Energy efficiency trends in Mediterranean countries

Report prepared by the MEDENER Network

MED-IEE Project : Energy Efficiency Indicators for Mediterranean countries

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Report prepared by Enerdata for the MEDENER Network
in collaboration with Alcor, ANME, ADEREE, APRUE and ALMEE

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1. Introduction

1.1. Presentation of the MEDENER project on energy efficiency Indicators

Energy efficiency improvements are generally considered as the best strategy to reduce CO_2 emissions, to limit the energy dependence and to alleviate the effect of oil price increase. Most countries have implemented energy efficiencies programmes at different stages. It now becomes necessary to implement a system of monitoring of the energy performances achieved so as to evaluate the impact of these policies and to better target new policy measures. It is also important to benefit from the experience of similar countries and to compare countries.

The MEDENER project on energy efficiency indicators relies on the experience achieved in European countries with the ODYSSEE project and in southern Mediterranean countries, especially Tunisia and Algeria. These countries have developed evaluation methods of energy efficiency trends through the implementation of detailed data bases on final energy consumption by sector and end-use.

This report presents energy efficiency trends of 9 Mediterranean countries: 4 southern countries (Algeria, Lebanon, Morocco and Tunisia) and 5 EU countries (France, Spain, Portugal, Greece and Italy).

The main results and deliverables of the project can be found at http://medener-indicateurs.net/uk.
The main energy efficiency indicators are presented for the nine countries covered in an interactive database with maps and graphs on the web site.

Box n°1 :
Medener, the Mediterranean Association of National Energy Agencies

The Mediterranean Association of National Agencies for Energy Conservation – MEDENER – brings together 12 organizations from both sides of the Mediterranean (ADEME-France, ADENE-Portugal, IDAE-Spain, CRES-Greece, ENEA-Italy, ADEREE-Morocco, ANME-Tunisia, APRUE-Algeria, ALMEE-Lebanon, NERC-Syria, NERC-Jordan and PEC-Palestinian Authority) in charge of energy efficiency policies and renewable energies. Created in 1997 as an international non-profit association, it aims to exchange experience, expertise and "best practices". The expansion of synergies between members therefore serves to reinforce the regional partnership around energy conservation issues that are specific to the Mediterranean region.

This network is committed to a number of joint projects, especially in **defining energy conservation policies** and in contributing to the **emergence of key projects** in a number of countries: implementing heat and insulation regulations and putting together pilot operations in the field of energy efficiency, organizing training on low power renewable energies and energy conservation, etc.

During the General Assembly held on 13 February 2012, the "**Rabat Declaration**" was adopted by all members. It proposes to transform this network, in the short term, into a true regional energy efficiency agency comprising a full time team. Consequently, in the context of the **Union for the Mediterranean**, MEDENER now participates to the definition of the energy efficiency part of the **Mediterranean Solar Plan** and wishes to reinforce its role as an operational partner in implementing this Plan. Among the ongoing projects, we should mention **pilot buildings offering high energy performance levels,** generalizing **energy efficiency labelling**, creating an energy observatory with a database on **energy efficiency indicators** and on renewable energies.

Most countries of the Mediterranean Basin have implemented strategies and energy efficiency policies. Their development **has allowed to implement a detailed monitoring system of the energy performance** to assess the impact of policies, to understand the energy demand trends and to measure progress towards energy efficiency and renewable to better target new developments.

Figure 1: MEDENER, the Mediterranean Association of national agencies for energy conservation

1.2. Objectives and content

The objective of this report is to describe and compare energy efficiency trends in nine countries of the south and north of the Mediterranean over the period 2000-2010: Algeria, Morocco, Lebanon, Tunisia, France, Spain, Italy, Greece and Portugal. The report is based on data and indicators prepared for Southern countries under the MEDENER project on energy efficiency indicators and for northern countries under the ODYSSEE - MURE project.

The project relies on the experience and methodology of the ODYSSEE - MURE project for calculating energy efficiency indicators. Four countries, Tunisia, Algeria, Morocco and Lebanon participated in the project through their national energy agency (or equivalent), framed by two technical coordinators Enerdata, a French society specializing in the analysis of energy demand and ALCOR, a Tunisian consultant on energy efficiency and renewables. The project was coordinated by ADEME from France and ANME from Tunisia.

Among the southern countries, two countries had already some experience on energy efficiency indicators, Tunisia since more than 10 years and Algeria more recently. Various studies have been conducted in Tunisia on energy efficiency indicators through collaboration between the National Energy Efficiency Agency (ANME) and ADEME since 2005. In 2011 the Algerian Energy Efficiency Agency, APRUE, has implemented, with the support of ADEME, a national database on energy efficiency indicators; an energy observatory has been created and is under development. In 2012 the agencies of Lebanon (ALMEE) and Morocco (ADEREE) have initiated and developed databases on energy efficiency indicators in the framework of the MEDENER project on energy efficiency indicators.

This report is the outcome of a first pilot operation on 4 countries of the South and aims at being spread on other Mediterranean countries in a second phase.

1.3. Data sources

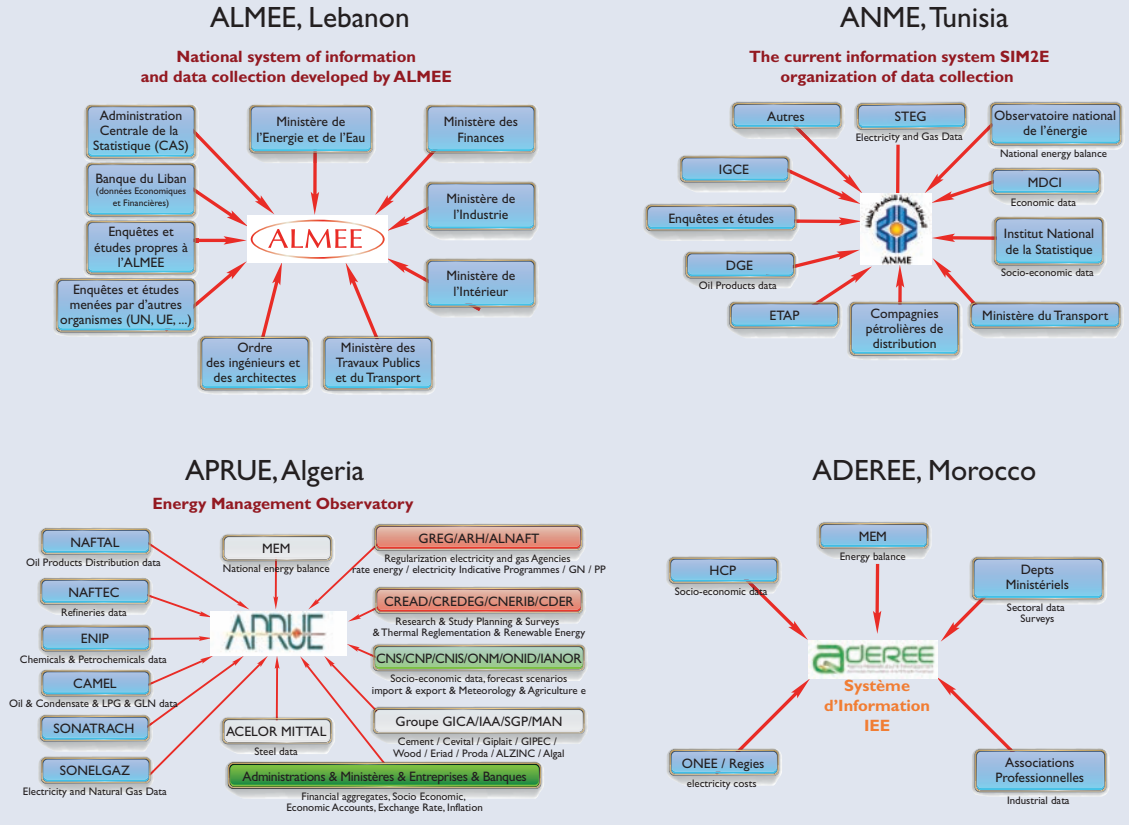
For Southern countries, the work of data collection was performed by the four energy efficiency agencies participating to the project:

- APRUE, National Agency for the Promotion and Rationalization of the Use of Energy, Algeria;
- ALMEE, Lebanese Association for Energy Conservation and Environment, Lebanon;
- ADEREE, National Agency for the Development of Renewable Energy and Energy Efficiency, Morocco.
- ANME, National Agency for Energy Management, Tunisia.

Each team was responsible for collecting data from national institutions (Ministries, Statistical Institutes), power and gas utilities, oil companies, industry associations, banks etc. The project has demonstrated that there a lot of data is available in the different countries, but that the information was diffuse and scattered among different actors (***Box 2*** and ***Figure 2***). An intensive data collection has been made during the duration of the project, with the primary objective to involve all stakeholders to collaborate in the provision of data.

Box n°2:
National players involved in the data collection

Figure 2: Organization of the data collection in southern countries



1.4. Conclusions and recommendations

This first phase of the MEDENER project on energy efficiency indicators made it possible to calculate around 150 sectoral energy efficiency indicators for southern Mediterranean countries. These energy efficiency indicators were adapted from the methodology developed in the framework of the EU project ODYSSEE MURE.

The main outputs and deliverables of the project are the following:

- Development of training materials to enhance the experience of agencies in the interpretation and analysis of energy efficiency trends (capacity building) ;
- Establishment of a framework for data collection and updating;
- Creation of national databases for Morocco and Lebanon;
- Development of a regional database on energy efficiency indicators for nine Mediterranean countries.
- Production of a regional report describing energy efficiency trends in 9 countries in Mediterranean countries and of four national reports (Algeria, Lebanon, Morocco, Tunisia).

In order to sustain the project and the calculation of energy efficiency indicators, the data collection process should be institutionalized, so as to give it a greater legitimacy in front of the various actors or policy policymakers. Thus the various agencies responsible for data collection will have an easier access to data that may exist in each country from the various institutions: ministries, statistical agencies, public or private actors.

The first phase of the project made it possible to highlight several points that may be reinforced if the project is continuing:

- The energy efficiency indicators developed during the first phase only cover part of the indicators used in European countries (ODYSSEE MURE project); more advanced indicators should be developed in a second phase.
- Phase I underlines data gap in countries, that can be solved with an additional effort;
- Phase I focused on a statistical approach to measure energy savings: efforts should be done to link these measures to a bottom-up evaluation of programmes, so as to have an extended evaluation of the observed indicators and to relate them with the energy savings from the programmes implemented by the country.

2. Energy efficiency context

2.1. Challenges and objectives of energy efficiency policies

Energy efficiency has gradually developed in the countries of the southern Mediterranean and now represents a major political issue in most of these countries. Aside from Tunisia, which has a long experience in energy efficiency, there exists few concrete energy efficiency measures implemented in the other countries, even if the situation seems to be changing recently.

The following table presents national energy efficiency programs implemented in southern countries with objectives by sector.

Table 1 :
Objectives of energy efficiency programmes in MEDENER countries

Country	Programme	Sector	Goals
Tunisia	Four-Year Plan 2008-2011	All	Intensity reduction of 3% / year
		Residential	Renovation of 21 500 dwellings between 2008 and 2011
		Lighting	Distribution of 2 millions of CFL/year
		Solar water heaters	Installation of 480 000 m2
	National Programme 2010-2016		Improvement of energy efficiency to reach an energy intensity 0.268 toe/1000dinars in 2016 (against 0.286 toe/1000 dinars in 2011).
Algeria	National Programme of Energy Management 2011-2013	Residential	Thermal renovation of 1,500 buildings
		Tertiary	55 energy audits
		Industry	180 energy audits and feasibility studies
		Transport	Audits, installation of LPG kits for cars, 100 CNG buses
Lebanon	National Plan of energy efficiency (2011-2015)		
Morocco	National Plan of energy efficiency (2004-2020)		

2.2. Trends in energy consumption

2.2.1. Primary energy consumption

Total consumption, also called primary energy consumption, includes final energy consumption and consumption and losses of the energy sector[1] (also called transformation sector) as well as consumption for non-energy uses. The final energy consumption includes the consumption in industry (excluding energy industries), transportation, residential, services and agriculture.

The southern Mediterranean region, made of Algeria, Lebanon, Morocco and Tunisia in this report, had a high economic growth of 4.3% per year from 2000 to 2010. During the same period the GDP of the five European countries (France, Spain, Italy, Portugal and Greece) grew only by 1.1% per year on average, with a recession in 2008 - 2010[2].

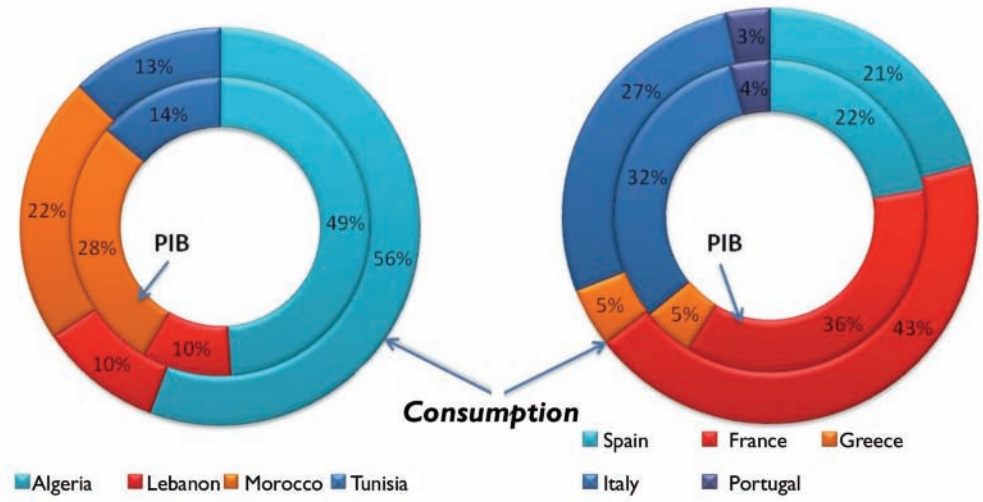
The total consumption of the southern countries reached 73 Mtoe in 2010, with a progression of 3.8% per year since 2000. For European countries the consumption was 620 Mtoe and was almost at the same level as in 2000 (***Figure 3***).

France and Algeria play an important role in the 2 sub-regions:

- France represents about 40% of consumption and GDP of the 5 EU countries; it is followed by Italy;
- Algeria absorbs more than half of the consumption of southern countries and generates half of the GDP of the area; it is followed by Morocco (21% and 28% respectively)

In terms of GDP per capita Lebanon is close to EU countries with € 20,000 per inhabitant (at purchasing power parities) compared with 5 000 € per inhabitant on average in the three other southern countries.

Figure 3: Primary energy consumption and GDP (2010)



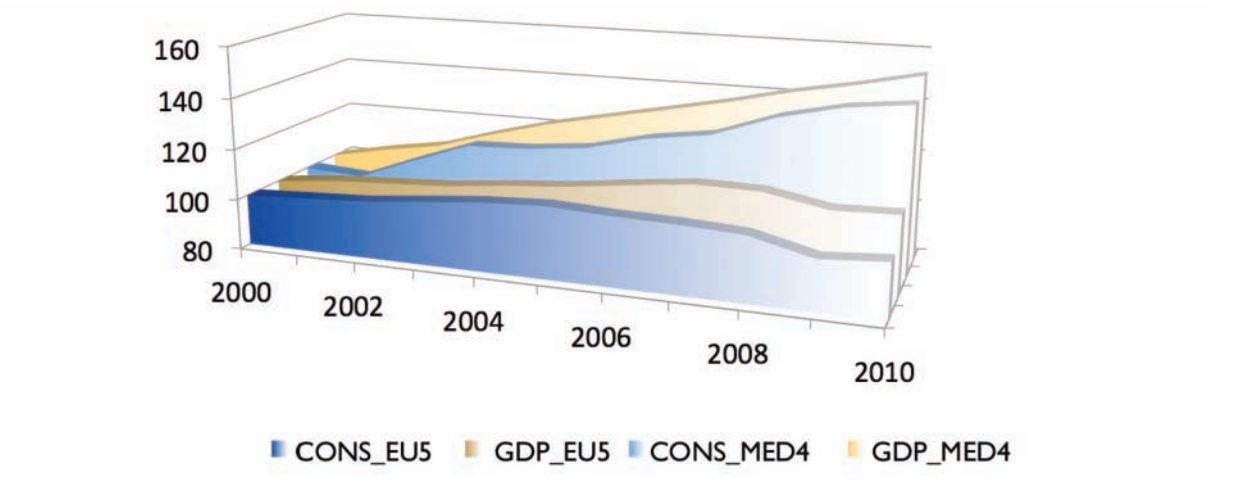
[1] Including transmission and distribution losses.

[2] Gross Domestic Product (GDP) is measured in constant prices and purchasing power parities of 2000.

There is a net decoupling between the primary energy consumption and the GDP in EU countries since 2005, contrary to Mediterranean countries where the growth of consumption is close to that of GDP (*Figure 4*).

