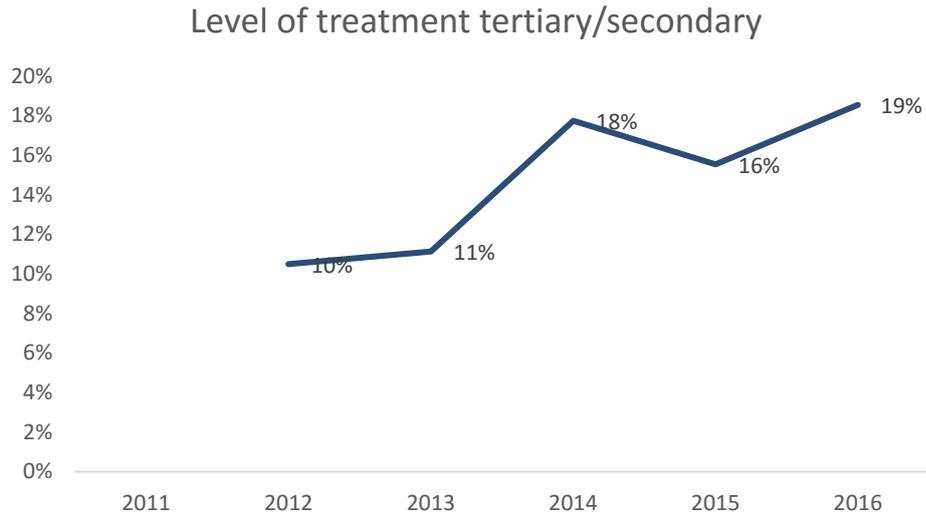


Figure 14. Percentage of tertiary/secondary treated water

In comparison with cities of the same size (nearly 1 million inhabitants), Fez, where sanitation is managed in a similar way to in Marrakech, and Tanger, where sanitation is managed by a private operator:

- The level of connection to the public sewerage network is higher in the other two cities, compared with Marrakech
- The volume of wastewater treated is much larger in Marrakech compared with the other two cities (Figure 15). The rate of wastewater treatment is the highest in Morocco, which makes the city of Marrakech a reference in this respect.

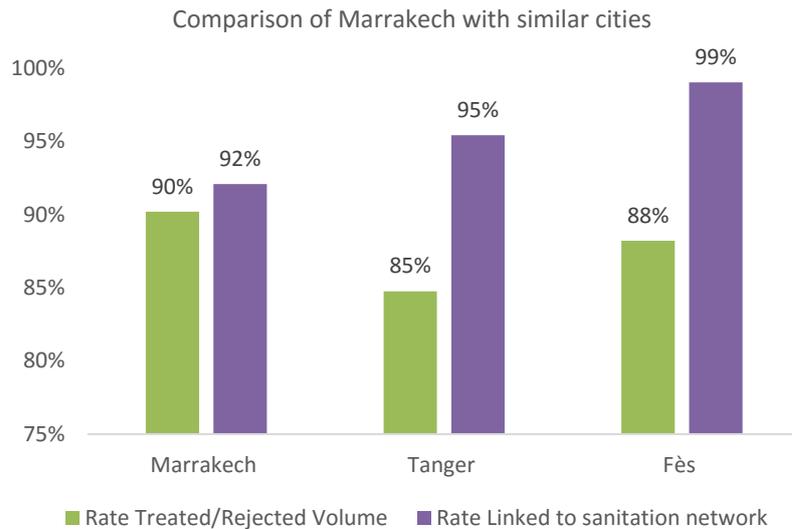


Figure 15. Treated volume/collected volume and coverage rate in Marrakech, Tanger and Fez

### III.3. Investment in sanitation

An investment of MAD2.7 billion (USD270 million) resulted in improvements in the connection rate to the sewerage network, the extension of the network, and improvements in the quantity and quality of treated water. An investment of MAD1.5 billion was made in just three years (2009, 2010 and 2011) representing 56 per cent of investment over the last ten years (Figure 16). In addition to the amount invested in the Sewage Treatment Plant (STP), the amount invested over the three-year period was for the wastewater re-use project (tertiary treatment).

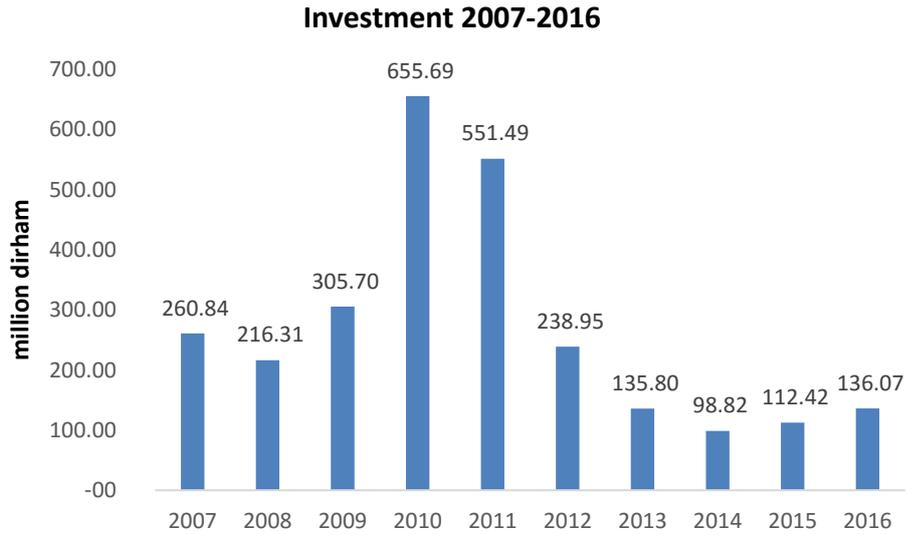


Figure 16. Investment of 2.7 billion dirham 2007-2016 in sanitation in Marrakech

In the last ten years, investment by municipal utilities and concessionaires was MAD20.4 billion (USD2 billion). Investment by RADEEMA represented 13.2 per cent of total investment. The population connected to the RADEEMA network is only 7 per cent of the national population served domestically by municipal utilities and concessionaires (Figure 17).

