AGENCIA LOCAL ENERGIA·MURCIA

A L E M

CONTRACT FINAL REPORT

Contract: "Technical Assisting Service for the Execution of Elaboration of Baseline Energy Inventory and Sustainable Energy Action Plan of Salé & Energy Auditing of Salé City Council"

14th JULY 2011

ALEM

LOCAL ENERGY AGENCY OF MURCIA

EXECUTIVE SUMMARY

This report summarizes the baseline energy inventory, the SEAP and the proposed pilot action for the City of Salé (Morocco).

The baseline energy inventory seeks to analyze the actual status of energy consumption in terms of efficiency and sustainability and to estimate the overall energy consumption of the City of Salé and the green house gas emissions per inhabitant in the baseline year.

Firstly, it is briefly described the demographic, economic, geographic, climatic and urban characteristics of the territory of the Municipality of Salé. Secondly, it is estimated the availability of local renewable energy resources, its current use and its potential use. Finally, it is characterized the energy consumption of energy in Salé in the baseline year 2008.

Regarding energy consumption per sectors, Industry and Residential (Housing) are the ones that absorbs more than two thirds of the total energy consumption of Salé per year. Industry absorbs 33% and residential 30%. Mobility nearly absorbs 25% of the total energy consumption per year. Tertiary sector covers around 7%.

It is estimated that the final energy consumption within the Municipality of Salé (without including the Industry Sector) is 2,147GWh/year. Approximately 56% of this energy consumption is due to fuel used in vehicles mobility, 18% belongs to fuel consumption in the residential sector, and 20% in electricity consumption.

Regarding green house gas emissions, Salé generated 875,361 tCO_2 in the baseline year. Approximately 34% of this generation is due to electricity consumption, 35% to fuel used in vehicles mobility, 10% belongs to fuel consumption in the residential sector, and 18% to waste generation.

The objective of the Sustainable Energy Action Plan of Salé (SEAP) is to reduce a 20% the CO_2 emissions per inhabitant by 2020 though the execution of measures oriented to reduce the energy consumption and the promotion of renewable energies in the territory of the municipality of Salé. Based on the baseline energy inventory, in an “non-acting” scenario the energy consumption in Salé would pass from 2,147GWh in 2008 to 3,062GWh in 2020. Therefore the overall objective of the SEAP is to reduce a total of 1,344,070 MWh/year by 2020, which means reducing the energy consumption in a 62% with respect to a “non-acting” scenario in 2020. In an “non-acting” scenario the emissions inventory would pass from 0.875 million tCO_2 in 2008 to 1.248 million tCO_2 in 2020. Therefore the overall objective of the SEAP is to reduce a total of 547,767.2 tCO_2/year by 2020.

The overall estimated budget of the execution of the SEAP for 2012-2020 is 245,772,580 MAD, i.e. 21,712,125 €. This means approximately an investment of 31 million MAD per year, i.e. 3 million EUROS per year. In this budget it is not included the costs of the measures already executed such as the Tram Salé-Rabat which are included in the SEAP.

The execution of the measures planned between 2012 and 2020 in the SEAP (i.e. not including the already executed measures such as the tramway) will generate a global

saving of 882,109,394 MAD between the 2012 and 2020 due to the overall reduction of the energy bill of the City of Salé.

BASELINE ENERGY INVENTORY OF SALÉ

The baseline energy inventory seeks to estimate the overall energy consumption of the City of Salé in one year, the baseline year (i.e. the whole energy consumed within the territory of the Municipality of Salé including private and public consumption). With these data, a baseline emission inventory will be performed to estimate the overall green house gas emissions generated by the City of Salé in the baseline year per inhabitant. This green house gas emission per inhabitant of the baseline year will be set as reference year in order to compare the results and effectiveness of the Sustainable Energy Action Plan in 2020.

1.1. Description of the municipality

1.1.1. Population

The current population of Salé is around 1,000,000 inhabitants [1]. In 2004, the population was 814,871 inhabitants with 168,497 familiar nuclei according to [16]. Other sources indicate that the population of Salé in 2007 was 903,485 inhabitants. All in all, the population of Salé has experienced an important growth showing 75,799 inhabitants in 1960 and multiplying by 10 in 44 years. The population rate is 2.8% per year. The demographic density of Salé is 7,900 inhabitants/km^2.

The population is organized in 5 urban districts or agglomerations defined within the City of Salé in the “Charte Communale” in 2003. The following table shows the distribution of the population in the agglomerations in 2004 [16]:

Districts	Population	Familiar nuclei	Mean familiar size	Growing rate(%)
Bab Lamrissa	139,744	31,744	4.4	2.1
Bettana	98,751	21,200	4.7	0.1
Hssaine	63,588	34,971	4.7	8.1
Laayayda	114,799	21,238	5.4	3.5
Tabriquet	234,690	49,107	4.8	1.4
Total	751,572	158,260	4.8	2

The population distribution in Salé is 49.5% men and 50.5% women. The population is young, more than 30% of the inhabitants are under 14 years. The population of more than 60 years is around 6.1% of the total.

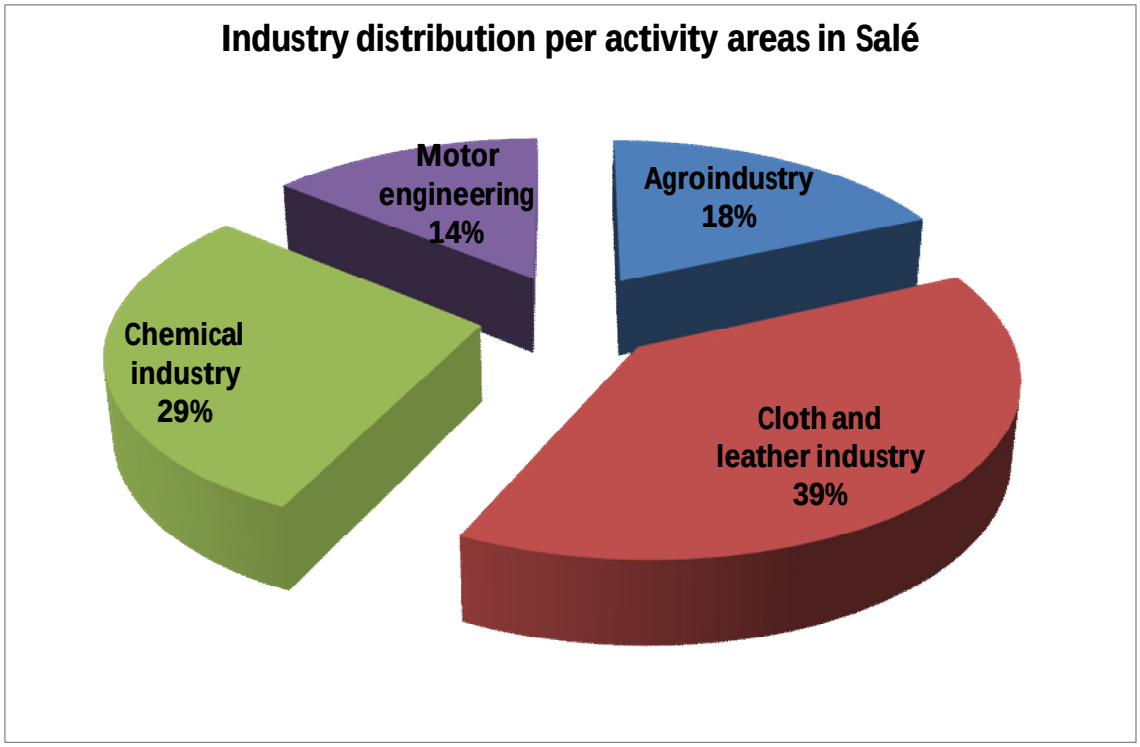
Regarding the civil state of the population approximately 53% of the population older than 15 years is married. The average age of the first marriage is 32 years old for men, 27 years for women.

1.1.2. Economic description

Salé is an important city in the economical structure of Morocco. Its importance is partially due to the short distance to the Capital of the Kingdom and the limitation of Rabat to grow due to the lack of space.

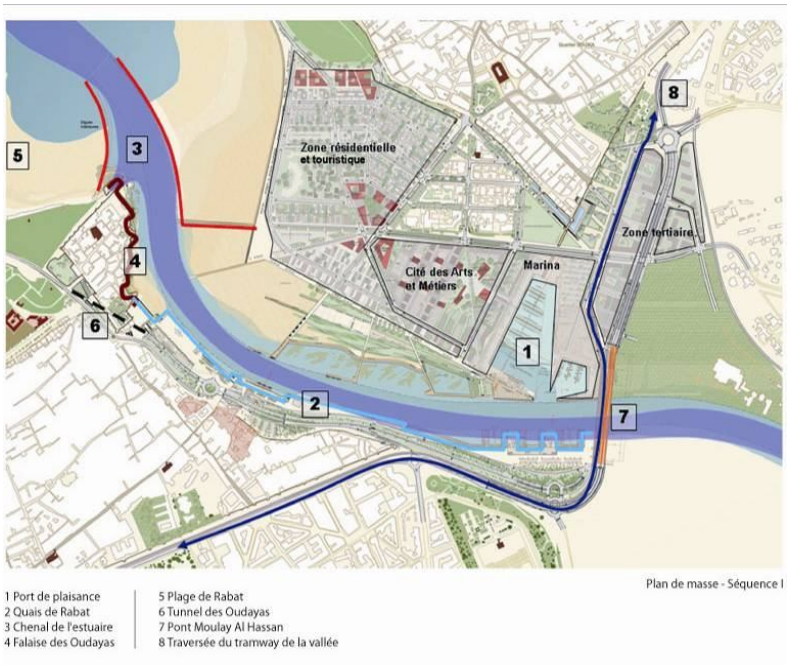
In 1999, Salé city appeared to be the first city at the regional level regarding employment (about 15,860 permanent workers), turnover and production [11]. The majority of its working population is employed in Rabat, essentially in the administrative sector. The occupation rate was 37% in 1999. Men occupation represented 52.8%, whereas women occupation represented 21.4%.

Regarding the commercial sector, updated data [1] shows that the city has 6,532 small business providing different kind of services. Regarding the industry, there are 171 units located over 4 major industrial activity areas:



Additionally, a new industrial pole is being developed. It is called Technopolis (see following figure) oriented to technology areas of activities: off-shoring, ICTs, tertiary services.

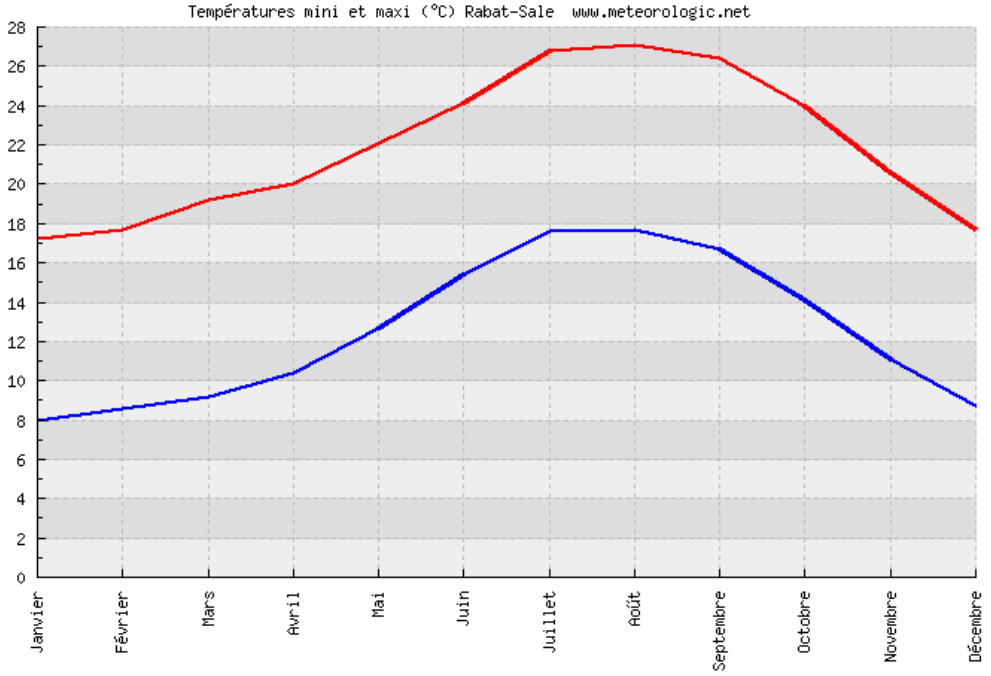
Regarding current developments, one of the most important is the Plan for the Development of the Bouregreg Valley [12] (see following figure) with 15 billions USD $ in 10 years in 6000 ha, most of them in the City of Salé. It includes among other facilities a Marina, the development of a tertiary zone and a tram connection over the river between Rabat and Salé.



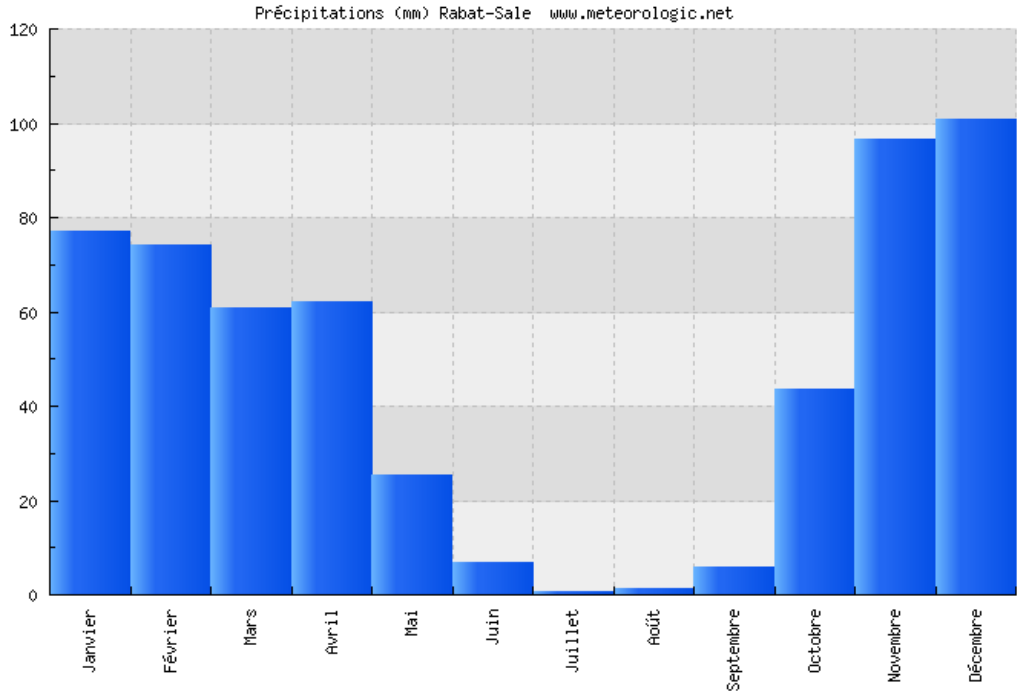
Regarding the formation of the working population, Salé has 61 professional formation centers and two high schools specialized in applied technology: Hay Essalam and Sala AL Jadida. Salé also holds the High School of Technology and the Faculty of Social, Economic and Legal Sciences. Additionally, the National School of Forest Engineers (ENFI) is settled in Salé, which could play an important role in the field of forest management and generation of biomass fuel actions within the Sustainable Energy Action Plan of Salé.