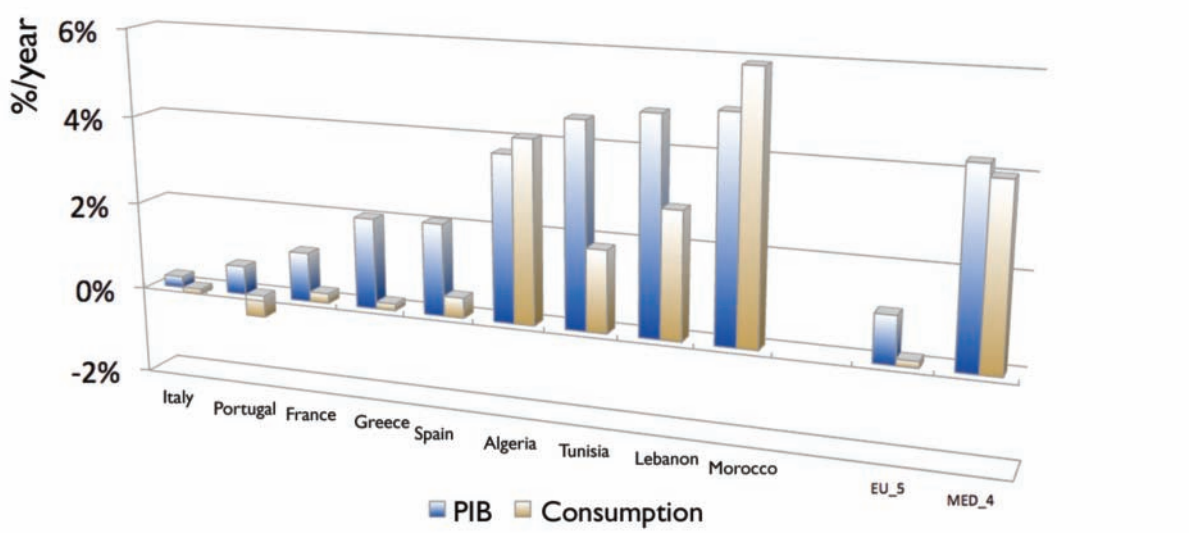
Since the economic and financial crisis of 2008, the GDP and the primary consumption of the five EU countries sharply fell (-1.4% and -1.9% per year respectively). The southern countries have been less impacted by the crisis: their GDP and consumption jointly grew by more than 3.4% per year.

Figure 4: Trends in primary consumption and GDP by sub-region



The decoupling between the primary consumption and the GDP is effective in most countries, with the exception of Algeria and Morocco where consumption and GDP increased in the same way. Due to the weight of Algeria in the southern Mediterranean area, this trend has an important impact on the whole sub-region (*Figure 5*).

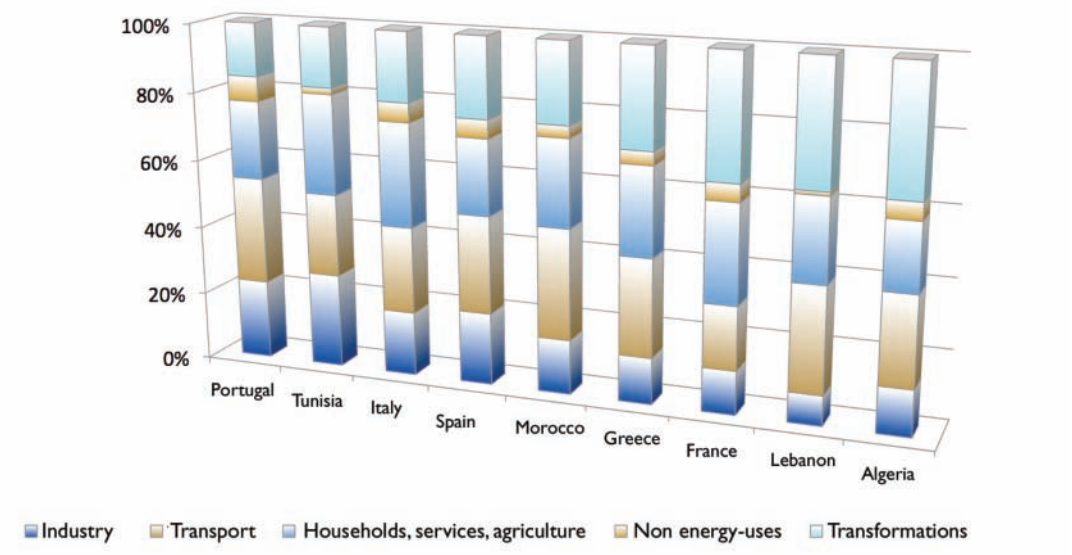
Figure 5: Primary energy consumption and GDP trends by country (%/year, 2000-2010)



[3] MED_4: Algeria, Lebanon, Morocco and Tunisia; EU_5: Spain, France, Greece, Italy and Portugal

OIndustry and transformations are dominant in the primary energy consumption (40 % of primary consumption in Portugal, Morocco and Italy, 50 % in Algeria in 2010) (*Figure 6*).

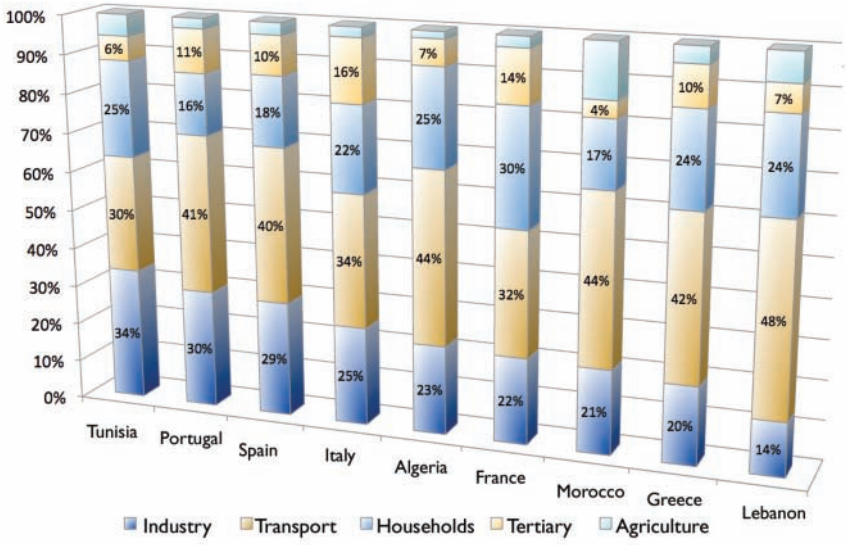
Figure 6: Primary energy consumption by main sector (2010)



2.2.2. Final consumption

The final energy consumption of the 9 Mediterranean countries reached 465 Mtoe in 2010, a growth of 0.9 % per year since 2000. Transport accounts for over 40 % of this final consumption in most countries, except in Tunisia (30%), Italy (34%) and France (32%). Industry, the most energy intensive sector, has an important contribution in Tunisia, Portugal and Spain (30% of the final consumption in 2010) (*Figure 7*).

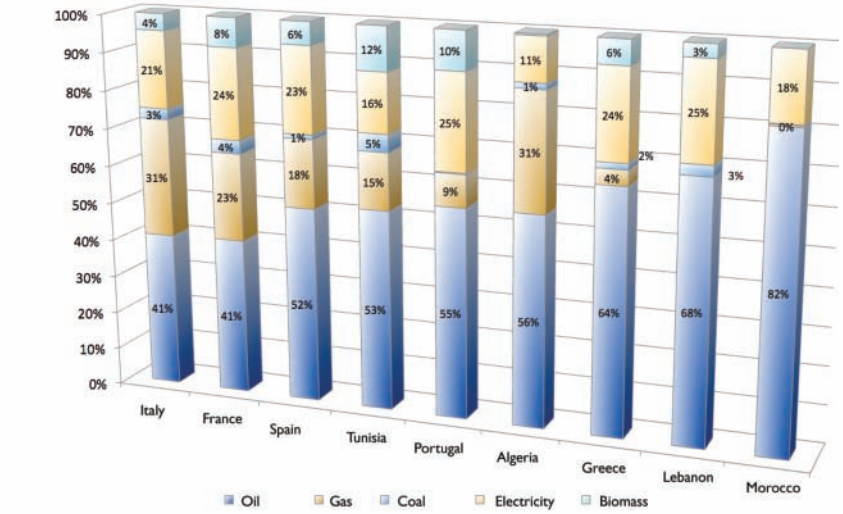
Figure 7: Breakdown of final energy consumption by sector (2010)



Oil remains the main energy consumed in Mediterranean countries (about 40% of final consumption in Italy and France, 70 % in Lebanon, 80% in Morocco). Biomass accounts for only 8% of the final consumption, but is underestimated in southern countries because a lack of official data (*Figure 8*). In fact, the marketed wood represents only a small part of the total consumption of biomass; biomass taken directly from forests or crop residues is not recorded

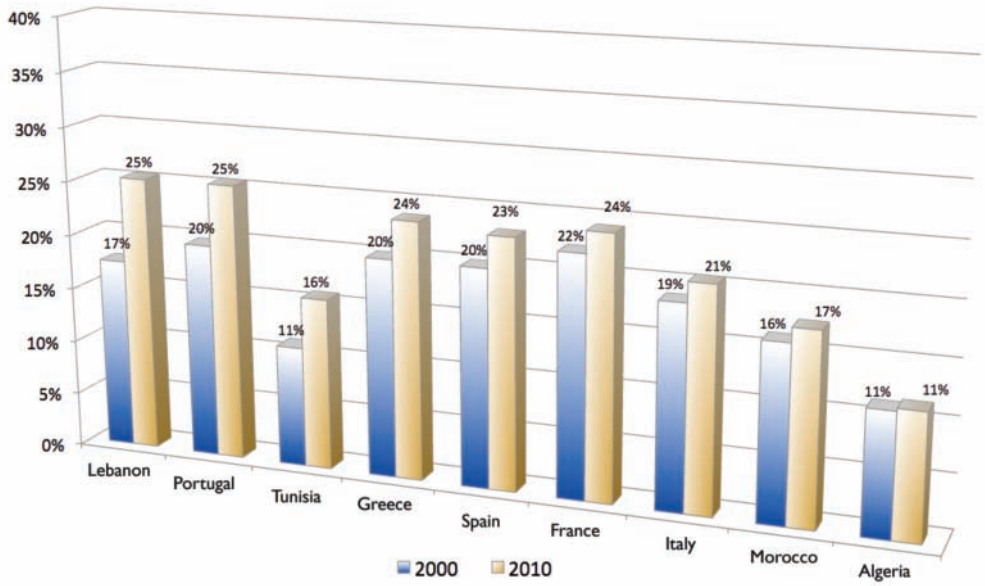
in official statistics. In Morocco, there is no official figure on biomass; a study estimated that the consumption of wood in the early 90s represented 30% of the total energy consumption[4].

Figure 8: Breakdown of final consumption by energy source (2010)



Electricity is at the heart of economic and social development of many countries. Its share in the final energy consumption grew strongly in all countries, in particular in Lebanon (+8 points from 2000), Portugal and Tunisia (+5 points) and Greece (+4 points) (***Figure 9:***). This increase in consumption is linked to demographic change, industrialization, development of ICTs (Information and Communication Technologies) and air conditioning in the tertiary sector as well as to the increasing appliances ownership for households (refrigerators, TV and air conditioning) and, in the case of Morocco, to the electrification of rural areas (the electrification rate of the country grew from 68% in 2000 to 95% in 2010).

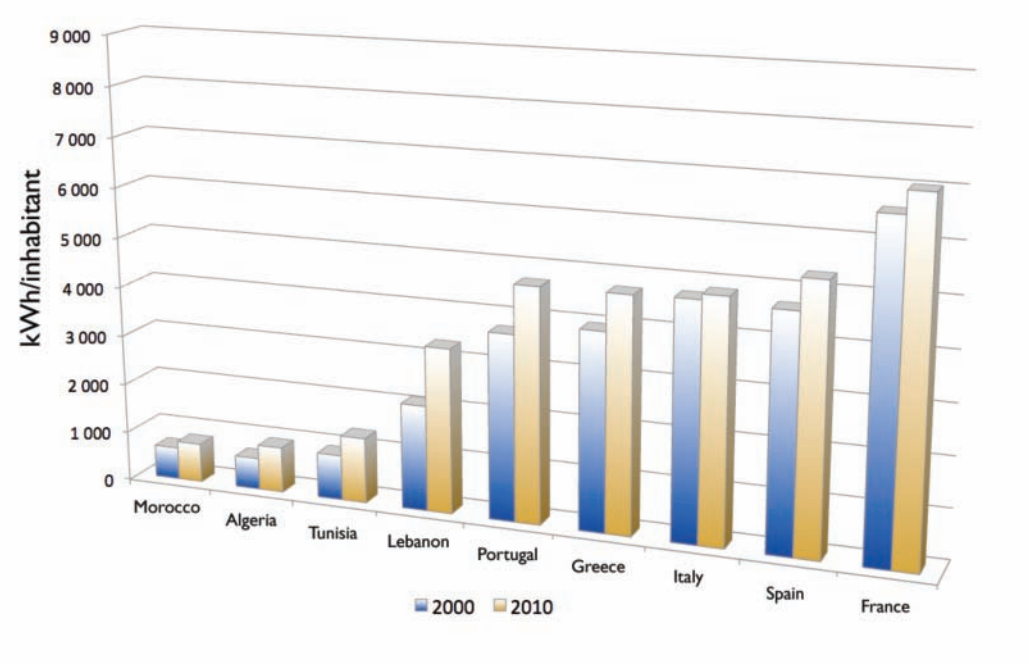
Figure 9: Share of electricity in the final energy consumption



[4] Study on fuel wood demand and supply conducted in 1992 and 1994 by the Administration of Water and Forestry as part of a project funded by the World Bank. The study estimated that the consumption of wood should be estimated at 11.3 Mt, of which 50% taken from forests.

As of 2010, Morocco had the lowest electricity consumption per capita with 785 kWh[5], followed by Algeria (914 kWh), Tunisia (1315 kWh) and Lebanon (3310 kWh). Among EU countries, Greece, Italy and Spain consume around 4500 kWh per capita, Spain 5300 kWh and France 7000 kWh. In southern countries, we should also take into account the rapid growth in this per capita consumption (4% per year in Tunisia and Algeria, 4.6% per year in Lebanon over the period 2000 - 2010) (***Figure 10***). The electricity consumption in these countries will continue to grow rapidly, on average by 6% per year by 2025, as estimated by the Mediterranean Energy Observatory for the South and Eastern Mediterranean Basin.

Figure 10: Electricity consumption per capita (electrified)



[5] Total electricity consumption divided by the electrified population.

2.3. Global trends in energy efficiency: primary and final intensity

Three types of indicators are usually considered to evaluate energy efficiency:

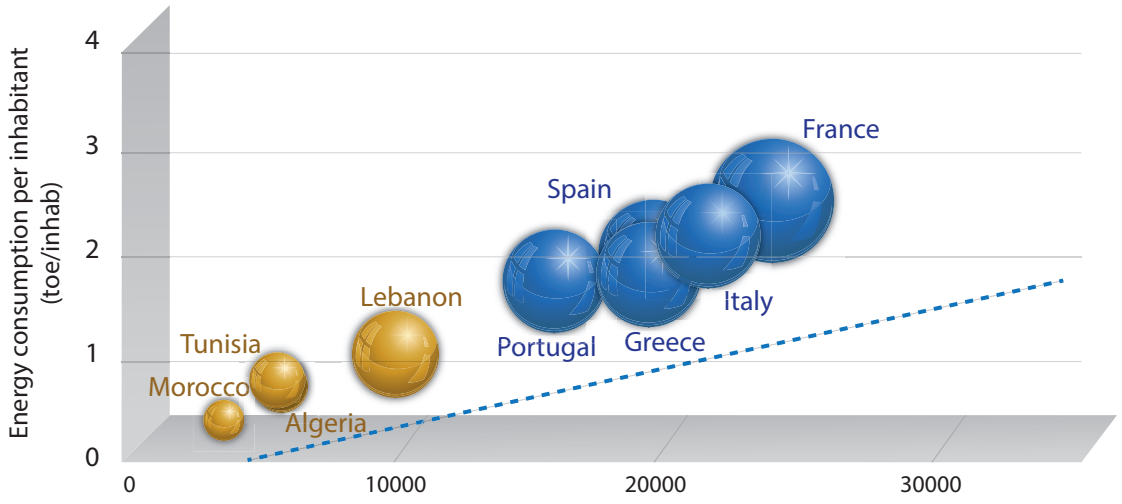
(i) Economic ratios or energy intensities, i.e. ratios between the energy consumption and economic activity measured at constant prices (Gross Domestic Product GDP, value added). Intensity can be calculated for the whole economy or for a sector. Energy intensity can be expressed at purchasing power parity to compare countries.

(ii) Techno-economic ratios, calculated by sub-sector or end-use, as a ratio between the energy consumption and an indicator of activity in physical units (dwellings, vehicles, ton of steel, passenger-kilometres, etc.). These techno-economic ratios are also called unit or specific consumption.

(iii) Diffusion indicators that measure the penetration of energy efficient technologies (CFL, solar water heaters) or "good practice" (share of public transport, mobility of public transport).

There exists a strong correlation between final energy consumption per capita and per capita income. For example, the GDP per capita of France is six times higher at purchasing power parities than in Morocco, the energy consumption per capita is almost seven times higher, and the electricity consumption per capita is almost ten times higher in France than in Morocco (***Figure 11***).

Figure 11: Final energy consumption and GDP per capita (2010)



GDP per inhabitant (€2000 at PPP)

The most common indicator used to evaluate the overall energy performance of countries is the primary energy intensity. This indicator is defined as the total amount of energy required to produce one unit of GDP.