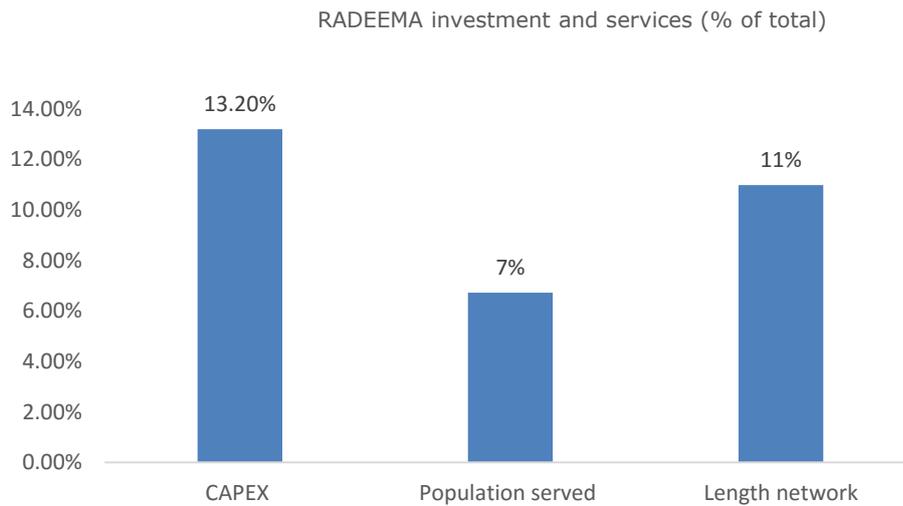


Figure 17. Capital expenditure by RADEEMA (% of total investment)

### III.4. Perspectives

The wastewater treatment plant of Marrakech receives an average of 110,000 m<sup>3</sup> wastewater a day, which represents 94 per cent of its throughput capacity. The current capacity of 118,000 m<sup>3</sup>/day will be surpassed in 2018.

Future investments planned as part of the contract between the State and RADEEMA amount to MAD668.2 million 2017–2019 (Table 14)

Table 14. Investments planned 2017–2019

	Investment planned 2017–2019 (MAD million)	Structures %
Extension of STP throughput	223,956.00	33.5
Construction of a solar drying unit for STP	106,931.00	16.0
Strengthening and extension of network (collectors)	109,826.00	16.4
Improvement of the distribution network	136,927.0	20.5
Other	90,585.00	13.6
<b>Total: Wastewater treatment</b>	<b>668,225.00</b>	<b>100</b>

The plan to extend STP throughput is a priority. The plan aims to meet the wastewater treatment needs of the city of Marrakech by 2030, thereby achieving Morocco's commitments to sustainable development and protection of the environment. For the cost of MAD224 million. RADEEMA anticipates a rate of (primary) raw treatment of 98 per cent by the end of 2019. The objective of 100 per cent treatment seems easily attainable by 2030.

Strengthening and extending the distribution network is the second priority for RADEEMA, whose aim is to link 94.3 per cent of the population to the network. The overall goal of the project is to connect nearly 100 per cent of the population by 2030.

According to the RADEEMA economic and financial model, sanitation investments 2017–2030 will reach MAD1.4 billion (USD140 million) (Table 15). The investment required for the extension of the STP will amount to 20 per cent of the total investment.

Table 15. RADEEMA investment planned 2017–2030

	Investment envisaged 2017–2030 (dirham)	%
Infrastructure	622,092	43
Distribution	565,145	39
Household connections	51,652	4
Finance costs	200,000	14
<b>Total</b>	<b>1,438,889</b>	<b>100</b>

#### IV. FINANCING SANITATION IN THE CITY OF MARRAKECH

According to the data presented in the previous section, the types of treatment in urban Marrakech are (calculated on the basis of a population of 968,293):

- Population connected to the sanitation network with a level of treatment consistent with the norm (primary level): Estimated rate = Served Population \* Level of treatment in percentage = 95%\*93.4%\*968,293
- Population connected to the network and without access to treatment (93.4%-88.7%) \*968,293 =4.7
- Population without access to the sanitation network (1-93.4%) \*968,293

Table 16. Access to wastewater treatment in Marrakech

	Population	Rate (%)
Households linked to public networks with good treatment of wastewater	859,166.38	88.7
Households linked to public networks without good treatment of wastewater	45,219.28	4.7
Households not linked to public networks	63,907.34	6.6
Total	968,293.00	100

Other types of treatment are not applicable in the study area:

- Septic tanks without regulated emptying services
- Other types of toilets on site without regulated emptying services
- Public community toilets not linked to the network
- No treatment
- Septic tanks with regulated emptying services
- Other types of toilets on site with regulated emptying services
- Community or shared public toilets linked to the network or regulated emptying services

Sanitation in the city of Marrakech is managed by RADEEMA using financing generated by all its activities (water, sanitation, electricity). For activities incurring deficits RADEEMA cross-subsidizes funding.

## V. SOURCES OF FINANCING FOR SANITATION

As in any structure or authority, financing sanitation poses a problem at two levels:

- Financing essential, recurring operational expenses (i.e. maintenance, operations, repairs, etc.)
- Financing capital investment (i.e. equipment for homes, collection networks, installation of wastewater treatment facilities, etc.).

Evaluation and analysis of financing differs according to the type of expenses:

- Recurring expenses must be covered by revenues (rates paid by users, income from operations and income from services requested by clients) (Table 17).