1.1.3. Climatic Conditions

Salé features a warm oceanic / Mediterranean climate. It has a mild temperate climate, shifting from cool in winter to warm days in the summer months. The nights are cool, with daytime temperatures generally rising about +9/10 °C. The winter highs typically reach only 17.5 C in December–January. The following figure shows the evolution of maximum and minimum temperatures along the year. The mean annual temperature is 17°C.



The atmosphere in Salé is humid, due to the double influence of the ocean and the river. The level of relative humidity is within the 75 and 85% during the whole year. Rainfall varies widely. The annual mean for the last ten years is 559.8 mm, but large differences can be registered from year to year. The following figure shows an example of annual precipitations in Salé:



1.1.4. Geographical and Urban Conditions

Salé is located at sea level in the Atlantic coast at 34º 02' North and 6º 48' West and is located on a plateau on the right bank of the River Bouregreg. The territory of the

Municipality of Salé is approximately 127 km^2. The official data of [8] indicate that Salé has 15,095 ha.

The following map from [10] shows the urban areas, the industrial areas, the forest areas in the territory of Salé. In the north of Salé, the agricultural zone of Bouknadel ensures continuity between the Forest of Mamora and the coast [9].

As previously indicated, Salé is organized in 5 urban districts or agglomerations defined within the City of Salé in the “Charte Communale” in 2003: Bab Lamrissa, Bettana, Hssaine, Laayayda and Tabriquet [16]. Historically, Salé is part of the Rabat agglomeration. In Salé, the colonial town consists of a few residential districts which formed the first urban extensions around the Medina. The development after the independence consisted of social housing and new neighborhoods. In the 80s and 90s the latter comprised more than half of urban growth. Both developments gave Salé the

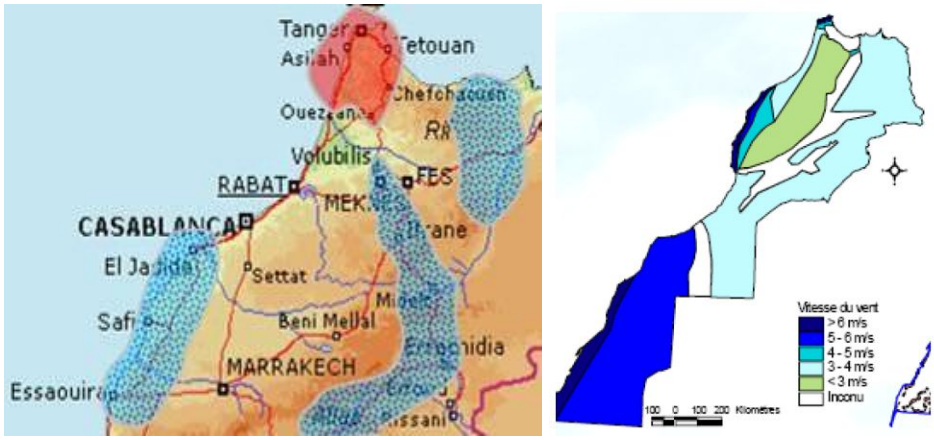
role of Rabat's dormitory town. As an example of the urban growth it can be named the "new town" of Sala Al Jadida, which is actually very similar to some European suburbs [10]. The urbanization tax of Salé is 93.3% in 2004 according to [15].

1.1.5. Availability of renewable energy sources

Based on the information available it will be described the availability of renewable energy sources in the territory of the Municipality of Salé.

1.1.5.1. Wind

The following map shows the availability of wind resources in the area of Salé and the north of Morocco:



In the map on the left hand side, the blue areas represent regions with global potential of 1,000MW (7.5-9.5 m/s), whereas the red areas represent regions with a global potential of 1,000 to 15,000 MW (9-11 m/s). In the map of the right hand side, it is shown the areas with mean velocity levels lower to 6m/s from CDER found in [21]. As shown, Salé has a mean velocity level between 3 and 4 m/s. The economically viable wind potential in the territory of the Municipality of Salé is relativelly low, however it is expected local areas of relativelly energetic wind potential peaks due to the close distance to the coast. This potential should be analyzed by an ad-hoc study.

No facility for the exploitation of wind as a renewable energy source, was detected in Salé.

1.1.5.2. Biomass

The following map shows the availability of biomass resources in the area of Salé and the north of Morocco:

In the map, the purple areas represent agriculture zones whereas the green areas represent forests. As shown, the territory of the Municipality of Salé accounts for this two sources of biomass, which could be taken in advance as energy resource.

The area covered by forest and agriculture in the territory of the Municipality of Salé is relatively important. Additionally, due to the size of the City of Sale, urban wood waste, which includes wood residues and pallets, could be used as a stable energy source through their transformation into wood chips. Therefore it is estimated that there is an available biomass resource of 2000 tons of biomass per year, which implies a minimum of 4MWh/year of energy.

In order to take advance of these resources it is needed to set-up a logistic stocking and distribution infrastructure.

It is not detected any facility of the exploitation of biomass renewable energy sources in the territory of Salé apart from the traditional use of wood for the generation of heat in housing.

1.1.5.3. Solar

The following map shows the availability of solar resources in the area of Salé and the north of Morocco:

In the map, the yellow areas represent regions with less than 4.7 kWh/m^2 of solar radiation, the brown areas represent regions with solar radiation levels between 4.7-5 kWh/m^2, the orange areas represent regions with solar radiation levels between 5-5.3 kWh/m^2, whereas the red areas represent regions with solar radiation levels between 5.3-5.5 kWh/m^2.

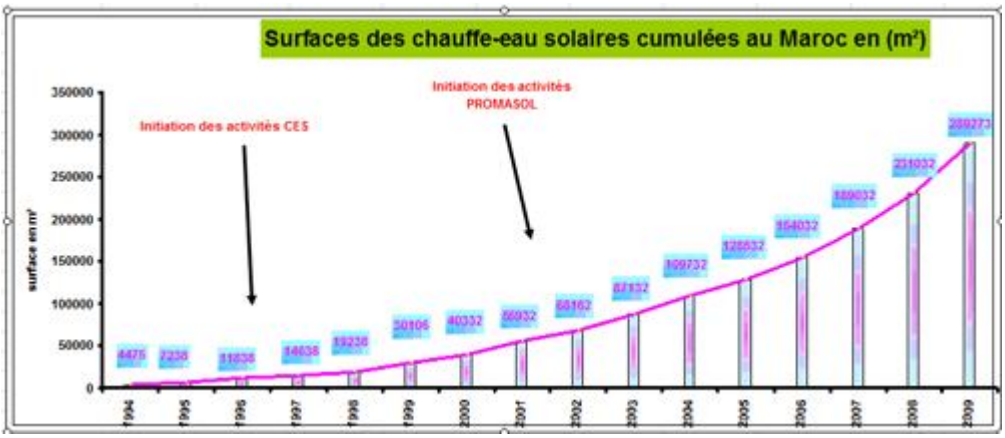
As shown, the territory of the Municipality of Salé receives an average solar radiation level between 4.7 and 5.3 kWh/m^2. This is an important energy source potential available that should be taken in advance.

This level of radiation permits to install solar photovoltaic power plants with a relatively high level of efficiency. Taken into account the latitude, the climatic conditions and the radiation level of Salé, the estimated an average level of production is around 1,600 kWh generated per peak kilowatt of power installed for fixed (non-tracking) technology facilities with a medium-high level of quality in the components. For facilities with one axis tracking system technology the level of production estimated is around 1,800-1,900 kWh generated per peak kilowatt of power installed and 2,000-2,100 kWh generated per peak kilowatt of power installed for the case of facilities with two axes tracking system technology.

The level of solar radiation and the availability of water resources also permit to install solar concentration thermo-electric power plants of medium-temperature and high-temperature technologies in the Municipality of Salé with a relatively high level of efficiency that would depend on the technology used. Taking into account the available technology [2] level of irradiation available in Salé, it is roughly estimated an average electricity production of around 750 kWh per square meter of solar collector panels installed per year.

Finally, the solar resource can be also used through low temperature technologies for the generation of hot sanitary water.

Based on the national inventory of solar thermal facilities it could be estimated the amount of solar thermal facilities in Salé. The following figure from [14] shows the national evolution of installed surface in Morocco [14].



According to these data and the fraction of the national population that is settled in Salé should be around 7500 m^2. In order to contrast this rough approach and to estimate the actual amount of solar thermal facilities in Salé, satellite images of the different neighborhoods of the City of Salé were analyzed due to the lack of any other official local data. According to [21] it is estimated that in 2007 the amount of solar thermal pannel surface installed in Morocco was 45,000m^2. Taking into account Salé population this means around 1,400m^2 of solar thermal pannel surface installed in Salé. Assuming that the average surface per facillity is between 2-4 m^2, this means that the City of Salé has aproximatelly 350-700 facillities. However, an ad-hoc analysis of the City of Salé showed that than 0.1% of buildings inspected in satelite images had

solar thermal facilities in the roofs. Therefore, based on this estimation, it will be considered in the baseline energy inventory that there is less than 500 m^2 of solar thermal facilities in the City of Salé.

Regarding solar photovoltaic facilities, [21] indicates that the amount of total photovoltaic power installed in 2007 was 6MW in Morocco. Most of these facilities are isolated and have been developed under the PERG, the rural electrification program that was launched in 1996. In 2006 it was estimated that approximately 85% of the rural housing used this program. This data indicates that around 187.5 kW of photovoltaic power was installed in Salé.

Therefore in this study it is assumed that the solar power installed in Salé in 2008 is:

Solar Energy Technology	Total Surface installed (m^2)	Solar energy consumed (MWh/year)
Low temperature solar thermal for water heating	500	60.75
Photovoltaic	1,340	300

In the estimation of the heat generated by the low temperature solar thermal water heating facilities is has been assumed that the facilities are able to generate 100W of heat per sun equivalent peak hour. In winter it was assumed that there were profited 3 sun peak equivalent hours per day per facility. The rest of the year it has been assumed to be profited 9 sun peak equivalent hours per day per facility.

1.1.5.4. Hydraulic and marine resources

Salé accounts for the Bouregreg river with a relatively important level of hydraulic resources. Actually, it is one of the most important streams of Morocco. The Bouregreg river is 240 kilometers long, with a tidal estuary of approximately 24 kilometers extending upriver. Its average discharge is 23 m^3/s and can reach 1,500 m^3/s during periods of flooding.

According to data of the Ministry of Equipment provided by [30], Bouregreg shows the following official characteristics:

Basin surface	9550 km^2
Mean year flow rate	680 Mm^3/year
Nominal retention capacity	480 Mm^3

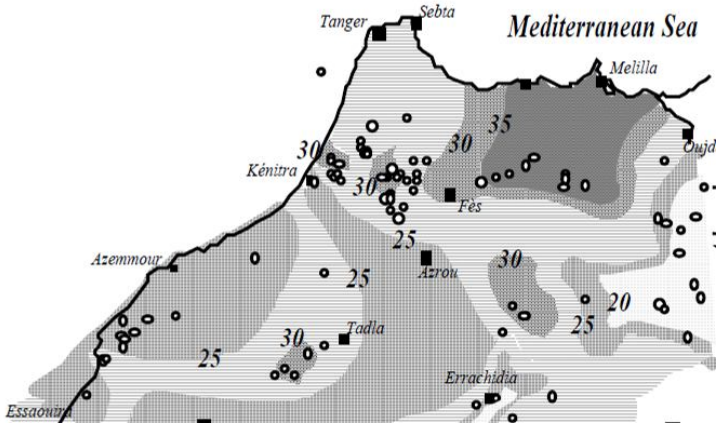
These resources could be partially used through small high water jumps within the Municipality of Salé for the installation of mini/micro-hydro power plants of small power (less than 3MW) as demonstrative and/or pilot projects.

The territory of Salé also has available marine resources in the coast, which could be partially used in demonstrative and/or pilot tidal-type projects of small power (less than 500kW) in the mouth of the Bouregreg River.

It is not detected any facility of the exploitation of hydro renewable energy sources in the territory of Salé.

1.1.5.5. Geothermal resources

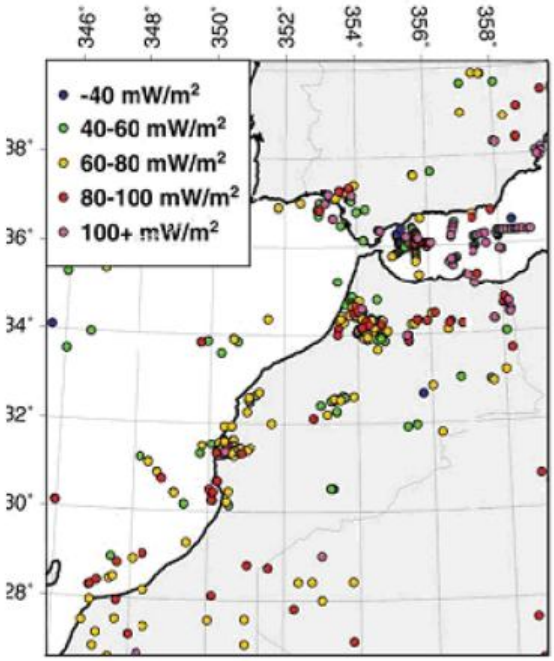
The following map shows the availability of geothermal resources (in terms of deep geothermal gradients), in the area of Salé and the north of Morocco [3]:



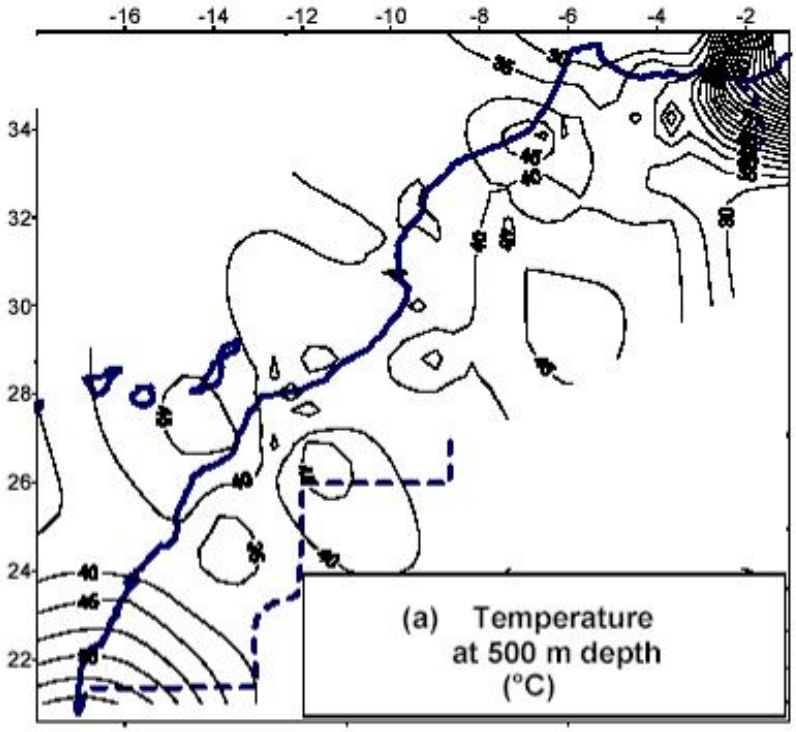
In the map, the light grey areas represent regions with less than 25-30 ºC/km of geothermal gradient, the medium grey areas represent regions with geothermal gradients between 20-25 ºC/km whereas the dark grey areas represent regions with

more than 30ºC/km of geothermal gradient. The territory of Salé (under the Kénitra), shows geothermal gradient levels between 20 and 30 ºC/km.