Energy intensity is generally considered as a reliable and simple indicator, as it is based on consumption data from energy balances and GDP from national accounts. However, the energy intensity appears more as an indicator of "energy productivity" than a real indicator of energy efficiency from a technical point of view or in relation with energy efficiency policies. Energy intensity

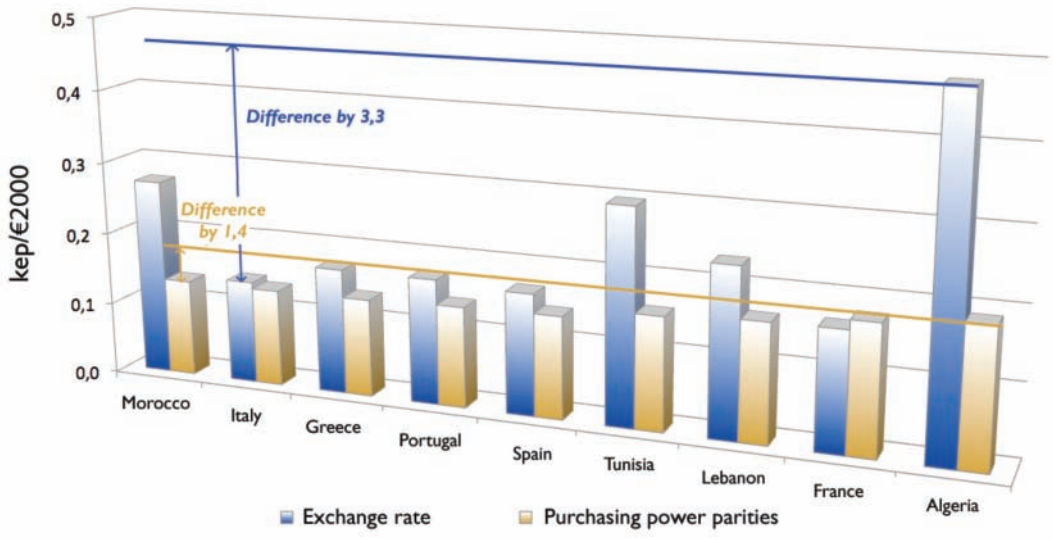
is nonetheless the only indicator that allows comparing the overall energy efficiency performance between countries, even if the observed differences also include other factors not linked to energy efficiency.

Differences in energy intensities between countries may also be related to: (i) the economic structure of the country, namely the contribution of the different sectors to GDP, (ii) the power generation mix (thermal, nuclear and renewable), (iii) the importance of other transformations (as in case of Algeria with the hydrocarbon sector), (iv) the climate, and (v) lifestyles and economic development in general. In this report different indicators will be presented and corrected from some of these various effects to get a clearer picture of energy efficiency trends and levels in the different countries.

Within the framework of the European project ODYSSEE MURE, energy efficiency gains are measured by an energy efficiency index calculated for each consumer sector (ODEX[6]). However, this index requires a large amount of data and could not be used at this stage of the project.

At purchasing power parity (in constant € of year 2000), Morocco and Italy have the lowest primary energy intensity. Using purchasing power parities reduces the intensity differences by increasing the value of GDP of countries with a low cost of living. This approach is generally considered to be more relevant to compare countries with different costs of living. The difference in intensity level expressed at exchange rates and purchasing power parities is a factor 2 for Morocco and Tunisia, 2.5 for Algeria and 1.4 for Lebanon (*Figure 12*).

Figure 12: Primary energy intensity: exchange rate versus purchasing power parity (2010)

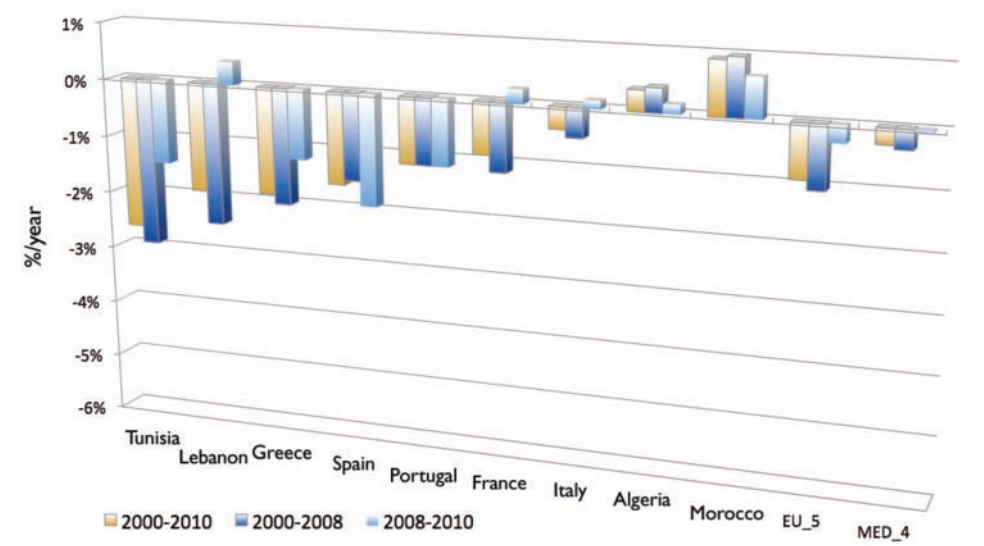


Over the period of 2000-2010, the primary intensity of most countries has decreased, except in Morocco and Algeria. In southern countries this decline was 2.5 times slower than in EU countries, except in Tunisia and Lebanon, where intensities decreased by 2.6% and 1.9% per year respectively *Figure 13*). The economic and financial crisis of 2008 has slowed down the intensity decline in EU

[6] More information about ODEX: http://www.odyssee-indicators.org/registred/definition_odex.pdf

countries. The reversed trends observed in France and Italy is essentially due to climate effect; at normal climate the intensities of these two countries keep on decreasing (-1% per year in France, -0.2% per year in Italy) (see ***Box 3, Figure 14***)[7].

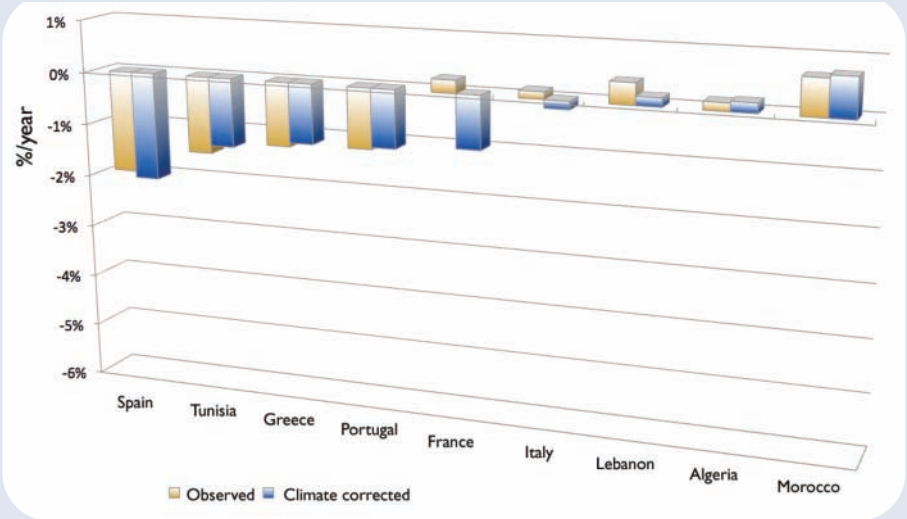
Figure 13: Primary energy intensity trends (2000-2010)



Box 3:
Impact of climatic corrections on energy intensity

In France and Italy, the primary energy intensity slightly increased (0.2% per year) over the period 2008 - 2010, whereas under normal climatic conditions (i.e. taking into account climatic corrections), these intensities have been decreasing (-1% per year in France and -0.2% per year in Italy). In Southern countries, climatic corrections have low impact on primary intensity, due to the lower weight of heating and cooling in total consumption.

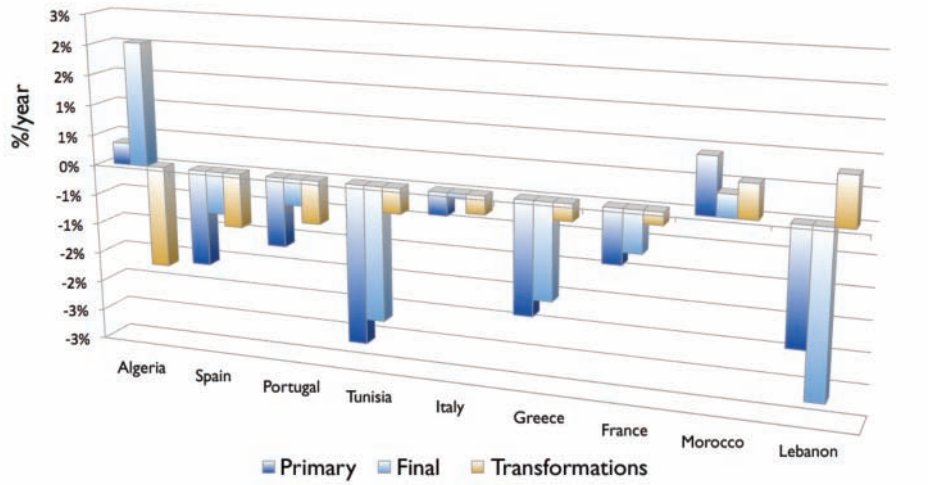
Figure 14: Primary energy intensity trends (2008-2010)



[7] Although climate may have a significant impact on energy consumption in the residential and tertiary sectors, the intensity presented in the report is not corrected from climate variation due to a lack of reliable data on degree days for southern Mediterranean countries. For these countries data on heating and cooling degree days are only available for one city and since 2005. Data on degree-days are available for EU countries in the framework of the ODYSSEE MURE project.

In most countries except Morocco and Lebanon, the primary intensity has been decreasing faster than the final intensity. In case of Algeria it has been growing less rapidly. Thus, the energy sector (that represents the difference between the primary and final intensity) has contributed to the reduction of the primary intensity in all these countries due to improvement in the power generation efficiency linked to the penetration of gas combined cycles and renewables (***Figure 15***)[8].

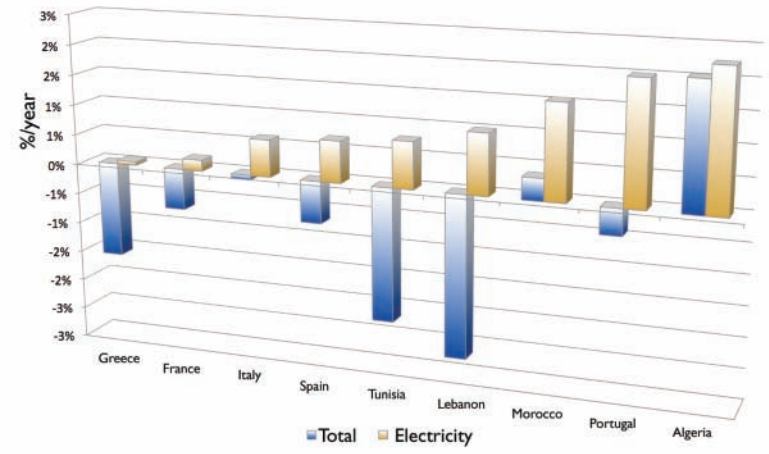
Figure 15: Trends in primary and final energy intensity (2000-2010)



Over the period 2000-2010, the final energy intensity of Mediterranean countries fell by 0.4 % per year. This result is not equal across the two sub-regions: in the five EU countries the intensity decreased by 0.5% per year while in the South it increased by 0.4 % per year on average.

The electricity intensity has been increasing in all countries (***Figure 16***). In Southern countries, the growth in electricity intensity is particularly linked to the economic development, with a rapid growth of electricity demand across sectors, especially for households, due to the increasing number of electrical appliances and, in the case of Morocco, the electrification of rural areas.

Figure 16: Trends in final energy intensity: total and electricity (2000-2010)[9]



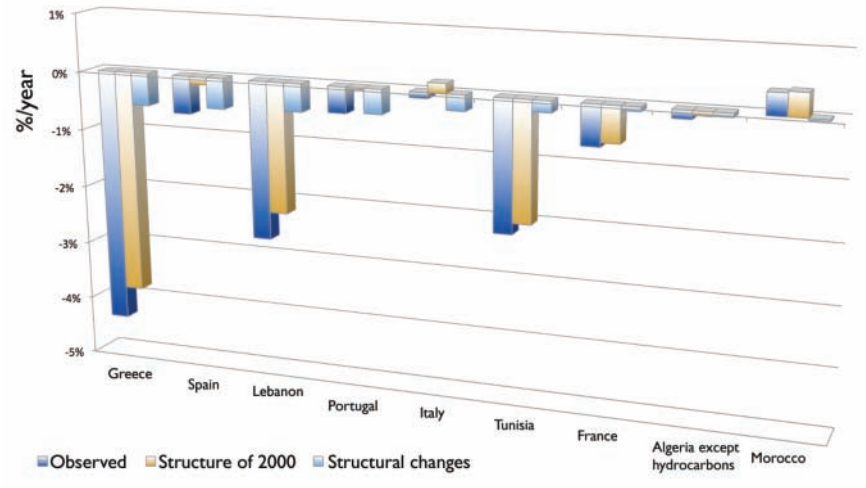
[8] See further analysis on the energy sector.

[9] In Algeria due to the predominant weight of hydrocarbons, the calculation was made without hydrocarbons. The share of hydrocarbons in the GDP fell sharply from 2000 to 2010, but still represents nearly 30% of GDP.

To assess the progress of energy efficiency in the different countries, it is more relevant to exclude the influence of changes in the GDP structure, i.e. in the contribution of the three main economic sectors in the GDP (agriculture, industry and services). This is obtained by calculating an intensity at constant GDP structure, assuming a constant share of agriculture, industry and services in the GDP. The difference between the variations of the intensity at constant structure and the observed intensity shows the influence of structural changes in the economy.

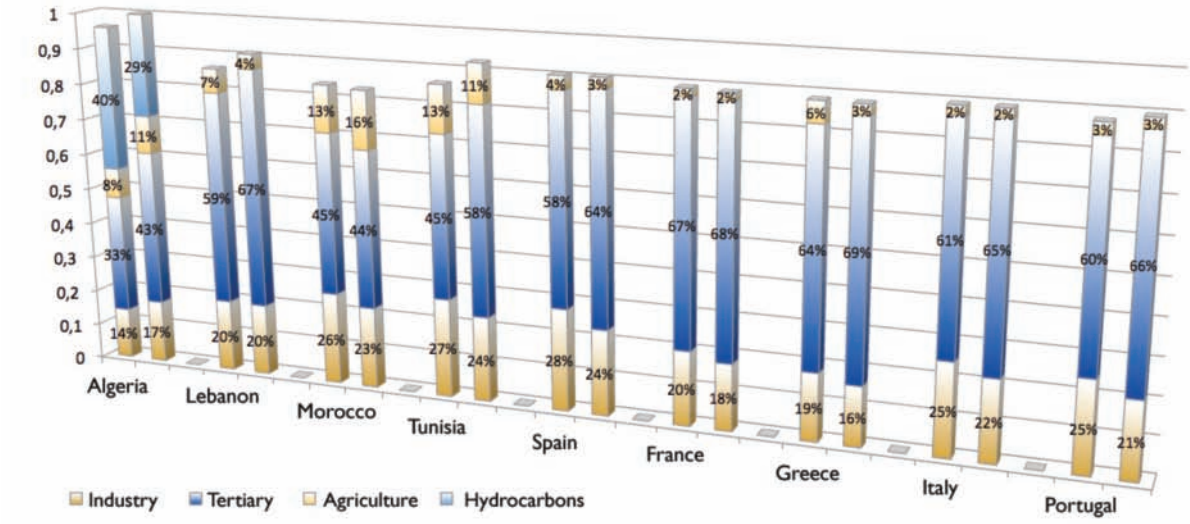
In Greece, Spain, Portugal and Lebanon, the final energy intensity has been decreasing faster than the intensity at constant structure: this means that part of the decrease was explained by structural changes, mainly due to the increasing weight of the service sector in the GDP, as services are on average 7 times less energy intensive than industry[10].

Figure 17: Impact of structural changes in the GDP on the final intensity (2000-2010)



The share of services has increased by 13 points in Tunisia, 9 points in Lebanon, 6 points in Spain and Portugal between 2000 and 2010. On the contrary, the share of industry has declined in all countries (- 3 points on average) (*Figure 18*). The service sector contributed to reduce the final energy intensity by 0.5% per year on average in Greece, Spain, Portugal and Lebanon.