Table 17. Recurring expenses 2007–2016

	Cumulative 2007-2016 (MAD)	%
Operating costs	1,044,091,454.2	42.4
Supplies and materials	543,410,204.2	22.1
External costs	66,736,345.1	2.7
Staff costs	429,494,414.8	17.4
Other operating costs	4,450,490.2	0.2

- Capital Investment expenses can be estimated in two ways:
  - Earnings from operations before depreciation and amortization (EBIT DA)
  - The capital invested with costs of financing (weighted average cost of capital WACC).

We will develop both approaches.

Table 18. Investments financed 2007–2016

	Cumulative 2007-2016	%
Infrastructure	1,865,650.2	68.8
Distribution	637,664.5	23.5
Household connections	32,055.3	1.2
Finance costs	176,731.4	6.5
Total	2,712,101.5	100

An analysis of RADEEMA's financial statements and activity reports identifies five main sources of financing:

- Resources generated directly by users (rates, charges, cash generated from operations, with or without participation, re-used water)
- RADEEMA resources, generated by other services managed by RADEEMA as part of all its activities
- External resources in the form of loans granted by national and international financing institutions
- External resources in the form of payments by commercial users (notably developers and golf courses)
- Public subsidies for investment mainly from the state (National Sanitation Programme and the National Initiative for Human Development).

Multi-utility (water, sanitation, electricity) activities are a model specific to Morocco. Budget surpluses from multiservice activities finance structural deficits in water treatment, thus contributing to the overall balance of the system. It is an innovative financing mechanism based on specific institutional circumstances.

The analysis of the sources of financing of treatment activities involves three stages:

- Stage 1: Analysis of recurrent costs
- Stage 2: Analysis of investment costs
- Stage 3: Calculation of Free Cash Flows. This will demonstrate a clear deficit in the realm of treatment and assess RADEEMA's own resources generated by the multi-utility activities used to cover it.

### V.1. Covering recurrent costs from recurrent income

A system can work sustainably only if recurrent expenses are covered by users. The income generated from sanitation is about MAD1,972 billion (Table 19):

- Charges for consumption and fixed costs paid directly by the users account for 58.8 per cent
- Work with no financial contribution from customers generates 28.47 per cent

- Work with participation generates 9 per cent
- The sale of re-used water is still in the stage of preliminary development, barely clearing 3.77 per cent of RADEEMA recurrent costs.

Table 19. RADEEMA income 2007–2016

	Cumulative 2007-2016 (MAD)	%
Charges for consumption and basic salaries	1,159,874.57	58.80
Sale of re-used water	74,418.61	3.77
Other income (jobs without participation, etc.)	561,702.68	28.47
Income of repayable jobs	176,731.44	8.96
Total income	1,972,727.30	100.00

Consumption charges and fixed costs paid by users constitute the most significant income. The average increase in income was 2 per cent. The exceptional increase in income of 19 per cent in 2009 was due to an increase in the rates for treatment (the only tariff increase over this period). Over the last two years, growth in income has remained stable at 3 per cent.

The resources generated by consumers are used to finance recurring expenses, which have increased significantly since 2009. The development of the STP generated new operational costs of MAD62 million a year on average (USD6 million) and caused a drop in the working margin (earnings from operations before depreciation and amortization - EBITDA) available to cover amortization and new financial expenses. Debt servicing has decreased (Figure 18):

- The EBITDA went down by 57.5 per cent between 2007 and 2016 due to the additional operational costs caused by the creation of the STP
- The increase in depreciation expenses reduced EBIT, which became negative in 2011. In other words, RADEEMA does not generate sufficient working income to service its debt.

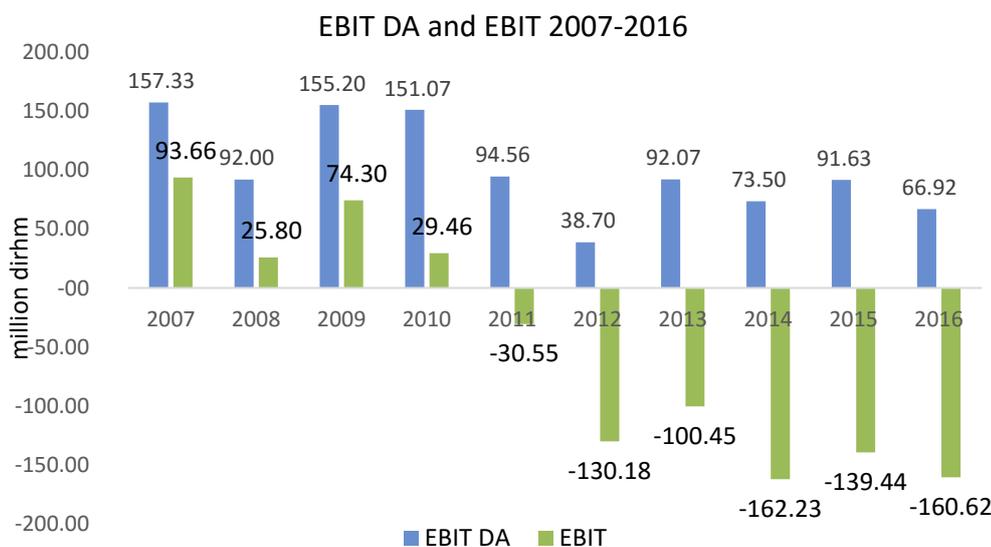


Figure 18. Earnings from operations before depreciation and amortization (EBITDA) and earnings from operations (EBIT) (million dirham)

## V.2. Coverage of capital investment expenses: calculation of Free Cash Flows

An analysis of cash flows 2007–2016 shows that:

- Over the period 2007–2016, the city of Marrakech (through RADEEMA) invested 2.7 billion dirhams. A significant part of this was invested in building the STP to enable a satisfactory standard of treatment at primary and secondary levels.
- The capital financing structure improved in comparison with 2006. The decrease of EBITDA, as a result of the increase in operational expenses for maintenance of the STP, caused a loss of MAD459 million that brought equity capital for treatment down to MAD250 million (for an initial allocation of equity capital of MAD750 million), covering only 7 per cent of net investments:
  - At the end of 2016 customer investment grants covered 39 per cent of fixed assets (338% net increase over the period) excluding golf courses, the main consumers of re-used water (treatment level service sector)

- Subsidies granted by the state as part of the National Sanitation Programme (PNA) and the National Initiative for Human Development (INDH) totalled MAD312.9 million
- Over this period RADEEMA contracted MAD627.1 million in debt to finance treatment and repaid MAD416.5 million. The outstanding sum is MAD210 million
- The remaining deficit of MAD1.8 billion was re-financed with the surplus from services, that is 49 per cent.