Regarding the heat flow level in Salé, the following map, from [4], shows that the heat flow level in Salé is estimated to be around 80-100 mW/m^2.



At medium level depth (i.e. 500 m depth), the average temperature level at Salé rounds the 45ºC according to [5].



Regarding shallow geothermal resource, [3] estimates rough average geothermal temperatures between 23 and 27 ºC for depths between 10 and 40 meters.

Additionally, there exist evidences of local hot springs in the area surrounding the Bouregreg river, such us the old roman thermal baths of Chellah. Therefore it is not disregarded the potential existence of hot springs in Salé territory. This potential heat source should be deeply analyzed by ad-hoc studies.

All in all, the level of temperature in the shallow depth (T<50ºC) indicates that there is a potential use of geothermal heat-sink applications for heat and ventilation air conditioning systems (HVAC systems) for cooling and heating through geothermal heat-pumps. This way the temperature jump between the evaporation and condensation temperature of the heat pumps is considerably reduced due to the lower temperature of the land as condensation media compared to the atmosphere. The heat sink probes should be set based on ad-hoc decision making between 10 and 250m depth, depending of the heat transfer coefficients of the local land.

The use of this type of geothermal heat-pumps would generate a saving of electricity of 50-66% with respect to the conventional heat-pump systems.

It is not detected any facility of the exploitation of geothermal renewable energy sources in the territory of Salé.

1.1.5.6. Combined heat and power

There exist a combined heat and power facility in the Salé Traditional Craftwork & Pottery Center of Darwin.

1.1.6. Mobility

The city has four means of public transport: train, plane, bus, taxis. Additionally it is a new one that will be in operation: the tram. Salé accounts for:

- 2 Railway stations
- 1 Airport
- 1 coach/bus station
- 1 Tramway
- 2000 taxis.

The public bus urban transport service is managed by a private company under delegated management law, is now subject to EURO 3 standards, which means a considerably reduction of CO_2 emissions with respect to national law.

Local data of bus public transport in the city of Salé were provided by [30] and shows the following characteristics:

- Total number of the bus fleet: 480 busses
- Number of kilometers covered annually: 40,000,000 Km
- Average Gasoil consumption per bus: 46 L/100 Km
- Gasoil price in bulk as bought from wholesaler: MAD 5.70 per litre

Regarding private vehicles, connection between Rabat and Salé is an important transport problem. Around 650,000 people usually commute daily using 150,000

private vehicles. This demand problem is currently being solved through the Tram Salé-Rabat project. Regarding other mobility characteristics of Salé, there are ad-hoc mobility analysis studies. For more details about it can be found in [6] and [7].

Since airports emissions are optional sources to be included in the Covenant of Mayors and since there is no local power of influence on them, it was decided not to include them in the –20% objective of the SEAP of Salé.

1.1.7. Buildings

Regarding residential buildings, currently the mean household size in Salé is 4.6 according to [16]. An important change has occurred in the last decade, since the mean household size used to be 5.5 in 1994 [10].

The city of Salé passed from 53,232 houses in 1982 to 95,414 in 2004, i.e. a growth of 79% in 22 years [16]. This important fast urban growth generated the development of non-regulated settlements (Tabriquet Nord, Sidi Moussa, Kariat Ouled Moussa, Oued Ed-Dahab, etc.) and the subsequent efforts of the public administration for the re-location of the settlements as in Sala Al Jadida in 1997 [16].

The following table permits to characterize the distribution of buildings built previously to the year 1994 in Salé based on official data published on 2002. Please note that the table shows the number of households according to the type of neighborhood not in Salé but in the whole agglomeration of Rabat-Salé-Temara [10]:

Type of Housing	Number of Households
Basic housing	230,000
Rural type housing in urban areas	80,000
Premises not meant for housing, bedrooms in hotels	40,000
Traditional Moroccan houses	150,000
Slum housing districts	350,000
Total	850,000

The first four categories, comes from the general census on the population and on housing of 1994 [13]. The fifth column corresponds to a specific census of 1993 found in [8].

Regarding public buildings, the energy auditing of public buildings has characterized the energy performance of the public buildings of Salé and has shown specific outputs that can be found in [17].

Salé has 833 kinder gardens, 160 primary schools and 61 secondary centers.

Regarding energy related requirements of future buildings, the National Program of Energy in Buildings of Morocco [15] shows that Salé corresponds to Zone 1 (Atlantic coast) of the climatic national zone distribution in the thermal legislation of buildings at national level. The future law (law project nº47-09 relative to the Energy Efficiency) that is currently under development includes the following technical specifications for the zone of Salé:

Level of	U in roof	U in external	U in windows	Solar Factor

windows	W/m²·K	walls W/m²·K	W/m²·K	of windows
< 15 %	< 0.75	< 1.2	< 5.8	Not needed
16 - 25 %	< 0.75	< 1.2	< 5.8	North: not needed Others < 0.7
26 – 35 %	< 0.75	< 1.2	< 3.3	North: not needed Others < 0.5
36 – 45 %	< 0.65	< 1.2	< 3.3	North < 0.7 Others < 0.3

1.1.8. Municipal public lighting

The public lighting of Salé has an, annual electricity consumption of 26 GWh, an average lifetime of lamps of 18 months and an annual cost of spare part 800000€ [1].

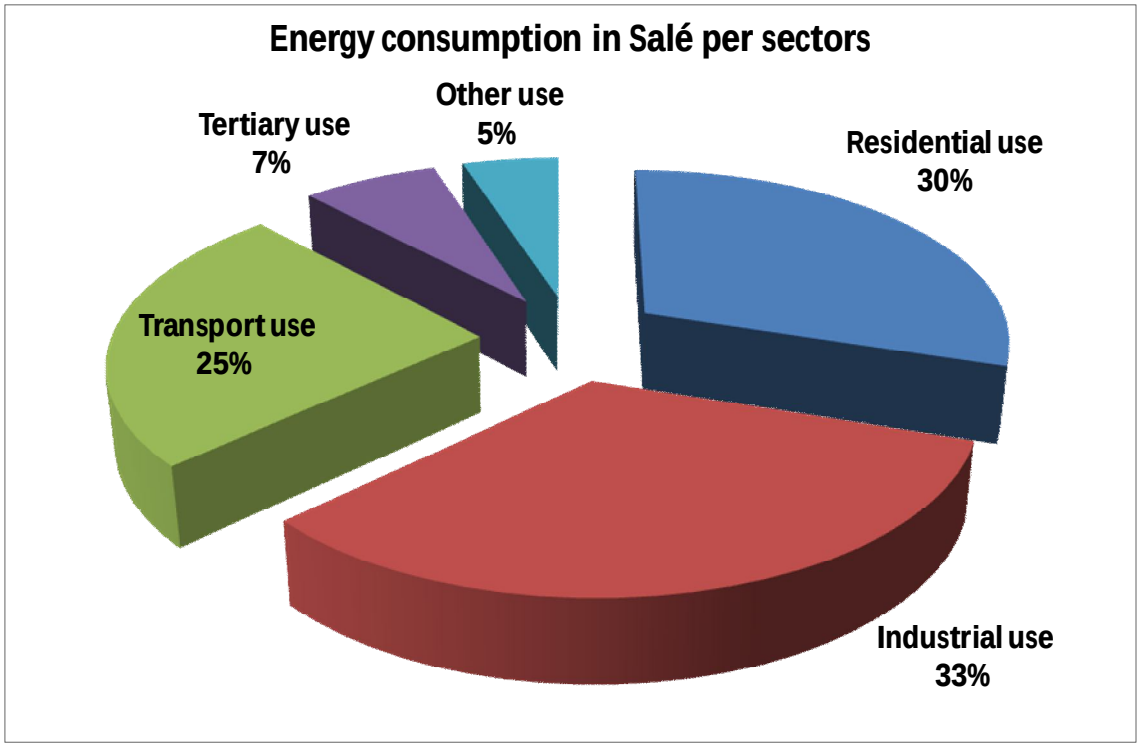
1.2. Baseline energy inventory of Salé

1.2.1. Baseline year

The baseline year fixed as a reference to compare the results in 2020 is the year 2008. The reason for the election of this year is that the data of energy consumption of the City of Salé available and collected belonged to the year 2008.

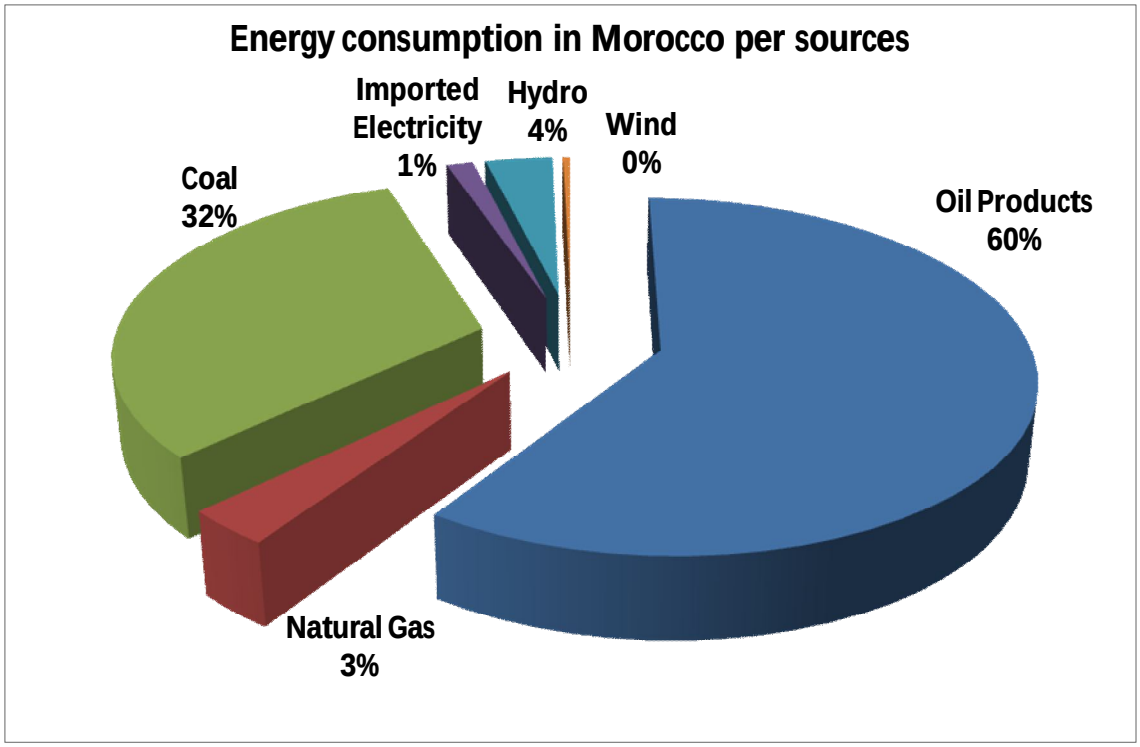
1.2.2. Energy consumption and distribution per sectors and sources

According to the data provided in [1], the average energy consumption per capita in Salé is 0.47 Toe/year i.e. 5.47 MWh/year/inhabitant. The following graph shows the energy consumption in the territory of Salé per sectors:



As shown, industrial use of energy is the most important in the city with 33% of the consumption. The second most important sector is housing with a 30%. The third most important sector is transport with a 25%. Tertiary sector only consumes 7% of the total energy of the Municipality.

Regarding the energy consumption per sources the following figure shows the national primary energy distribution published by the Ministry of Energy and Mining, Water and Environment of Morocco in 2005 and found in [20]:



Source:	Energy consumption in MWh/year
Oil products	84,752,907
Natural Gas	4,700,581
Coal	45,438,953
Imported Electricity	1,994,186
Hydro	4,985,465
Wind	569,767.4
Total Production	**142,000,000**

Regarding fuel consumption (i.e. oil products, natural gas and coal) by sectors, [19] shows that at national level in 2008, approximately 25.65% of the fuel energy is consumed by the road transport sector and 9.5% for the heating in the residential sector.