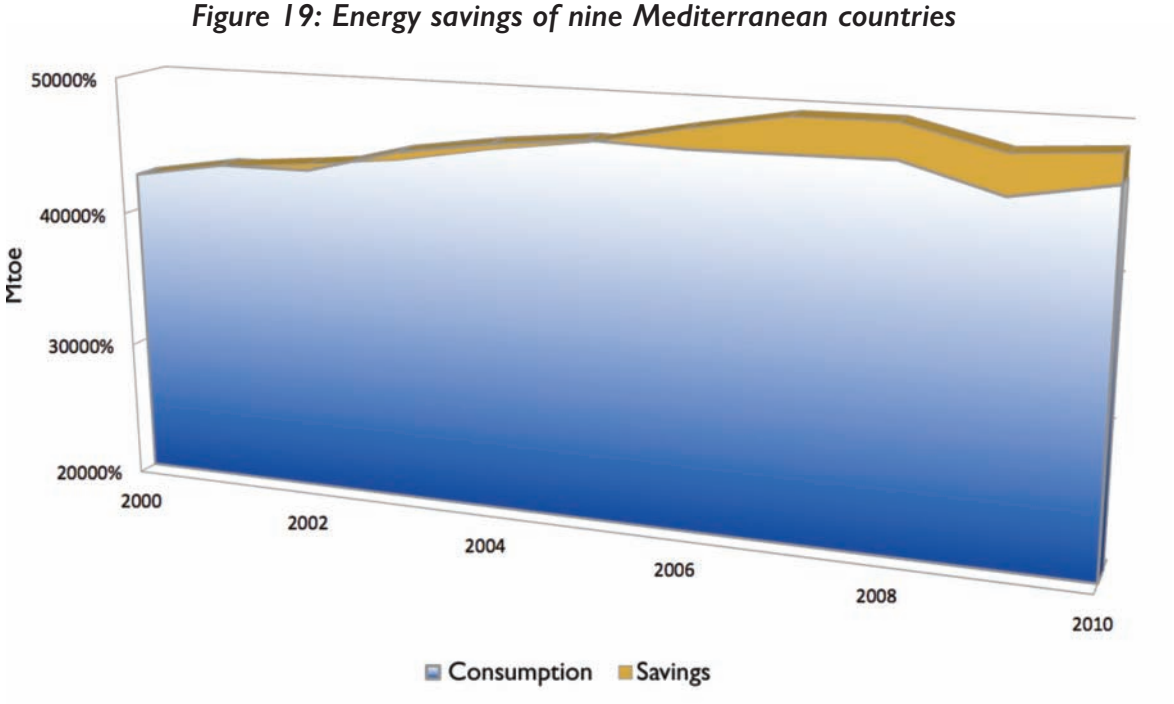
Figure 18: Value added by sector in GDP (2000/2010)



[10] Factor 3 in Algeria, 8 in Portugal, Greece and Spain and 12 in Tunisia.

Energy savings associated to the decrease in final energy intensity can be calculated as the difference between a fictitious consumption, calculated with an energy intensity at constant structure of a base year (2000) and the observed consumption. In Southern and Eastern Mediterranean countries, energy savings reached 22 Mtoe over a final consumption of 465 Mtoe, which represent less than 5% of final consumption. In other words, without these savings, the final energy consumption would have been 5% higher than the observed one in 2010 (***Figure 19***). Only EU countries recorded energy savings.

Figure 19: Energy savings of nine Mediterranean countries



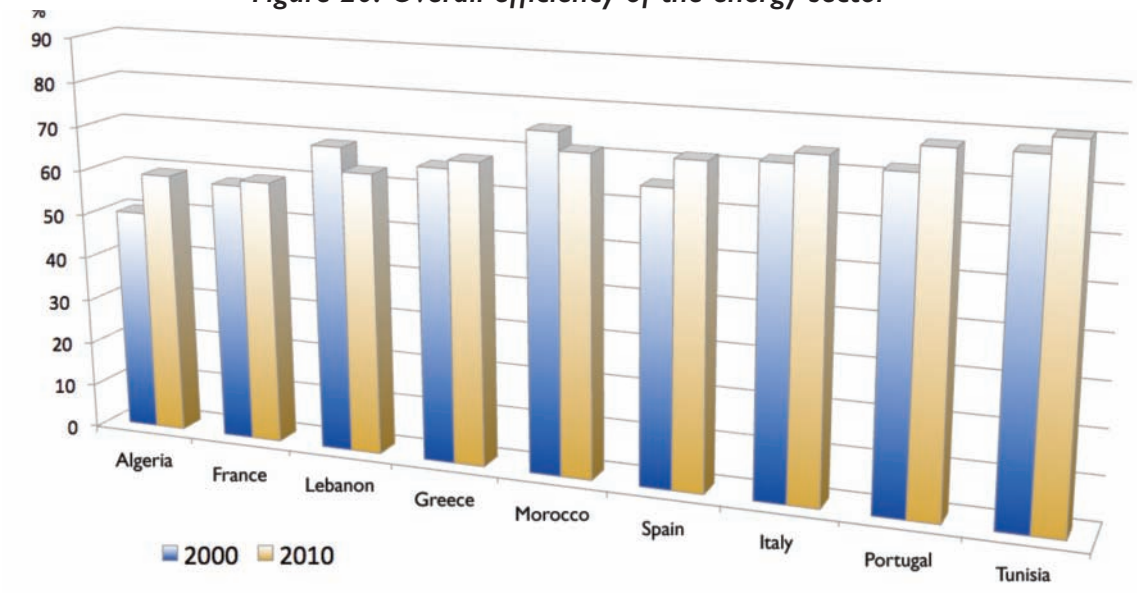
3. Energy efficiency trends in the energy sector

The energy sector includes the power sector, refining, oil and gas production as well as LPG and LNG plants. In most countries except Algeria the consumption of the energy sector mainly corresponds to consumption and losses in the power sector, namely power generation losses in thermal and nuclear plants, own-consumption of power plants and electricity transmission and distribution losses[11]. In Algeria, the energy sector also includes the production and processing of hydrocarbons: the two main important consumers are power generation and LNG units.

The overall performance of the energy sector is calculated by calculating the ratio between the final energy consumption and the primary energy consumption: the higher it is, the higher is the share of primary energy reaching final consumers and, therefore, the more efficient is the sector.

The efficiency of the energy sector varies from 60 % in France and Algeria to 77 % in Portugal and 80% in Tunisia. The lowest values observed in France and Algeria can be explained by the high share of nuclear in France and the size of the hydrocarbons sector in Algeria. The high efficiency in Portugal is due to the high share of renewables in power generation. In most countries, this efficiency is increasing due to energy efficiency improvement in electricity production (***Figure 20***).

Figure 20: Overall efficiency of the energy sector

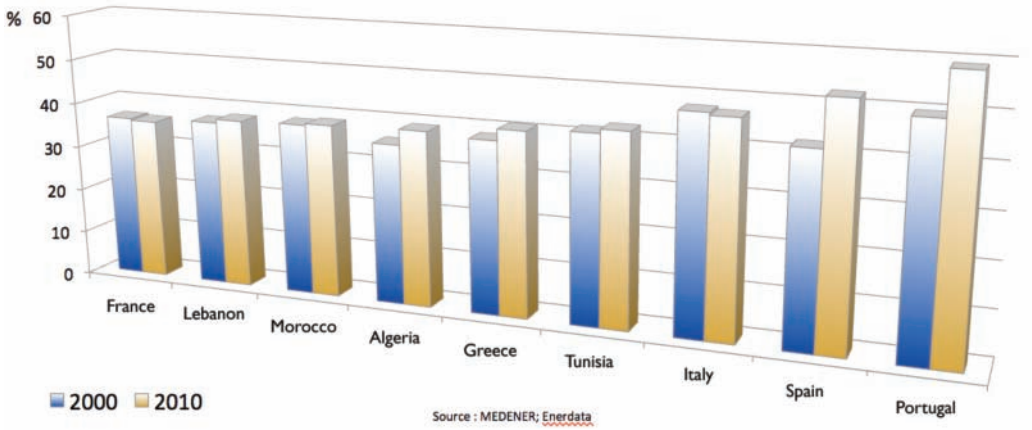


The efficiency of the power sector is influenced by the electricity mix (share of renewable and nuclear energy) and the efficiency of thermal production. Portugal and Spain are the two countries with the highest performance (59% and 52% respectively) and the highest progression (+10 points) (***Figure 21***). This good

[11] These consumption and losses represent about 95% of the energy sector consumption in these countries.

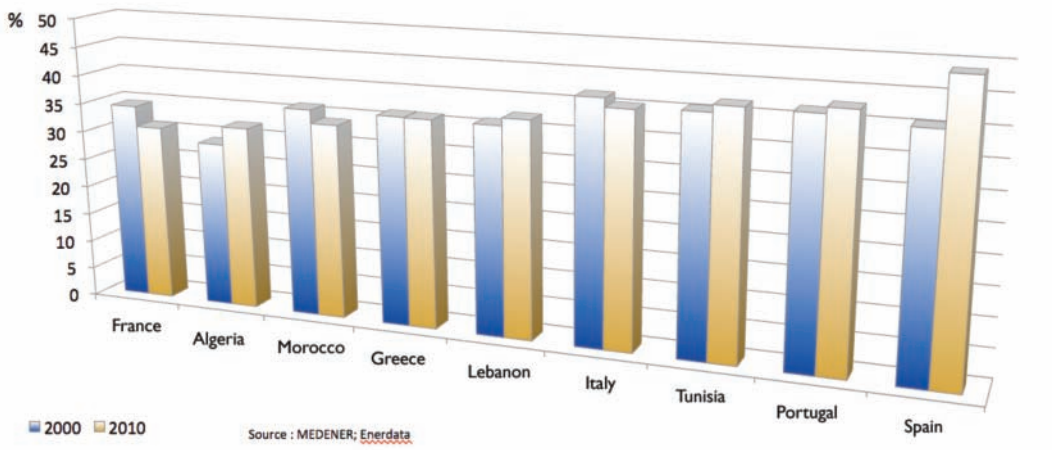
result is explained by the sharp increase in the share of renewables in power generation[12] and the rapid diffusion of gas combined cycles. The performance of the electricity sector is relatively low in France, because of the high share of nuclear in the power mix (with its low efficiency of 33% against 40-50% for thermal) and in Lebanon, because of the importance of autoproduction in industry and buildings linked to the frequent power cuts (about 30% of total production).

Figure 21: Efficiency of the power sector



Spain and Portugal are the countries with the most efficient thermal generation (49% and 43% respectively) and the greatest efficiency gains linked to the penetration of gas combined cycles (***Figure 22***) . The low performance of thermal power plants in France is not meaningful because of its low share in power generation.

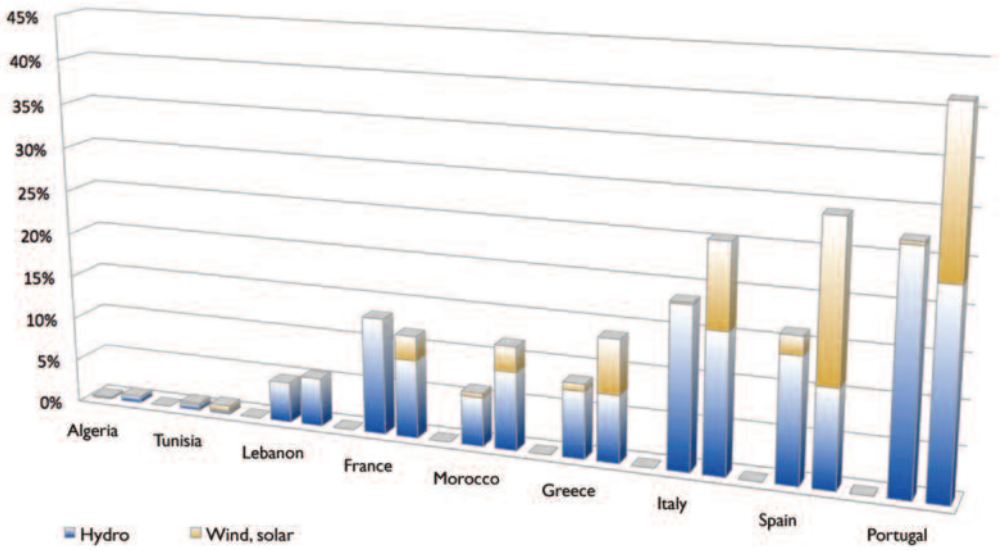
Figure 22: Efficiency of thermal power plants



The share of renewable in electricity generation has increased in all countries (except in France). This share is around 30% in Spain, 40% in Portugal with increasing shares (+14 points in these 2 last countries between 2000 and 2010) (***Figure 23***). It is still very low in Algeria and Tunisia (<1%).

[12] As the production of electricity from renewable energy sources (hydro, wind and solar) is considered with an efficiency of 100%, the penetration of renewables in the power mix improves the average efficiency of power generation.

Figure 23: Share of renewable sources in electricity generation (2000, 2010)

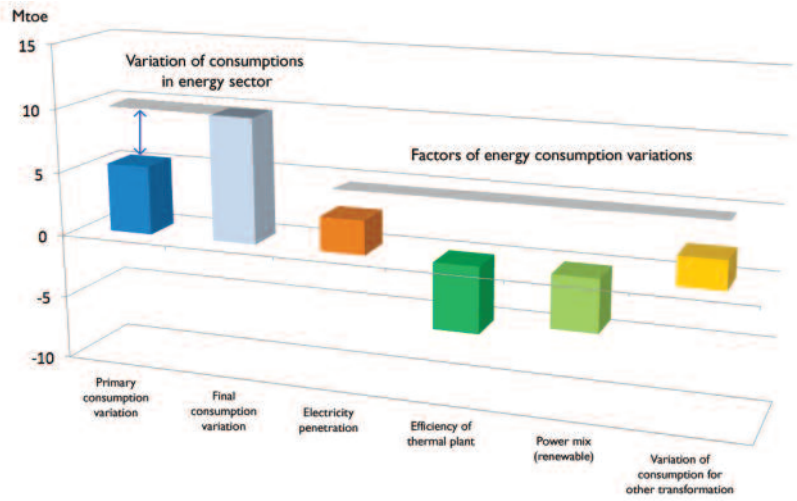


Energy efficiency gains have contributed to limit the growth in the consumption of the transformation sector and thus in the primary energy consumption. The electrification of the economy, measured by the increasing share of electricity in the final energy consumption, contributes to increase the electricity production and therefore the losses in thermal and nuclear power plants. Box 4 presents the factors responsible for the variation of primary energy consumption in Spain over the period of 2000-2010.

Box 4:
Drivers of the primary energy consumption variation in Spain (2000-2010)

Between 2000 and 2010, the primary energy consumption increased by 5 Mtoe in Spain. This increase can be explained by four factors: on the one hand, the increasing contribution of electricity in final consumption (from 19% to 23%) and the consumption of other transformations contributed to increase the primary energy consumption; on the other hand, efficiency improvement of thermal power plants (from 41% to 49% between 2000 and 2010) and the increasing use of renewables in electricity production contributed to reduce the consumption by 5.2 and 4.2 Mtoe, respectively.

Figure 24 : Primary consumption variation in Spain (2000-2010)



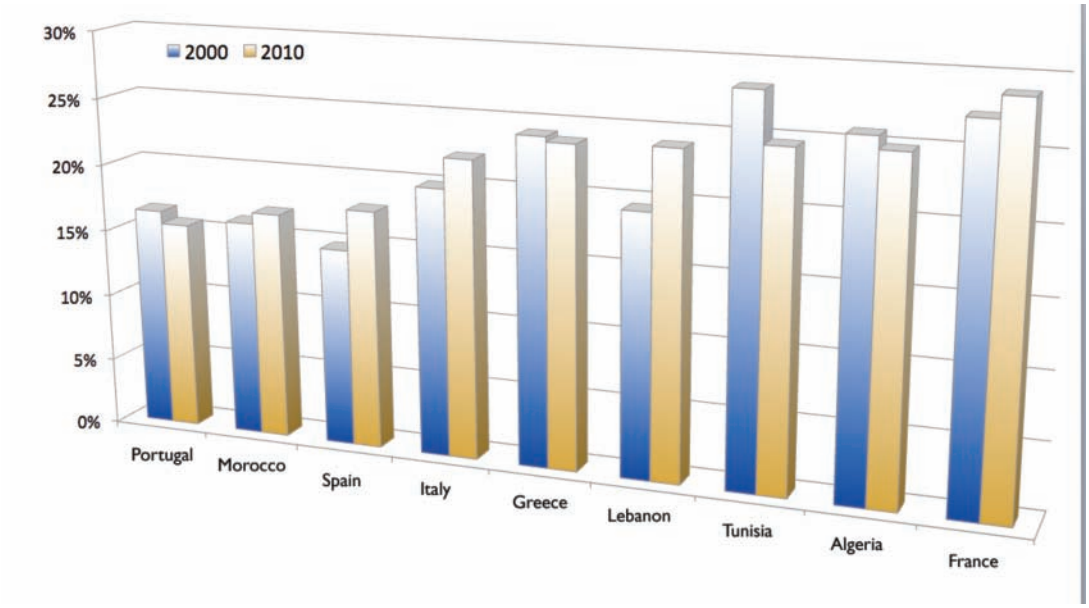
4. Energy efficiency trends for households

Households consume on average 25% of final energy consumption in Mediterranean countries (23% in 2010), with a rather similar share for southern and northern countries (23% and 24%). However there exist significant differences among countries, with a share as low as 15% in Portugal and Morocco and reaching 28% for France. In addition, energy uses and equipment ownership are also very diverse due to differences in energy prices and income level.

4.1. Trends in consumption and households profile

In most countries, the share of household in final energy consumption grew between 2000 and 2010, except in Tunisia and Algeria, as well as more recently in Portugal and Greece due to the economic crisis. This increase is mainly due to electricity uses, such as air conditioning, electronic equipment (ICT), as well as to multiple equipment ownership (***Figure 25***).