Table 20. Financing 2006 and 2016

	Structure of financing 2006		Structure of financing 2016	
	Amount (MAD)	% fixed assets	Amount (MAD)	% fixed assets
Net fixed assets (I)	1,023,116.78	100	3,689,550.10	100
Total resources (II)	936,584.74	92	1,886,023.44	51
Equity capital	444,046.96	43	250,198.12	7
Combined deficit/surplus (EBIT-financial cost-taxes)	-266,005.16	-26	-459,854.00	-12
Capital (initial allocations)	710,052.12	69	710,052.12	19
Investment grants	420,601.25	41	1,425,253.62	39
Financial debt	71,936.53	7	210,571.70	6
Deficit (II)-(I) re-financed	86,532.04	8	1,803,526.66	49

### V.3. Conclusions

Without income from services and the surpluses generated from supplying electricity to industrial users, it would be impossible for RADEEMA to cover operational costs and invest in wastewater treatment. Income (EBITDA) and sources of financing (equity capital, investment subsidies and debt) cover only 75 per cent of total expenses (recurrent expenses and investment expenses).

The calculation of free cash flows 2007–2016 (CF = EBITDA – CAPEX – theoretical taxes – variation BFR) shows that operating and investment expenses are not covered by the cash generated (Figure 19): a deficit (accumulation of free cash flows) of MAD2.008 billion was covered by debt, investment subsidies and internal subsidies between activities managed by RADEEMA:

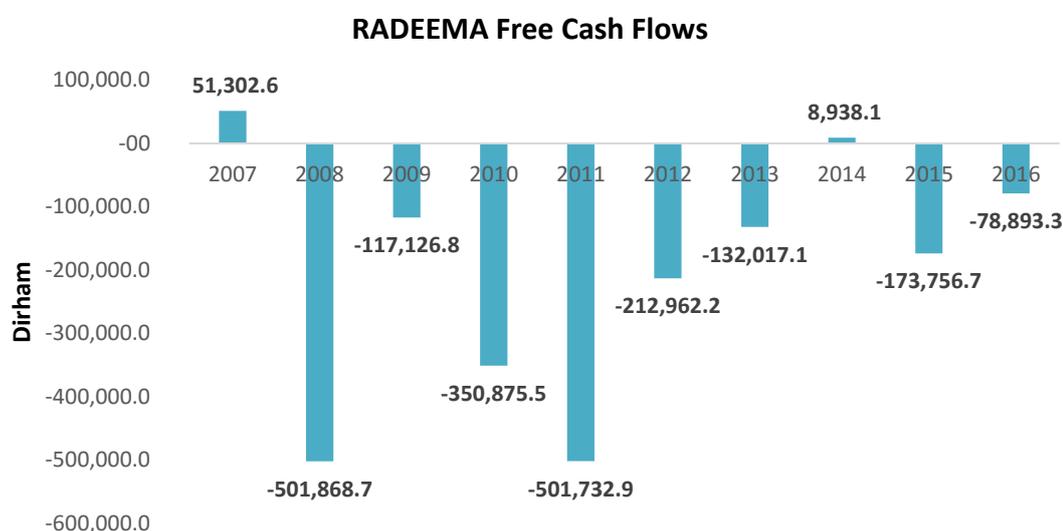


Figure 19. RADEEMA free cash flows 2007–2016

### V.4. Free Cash Flows for Equity: global cover of costs by external sources and determination of the surplus from services

#### V.4.1. External loans

In terms of external resources, RADEEMA benefited from loans from financiers and commercial banks (Table 21):

- European Investment Bank (development bank), MAD340 million, a part of which was released before 2007
- A private consortium of commercial banks in Morocco, MAD330 million
- A loan from the Co-operative Bank of Marrakech, a mutual bank, of MAD50 million

Table 21. Structure of loans contracted by RADEEMA

MAD '000	Duration	Outstanding	Refund at the end of 2016	Financial expenses end 2016	Financial expenses end 2016/global outstanding %
European Investment Bank	15 years	340,409.78	340,409.78	25,350.25	7.4
Total commercial local banks		480,000.00	98,214.29	127,874.07	26.6
Consortium of commercial local banks	15 years	330,000.00	68,750.00	101,288.20	30.7
Popular Bank Morocco	15 years	50,000.00	29,464.29	26,585.87	17.7

- RADEEMA was able to repay the entire European Investment Bank loan in foreign currency at a very low rate (2%). The interest paid by RADEEMA over 15 years was MAD25.4 million, that is 7.4 per cent of the loan.
- The interest from both local loans over the studied period is MAD127 8, that is 26.6 per cent of the amount borrowed.