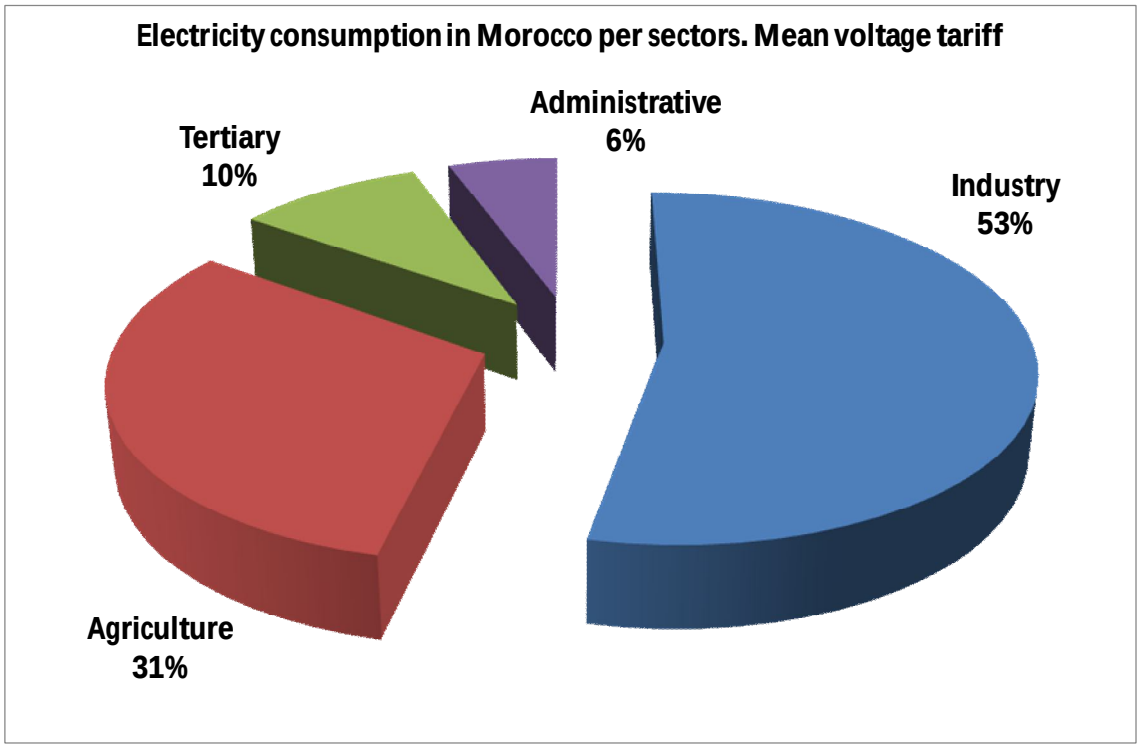
In the following table it is shown the national mix for electricity production in 2008 obtained from the International Energy Agency [19]:

Production from:	Electricity in MWh/year
Oil	5,031,000
Natural Gas	2,867,000
Coal	11,699,000
Biomass	0
Waste	0
Nuclear	0
Hydro	1,373,000
Geothermal	0
Solar Photovoltaic	0
Solar Thermal-electric	0
Wind	298,000
Tide	0
Other sources	0
Total Production	**21,268,000**

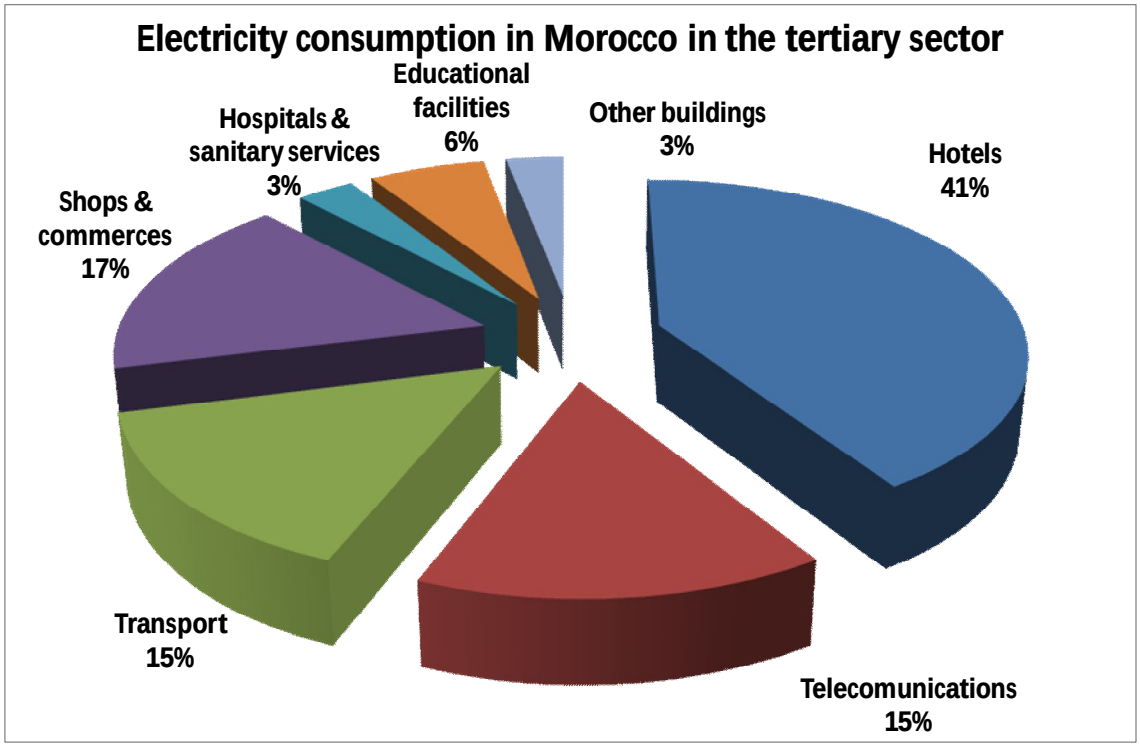
Regarding the distribution of national electricity consumption by sectors, the following figure shows the distribution published by the National Electricity Office (ONE) in 2004 and found in [20]:

In the high and very high voltage tariffs, which are oriented to industry and transport (only 8.9%) it was consumed 2,548 GWh/year at national level. In the mean voltage tariff, the data were the following in 2004:

Sector	Energy consumption MWh/year	Evolution in % of number of contracts	Evolution in % of energy consumption MWh/year
Industry	1,504,851	7.8	7.5
Agriculture	884,296	9.3	14.4
Tertiary	269,694	8.7	9.7
Administrative	159,146	-1.3	2.0
Total	2,817,987	7.7	9.5

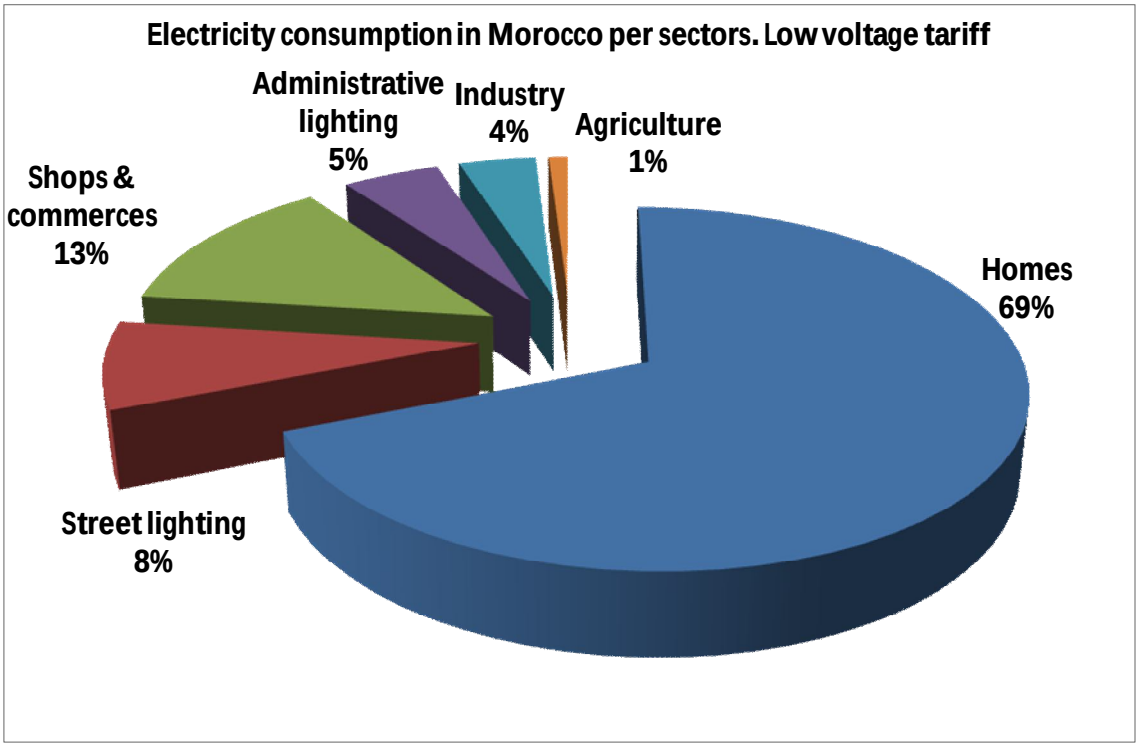


The following figure shows the distribution of electricity consumption per final use in the tertiary sector:



The low voltage tariff is oriented generally for residential purposes. The total energy consumed in this tariff was 2,938 GWh/year at national level which was the 18% of the total consumption at national level. Approximately, 74.32% of the contracts were of housing and 24.5% for the rural electrification global program (PERG). The following

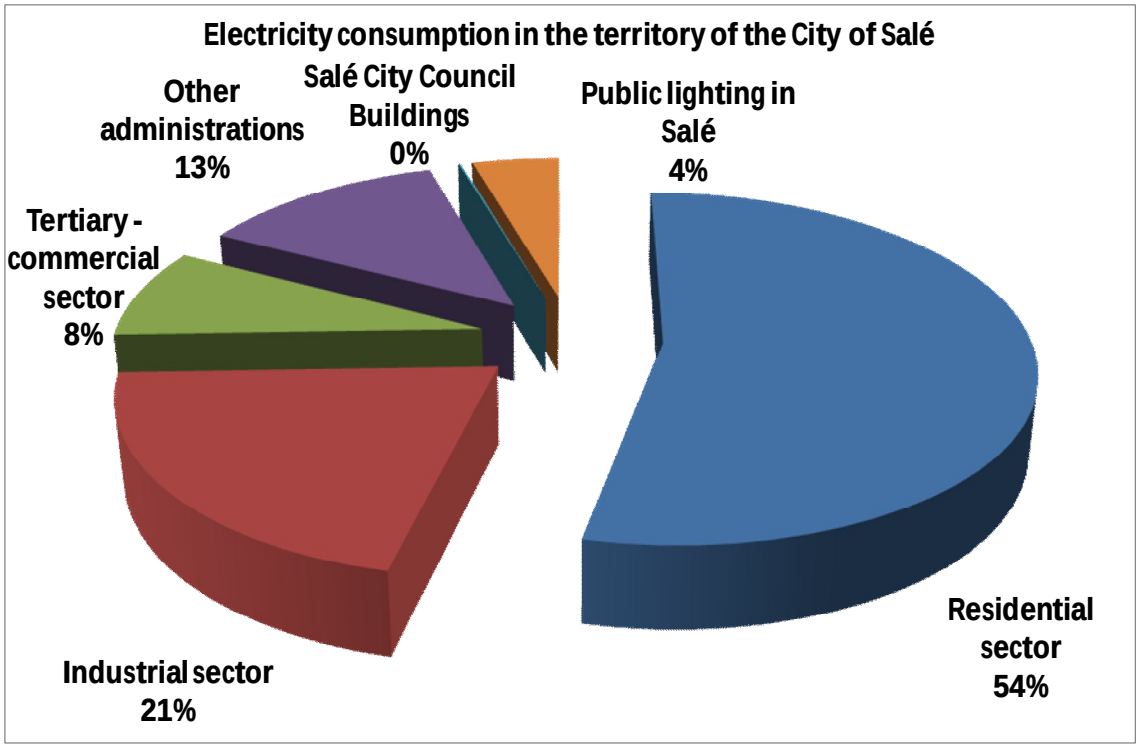
figure shows the distribution of energy consumption per sectors within this tariff in 2004:



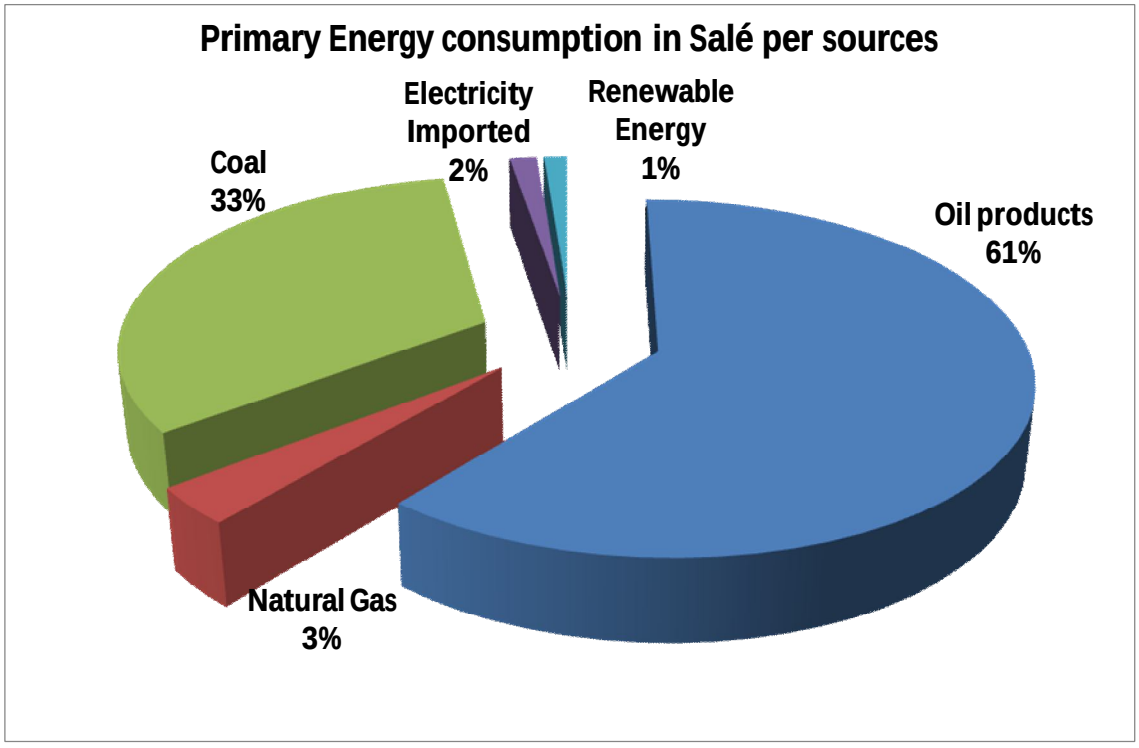
All in all, according to these data, the industrial sector consumes approximately the 53.6% of the electricity at national level.

Regarding local data at Salé, REDAL provided the following electricity data for 2010 [30]:

Data	Consumption in kWh	Number of contracts	Mean energy consumption (kWh)
Total electricity consumption	494,550,203	217,009	2,279
Electricity consumed at residential sector (domestic use + privet lighting)	277,792,966	193,519	1,435
Electricity consumed at industrial sector (Force and medium tension)	108,418,806	1,279	84,768
Electricity consumed at commercial sector	42,866,268	20,655	2,075
Electricity consumed by the Administration	65,472,163	1,556	42,077
Electricity consumption of Salé City Council Buildings	688,440	120	5,737
Electricity consumption of public lighting in Salé	23,381,132	642	36,419



Based on the available data the primary energy consumption per energy sources for the Municipality of Salé is:



Energy source	Primary Energy Consumption in MWh/year	Data source
Oil products	2,648,528.34	National Primary

		Energy Mix. National Consumption per inhabitant
Natural Gas	146,893.169	National Primary Energy Mix. National Consumption per inhabitant
Coal	1,419,967.3	National Primary Energy Mix. National Consumption per inhabitant
Electricity Imported	62,318.3	National Primary Energy Mix. National Consumption per inhabitant
Renewable Energy	52,579.5	Local data & National Primary Energy Mix. National Consumption per inhabitant
Total	**4,330,286.62**	**-**

Taking into account that 33% of the total energy is consumed by Industry. The energy consumption of Salé without Industry sector is 2,901,292.04 MWh/year. This estimation includes the energy distribution losses generated from the electric power generation centers to the city of Salé.