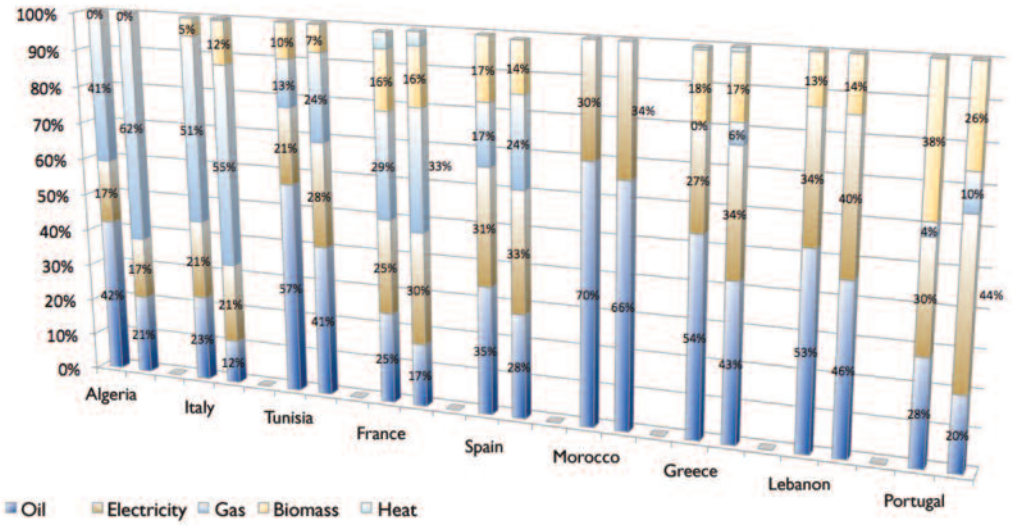
Figure 25: Share of households in final energy consumption



Gas remains the main energy source consumed by households in Algeria, Italy and France. Oil is significant in Lebanon, Tunisia and Greece, but its share is decreasing in all countries in favour of natural gas (Algeria, Italy, Spain), or electricity in other countries.

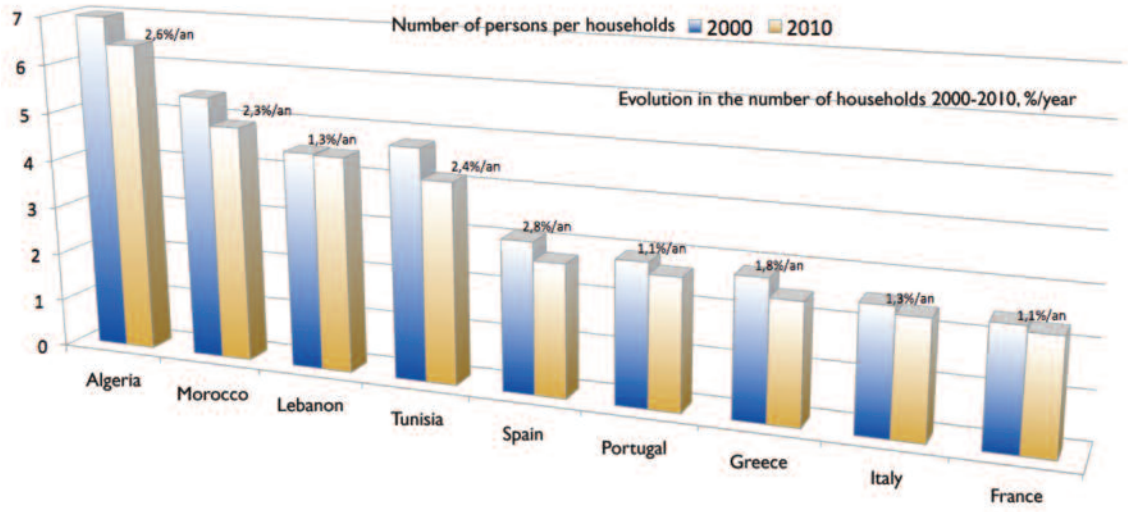
Biomass (mainly wood) can be significant in EU countries (12% of the household consumption in Italy, 14% in Spain, 16% in France and 26% in Greece and Portugal), boosted by policies and measures against climate change. In Southern Mediterranean countries, the quantity of wood sold is not well known and the policy us rather to shift from biomass to modern fuels (***Figure 26***)[13]

Figure 26: Final energy consumption of households by energy source (2000, 2010)



The average size of household can be quite different between Southern and EU countries (4 and 6 persons per household in the South against 2.5 in EU countries). The growth in the number of households, a driver of energy consumption growth, is more dynamic in southern countries than in the EU: the number of households increased by 2.4% / year on average from 2000 to 2010 in southern countries, due to the combined effect of population growth and significant decline in the number of persons per household, against 1.6% / year in the EU, where there is a much lower population growth and a certain stability in the average household size (***Figure 27***).

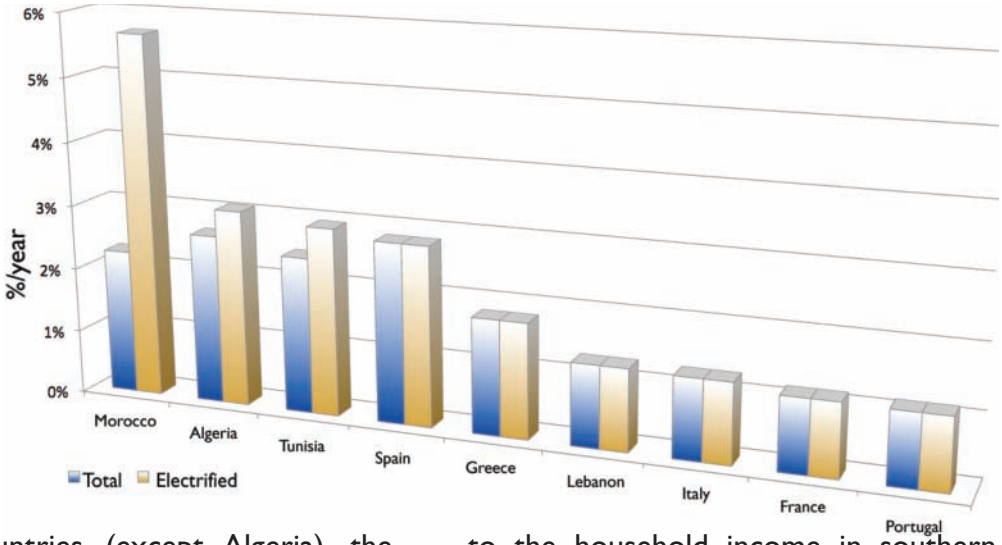
Figure 27: Trend in the average household size and number of households



[13] For Morocco, wood is not taking into account because it does not exist official data.

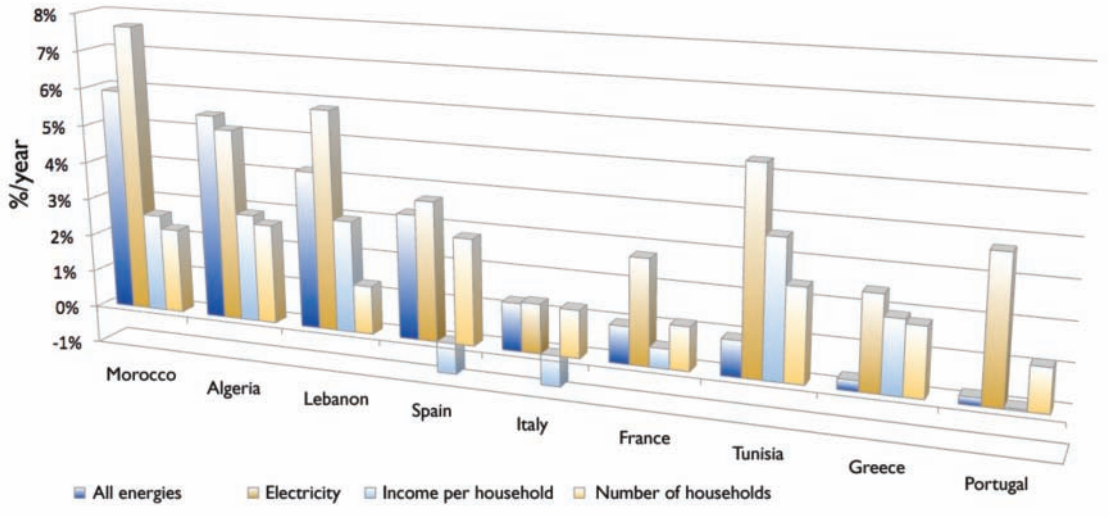
The impact of the increase in the number of households on the consumption is reinforced by taking into account the progress of rural electrification. This effect is particularly important in Morocco, where the share of electrified households increased by 27 points reaching 95% in 2010 up from 68% in 2000, resulting in a growth of the number of electrified households of 5.5%/year between 2000 and 2010. In Tunisia and Algeria, this effect is less important as the electrification rate of households was already 95% in 2000 and reached almost 99% in 2010. The number of electrified household is a more relevant indicator to characterize the trends in household electricity consumption (***Figure 28***).

Figure 28: Trends in the number of households: total and electrified (2000-2010)



In all countries (except Algeria), the household electricity consumption grew faster than consumption for other fuels (***Figure 29***). This growth is directly linked to the household income in southern countries (3%/year on average); in Europe, the household income tends to decrease due to the economic crisis[14].

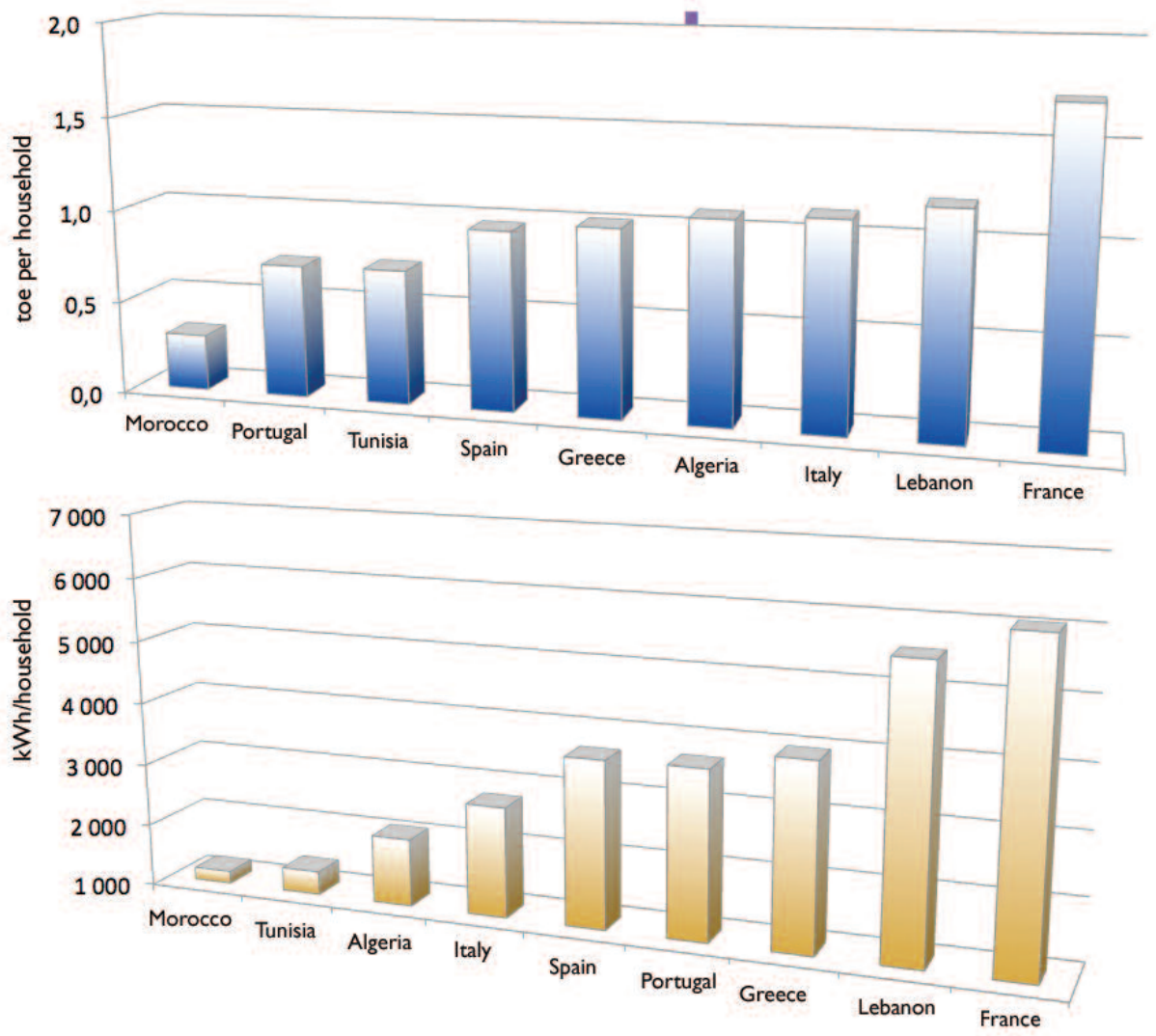
Figure 29: Energy consumption, household income and number of households (2000-2010)



[14] Between 2008 and 2010, households income, measured with the final consumption expenditure of households decreased by 0.8%/year in Portugal, 1.5%/year in Italy, 3.8%/year in Spain and 4.5%/year in Greece.

The average unit consumption per household (ratio between the energy consumption of households and the number of households), varies quite a lot among Mediterranean countries, from 0.25 toe/household in Morocco, to around 1 toe in Spain, Greece and Algeria, and 1.8 toe in France[15] (***Figure 30***). For electricity, the differences are even greater: 1200 kWh per household in Morocco, 1370 kWh in Tunisia, 5500 kWh in Lebanon and even 6000 kWh in France.

Figure 30: Unit consumption per household: total and electricity (2010)



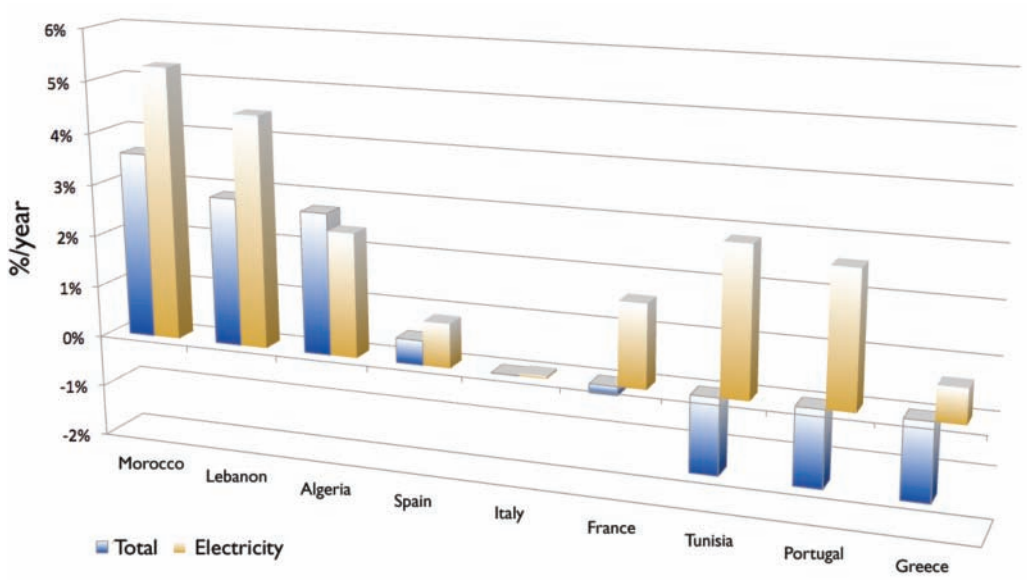
Between 2000 and 2010, energy consumption per household has significantly increased in Lebanon, Algeria and Morocco (about 3%/year), while it has been decreasing in Greece and Portugal due to the economic crisis, and in Tunisia due to the substitution of biomass with natural gas and LPG.

Energy consumption data have not been adjusted from climatic variations due to a lack of data on degree days in Southern countries. According to the years and countries climatic variations may have a significant impact on consumption trends, as shown in **Box 5**.

[15] Biomass is not taken into account in Morocco due to the lack of reliable data.

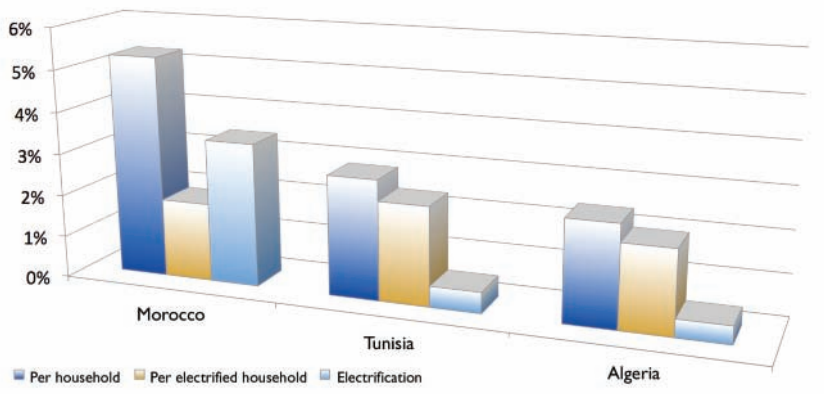
The electricity consumption per household is increasing significantly in Morocco and Lebanon (over 4%/ year) and in other countries (2-3%/year) due to a growth in equipment rate (refrigerators, TV, ICT, air conditioning, water heater). France has a quite unusual situation compared to the other countries as about 30% of the electricity consumption is for space heating. In Spain and Greece, the electricity consumption growth has slowed down significantly since 2008 because of the economic and financial crisis[16] (***Figure 31***).

Figure 31: Trends in unit energy consumption per household



Per electrified household, the electricity consumption increased less rapidly than per household, due to the electrification of rural households. In Morocco, the sharp increase in the electrification rate from 68 to 95% between 2000 and 2010 explains two thirds of the growth in electricity consumption per household from 2000 to 2010; in Tunisia and Algeria, where almost all households have access to electricity (95% in 2000 to almost 100% in 2010), the electrification explains less than 20% of the electricity consumption growth (***Figure 32***).