#### V.4.2. Investment subsidies

Investment subsidies are made up of the contributions of customers (billable jobs), state subsidies and payments from RADEEMA golf course clients. Net investment subsidies (minus repayments) by RADEEMA for wastewater treatment were MAD1.464 billion (Table 22):

Table 22. RADEEMA investment subsidies 2007–2017

	Cumulative 2007-2017	Structure %
Contributions of customers (billable work)	690,026.65	47.1
Payments from golf courses	461,000.00	31.5
Total payments of investment, RADEEMA clients	1,151,026.65	78.6
Subsidies of investment of the State	312,869.56	21.4
• Of which INDH: National Initiative of Human Development	162,369,56	11.1
• Of which PNA: National Sanitation Programme	144,000.00	9.8
• Other subsidies of investment of the state	6,500.00	0.4
Subsidies of investment	1,463,896.21	100

Customers and golf courses contributed 78 per cent of RADEEMA's investment expenses.

State support from budget appropriations was MAD312.9 million, from:

- The National Initiative of Human Development (INDH): MAD162.4 million, mainly to support connections to wastewater treatment networks in disadvantaged districts of Marrakech
- The National Sanitation Programme (PNA) of wastewater treatment: MAD144 million.

The state subsidies through INDH and PNA are output-based aid (OBA). The support through these two mechanisms (in the form of donations that RADEEMA does not have to refund) is one important part of social programmes to connect disadvantaged populations.

Moreover, it must be noted that OBA can be used to compensate operators in return for setting affordable tariffs for low-income users.

#### V.4.3. Internal subsidies from services

To identify the amount of internal resources (surplus of equity capital needed to cover deficit), we analysed cash flows for equity:

Free Cash Flow to Equity = Free Cash Flow + Financial Products – Financial Expenses – Redemption Debts + New Debts + Augmentations / Reduction Appropriations of Investment

Sum 2007-  
2016

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

Initial Fixed assets	1 022											
	287,91											
		157	92	155	151	94	38	92		91		
EBIT DA		328	001	203	065	562	069	069	73 497	629	66 924	1 012 347
		260	216	305	655	551	238	135		112		
CAPEX		842	306	700	689	491	953	800	98 821	424	136 074	2 712 100
Theoretical		28		22								
Taxes		099	7 741	290	8 838	-00	-00	-00	-00	-00	-00	66 968
Variation		-182	369	-55	-162	44	12	88		152		
Working Capital		915	823	661	587	804	709	286	-34 262	962	9 743	242 902
Free Cash Flows	-1 022	51	-501	-117	-350	-501	-213	-132		-173		
	287,91	302	869	126	875	733	593	017	8 938	757	-78 893	-2 009 623
Annual		63	66	80	121	125	168	192	235	231		
Amortization		664	197	901	605	115	878	515	727	072	227 543	
				10		11		12				
Financial Income		5 835	9 197	9 610	521	373	7 882	836	9 149	2 979	3 086	82 468
						10	21	25		26		
Finance Costs		1 549	2 635	2 876	2 406	428	515	446	28 656	331	20 170	142 012
Debt			20	45	46	47	48	50		38		
Amortization		8 628	975	457	456	654	918	201	71 987	214	38 214	416 704
Increasing Debt		67	105	74		330		50				
"New Debt"		017	471	582		000		000				627 070
Investment		245	317	216		291	98	83		147		
Subsidiary		827	651	157	785	819	749	879	62 151	210		1 464 228
Initial Equity	444											
	719,00											
Free Cash Flows	-577	359	-93	134	-388	73	-177	-60		-88		
For Equity	568,91	804	160	890	431	377	395	949	-20 405	113	-134 191	-1 674 594

The cumulative FCFE resulted in a deficit 2007–2016 of MAD432.7 million, compensated by the surpluses provided by RADEEMA's electricity activities.

#### V.4.4. Free cash flows after servicing debt and integrating investment subsidies: case of sanitation

Table 23. Free cash flows after servicing debt and integrating investment subsidies

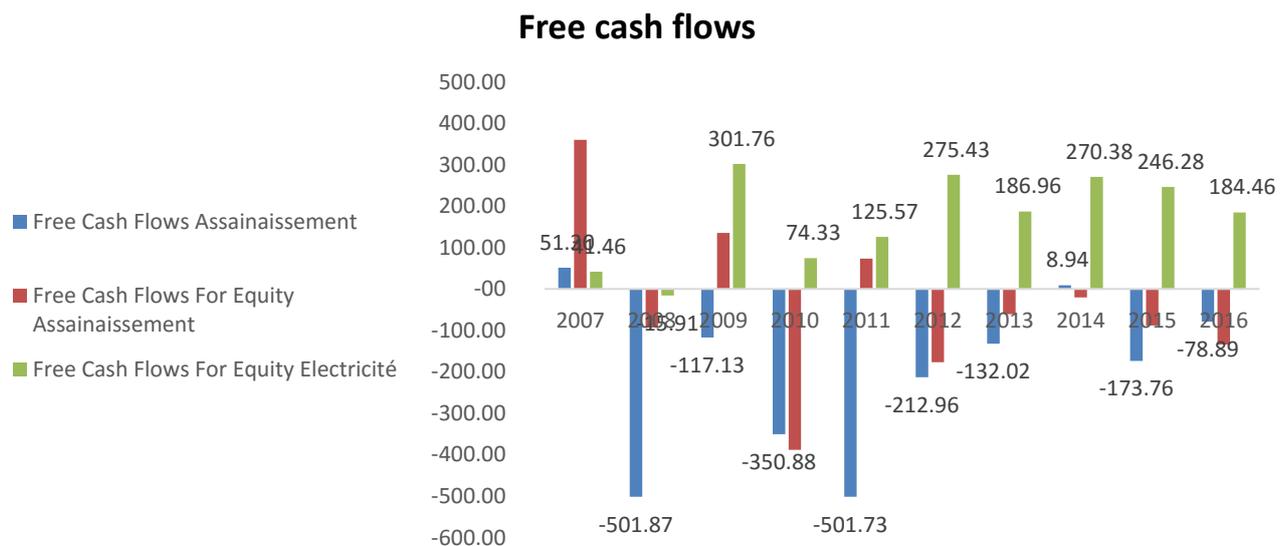


Figure 20. Free cash flows for sanitation, and sanitation and electricity equity

#### V.4.5. Free cash flows after servicing debt and integrating investment subsidies: RADEEMA (all activities)

Table 24. Free cash flows after servicing debt and integrating investment subsidies