Since, the Covenant of Mayors methodology directly requires the electricity consumption data, those losses must not be taken into account in the balance. Therefore an the final energy consumption balance has been elaborated as follows:

The distribution of electricity consumption obtained from REDAL the electrical company obtained from [30] in Salé is 494,550MWh/year (including industry). Based on the available data from [30], the electricity consumption of the Industry sector in Salé is 108,418MWh/year.

Final Use	**Final Electricity Consumption MWh/year**	**Data source**
Municipal buildings, equipment/facilities	688.44	Local Data from electrical company REDAL [30]
Tertiary (non municipal) buildings, equipment/facilities	42,866.27	[Local Data from electrical company REDAL [30]
Residential buildings	277,792.96	Local Data from

		electrical company REDAL [30]
Municipal public lighting	23,381.13	Local Data from electrical company REDAL [30]

Regarding the final fuel consumption in Salé, the fuel consumption in the residential sector has been estimated to be 9.5% of the total fuel energy (including the one used in the electricity power production mix at national level) consumed in Salé. This is assumed to be consumed in liquid gases form which is the most common fuel used in the residential sector in Salé.

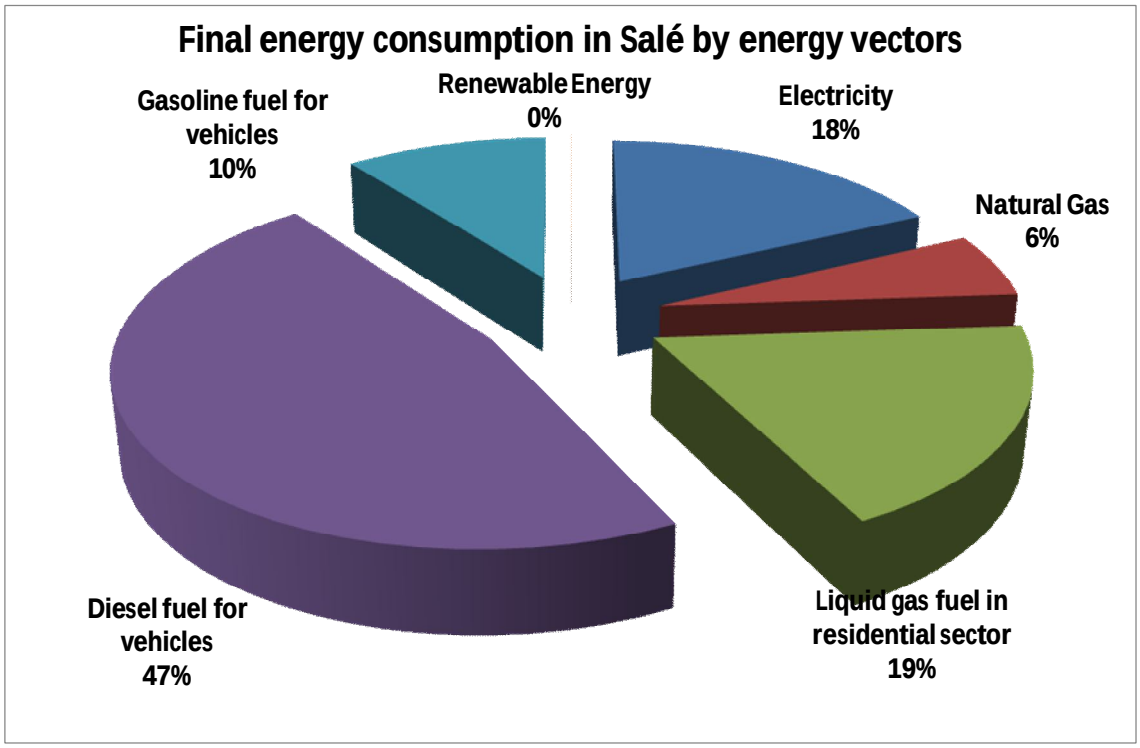
The natural gas consumption in Salé was estimated from the total energy consumed in this form in Salé, obtained from the last figure and extracting the one used for the electricity power production mix.

The fuel used for vehicles motion can be estimated based on [19] data that indicates that the 25.65% of the total fuel energy consumed in Salé (including the one used in the electricity power production mix at national level). However, from the local data of [1] it can also be estimated since it is stated that 25% of the total energy consumption of Salé is used for transport purposes. Both estimations show a difference of 12.4%. Therefore is decided to assume the highest value (i.e. 1,234,413MWh/year) in order to ensure the achievement of the final objective of the Covenant of Mayors from a conservative point of view. Finally, the final distribution of fuel vehicle consumption among gasoil and gasoline are based on the Morocco refinery production in 2008 obtained from [24]. All in all the final fuel data are:

Final Fuel consumption	**Final Energy Consumption MWh/year**	**Data source**
Fuel in residential sector	400,461.5	[19] estimated as 9.5% of the total energy from fuel consumed in Salé
Natural Gas consumption	126,954.4	[19] and [20] obtained from total natural gas consumption minus the one used in electricity generation in the national mix
Fuel consumption for vehicles motion	1,234,413	[1]
Diesel fuel for vehicles	1,009,997	[24] 81% of the total fuel for vehicles generated at national level is Diesel
Gasoline fuel for vehicles	224,293	[24] 18% of the fuel for vehicles generated at national level is gasoline

To sum up, the final energy consumption within the Municipality of Salé without the Industry sector in the baseline year is shown in the next table:

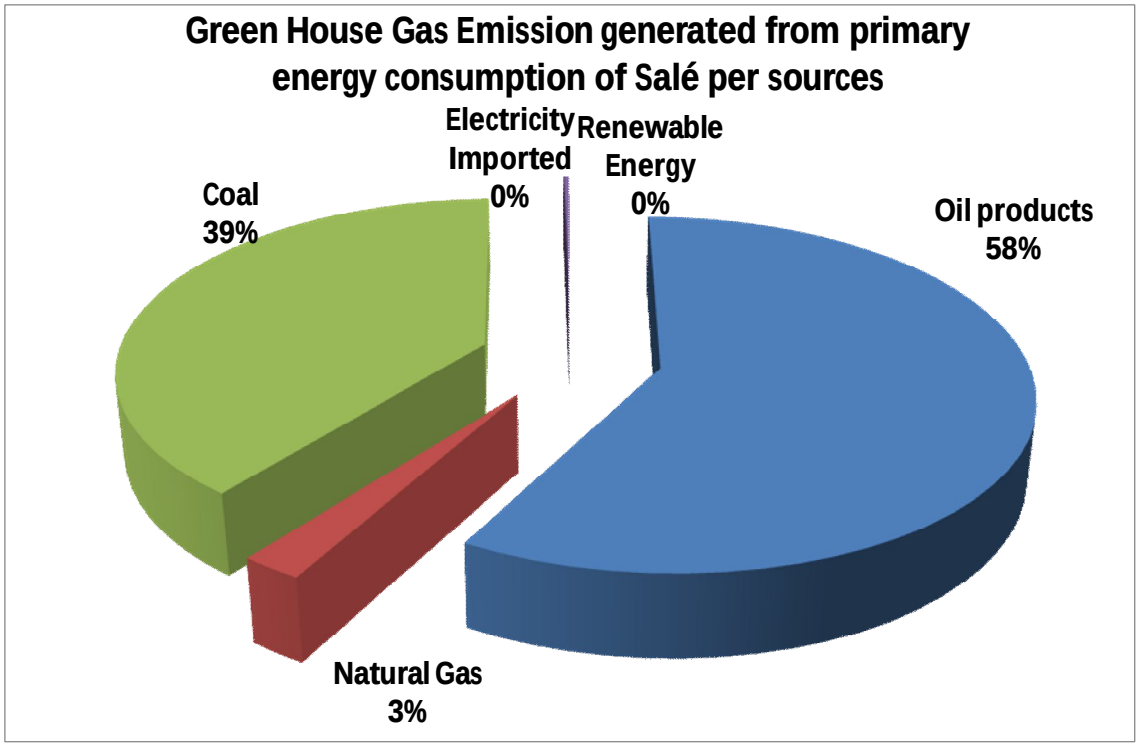
Energy source	Final Energy Consumption in MWh/year	Data source
Electricity	386,131	Local Data from electrical company REDAL [30] (excluded industry)
Natural Gas	126,954	[19] and [20] obtained from total natural gas consumption minus the one used in electricity generation in the national mix
Liquid gas fuel in residential sector	400,462	[19] estimated as 9.5% of the total energy from fuel consumed in Salé
Diesel fuel for vehicles	1,009,997	[24] 81% of the total fuel for vehicles generated at national level is Diesel
Gasoline fuel for vehicles	224,293	[24] 18% of the fuel for vehicles generated at national level is gasoline
Direct use of Renewable Energy	361	Local data & National Primary Energy Mix. National Consumption per inhabitant
Total	**2,147,898**	**-**



1.3. Green house gas emission inventory

In order to estimate the green house emissions it is necessary to know the energy consumption per sources, i.e., electricity consumption, oil products consumption, renewable energy consumption among others.

Based on the primary energy data, it can be estimated the house gas emission inventory generated from the energy consumption for the Municipality of Salé (including the industry sector) per sources:



Regarding green house gas emissions not linked to energy consumption sucha as the generated from waste management, [26] estimates that Morocco produces approximately 4.7 million tons of waste per year, i.e. 1,47tons of waste per person per year. According to [27], it is estimated that it is generated 95.7kgCO_2 from solid waste per inhabitant per year in Morocco. Based on this data, the Municipality of Salé generates approximately 95,714.3tCO_2/year associated to solid waste.

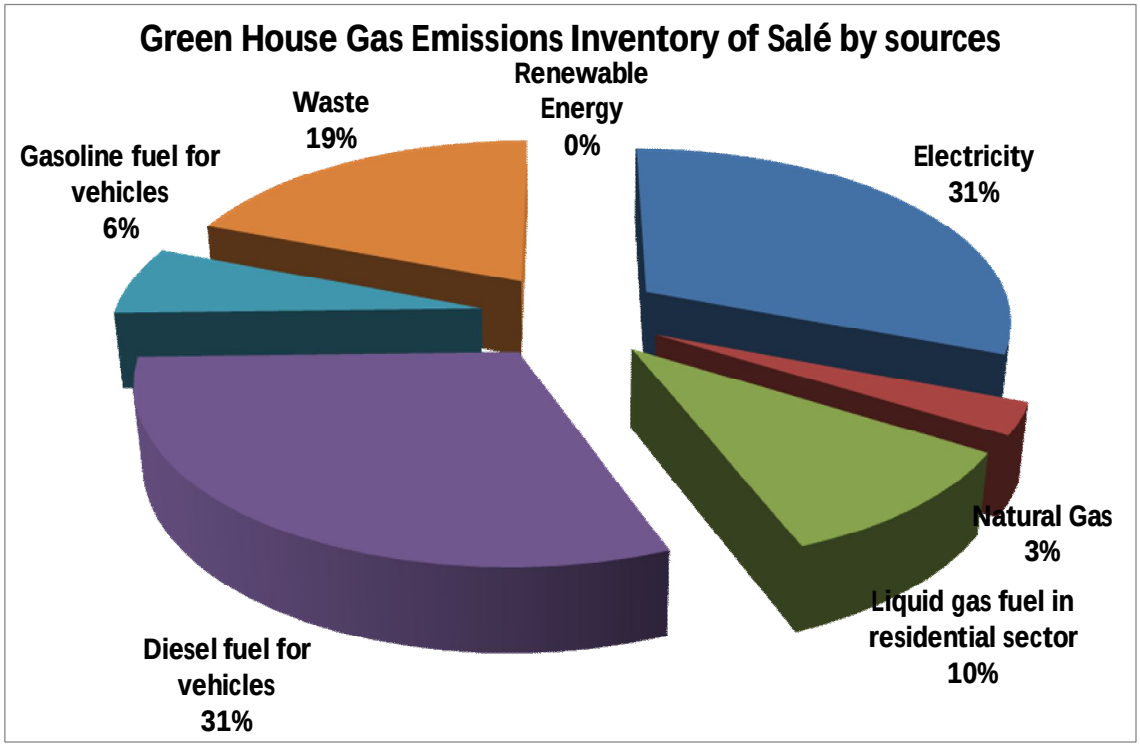
Regarding water waste green house gas emissions, [28] from Ministry of Land-Use Management, Water and the Environment of Morocco estimates that approximately in a city of Morocco is generated 25.47m^3 of waste water per inhabitant per year and 71.37kgCO_2 per inhabitant per year associated to these wastes. Therefore, the green house gas emissions generated in the Municipality of Salé due to waste water is approximately 71,370.6tCO_2/year

Based on the final energy data and waste data available the green house gas emission inventory for the Municipality of Salé without taking into account the Industry sector in the base year is:

Source	Green House Gas Emissions tCO_2/year	Data source
Electricity	270,678.1	Local Data from electrical company REDAL [30] (excluded industry)
Natural Gas	25,515.5	[19] and [20] obtained from total natural gas consumption minus the one used in

		electricity generation in the national mix
Liquid gas fuel in residential sector	90,025.5	[19] estimated as 9.5% of the total energy from fuel consumed in Salé
Diesel fuel for vehicles	266,659.3	[24] 81% of the total fuel for vehicles generated at national level is Diesel
Gasoline fuel for vehicles	55,398.5	[24] 18% of the fuel for vehicles generated at national level is gasoline
Waste	167,084.9	[26], [27] national data
Renewable Energy	0	Local data & National Primary Energy Mix. National Consumption per inhabitant
Total	**875,361.9**	**-**

All in all, the total amount of **green house gas emissions of Salé without the Industry sector in the base year is 875,361.9 tCO_2/year.**



1.4. Covenant of Mayors Template of the baseline emission inventory

The next page show the baseline emission inventory in covenant of Mayors template format.