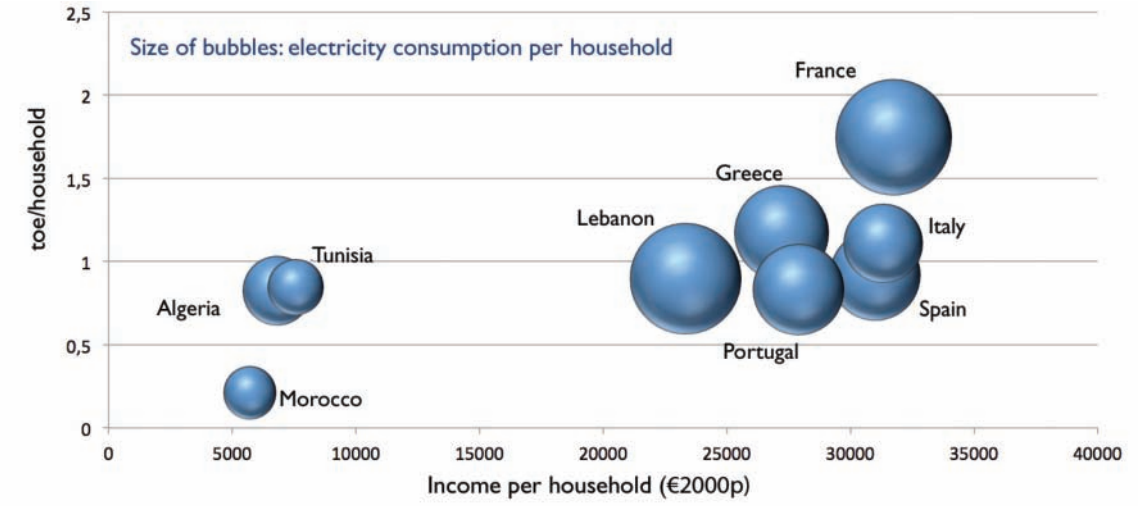
Figure 32: Effect of household electrification on the unit electricity consumption



[16] Between 2000 and 2007, the electricity consumption per household increased by 2%/year in Spain.

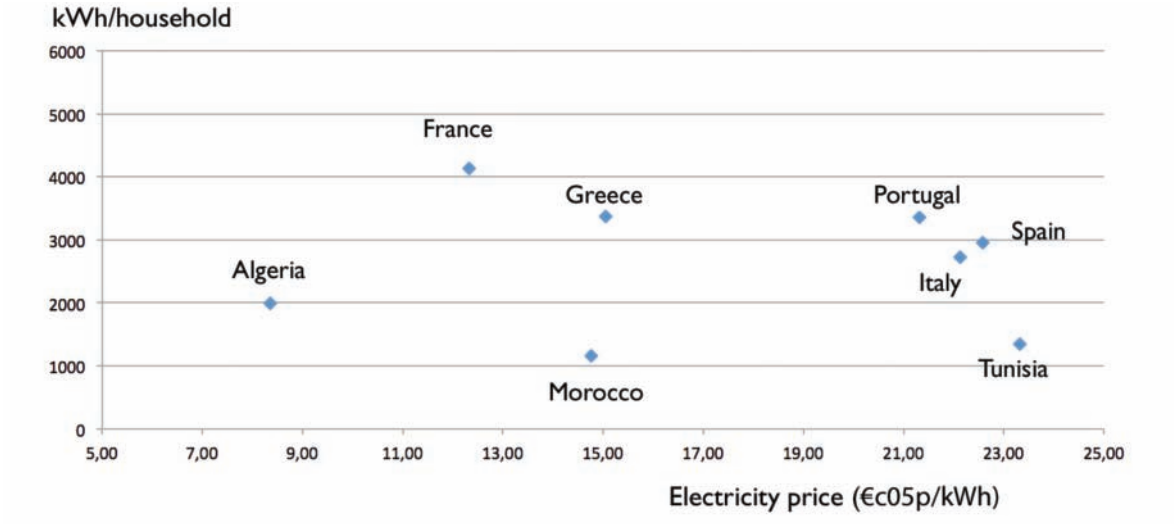
Southern countries (Morocco, Tunisia, Algeria) are characterized by a low energy consumption and revenue (about 7000 €/ households, which is 4 times lower than the average income of EU countries and Lebanon) (*Figure 33*). At the same level of income, there is a significant dispersion of consumption per household, either for total consumption or electricity alone.

Figure 33: Energy consumption per household and income (2010)[17].



Discrepancies in energy consumption per household can be explained by differences in climate as well as energy prices or policies and measures implemented. In general, EU countries have higher price levels and more incentive policies (as well as Tunisia). At similar price level, there is a wide disparity among countries in the electricity consumption per household (e.g. Morocco and Greece)[18] (*Figure 34*).

Figure 34: Electricity consumption per household and prices[19] *(2010).*



[17] The size of bubble measures the electricity consumption level.

[18] Electricity price expressed at purchasing power parities.

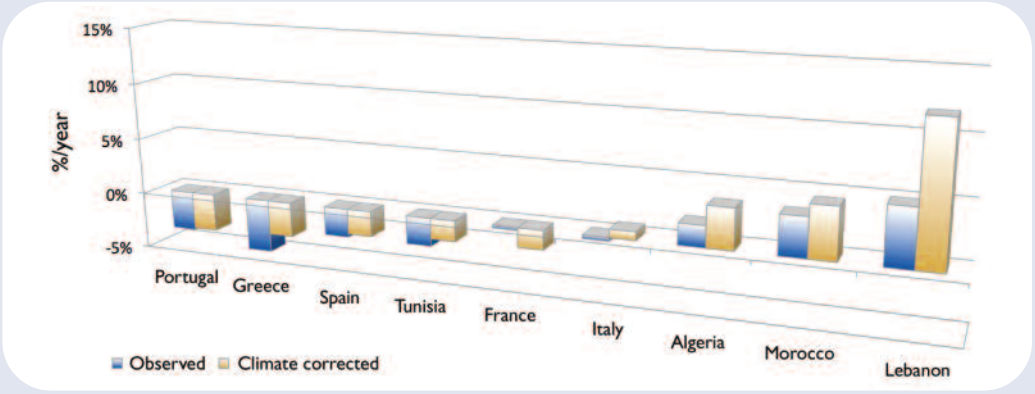
[19] kWh per electrified household, heating excluded .

Box 5: Impact of climate on the energy consumption per dwelling

Climatic variations from one year to another can significantly impact trends in the household energy consumption for heating and cooling. To eliminate the influence of climatic variations, energy consumption data and indicators can be expressed at normal climate.

Climatic variations have had a significant impact on household consumption over the period 2005-2010, especially in France, Tunisia, and Algeria because of a "warm" winter in 2010 (5% warmer than 2005). Due to limited data for Southern countries, climatic corrections could not be implemented on a longer period for these countries; the methodology and results for EU countries is available on a report written in the framework of the ODYSSEE MURE project[20].

Figure 35: Trends in unit consumption per household (2005-2010)(2005-2010)



The household energy consumption can be split in two types of end-uses: thermal uses, which include space heating, water heating and cooking, and the specific electricity uses (or captive uses) for appliances, ICT (TV, PC, etc ...), lighting and air conditioning.

4.2. Thermal uses

4.2.1. Energy efficiency policies in force

Tunisia and Algeria have introduced thermal regulations for new buildings. Lebanon thermal regulations exist but on a voluntary basis. Tunisia has also set up energy audits for dwellings.

Improving energy efficiency of buildings is an important issue in EU countries because of the significant weight of space heating (on average around 60-70%). Thermal regulations for new buildings and the mandatory inspection of boilers and air conditioners are now in force in all EU countries as required by the EPBD Directive.

[20] http://www.odyssee-indicators.org/publications/PDF/Buildings-brochure-2012.pdf

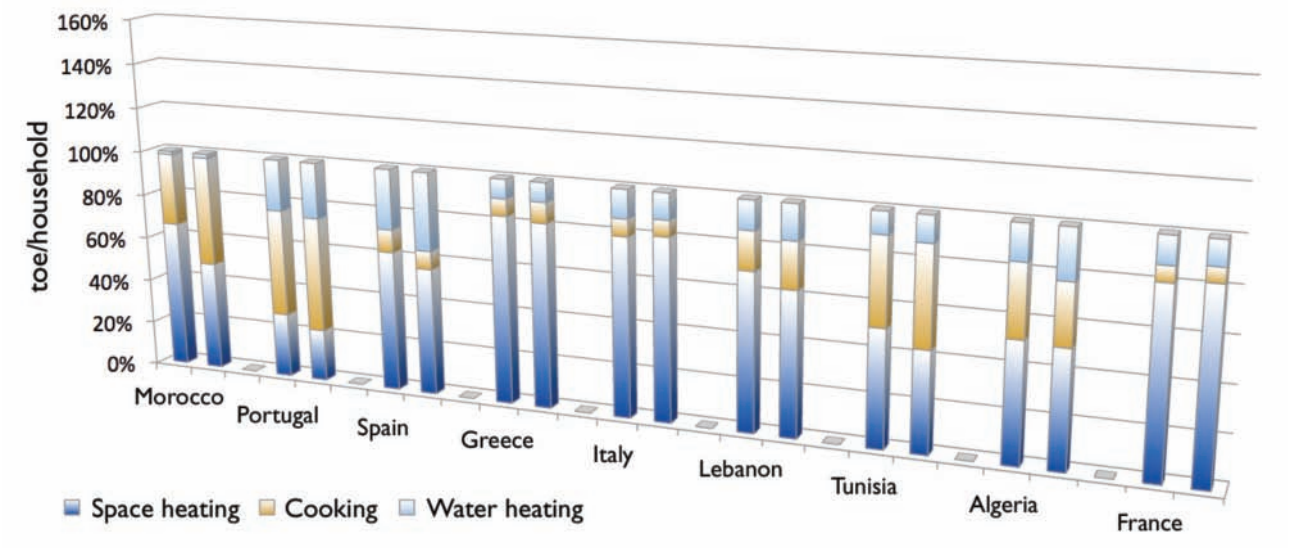
Many countries also propose financial incentives (subsidies for energy audits, investment subsidies, subsidized loans) and tax incentives (tax credit, exemption from VAT, reduced VAT rate) or market-based instruments such as energy saving obligations for utilities combined with tradable energy savings certificates (white certificates) as in France and Italy.

According to EPBD and starting from 31sth of December 2020 all new buildings will have to be nearly zero energy buildings, which implies a strong insulation and that the energy consumed will have to originate to a large extent from RES. Energy Performance Certificate (EPC) is now required for every building (dwelling or commercial building) when it is constructed, sold or rented. The certificate gives information about the energy efficiency of the building to owners, prospective buyers and tenants.

For air conditioning, a label has been introduced to inform consumers about the energy performance of the equipment. For water heaters, the installation of solar equipment is now mandatory in some countries such as Spain, Portugal, Greece and Italy.

In most countries except Algeria, Lebanon and Spain, the energy consumption for thermal uses has been decreasing over the period 2000-2010. Space heating represents the largest share of consumption, except in Portugal (***Figure 36***).

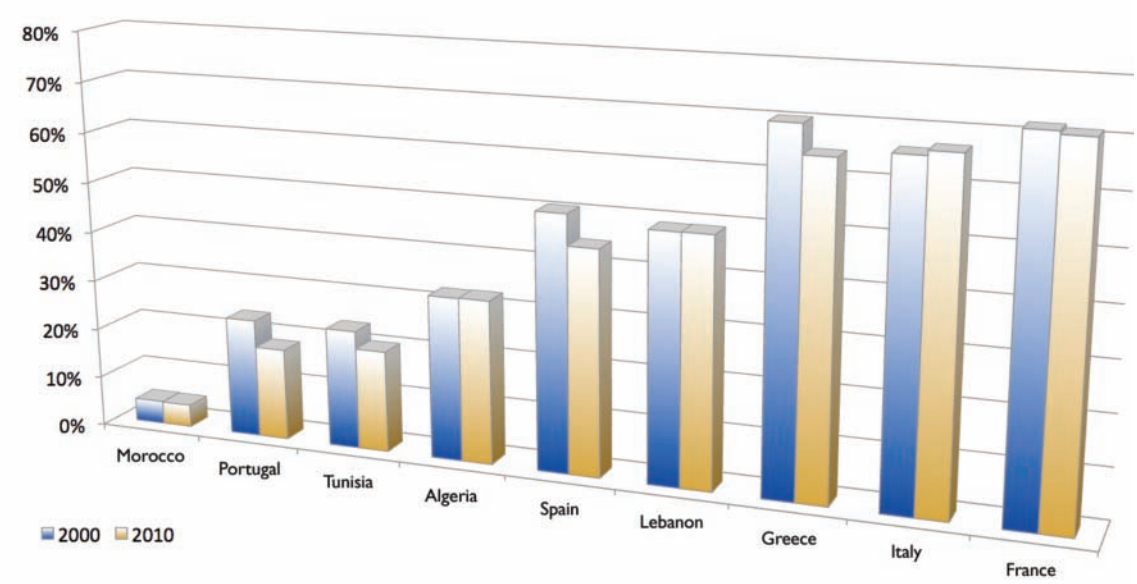
Figure 36: Energy consumption per dwelling for thermal uses (2000, 2010)



4.2.1.1. Space heating

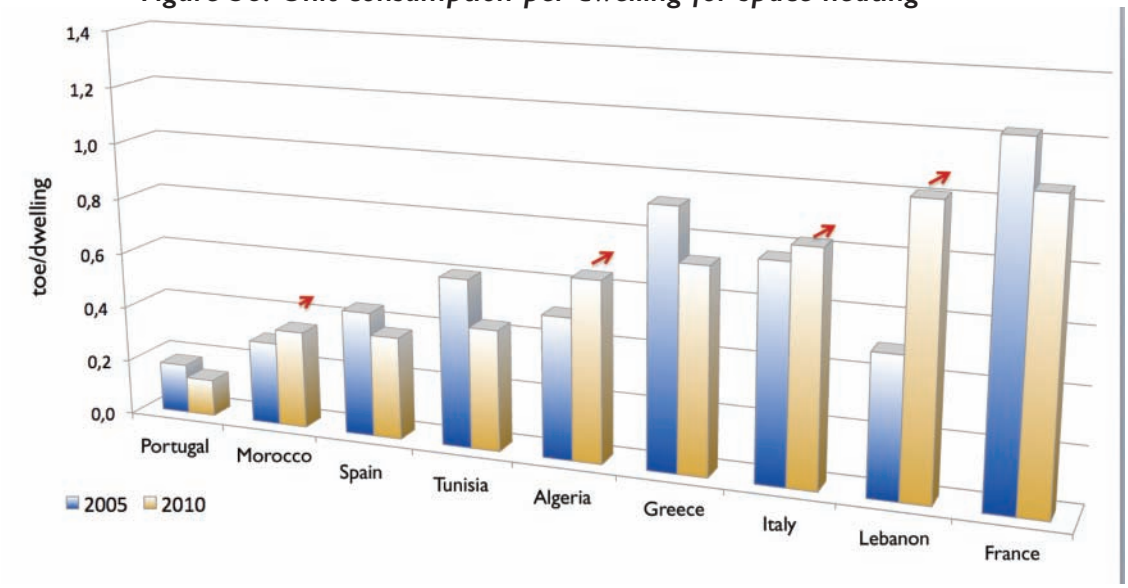
There are significant disparities in the share of heating according to countries: from 5% in Morocco, to more than 60-70% in Italy or France. In most European countries, the share of heating has been to decreasing. This trend is mainly explained by the energy savings linked to the improved efficiency of new buildings and heating appliances (***Figure 37***).

Figure 37: Heating share in household's energy consumption



In all EU countries, except in Italy, there was a significant decrease in the specific consumption for heating, especially due to the policies implemented (-4.6% /year in Portugal, -2.5% / year in Spain and France). On the opposite in Southern countries, this unit consumption tends to increase, except in Tunisia, driven by better comfort in winter (***Figure 38***).

Figure 38: Unit consumption per dwelling for space heating[21]

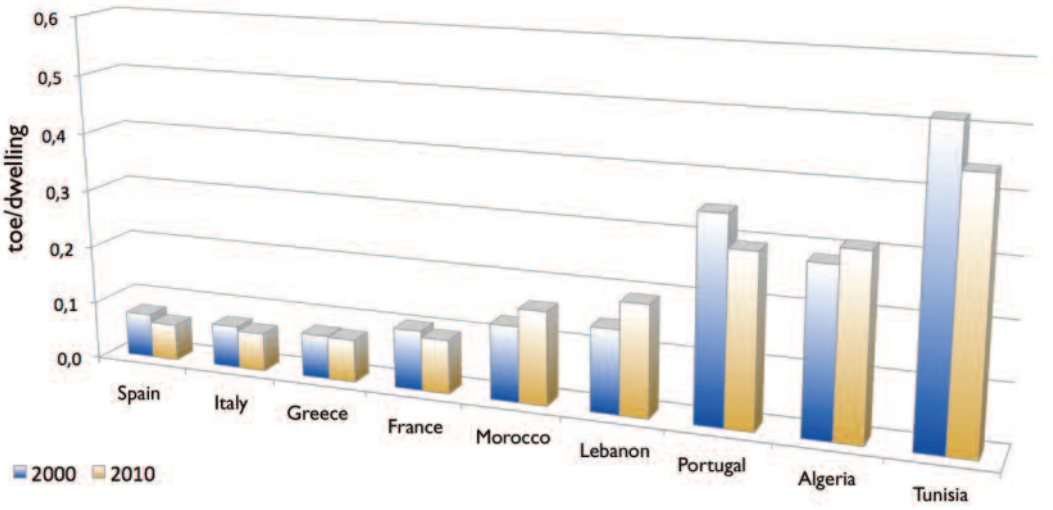


[21] At normal climate, per dwelling with heating system.