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Sum 2007- 2016
Initial Fixed assets	555 444											
EBIT DA		165	231	287	336		310	270	324			2 929
CAPEX			143	136	236							1 017
Theoretical Taxes		150	893	874	509	320 654	030	890	350	332 744	349 351	445
Variation Working Capital												127
Free Cash Flows	-555 444	98 075	243	015	440	93 022	82 773	60 879	50 422	66 871	49 387	628 321
Financial Income		49 545	-00	68 995	83 282	75 849	71 466	56 916	72 003	72 187	78 078	
Finance Costs												
Debt Amortization												
Increasing Debt "New Debt"												
Investment												
Subsidiary												
Security deposit												
Initial Equity	-9 304,00	-1 072	679	569	-52 760	67 750	-42 458	49 246	-12 588	-64 775	38 778	9 231
Free Cash Flows	444	18 602	-53 029	433	69 547	84 033	249	849	513	258 461	183 108	766
For Equity												
Initial Equity												
Free Cash Flows												
For Equity												

It can be seen that the net deficits of the sanitation activity are fully offset by the surpluses of the electricity business. Multi-utility is a long-term financing option if the consolidation of all the sectors that compose it are balanced (Table 24).

#### V.4.6. Structure of future financing

As part of the sustainable development plan of Morocco (Circular Economy), the city of Marrakech plans to invest MAD1.438 billion 2017–2030 (Table 25). MAD668.2 billion will be invested 2017–2019; this amount has already been contracted with the state as part of the contract programme.

#### V.4.7. Projected investment

Table 25. Projected investment 2017–2030 (Moroccan dirhams)

	Envisaged investment 2017– 2030	Envisaged investment 2017– 2019	Envisaged investment 2020– 2030
Infrastructure	622,092.00	466,637.00	155,455.00
Distribution	565,145.00	136,927.00	428,218.00
Household connections	51,652.00	19,661.00	31,991.00
Finance costs	200,000.00	45,000.00	155,000.00
<b>Total</b>	<b>1,438,889.00</b>	<b>668,225.00</b>	<b>770,664.00</b>

To ensure the financing of investments, RADEEMA intends to principally rely on its own income from services (particularly electricity). In the context of services, overall economic equilibrium is the only guarantor of the sustainability of this mode of financing.

Will RADEEMA be able to maintain this balance, in spite of the importance of investments?

To assess the capacity of RADEEMA to clear sufficient resources to provide all services, we compare the cost of capital invested to the profits generated by the fixed assets. The profitability will be measured by IRR (internal rate of return). The period of calculation will be limited to 2007-2019 (achievements + expectations of the contract programme).

The problem which arises is estimating the cost of equity capital brought by RADEEMA to support sanitation activities:

- The financial cost of equity capital is usually measured in terms of expected profitability obtained by adding a risk premium for RADEEMA to a risk-free rate. To calculate the risk premium, it is usual to use the risk premium of a similar listed company.

The only similar listed company in Morocco is Lydec, which is in charge of distributing electricity, drinking water and sanitation in the city of Casablanca

- To use only the book cost of equity, measured by 'ROE = Return On Equity', the profitability of equity capital can be defined by ROE 'Return On Equity' of electricity activities.

Given that RADEEMA is a government-owned firm which does not distribute dividends, we will use the second approach, which is the most suitable. The cost of equity capital will be calculated by:

$$\text{Cost of the invested capital} = \left( \frac{\text{Equity capital}}{\text{Equity capital} + \text{indebtedness}} \right) * \text{ROE} + (1-T) * \left( \frac{\text{Cost of debt}}{\text{Equity capital} + \text{indebtedness}} \right)$$

The period of analysis is 2007–2019, about which official data in terms of achievements, and in terms of predictions (2017–2019) are available:

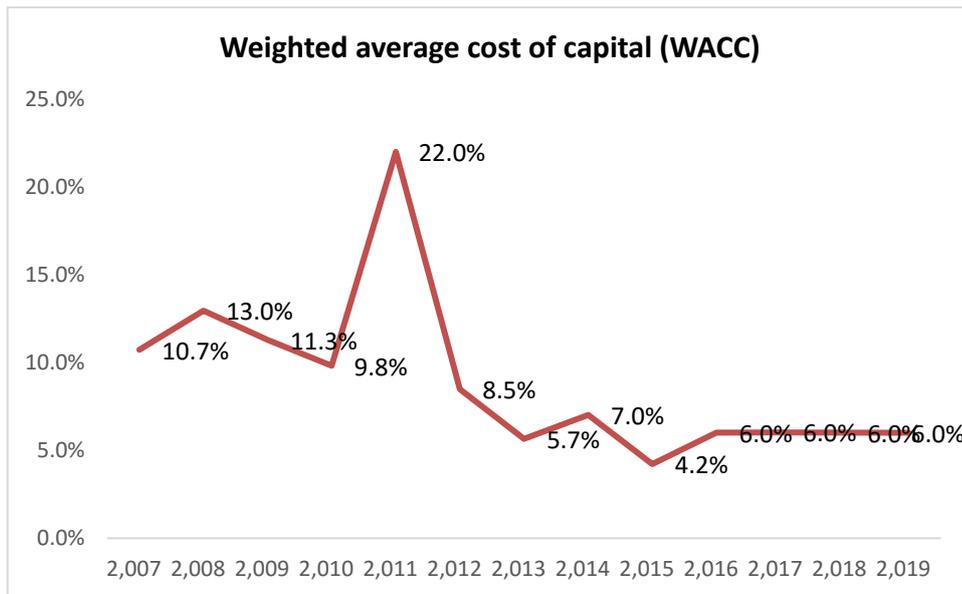


Figure 21. Cost of capital (weighted average cost of capital)

It is notable that, since 2013 when RADEEMA began financing investments through debt, the cost of capital fell from 20 per cent to 6 per cent (Figure 21). The cost is planned to be maintained at this level over the coming years. The IRR over the period 2007–2019 is 5.9 per cent, which proves that RADEEMA has the capacity to use electricity surpluses to fund the needs of sanitation.