Sustainable Energy Action Plan (SEAP) template

BASELINE EMISSION INVENTORY

1) Inventory year: 2008

For Covenant signatories who calculate their CO2 emissions per capita, please precise here the number of inhabitants during the inventory year: 1000000

-: Average consumption 0,47toe/year

Instructions

2) Emission factors

Please tick the corresponding box:
- ☑ Standard emission factors in line with the IPCC principles
- ☐ LCA (Life Cycle Assessment) factors

Emission reporting unit

Please tick the corresponding box:
- ☑ CO2 emissions
- ☐ CO2 equivalent emissions

3) Key results of the Baseline Emission Inventory

Green cells are compulsory fields

Grey fields are non editable

A. Final energy consumption

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

9,5% of the fuel energy

Category	FINAL ENERGY CONSUMPTION [MWh]															
			Fossil fuels								Renewable energies					
	Electricity	Heat/cold	Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	688,44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	688,44
Tertiary (non municipal) buildings, equipment/facilities	42866,268	0			0	0	0	0		0			0	0	0	42866,268
Residential buildings	277792,966	0		400461,95	0	0	0	0		0	0	0	0	60,75	0	678315,662
Municipal public lighting	23381,132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26000
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	33% not inclu	not included	not included	not include	not include	not include	not inclu	not include	not inclu	not included	not include	not include	not include	not include	not included in seap	
Subtotal buildings, equipments/facilities and industries	386131,397	0	126954,4	400461,95	0	0	0	0	0	0	0	0	0	60,75	0	913608,493
TRANSPORT:																
Municipal fleet	0	0	0	0	0			0	0	0	0	0	0	0	0	0
Public transport	0	0	0	0	0			0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	0	0	0			0	0	0	0	0	0	0	0	0
Subtotal transport	0	0	0	0	0	1009997	224293	0	0	0	0	0	0	0	0	1234289,56
Total	386131,397	0	126954,4	400461,95	0	1009997	224293	0	0	0	0	0	0	60,75	0	2147898,05

Municipal purchases of certified green electricity (if any) [MWh]:	0
CO2 emission factor for certified green electricity purchases (for LCA approach):	0

Local data from Redal mines industry

-: 25,65% of the fuel energy for road transport

B. CO2 or CO2 equivalent emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Category	CO2 emissions [t]/ CO2 equivalent emissions [t]															
			Fossil fuels								Renewable energies					
	Electricity	Heat/cold	Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Biofuel	Plant oil	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	482,59644	0	0	0	0	0	0	0	0	0	0	0	0	0	0	482,59644
Tertiary (non municipal) buildings, equipement/facilities	30049,2539	0		0	0	0	0	0	0	0	0	0	0	0	0	30049,2539
Residential buildings	194732,869	0		90025,447	0	0	0	0	0	0	0	0	0	0	0	284758,316
Municipal public lighting	16390,1735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16390,1735
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	33% not inclu	not included	not included	not include	not include	not include	not inclu	not include	not inclu	not included	not include	not include	not include	not include	not included in seap	
Subtotal buildings, equipments/facilities and industries	270678,109	0	25515,549	90025,447	0	0	0	0	0	0	0	0	0	0	0	386219,106
TRANSPORT:																
Municipal fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal transport	0	0	0	0	0	266659,3	55398,5	0	0	0	0	0	0	0	0	322057,871
OTHER:																
Waste management																95714,286
Waste water management																71370,629
Please specify here your other emissions																
Total	270678,109	0	25515,549	90025,447	0	266659,3	55398,5	0	0	0	0	0	0	0	0	875361,891

Corresponding CO2-emission factors in [t/MWh]	0,701	0	0,200983	0,224804	0,346752	0,26402	0,24659	0,342538	0,3468	0	0	0	0	0	0	
CO2 emission factor for electricity not produced locally [t/MWh]	0,701															

Obtained from 58% coming in lighting saves 13000tonsCO2
Data from 2008 IEA shows 0,7

C. Local electricity production and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Locally generated electricity (excluding ETS plants , and all plants/units > 20 MW)	Locally generated electricity [MWh]	Energy carrier input [MWh]											CO2 / CO2-eq emissions [t]	Corresponding CO2-emission factors for electricity production in [t/MWh]
		Fossil fuels					Steam	Waste	Plant oil	Other biomass	Other renewable	other		
		Natural gas	Liquid gas	Heating oil	Lignite	Coal								
Wind power	0												0	0
Hydroelectric power	0												0	0
Photovoltaic	0												0	0
Combined Heat and Power	artesany center	artesany center					0	0	0		0	0	tesany cent	
Other *Please specify:*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	

D. Local heat/cold production (district heating/cooling, CHPs...) and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Locally generated heat/cold	Locally generated heat/cold [MWh]	Energy carrier input [MWh]										CO2 / CO2-eq emissions [t]	Corresponding CO2-emission factors for heat/cold production in [t/MWh]
		Fossil fuels					Waste	Plant oil	Other biomass	Other renewable	other		
		Natural gas	Liquid gas	Heating oil	Lignite	Coal							
Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0
District Heating plant(s)	0	0	0	0	0	0	0	0	0	0	0	0	0
Other *Please specify:*	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	

SUSTAINABLE ENERGY ACTION PLAN OF SALÉ

SUSTAINABLE ENERGY ACTION PLAN OF SALÉ

The City of Salé is committed to reduce the green house emissions emitted in the Municipality as well as to increase the air quality of Salé through the promotion of energy saving measures and the promotion of the use of the renewable energies as a bases of the sustainable development of the City.

This commitment seeks to follow the indications of His Majesty The King of Morocco presented in July 2008:

«Le Maroc n'a d'autre choix que de renforcer localement sa capacité de production d'énergie et d'ouvrir la voie aux investissements prometteurs en matière d'approvisionnement énergétique. Il se doit également de poursuivre résolument les efforts visant à faire des énergies alternatives et renouvelables la clé de voûte de la politique énergétique nationale.»

2.1. Overall CO_2 emission reduction target

The objective of the Sustainable Energy Action Plan of Salé (SEAP) is to reduce a 20% the CO_2 emissions per inhabitant by 2020 though the execution of measures oriented to reduce the energy consumption and the promotion of renewable energies in the territory of the Municipality of Salé.

According to [1], current energy consumption trends show that the energy demand is growing quickly, around 5% per year at national level and around 7-8% in electricity demand per year at national level due to the increase of the demography and the quick urbanization.

This is somehow expected due to the fast development of Salé, and in general terms, of the Kingdom of Morocco. In a “non-acting” scenario the energy demand of Salé would increase 70% with respect to the baseline year.

Therefore, the objective of reducing 20% the green house emissions per inhabitant by 2020 indirectly means to reduce the energy consumption between 50 and 90% by 2020 with respect to the baseline year in global terms. This is the main challenge of the SEAP: overcome the increasing energy demand tendency and invert it to reach 20% reduction of the green house gas emissions per inhabitant with respect to the baseline year by 2020.

In order to achieve this goal the main hypothesis assumed regarding evolution of population and energy consumption per person in the period 2012-2020 are the following:

- Increase of population 1.6%/year according to national and local estimations.
- Increase of energy consumption and green house gas emissions of 3%/year per inhabitant.

Based on the baseline energy inventory and the previous prediction hypothesis, in an “non-acting” scenario the energy consumption in Salé would pass from 2,147GWh in

2008 to 3,062GWh in 2020. Therefore the overall objective of the SEAP is to reduce a total of 1,344GWh/year by 2020, which means reducing the energy consumption in a 62% with respect to a "non-acting" scenario in 2020.

Based on the baseline emission inventory and this hypothesis, in an "non-acting" scenario the emissions inventory would pass from 0.875 million tCO_2 in 2008 to 1.248 million tCO_2 in 2020. Therefore the overall objective of the SEAP is to reduce a total of 547,767.2 tCO_2/year by 2020.

2.2. Long-term vision. Priority areas of action, main trends and challenges

The SEAP is oriented to reduce a 20% the CO_2 emissions per inhabitant by 2020. This objective seeks to, to improve the security of the supply and diversification, to promote the sustainable development and to generalize the energy access and to optimize the energy costs.

The priority areas of the SEAP are the followings:

- City Council Activity
- Buildings and Housing
- Tertiary Sector
- Urban mobility
- Use of Renewable Energy Sources
- Information and awareness

Current trends show that the energy demand is growing quickly, around 5% per year at national level and around 7-8% in electricity demand per year at national level due to the increase of the demography and the quick urbanization [1]. This is the main challenge of the SEAP: overcome this tendency and reach a 20% saving per inhabitant.

2.3. Organizational and financial aspects

In this section it is described the management and financial aspects of the Sustainable Energy Action Plan of Salé.

2.3.1. Coordination and organizational structures created/assigned

The SEAP will be coordinated by City Council of Salé that will define and assign the responsibility of the execution to one or several City Council Services and other stakeholders once the SEAP has been approved by the Plenary of the City Council of Salé (i.e. the assembly of elected members, not technical members).

2.3.2. Staff capacity allocated

It is planned a minimum of 2 man power to coordinate the execution of the measures.

2.3.3. Involvement of stakeholders and citizens

It will be created an official City council internal energy committee with the heads of departments of the City Council.

It will be created an External Energy Committee with the most important local stakeholders of the city of Salé. This committee will include among others: the Mayor of Salé or delegated person, a representative of the Bouregreg Association (NGO), a representative of Sala al Moustakbal Association (NGO), a representative of ADEREE and/or the former CDER Centre de Développement des Energies Renouvelables of Morocco, a representative of the Ministry of Energy and Mining, Water and Environment of Morocco, a representative of the professional engineers association, a representative of the professional architects association, a representative of the electricity distribution company and utilities with presence in Salé, a representative of the fuel distribution companies of Salé, a representative of the chamber of commerce, a representative of neighborhood association, representatives of the buildings sector in Salé, representative of the tramway, a representative of the public bus service, a representative of the taxis services, a representative of the renewable energies enterprises association of Morocco, representatives related to energy of closest universities, a representative of the liquid gases distribution companies with presence in Salé, a representative of natural gas companies, a representative of the coordination of the metropolitan transport plan Salé-Rabat, a representative of the Institute of Urban and spatial management of Rabat.

2.3.4. Overall estimated budget

The overall estimated budget of the execution of the SEAP for 2012-2020 is 245,772,580 MAD, i.e. 21,712,125 €. This means approximately an investment of 31 million MAD per year, i.e. 3 million EUROS per year. In this budget it is not included the costs of the measures already executed such as the Tram Salé-Rabat which are included in the SEAP.

The execution of the measures planned between 2012 and 2020 in the SEAP (i.e. not including the already executed measures such as the tramway) will generate a global saving of 882,109,394 MAD between the 2012 and 2020 due to the overall reduction of the energy bill of the City of Salé.

Taking into account the measures included in the plan that are already executed (between 2008 baseline year and 2011). The overall estimated budget of the execution of the SEAP is 4,071,768,000 MAD, i.e. 359,522,140 €. With this data it is estimated that the SEAP will generate a global saving of 10,637,490,632 MAD (i.e. 939,251,303 €) due to the overall reduction of the energy bill of the City of Salé.

2.3.5. Foreseen financing sources for the investments within the action plan

The financing of the actions is foreseen through City council funds, the national renewable energy & energy efficiency Moroccan program, and, in the case of big infrastructures, financed by concession-operated schemes.

2.3.6. Planned measures for monitoring and follow up

The monitoring is planned to be executed through staff allocated as SEAP coordinators (2 man power) as well as by the feedback obtained from periodical meetings of the internal and external energy committees.

2.4. Description of actions by sectors

2.4.1. Buildings, equipment facilities & industries

2.4.1.1. Municipal buildings, equipment and facilities

- Introduction of solar thermal facilities in the sports centers and city council public buildings with high hot sanitary water demand. 5 facilities.

Salé is placed in one of the sunniest latitudes of the Planet where solar radiation is intense and constant over the year. With the installation of solar thermal equipment, sport centers and public buildings with high thermal water demand can save a relevant percentage of fossil fuels consumption.

At least, 70% of the energy used in water warming needs, which is traditionally warmed with gas-oil or propane, shall be warmed by solar thermal modules. That means a very important saving in Municipal current costs.

The investment necessary is paid off in a mid-time period. And, of course, it reduces the impact of green house gases that the Municipality produces to the Environment.

This measure should be communicated to the users of the buildings. Besides, they should be informed about the energy saved.

Finally, the initiative should be considered an obligation in future buildings with similar characteristics in the Municipality.

- Energy auditing of all public buildings of the City Council of Salé. Implementation of the measures recommended

This action does not produce savings in emissions by its own, but the actions derived from it are focused in a reduction of energy consumption in Municipal Buildings.
Energy audits will inform about no profitable waste in lighting, air conditioning and heating. This will make possible to take into account of the savings the adoption of several measures in energy consumption and renewable energy facilities would suppose.

- Substitution of conventional traffic lights by LED traffic lights

It is a very profitable investment because LED lights use only 10% of the energy consumed by incandescent lights, they have a much longer life over 50 times, and maintenance is much cheaper. Furthermore, LED traffic lights are safer than traditional ones because they are more visible during day light time and failures are less frequent.
This measure is already being executed by the City Council of Salé during 2011.

- Installation of presence detector systems in common spaces of City Council Buildings

It represents one of the most economic measures in order to get energy savings in public buildings. Studying the lighting of a building, it is easy to determine where detectors that switch automatically on and off the lights should be installed. They are strongly recommended in corridors, restrooms, stairs, and other stances where users do not stay too long. Apart from this elements, time programmers are very useful to

ensure that lights or other appliances will not consume energy while they are not expected to, like during the nights, weekends, holidays, among others.

- Installation of high efficiency lighting technology in the future city council buildings

This action means to introduce new lighting technology in the City Council buildings. Together with the above one can suppose important savings of even 40% of the electric consumption depending on the use of the buildings.

- Energy saving measures in fountains and parks watering systems

It means the installation of high efficient pumps and frequency converters in order to reduce the power consumption of fountains and garden watering. Water pumps consume much more energy during its starting. It can be strongly reduced by frequency converters.

- Elaboration of an internal regulation of energy efficiency of the City Council. It fixes the use of natural gas or biomass in boilers and a minimum energy efficiency of new equipments and equipments to be substituted.

The installation o high efficient boilers and promoting of the purchase of them as the best choice, is the aim of this proposal. Biomass should be preferential, but natural gas is much better option than fuel-oil boilers.

In order to bet for the biomass alternative, it is very important that the local supplying is guaranteed. Only that case, it will certainly close the circle of the emissions because transport of biomass to long distances break definitely with this concept.

- Installation of water saving devices in the points of consumption of hot sanitary water.

Time programmers in water taps and aerators for baths and hot water dispensers can suppose a saving of 15% in water and fuel consumption. They are very commendable for public installations because in a short period, the investments in water efficiency appliances is paid off.

- Introduction of heat recovery in HVAC systems of public buildings with high power installed

Heat recovery systems in air conditioning are very interesting in large installations due to its capacity of recover the energy contained in the air that is being threw away by the air conditioning machines.

2.4.1.2. Tertiary (non municipal) buildings, equipment/facilities

- Introduction of solar thermal facilities in the Hospitals and public buildings with high hot sanitary water demand.

Hospitals and public buildings are the most indicated buildings for the exploitation of thermal solar energy because of its large and constant demand of heat all over the year. Geographical latitude where is placed Salé is completely suitable for solar thermal applications. Savings in energy and money is around 70%.