4.2.1.2. Cooking

In all countries, energy consumption per dwelling for cooking is decreasing except in Morocco, Lebanon and Algeria (Figure 39). Cooking is an important issue in these countries (50% of the household consumption in Tunisia and Morocco, 30% in Algeria).

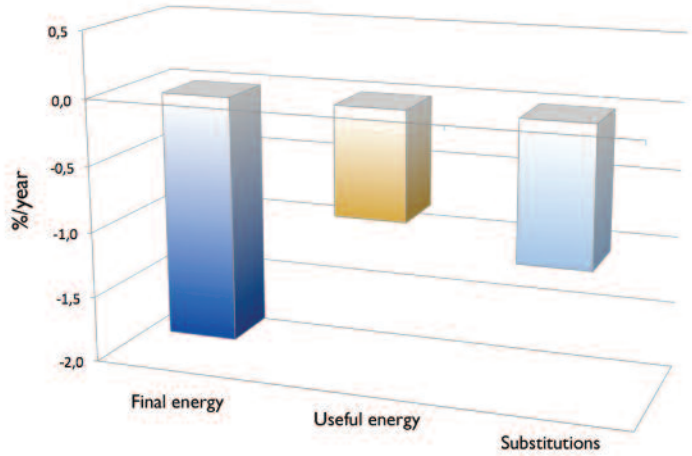
Figure 39: Unit consumption per dwelling for cooking



In Tunisia, the share of wood for cooking is decreasing due to a substitution to butane and natural gas: from 73% in 1990 to 60% in 2000 and 53% in 2010. The market share of LPG grew from 14% in 1990 to 40% in 2010. Natural gas now represents 8% of consumption in 2010 (against 1% in 1990).

As LPG and gas has a higher efficiency than wood, substitution to gas led to an increase in cooking efficiency. Since 2000 this specific consumption for cooking decreased by 1.8% /year, of which more than half is due to fuel substitution (***Figure 40***)[22].

Figure 40: Consumption for cooking per dwelling and substitution effect in Tunisia

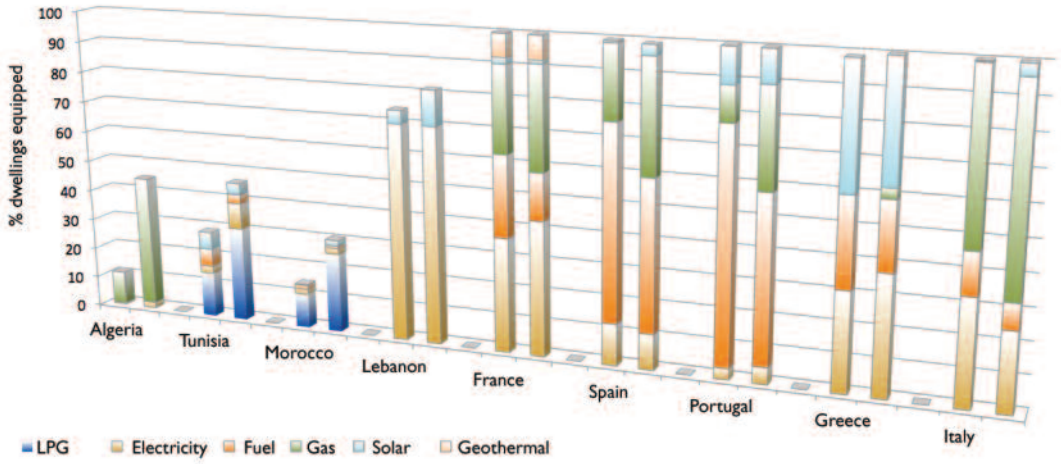


[22] The substitution effect for cooking was calculated as the difference between the annual change in unit consumption per dwelling in final energy and useful energy. Useful energy is calculated by multiplying the final energy consumption of each fuel by its average energy efficiency (i.e. 70% for LPG, 80% for gas, 90% for electricity and only 10 % for wood because wood is mostly used for baking bread in traditional ovens.

4.2.1.3. Water heating

There is a large disparity between Southern and EU countries concerning the equipment rate in water heaters. Less than 30% of homes have water heaters in Morocco, 45% in Algeria and Tunisia, 80% in Lebanon, compared to 100% in EU countries (*Figure 41*). The dominant energy for such equipment is also very different from one country to another, with a predominance of electricity in France and Lebanon, oil products in Spain and Portugal, natural gas in Algeria and Italy, LPG in Tunisia and Morocco and solar in Greece.

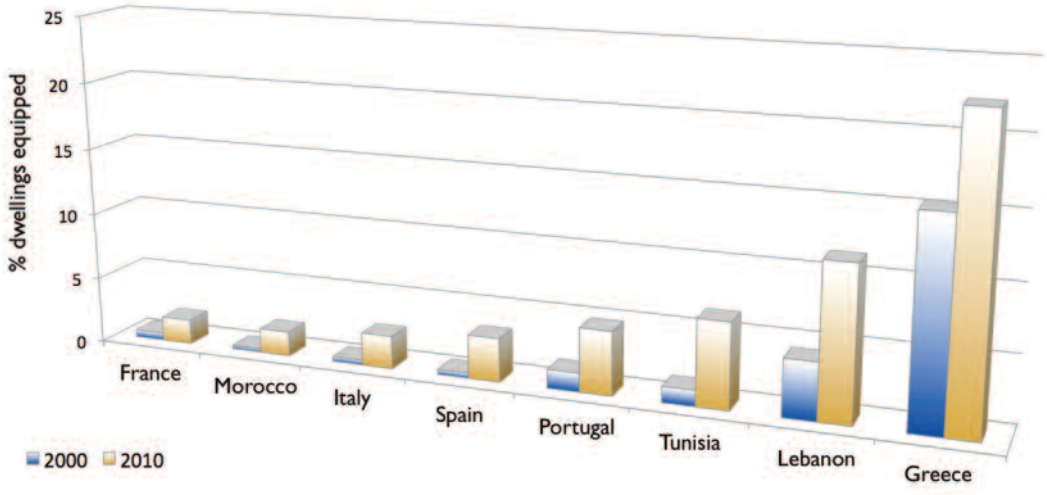
Figure 41: Share of dwellings with water heaters by energy



Around ¼ of households have a solar water-heater in Greece, following by Lebanon and Tunisia. In Greece the surface of solar collector is around 350 m2 per 1000 inhabitants, compared to 100 m2/ 1000 inhabitants in Lebanon, and only 11 m2 / 1000 inhabitants for Morocco (*Figure 42*).

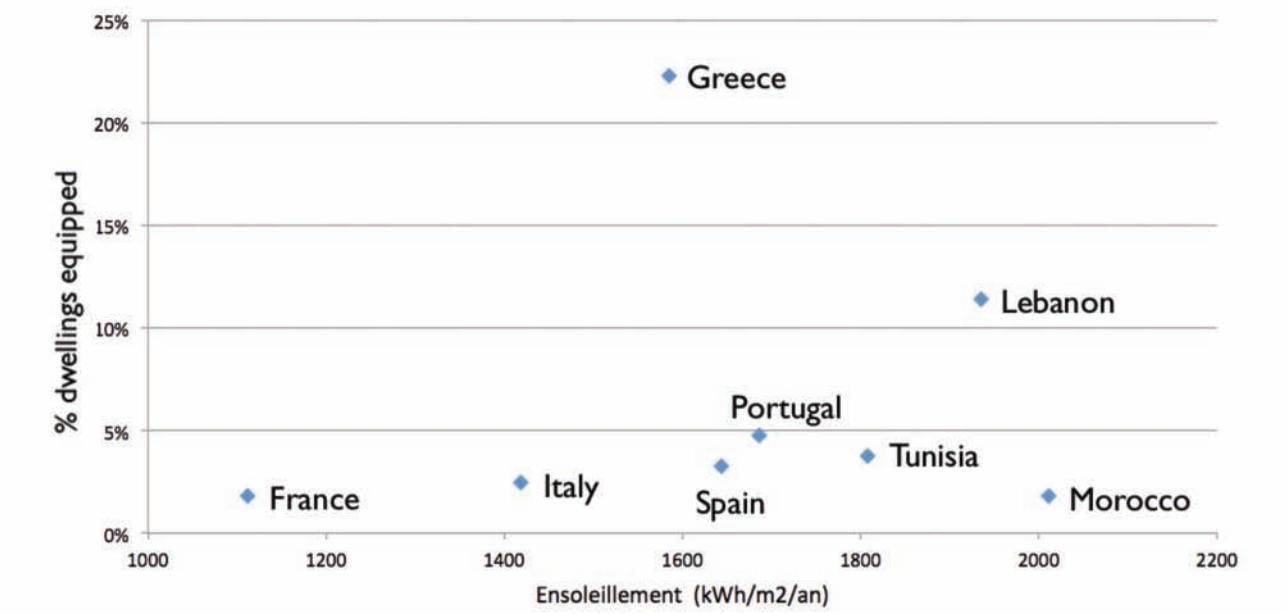
In Greece, the installation of solar water heater is now mandatory. Tunisia supports the dissemination of solar water heaters through subsidies and credit facilities (PROSOL). All these supports are the more effective than actual energy prices are high enough to make solar water heaters competitive.

Figure 42: Equipment rate of households in solar water-heaters



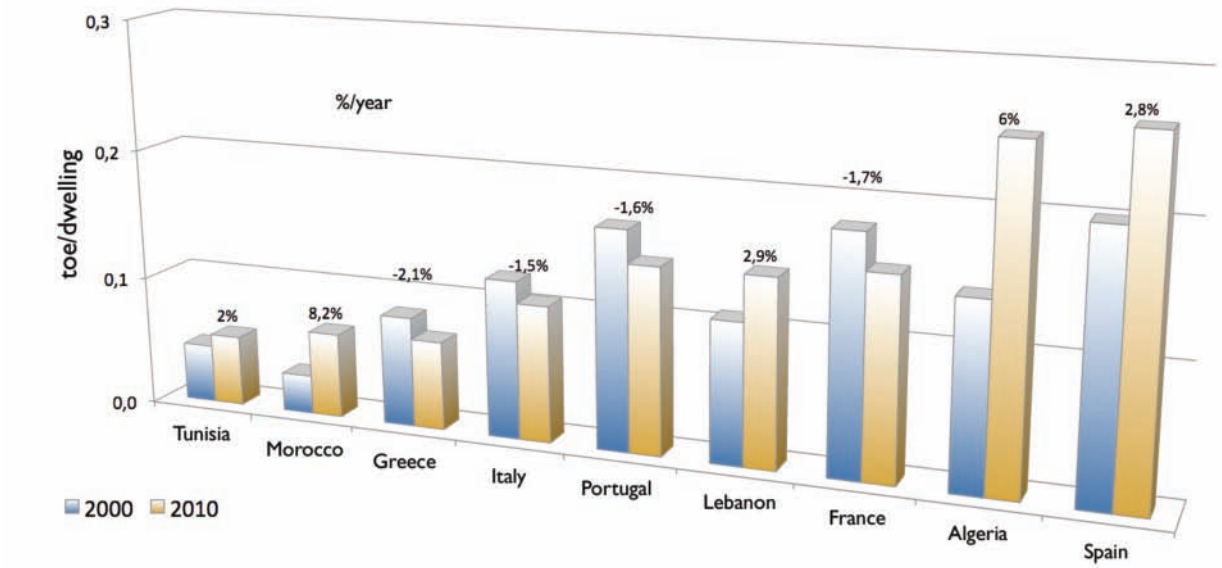
The area of solar collectors should be in principle linked to solar radiation. Despite a rather similar level of solar radiation, nearly ¼ households in Greece have a solar water heater, against less than 5% in Spain and Portugal (***Figure 43***) as policy support has been in place over a longer period in Greece.

Figure 43: Dwellings with solar water heater and solar radiation



The increase in unit consumption of household hot water is directly related to the needs of comfort, and in the South to the increase in the number of households with water heaters (***Figure 44***). One way to reduce this consumption or slow down its growth is to promote the installation of solar water heaters, source of energy savings of conventional energy sources at the level of final consumers, to the extent that they replace electricity, LPG, natural gas or petroleum products, but also at the primary level if the electricity is generated from thermal power plants (as in Lebanon), as shown in Box 6.

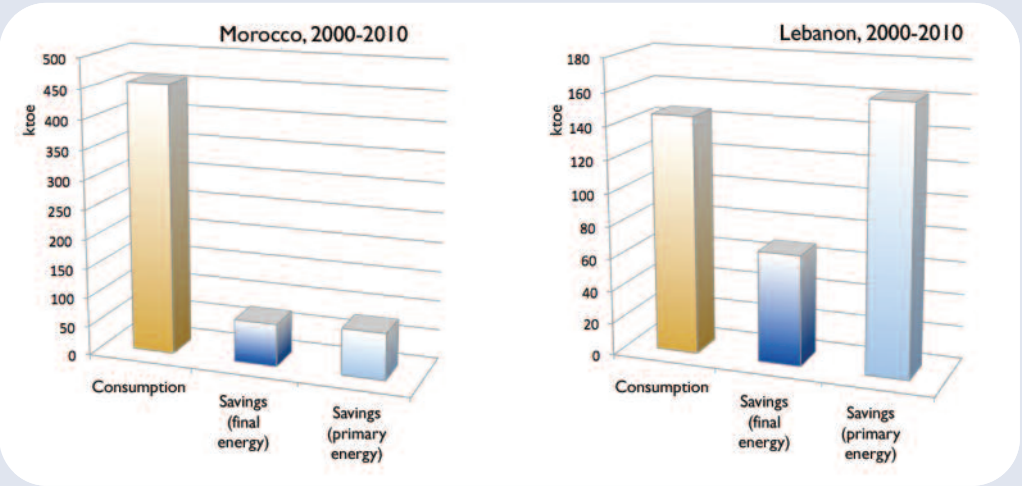
Figure 44: Unit consumption for water heating



Box 6: Energy savings from solar water heaters : case study for Morocco and Lebanon

Respectively 2% and 11% of households have a solar water heater in Morocco and Lebanon in 2010 that replace mainly LPG in Morocco and electricity in Lebanon. In Morocco, solar water heaters have saved 72 ktoe (in final energy), or 15% of the energy used for water heating. In Lebanon, savings from solar water heaters (11% of households equipped) represent 68 ktoe of final energy and 140 ktoe in primary terms, taking into account the efficiency of thermal power plants

Figure 45: Energy savings from solar water heaters



4.2.2. Captive electricity uses: electrical appliances, lighting and air conditioning

Electricity consumption for lighting, appliances and air conditioning has rapidly increased in all countries. In the rest of the report, air conditioning will be considered separately from the other two end-uses in order to focus on this end-use which has risen sharply in all countries and still have a high potential of growth.

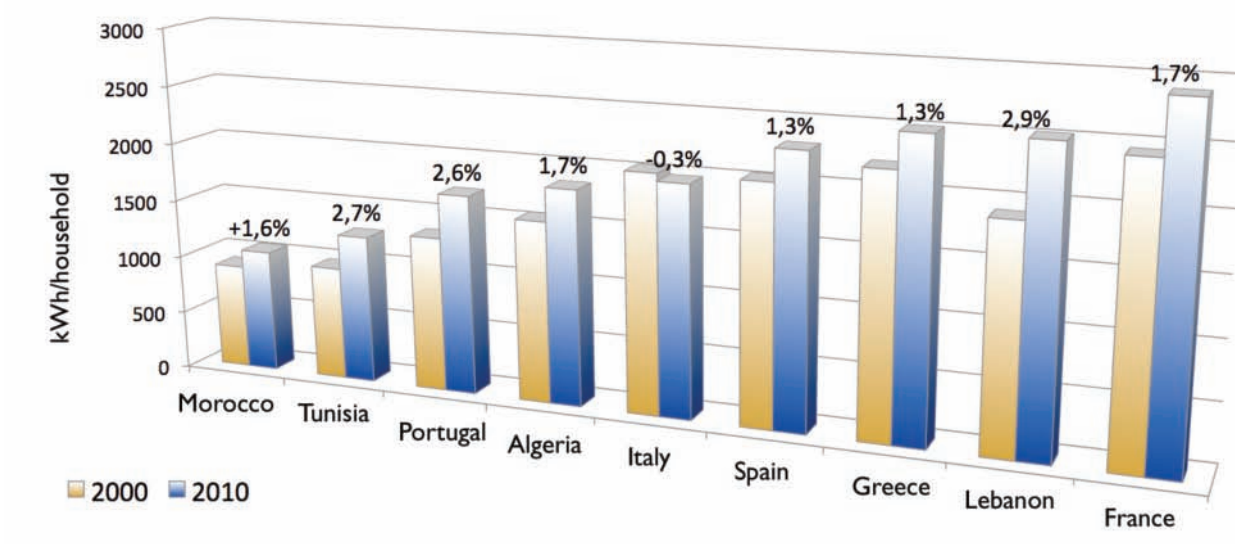
To limit the growth of electricity consumption for these end-uses, the European Commission has adopted several Directives on the energy labelling of large electrical appliances and lighting, which has been revised, as well as minimum efficiency standards for cold appliances. Nowadays most electrical appliances have to display an energy label containing information about their specific energy consumption through letters A +, A + + or A +++ for the best performing to G for the less efficient class. Most appliances sold now belong to class A or A++. In Europe, incandescent lamps are now banned from the market.

Algeria and Tunisia have already introduced energy labels for some large appliances (Lebanon on a voluntary basis). Southern countries encourage the promotion of CFL and organize free distributions of lamps for households or sell them at low prices (7 million lamps distributed in Tunisia from 2000 to 2010).