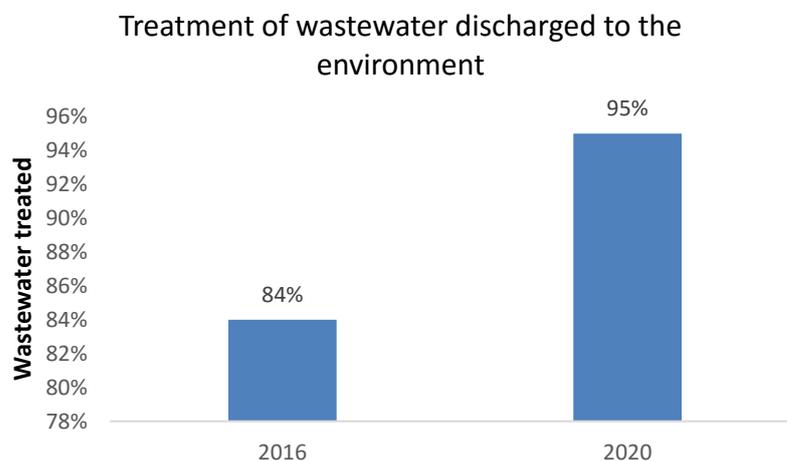
## VI. ANALYSIS AND LINES OF THOUGHT

The study of Marrakech shows that the development of sanitation requires significant investment and involves recurrent costs to support the treatment of wastewater. This poses the biggest problem for the utility in the city of Marrakech (RADEEMA), and for cities and localities which, in addition to other investments, have to bear the additional costs of treatment; treatment objectives are quite ambitious and are fixed as part of the strategy of sustainable development.

To recap, strategic objectives are fixed at two levels:

- At the level of urban areas managed by municipal utilities and concessionaires. Objectives are part of the Objectif 2020 Plan, which prioritizes:
  - Connecting households to networks, particularly low-income families
  - Extending wastewater networks:
    - Creating 15 STPs, with a total capacity of 63 million m<sup>3</sup> a year
    - Extending six STPs, for a capacity of 54 million m<sup>3</sup> a year
    - Creating two pre-treatment plants, for a total capacity of 110 million m<sup>3</sup> a year
  - Improving the volume of re-used water, and the preservation of water resources
  - Sanitation and protection of aquatic and marine environments.

Figure 22. Evolution of wastewater treatment 2016–2020



### VI.1. Areas managed by ONEE

For areas managed by the national operator ONEE, whose financing comes principally from the National Sanitation Programme and Purification of Wastewater (PNA), which was launched in 2005 jointly by the Department of Environment and the Ministry of the Interior, the objectives for 2020 and 2030 are to:

- Attain a rate of connection to the sewerage network in towns: of 75 per cent by 2016, 80 per cent by 2020 and 100 per cent by 2030
- Attain a volume of treated wastewater: of 50 per cent by 2016, 60 per cent by 2020 and 100 per cent by 2030
- Finance plans relating to rehabilitation and extension of the network, connection and strengthening the storm drainage system and creating STPs (primary, secondary or even tertiary treatment) to equip 330 cities and urban centres, reaching more than 10 million inhabitants.

To meet the objectives the total cost of investment is estimated at:

- MAD2.9 billion by 2020, which will be directly financed by municipal utilities and concessionaires
- MAD43 billion by 2020, financed by PNA, of which MAD21.5 billion is to be financed from the state budget and the remainder by operators, notably ONEE.

The question which arises is: will classical modes of financing (users, external subsidies—public or private) and recourse to backers and commercial banks be sufficient to face this huge financing need?

- Income from users will not be sufficient: indeed, current price setting has attained a saturation threshold and purchasing power is weak. Charges for consumption (according to volume and fixed costs) do not cover the operating expenses of

sanitation, which poses a structural problem for maintaining operators' balance sheets. Indeed, a system can work permanently only if at least recurrent expenses are covered by income and charges paid by users. The situation will deteriorate when future investment, the objectives of treatment and the high cost of sanitation generate additional costs for operators. In the case of RADEEMA, which we have analysed, incomes by invoiced m<sup>3</sup>, will cover only 83 per cent of operational expenses (excluding costs of investment), given that RADEEMA plans to attain at least 100 per cent primary treatment (Figure 23).

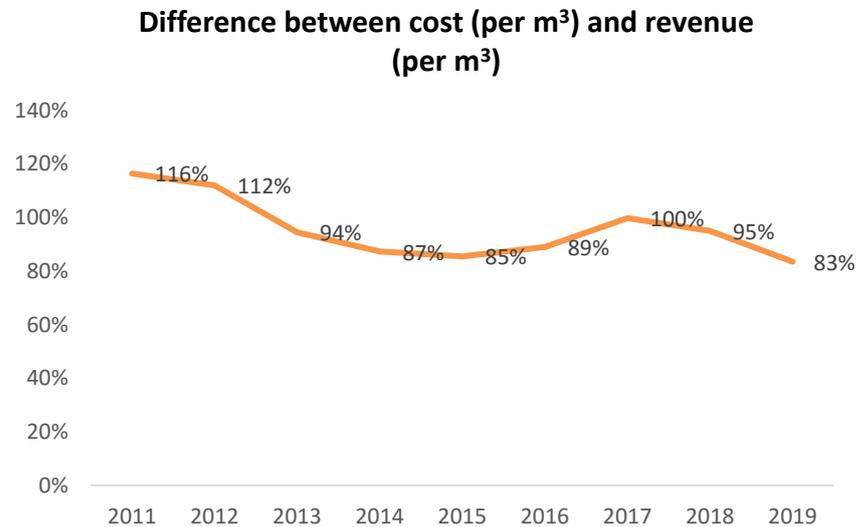


Figure 23. Gap between charges (per m<sup>3</sup>) and costs (per m<sup>3</sup>)