2.4.1.3. Municipal public lighting

- Energy auditing of the public lighting. Execution of measures

Public lighting is the main cost in current expenses of the city councils. The cost of the electric energy in lighting represents a lot of money every year.

Auditing the public lighting makes visible its defects and its potential savings. Audits presents which areas are over lighted or which does not get enough light, which technologies should be used depending on what should be lighted, for instance. And of course, it reflects which investments are more profitable in terms of energy and costs savings.

All in all, auditing the Municipal Public Lighting of Salé would bring a great improvement in public lighting.

- Substitution of conventional holiday lighting by energy efficient lighting (LED)

All the cities are decorated with colored lights on feasts and holidays. It is a high consumption lighting that runs only for some days or weeks. Usually it is use every year in the same dates, so it is reused for years.

The substitution of this conventional lighting for LED lighting technologies would suppose savings of even 90% in energy consumption. It represents a very profitable investment for the Municipalities. This measure is already being executed by the City Council of Salé during 2011.

- Installation of LED technology in public lighting

As mentioned before, it is considered necessary the introduction of LED technology and/or other high efficient technologies in the public lighting. This measure is specially efficient when changing mercury lamps by LED technology.

In that sense, the street lighting policy should tend to the conversion of the traditional lamps into LED. Some LED Projects planned are:

- LED lighting in the local stadium.
- LED lighting in Intra-Murros
- LED lighting all the way through the new tramway itinerary.

Objectives:

- 58% decrease in electricity consumption
- Average lifetime of lamps 5 years
- 2.1 million € saved
- 13000 t/O_2/year saved

2.4.1.4. Small and Medium Enterprises (industry not included)

- Green commerces certification Program: shops, restaurants, hotels, shopping centers

Shops and commerce can adopt a Green Commerce Certification Program promoted by the City Council and applicable to shops, restaurants, hotels, shopping centers, etc… It would certify which commerce are more respectable with the Environment. The City Council of Salé, can profit the "REWAJ national program" to help commerces to save energy though its promotion among the shops of the city and its assistance in the participation process.

2.4.1.5. Industries

Industry is not included in the objective of reduction of CO_2 emissions and therefore it is not planned measures for this sector.

2.4.2. Transport

2.4.2.1. Municipal fleet

- Progressive renovation of the City Council fleet by electric and hybrid vehicles.

They reduce pollution in the cities and make the country less dependent of petrol imports. Electric cars are very suitable for short and mid distance displacements because their autonomy is 80 - 250 kms.

- Eco-driving courses for City Council Staff.

Courses to help City Council staff to save fuel when driving. Estimated save 5% per person.

2.4.2.2. Public transport

- Tramway Salé-Rabat.

This measure is already being executed by the City Council of Salé during 2011. A detailed description of this action can be found in [18]. It is just presented here some of its characteristics.

Caractéristiques du Réseau 2011

La longueur totale exploitée pour les deux lignes est d'environ 20 km avec 31 stations (interstation moyenne de 500m).

	Ligne 1	Ligne 2	Tronc commun
Longueur	11,7 km	7,8 km	2,9 km
Stations	22	14	5
Fréquence	8 min	8 min	4 min
Temps de parcours	36 min	25 min	
Vitesse commerciale	19,5 km/h	19 km/h	
Capacité offerte	4 050	4 050	8 100 voy/h/sens
Amplitude du service	de 06h00 à 23h00		
Nombre de voyageurs/j	180 000		
Matériel roulant	22 rames de 65 m exploitées en rames doubles soient 44 véhicules de 32 m.		

- Execution of a Sustainable Mobility Urban Action Plan.

This is one of the most important measures of the plan. Its final objective is to seek a modal distribution of 33% public transport, 33% private car, 33% soft modes. The big objective is to succeed in the reduction of private car displacements by the optimization of the public transport services in the city and other complementary measures that generate to the citizen the change of the type of transport.

Therefore it is required to execute a diagnosis analysis of the mobility status of the city, including, most frequent displacements within the city, attraction mobility centers, main current privet car fluxes, traffic congestion key points, simulations of reconfigurations of public bus transport lines, simulations of reconfiguration of circulation and traffic of privet cars with different measures and scenarios, future parking availability, and freits distributions regulation among others.

It is required to study the mobility of the population and transport in the city to adapt the different public transport services available in order them to complement and not compete in the same routes. This it plan will re-design the public transport with the presence of the tram, the available infrastructures and will create a master plan to execute in the next 10 years in order to absorb the generated mobility and the projected one in the city. This provides complete information about mobility essential for planning the city of the future.

Among possible measures resulting from this study it might result the creation of Zone 30 areas, park&ride systems, promoting of public transport, alternative fuels to diesel as fuel in public transport bus, tram extension, subordination of new licenses or transfers of taxis to be environmentally friendly vehicles, installation of electric chargers for vehicles and parking spaces to electric cars, the development of mobility plans for

companies to focus attractors distinction of eco-taxis with distinctive stops and in vehicles.

It is estimated that the study will cost 3,000,000 MAD. This study will define the most viable measures to execute. It has been estimated that the measures will cost approximately 66,000,000 MAD.

- New taxis only hybrid, electric or with alternative fuels

New clean technologies in taxis is indispensable in a clean city of the immediate future. Many cities like San Francisco, New York, London or Madrid give grants and facilities to taxi owners that bet for clean cars.

Even polluting engines in taxi cars will be forbidden in some of these cities in the future.

- Development of a bicycle system

Nowadays, any city can be sustainable in terms of mobility if does not bet for the bicycle as the cleanest and healthiest mean of transport.
Modern cities are replacing their cars for bikes and closing the city centers to the cars.
Salé has no ramps and good weather, so it is a very suitable city for the implementation of a bicycle network system consisting of: bicycle lanes network and the public bicycle rental system among others.

2.4.2.3. Private and commercial transport

- Cycling lanes construction

As can be read above, bicycle is a essential mean of transport in the modern and clean cities.

- Tax reduction for hybrid, electric or high efficiency vehicles

This can be considered as a promotion policy to encourage the purchase of clean cars among the population.

Together with direct grants, this has obtained a great success in the cities where it has been implemented.

2.4.3. Local electricity production

2.4.3.1. Photovoltaic

- Installation of solar photovoltaic plants in roofs of 20 public buildings. 400 peak kilowatts installed. 20kW per building

But City Council can also install their own photovoltaic plants to produce their own energy. The roofs of some Municipal buildings are a very suitable place for this technology, and a first approach of 20 little installations of 20 kW each is a good beginning.

2.4.3.2. Combined heat and power

- Installation of methane driven internal combustion engines in the water treatment plant for the combined heat and power generation

There is a huge potential in the exploitation of methane gas produced from the oxidation of organic mass in water treatment plants to produce electricity.

Methane is much more pollutant than CO_2 for the atmosphere. So, when water treatment plants burn it, they are reducing its damage to the Environment. However, the heat produced when is being wasted. Installation of internal combustion engines can be used for electricity generation. That energy can be freely used for energy requirements of the water treatment plant.

This measure is planned to be executed in the REDAL Station d'Epuration 8TEP. In this measarue it can be taken the profit from the CDM Program from FEC: Fonds d'Equipement Comunal.

- Installation of methane driven internal combustion engines in the solid urban waste treatment plant for the combined heat and power generation. Potential projects could be «Bouregrag Biogaz» and the extraction of methane from wastes to be used as a combustible in pottery.

The solid urban waste treatment plant can also be used to generate electricity from biogas. This measure includes the actions planned in Oulja & Akreuch landfill. Akreuch landfill is included since it is the one where the Salé City wastes are treated.

2.4.4. Land use planning

2.4.4.1. Strategic urban planning

- Bylaw of energy efficient new buildings.

An obligation to make new buildings with technical energy efficiency criteria in order to get houses that save energy during its life when used by its owners.

Governments in concerned countries has made big efforts to adapt their normative to integrate this technical energy efficiency criteria.

This measure is being developed by ADEREE at national level and will generated a saving of aproximatelly 30% of the energy consumed by the new buildings in Salé.

- Solar thermal bylaw for new buildings

As mentioned before, it convenient that an obligation on the installation of solar thermal energy for water warming uses is adopted. This measure is already being executed by the City Council of Salé and the Ministry during 2011 though a national regulation

- Plantation of trees in parks, gardens and public land and/or protection of forest areas

Trees produce natural offset of the carbon dioxide and produce oxygen as natural air filters. They are shadows creators in sunny cities that make more comfortable and

peaceful the life of the citizens. Planting trees is a good complementary way to reduce CO_2 concentration of the municipalities. The measure estimates to plant or protect 5000 new threes in Salé. There is a national program where Salé City Council can join in.

- Maintenance of agriculture land protected

The maintenance of the agriculture and the protection of the natural areas is a compromise with the future generations. No house should be constructed in those protected areas in order to preserve them.

2.4.4.2. Transport and mobility planning

- Execution of a Urban Cycling Master Plan

It represents a master key in the sustainable mobility policies. It is preceptive a master plan to be followed in order to get comprehensive and efficient net of cycle lanes and other infrastructures and services like bike parkings and the public bicycle rental system.

It should also include a plan for the intermodality of the bicycle. Allowance of the introduction of the bicycle in the tram.

Bicycle should be complemented with other means of transport when the distance that citizens must travel is over 8-10 kms. In that cases tram, bus, train, should make easy to park or travel with the bicycle. It is called, intermodality.

2.4.4.3. Standards for refurbishment and new development

- Maintenance of agriculture & forest land protected against urban development.

As mentioned before it is necessary to protect the forests, and the agriculture in order to preserve them from the urban impact. This is imperative to leave a better planet to the future generations maintaining the carbon dioxide natural offsets. These types of lands act as natural CO_2 drains.

2.4.5. Public procurement of products and services

2.4.5.1. Energy efficiency requirements/standards

- Introduction of Energy Efficiency Criteria in City Council Tenders of Services and Infrastructures.

The introduction of energy efficiency requirements or criteria in the public tenders of the City Council of Salé in order to reduce the emissions. It is a 0 cost measure.

2.4.5.2. Renewable energy requirements/standards

- Requirement of solar thermal energy in all new city council facilities with hot sanitary water demand

This action implies that all the new buildings promoted by the city council incorporate solar thermal energy installations for water warming. That represents savings of over 70% of energy consumption in water warming and short pay off periods, which suppose a very profitable investment and a good reason to self obligate to install them.

2.4.6. Working with citizens and stakeholders

2.4.6.1. Advisory services

- Creation of staff allocated for the development of the SEAP and for energy saving actions

Create an advisory municipal service for citizens, commerces interested in saving energy and in the use of renewable energies in their activities and housing.

2.4.6.2. Awareness raising and local networking

- 20% emissions reduction commitment for citizens

The objective is to pass the -20% reduction of GHG emissions commitment of the Covenant of Mayors to the awareness citizens though a declaration where they commit to reach this objective in their energy consumption and activity.

- Bicycle working group with stakeholders

Social commitment in energy policies is essential to implicate the stakeholders to reduce their energy consumption. In this measure is proposed to create a committee with representative of the citizens in order to enhance cooperation for the development of the bicycle culture in the mobility habits of the citizens.

- Mobility working group with stakeholders

In this measure is proposed to create a committee with representative of the citizens in order to enhance cooperation for the development of the sustainable mobility habits within the citizens.

- Energy comity with stakeholders

This action can be complemented with the following proposals:

-Creation of Energy External Committee of Salé with the city stakeholders

-Creation of Energy Internal Committee of Salé with the head of departments of the City Council with most energy consumption in their services.

In order to reduce the city council energy consumption, the services that controls big buildings and lighting service must be implicated in the decision organs.

-Promotion and creation of a energy saving network within the National Moroccan Cities Association to share best practices.

This action seeks the same objective than the previous one, considering more cities to share the best practices and extend good policies.

- Car pooling program

Program oriented to help citizens to share own cars to go to the same destinations. It is easily implemented through a web page. The City Council of Salé can join or promote the “co-voiturage” campaign to execute this measure.

- Awareness Campaings for energy saving, ecodriving, promotion of renewable energy, use of sustainable mobility modes

- Green School Award Program

An award to help pupils to aware about energy saving. It will be given the award to the school with highest energy saving in a year. This measure is already being executed by the City Council of Salé during 2011.

2.4.6.4. Training and education

- Workshops of energy saving at home

Training courses to help citizens to have saving habits at home.

- Ecodriving courses for Citizens

Through eco-driving lessons to the citizens they learn how to save fuel in the driving using energy saving habits. It is estimated to save 5% per participant. These courses have been very effective in Europe.

- Program for the use of the bicycle among students to go to school, high school and higher educational centres.

- Energy Saving Family Award

An award to help citizens to aware about energy saving. It will be given the award to the family with highest energy saving in a year.

- Energy Efficiency Commerce Award

An award to help commerces to aware about energy saving. It will be given the award to the shop with highest energy saving in a year.

- Cycle to work program

Program Cycling to work for the promotion of the use of the bicycle in the displacement to the work.

A program to promote to bike to work to reduce the numbers of cars in streets and its problems related (pollution and noise).

- Actions and conferences programmed within the SURE project

2.4.7. Other sectors

Here it is included the national measures planed, among other fields, the ones related to mobility, buildings and the Moroccan Strategy of sustainable renewable energy and energy efficiency. The measured executed at national level will have an impact in the Municipality of Salé. This section will quantify them in energy saving and green house gas emissions saving terms.

The Moroccan Strategy of sustainable renewable energy and energy efficiency seek to reach 4 main objectives, to improve the security of the supply and diversification, to increase the regional and international integration, to promote the sustainable development and to generalize the energy access, optimizing the costs.

The objective of this national strategy is to reach 10% of renewable energy in the energy balance of 2012 and an increase of 12% in the energy efficiency by 2020.

It is specially oriented to energy efficiency in housing, and energy efficiency in transport. These two sectors will generate a overall reduction of 1,475,000 Teo per year in 2020 according to [1].

The execution of the measures of the national strategy will generate a saving of 0.433 MWh/year/inhabitant [1] and 0.1581 tCO_2/year/inhabitant and an investment of 224.6 dirham's/inhabitant. Taking into account the population of Salé, this means a total saving of 570.3 GWh/year and 207,387 tCO_2/year and a total investment of 296.1 millions dirham's during the program until 2020.

The national strategy is designed through renewable energy and energy efficiency support funds and leverage mechanisms and different legislation and regulations.

2.5. Covenant of Mayors Template of the SEAP

See file attached. It shows the SEAP in covenant of Mayors template format.

PILOT ACTION PROPOSED FOR SALÉ

PROPOSED PILOT ACTION:

Substitution of conventional public lighting by high efficient public lighting using LED technology.

It is proposed the installation of a high efficiency street lighting facility based on LED technology.

Budget: 40000 EUROS all taxes included

Number of light points: 10

Proximate average price per light point: 3500€/point (renovation of post, fixture, including installation civil work and all taxes)

Installation of an informative panel for the citizens with awareness purposes.