RADEEMA was able to improve the coverage of operating expenses 2015-2017, thanks mainly to the implementation of a cost control strategy, including of overhead costs. Users must pay more in order to cover recurrent expenses. Whether from RADEEMA or the other utilities distributing electricity, the operating deficit must be covered by internal cross-subsidy from surpluses provided by electricity services. The surplus of funds necessary to cover expenses differ from one year to another.

However, problems arise for municipal utilities which supply only potable water and sanitation (the most important case is that of greater Agadir). Electricity is managed by the national ONEE operator. Indeed, these municipal utilities cannot benefit from internal cross-subsidies to cover the deficit in sanitation (given that drinking water activities also require important investment and present a structural deficit).

Are there solutions to remedy this situation? As explained above, a system will work in the long-term only if operational expenses are borne by users of services. Currently two solutions can be envisaged:

- Implementing an appropriate tariff structure which will allow operators to cover recurrent costs with charges for consumption and fixed charges
- The state and communes find a system of subsidies which will cover costs from the outset.
- Own resources of operators: (Equity capital as part of cross-subsidies). Operators' own resources come from the margin earned from all activities (water, sanitation, electricity), or as part of a strategy to cover expenses (overheads). The Moroccan mode of financing, is one which we consider as innovative, in so far as electricity supply generates resources to cover the working deficit and a part of the investment cost. In Morocco there are problems of critical size and the lack of synergy between state companies, concessionaires and ONEE.
- Standardization and integration of operators in larger areas, at the scale of the region. Thought has been given to these issues for several years, particularly since the National Service of Drinking Water and the National Service of Electricity merged into the National Office for Electricity and Potable Water (ONEE). Morocco is experimenting with new models, based on public-private partnerships (PPPs), and reorganizing operations into regional companies with a clear separation between planning and financing. The new models for utility services could improve access to water, electricity and sanitation, while making the most of financial capacities.
- A feasibility study of the Souss-Massa region with the participation of all parties (State, ONEE, townships and autonomous state corporations) indicated that the preconditions for the success of regional all-purpose schemes are institutional reform to strengthen the capacities of municipal utilities for managing urban services and decentralization. With the help of the World Bank, Morocco is testing a programme to help communities to improve capacities in order to become regional operators.
- External income from investors: sanitation benefited from the support of investors and commercial banks in Morocco. However there has been a decrease in loans at concessional rates granted by international financial institutions which benefited operators. Loans granted by local banks are at higher rates of interest, thus limiting operators' ability to cover expenses.

Table 26. Loans to RADEEMA 2007–2026

MAD '000	Duration	Outstanding	Financial expenses	% outstanding	% financial expenses
European Investment Bank	15 years	340,409.78	25,350.25	41	12.29
Total commercial local banks	15 years	480,000.00	180,870.17	59	87.71
Total loans		820,409.78	206,220.42	100	100

Table 26 shows that loans from national banks represent 59 per cent of outstanding discounted bills financing sanitation and generate 87.7 per cent of interest expenses.

Loans from international backers leverage finance for investment and cover recurrent expenses to help operators. The development of guarantee instruments, in addition to the sovereign guarantee given by the state, may encourage investors to allocate more money to sanitation.

Loans from local banks are part of business between banks and operators. The rates applied by these banks are higher than those of investors because the banks do not demand a state guarantee. To compensate, the banks apply a risk premium which, in certain cases, can be up to 150–200 basis points (between 1.5% and 2%). All the local banks have promised to support the national sustainable development strategy by allocating funds to environmental plans. However, financial innovations allowing banks to offer instruments adapted to the needs of the sanitation sector have not yet been implemented. As part of the sustainable development strategy a partnership between operators and banks to provide access to less expensive financing should be encouraged.

- External resources provided by the state in form of OBA (Output-Based Aid): These state subsidies support investment in sanitation. In general, the subsidies are similar to OBA. The two main instruments the state has at its disposal to support sanitation are PNA and INDH (see above). INDH is a human development programme which only partly benefits sanitation. PNA is more specific to sanitation and is part of a long-term policy. The problem is that this programme is principally financed by the state budget from taxation.
- External resources provided by the state, as part of the strategy of sustainable development: The State of Morocco strategy for sustainable development commits to mobilizing resources to support key sectors, including sanitation. For example, the state dedicated MAD1.15 billion to planned actions, as part of its strategy of sustainable development for 2018. Sanitation and treatment of wastewater are to absorb MAD580 million, that is more than 50 per cent of the programme, proving the determination of the state to improve both access to sanitation and quality treatment. This amount will be allocated as follows:
  - MAD180 million to municipal utility companies for modernization, strengthening sewerage networks and STPs
  - ONEE will get MAD400 million to complete the same activities.

In conclusion, it is evident that, in comparison with other countries, Morocco's mechanism of financing through grouping three sectors—drinking water, sanitation and electricity—is the most important and the most innovative. This mode of financing should be preserved and extended to allow operators to attain a critical size in larger areas. This critical size, and only that, will allow investors to support sanitation.

The other specificity of the Moroccan case is the financial incentive provided by the state, through sectoral programmes, to support investment in local utilities, and particularly sanitation. These programmes have achieved a threshold of maturity and saturation and their functions now need to be updated and their capacities developed.