Location proposed: a centric square decided by City Council of Salé.

Energy saving estimation: between 38-58%. 2,74MWh/year saved. 1.91 tCO_2/year saved (Estimation based on initial 150W lamp converted into 75W lamps).

Technical recommendations:

Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- Chip manufacturer: for example CREE (1st world manufacturer)
- Minimum life time guaranteed required for chip: 5 years. Maintenance of at least 70% of the initial flux level at 25ºC of operational temperature during the 5 years period.
- Minimum guarantee for the driver required: 2 years
- Driver recommendations: the maximum operational temperature of the LED must be smaller than the maximum temperature recommended by the chip manufacturer for the nominal current of design of the light point.
- Protection index minimum: 65
- Recommended color temperature: between 3500-5500K.
- Recommended energy efficiency of the lamp: minimum 100 lumen/W for 3500K and 120lumen/W for 5500K
- Recommended chromatic reproduction index: over 70.
- The manufacturer must provide a photometric data sheet of the fixture+lens+chip system.
- Equipments must have CE certified stamp
- The equipment must fulfill the national norms of safety in electricity and electromagnetic compatibility among all the applicable ones.

ALTERNATIVE PILOT ACTIONS PROPOSED:

Installation of a solar photovoltaic facility.

It is proposed the installation of a photovoltaic facility in the roof of a public building or in a shelter in a public square.

Budget: 40000 EUROS all taxes included

Total power installed: 8kW peak. All costs included

Installation of an informative panel for the citizens with awareness purposes.

Location proposed: to be decided by City Council of Salé.

Energy saving estimation: 12,6MWh$_{electricity}$/year generated from the sun. 8.97 tCO_2/year saved.

Technical recommendations:

Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- Equipments must have CE certified stamp
- The equipment must fulfill the national norms of safety in electricity and electromagnetic compatibility among all the applicable ones.
- Recommended to use a tri-phasic inverter.
- Electrical equipment approved and certified with the CE mark.
- Modules facing South 0º and inclination equal to latitude minus 8º in case of fixed installations located over flat surfaces.
- Take into account the separation of the rows of modules and other potentially shaders elements respecting a minimum distance to ensure the full reception of sun of the modules during peak sun hours of the shortest day of the year (winter solstice).
- Solar field peak power must not exceed 120% of rated power of inverters.
- In order to guarantee that inverters work properly, the electric public network they are connected with, must be stable, according to the technical operational characteristics of the inverters.
- Use modules with manufacturer's warranty of at least 5 years, and a production warranty of at least 25 years. Ensuring 90% of production in the first 12 years and 80% after 25 years of operation.
- Use load-bearing structures made of aluminum profiles, which are lighter and much more resistant over time that those made of steel or other materials. The anchors they are fixed must be strong and secure against the wind action.
- Protect PV power plants against thefts, vandalism and natural disasters through an insurance policy that guarantees the replacement of 100% of the material in that cases. Ensure the installation against cuts in production with the payment of an amount for the energy not generated while the forced stop.

Installation of a solar thermal facility.

It is proposed the installation of a photovoltaic facility in the roof of a public building or in a shelter in a public square.

Budget: 40000 EUROS all taxes included

Total power installed: 20kW of thermal power. All costs included

Installation of an informative panel for the citizens with awareness purposes.

Location proposed: building with high hot sanitary water demand to be decided by City Council of Salé. Proposed the Complexe Sportif Salle Bouazza+Terrain de football, Boulevard Hassan II.

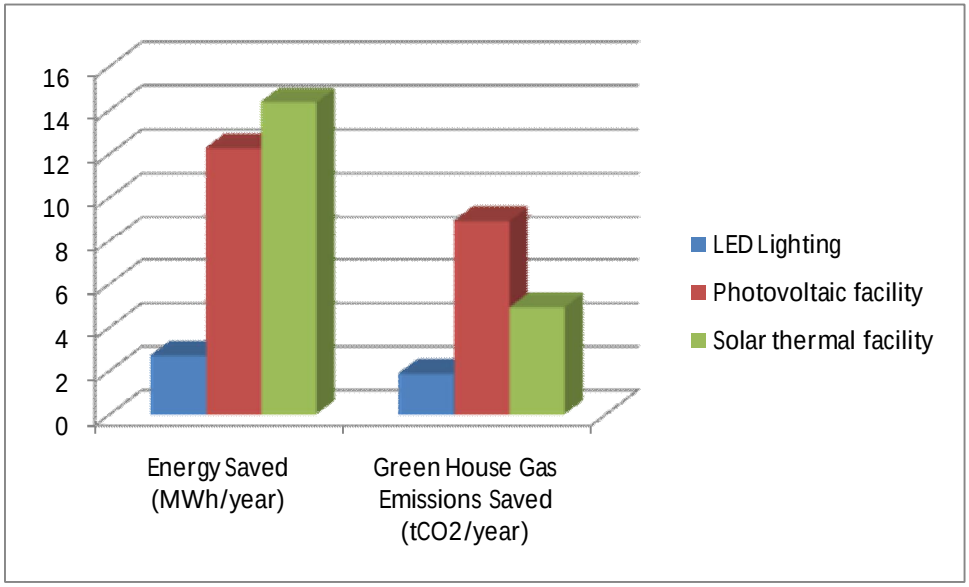
Energy saving estimation: 14,4MWh$_{thermal}$/year saved and obtained from the sun. 4.97 tCO$_2$/year saved (Estimations based on 720kWh$_{thermal}$/kWt$_{hermal}$ installed and substitution of diesel boilers for the generation of the hot sanitary water).

Technical recommendations:

Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- It is highly recommended that the equipments have CE certified stamp
- The equipment must fulfill the national norms of safety in thermal equipments, electricity and electromagnetic compatibility among all the applicable ones.
- Avoid over-dimension of the facility (i.e. energy demanded vs energy generated) in the design to avoid overheating of the equipments.
- Important to require the proper isolation of the piping.
- Important to slightly over-dimension the expansion deposit (pressurizer).
- Important to contract a maintenance service of the facility to ensure the efficiency of the equipment and piping.

COMPARISON OF ENERGY AND GREEN HOUSE GAS EMISSION SAVING OF THE PROPOSED PILOT ACTIONS



FINAL PILOT ACTION ELECTED

Installation of a solar photovoltaic facility as a ardor in a park of the city of Salé.

It is proposed the installation of a photovoltaic facility in the roof of a public building or in a shelter in a public square.

Budget: 40000 EUROS all taxes included

Budget distribution:

- 35000 EUROS all taxes included for the facility. Total power installed: 8kW peak. All costs included

- 5000 EUROS for an informative display showing the citizens the energy saved with awareness purposes.

Location proposed: In front to Salé Media Muros, next to the Marina and the new Bouregreg bridge.

Energy saving estimation: 12,6MWh$_{electricity}$/year generated from the sun. 8.97 tCO_2/year saved.

Technical recommendations:

Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- Equipments must have CE certified stamp
- The equipment must fulfill the national norms of safety in electricity and electromagnetic compatibility among all the applicable ones.
- Recommended to use a tri-phasic inverter.
- Electrical equipment approved and certified with the CE mark.
- Modules facing South 0º and inclination equal to latitude minus 8º in case of fixed installations located over flat surfaces.
- Take into account the separation of the rows of modules and other potentially shaders elements respecting a minimum distance to ensure the full reception of sun of the modules during peak sun hours of the shortest day of the year (winter solstice).
- Solar field peak power must not exceed 120% of rated power of inverters.
- In order to guarantee that inverters work properly, the electric public network they are connected with, must be stable, according to the technical operational characteristics of the inverters.
- Use modules with manufacturer's warranty of at least 5 years, and a production warranty of at least 25 years. Ensuring 90% of production in the first 12 years and 80% after 25 years of operation.
- Use load-bearing structures made of aluminum profiles, which are lighter and much more resistant over time that those made of steel or other materials. The anchors they are fixed must be strong and secure against the wind action.
- Protect PV power plants against thefts, vandalism and natural disasters through an insurance policy that guarantees the replacement of 100% of the material in

that cases. Ensure the installation against cuts in production with the payment of an amount for the energy not generated while the forced stop.

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APPENDIX:
Calculations of energy and greenhouse gas emissions saving in the SEAP actions

BUILDINGS, EQUIPMENT / FACILITIES & INDUSTRIES:

Municipal buildings, equipment/facilities:

Introduction of solar thermal facilities in the sports centers and city council public buildings with high hot sanitary water demand. 5 facilities

Hypothesis-Base Data:

It is estimated a save of 80% in fuel for the generation of hot sanitary water. Based on standard estimations of sports centers. It is estimated a energy generation from Solar Energy of 55MWh/year/building.
Fuel data: 3.207tCO_2/Toe. Boiler efficiency 80%.
Costs: 170000MAD-15000EURO/building

Energy auditing of all public buildings of the City Council of Salé. Implementation of the measures recommended

Hypothesis-Base Data:

Estimated the consumption of a mean administrative building of 70MWh/year in electricity. It is estimated a saving of 20% through the measures of the energy auditing.

Substitution of conventional traffic lights by LED traffic lights

Hypothesis-Base Data:

Saving: 0.53MWh/traffic light. 0,313tCO_2/traffic light. Data based on changes done in Europe (Valencia).
Costs: 3200MAD-281EUROS/traffic light block

Sale with 1 million inhabitants is estimated to have 16000streetlights. They must be substituted by 38400 LED lights.
Save 5000tCO_2. Save 8410 MWh/year.
Cost: 4,5mill€. Save 1mill€. Estimated Life: 11,5 years.
Electricity price 1,4MAD/kWh – 12,35c€/kWh. Source [20].

Installation of presence detector systems in common spaces of City Council Buildings

Hypothesis-Base Data:

Estimated a saving of 1% of energy saving in energy consumption of the building. It is assumed that the consumption of a mean administrative building of 70MWh/year in electricity.

Installation of high efficiency lighting technology in the future city council buildings

Hypothesis-Base Data:

Estimated a saving of 33% in the lighting of the building. It is estimated that approximately 18% of the energy consumption of an average administrative building is used for lighting. It is estimated a mean consumption of 70MWh/year per building. It is estimated that the measure will be applied in 20 buildings in the next 8 years.

Elaboration of a internal regulation of energy efficiency of the City Council. It fixes the use of a minimum energy efficiency of new equipments and equipments to be substituted.

Hypothesis-Base Data:

It is estimated to save approximately an extra 5% of the energy of each building where it is applied the regulation by the increase of the efficiency of the old equipments. Energy consumption per building estimated to be: 70MWh/building. Estimated measure to be applied in 20 buildings in the next 8 years.

Introduction of heat recovery in HVAC systems of public buildings with high power installed

Hypothesis-Base Data:

Estimated a saving of 50% of the cooling and heating energy consumption. Estimated that for an administrative building the HVAC systems consumes approximately the 35% of the electricity consumption. It is assumed that the consumption of a mean administrative building of 70MWh/year in electricity.

Municipal public lighting

Substitution of conventional holyday lighting by energy efficient lighting (LED)

Hypothesis-Base Data:

Initial estimated consumption of 10MWh/day of the holydays lighting. Saving of conversion to LED is estimated in 85%. Estimated 30 days per year of operation of the lighting.

SMEs (industry not included)

Green commerces certification Program: shops, restaurants, hotels, shopping centers

Hypothesis-Base Data:

Estimated the adhesion of 30 commerces. Estimated a saving of 4.5MWh/entity.

TRANSPORT:

Municipal fleet

Progressive renovation of the City Council fleet by electric and hybrid vehicles

Hypothesis-Base Data:

Hybrid car saves 40% emissions. Electric car saves 85% emissions. 15 vehicles

Public transport

TRAMWAY Rabat-Salé:

Hypothesis-Base Data:

1 tram passenger remove one car. 9Liters/100km in City per car. 10km mean route. 180000passengers per day (source: Tramway of Salé-Rabat). Increase of 5% number of passengers per year. 830kg/m^3 diesel. 0.086 Toe/MWh. 1.035Toe/ton. 3.07tCO_2/Toe.

Execution of a Sustainable Mobility Urban Plan in Salé

Hypothesis-Base Data:

Reduction of 20% of the privet car in the modal distribution of mobility. Initial estimation of trips per day 1700000. 11 months. 5 days/week. 4weeks/month. Mean average path in car 5km. Emissions 250gr/km.

Private and commercial transport

Tax reduction for hybrid, electric or high efficiency vehicles

Hypothesis-Base Data:

It is estimated a reduction of 20% of the taxes for high energy efficiency vehicles.

LOCAL ELECTRICITY PRODUCTION:

Photovoltaic

Hypothesis-Base Data:

PERG assumes that at 2009 the 85% of the rural population of Salé has solar photovoltaic systems. It is expected to reach 100% between 2009 and 2020. Data shows 200,000 families for Morocco has joint the program. This means an average of 6,250 families in Salé, i.e. 1,406m^2 installed. It is estimated to install in Salé the 15% of the rural population during 2009-2020, i.e. 35kW.

LAND USE PLANNING:

Strategic urban planning

Plantation of trees in parks, gardens and public land and/or conversion to protected forest areas

Based on [23] results, it is estimated that around 5000 trees will be planted in parks, gardens and public land areas and/or protected in forest areas that were not protected before the base year.

Maintenance of agriculture land protected

Based on [22] results, it is estimated that 10000m^2 of irrigated type crops absorbs approximately 9tCO_2 per year. Estimated 10km^2 of irrigated type crops in Salé.

WORKING WITH THE CITIZENS AND STAKEHOLDERS:

Training and education

Cycle to work program

Hypothesis-Base Data:

11 km/liter * 0.8 kg/liter *40 MJ/kg *5 days/week 4week/month 9 month/year
Emission: 250grCO_2/km. Mean average path: 4km. 500 workers.

Program for the use of the bicycle among students to go to school, high school and higher educational centres

Hypothesis-Base Data:

11 km/liter * 0.8 kg/liter *40 MJ/kg *5 days/week 4week/month 9 month/year
Emission: 250grCO_2/km. Mean average path: 4km. 300 students.

OTHER SECTORS:

Primary energy from renewable sources 3.9% in 2005. 10% in 2012. Objective 12% in 2020

Hypothesis-Base Data:

Primary energy consumption per inhabitant estimated to be the national average: 5,22MWh/hab. Obtained from [19]: the consumption of primary energy in 2008 was 1.74·105 GWh. 32 million inhabitants in Morocco in 2008.
Renewable energy sources in 2005: 3,9% of total. Source: [20] obtained from data published by the Ministry of Energy and Mining, Water and Environment of Morocco in December 2005. Objective in 2012: 10%. Source [1]. Assuming the same tendency it is estimated in 2020 to have 12% of renewable energy sources in the primary energy consumption. Based on this, it is estimated a saving of 8% (12%-4%). Taking into account increase of population 1.6%/year and increase of energy consumption 3%/year/hab.