4.2.2.1. Electrical appliances and lighting

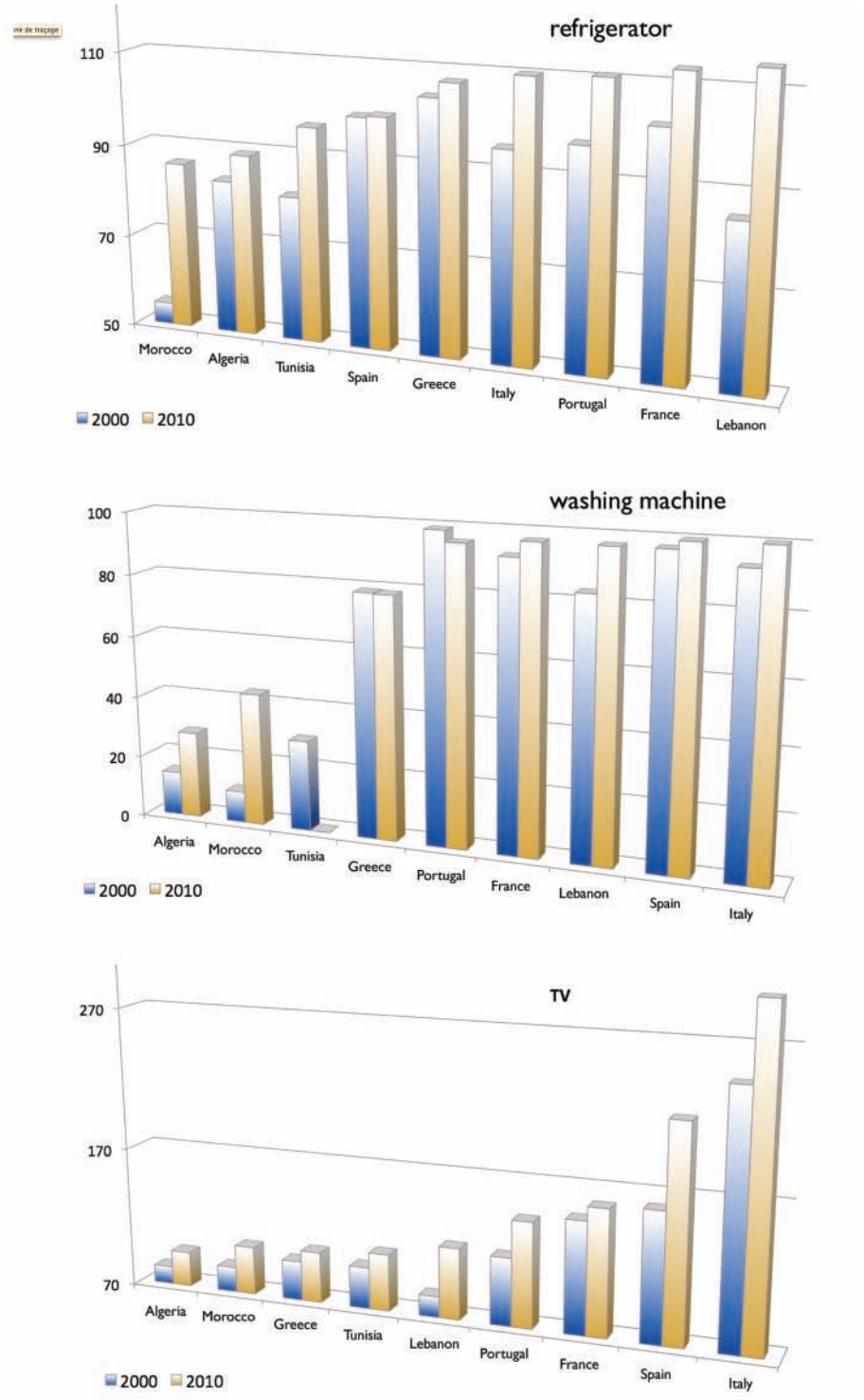
Between 2000 and 2010, the specific electricity consumption (excluding air conditioning) increased rapidly in all countries except in Italy (*Figure 46*) ; since 2007, these consumptions have increased very rapidly in Algeria (+5% / year), and Lebanon (11% / year). On the opposite in the EU, the specific electricity consumption per household has been decreasing since 2008, especially in Greece and Italy (respectively -0.8%/year and 1.1%/year) because of the economic crisis and the effect of the energy efficiency policies and measures.

Figure 46: Trends in electricity for electrical appliances (air conditioning excluded)



The increase in specific electricity consumption results of two opposite drivers: on the one hand, more equipment per household, as shown by the growth rate of large appliances (*Figure 47*); on the other hand, households bought new and more efficient equipment that consume less. In southern countries households have more and more washing machines, refrigerators, TV ; in the EU, households have often more than one equipment: 2 to 3 TV per household , more than one refrigerator etc.

Figure 47: Equipment rate of households in large electrical appliances (%)



Box 7 illustrates the decomposition of the variation of the electricity consumption for refrigerators to underline the role of the various drivers: the demography and the increase in the household equipment ownership contribute to increase consumption while, on the opposite, technical progress (energy efficiency) has reduced the specific electricity consumption.

Box 7: Decomposition of the variation of the consumption of refrigerators in Algeria

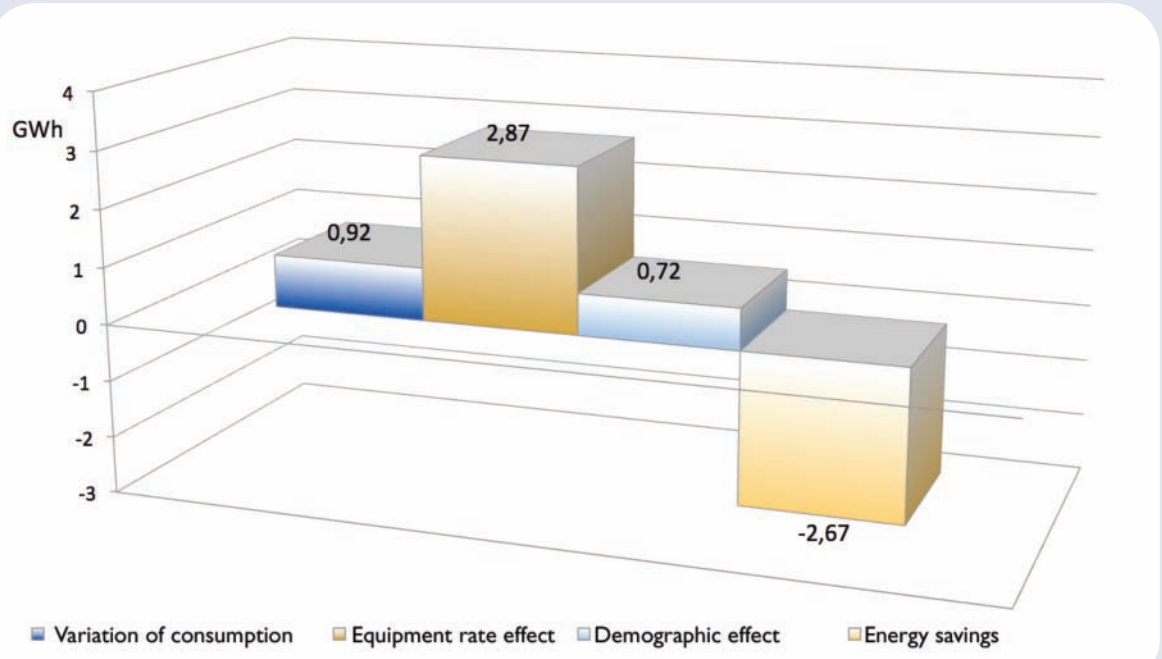
The electricity consumption of refrigerators, one of the main end-use in Algeria, has been influenced by several types of factors:

i. A "demographic" effect linked to the increase in the number of households (2.6% / year);

ii. An «equipment" effect related to the increase in the rate of household equipment ownership (83% of households had a refrigerator in 2010 against 90% in 2000);

iii. An "energy-saving effect, reflecting the energy efficiency gains from lower specific consumption of refrigerator, that is to say a decrease of 106 kWh (or 23% gains).

Figure 48: Drivers of the variation of the consumption of refrigerators in Algeria (2000-2010)

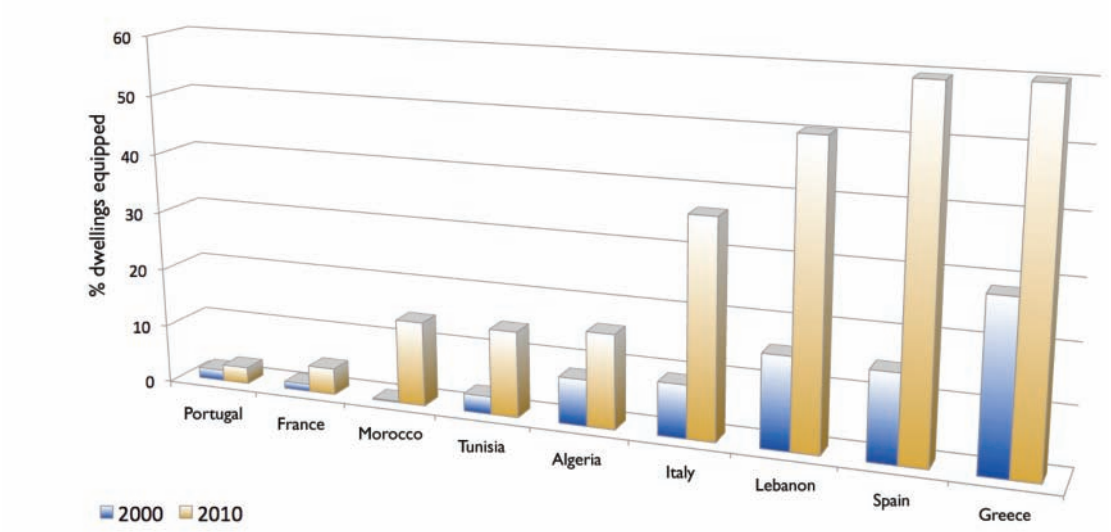


Source : APRUE/Enerdata

4.2.3. Air conditioning

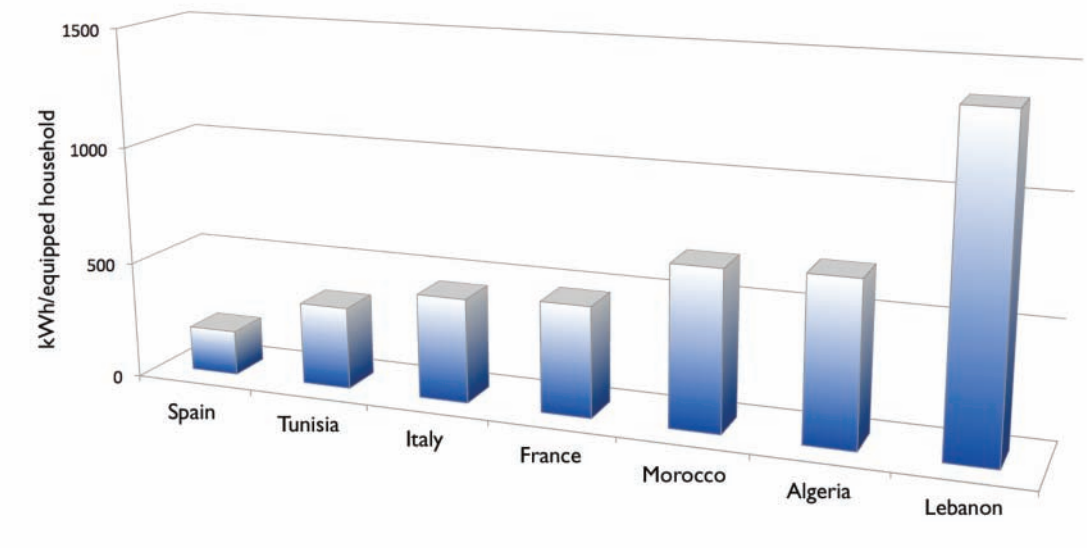
The number of households that use air-conditioning rose sharply in Greece, Spain, Italy and Lebanon between 2000 and 2010 (***Figure 49***) : from 28 to 105% in Greece (due to multi-equipment), from 15 to 60% in Spain, from 16 to 50% in Lebanon and from 9 to 37% in Italy. In southern Mediterranean countries, the equipment rate in air conditioners is lower but is expected to increase rapidly in the coming years: in Morocco, Tunisia and Algeria, about 15% of households now use air conditioning.

Figure 49: Equipment rate of households in air conditioners



The specific electricity consumption for air conditioning varies between 200 kWh/household (equipped) in Spain and 700 kWh for Algeria and 1400 kWh in Lebanon (***Figure 50***).

Figure 50: Electricity consumption for household air conditioning



5. Energy efficiency in transport

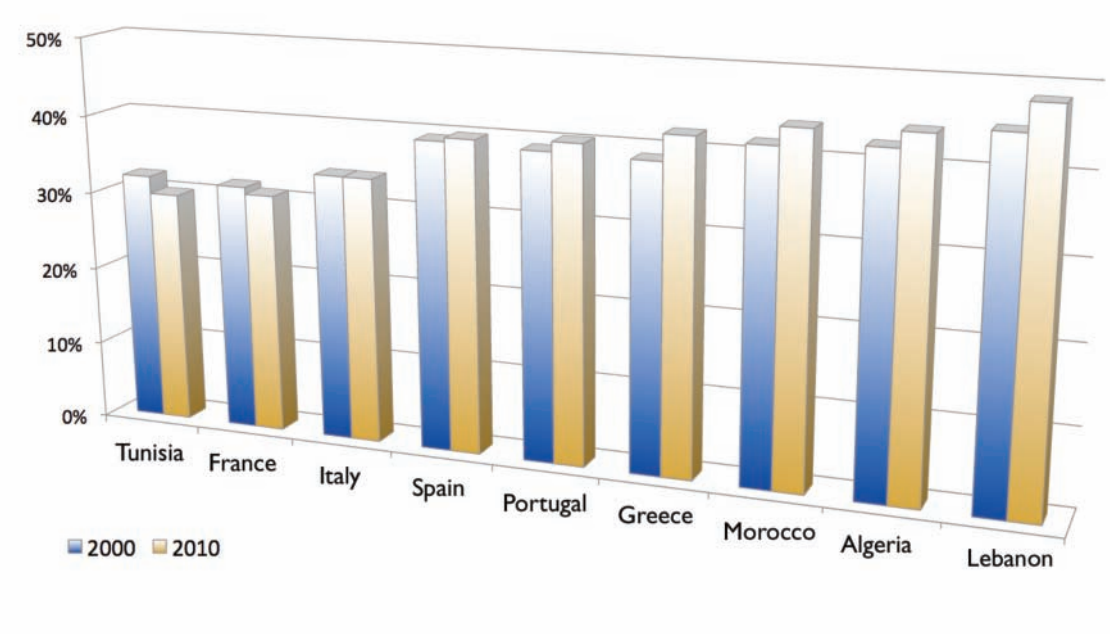
5.1. Trends in consumption

The share of transport sector in final energy consumption ranges from 30% (Tunisia, France) to more than 45% (Morocco, Algeria and Lebanon). It has increased everywhere since 2000, except in France (where consumption remained quite stable) and Tunisia. The growth rate in transport consumption is very different in the two regions: 0.6% / year since 2000 for EU countries, and around 5%/ year on average in southern countries (***Figure 51***).

This rapid consumption growth in Southern countries is due on the one hand to the rapid increase in the number of road vehicles (5%/year on average since 2000 in Morocco, Tunisia and Lebanon), in particular cars, driven by the economic growth, the low availability of public transport and the monopoly of road for goods.

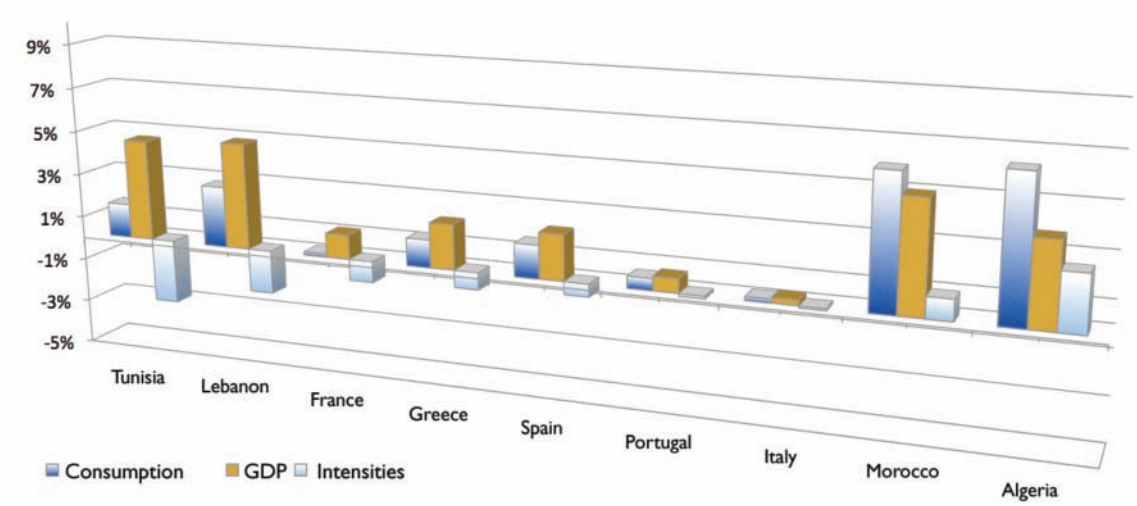
Even if the transport sector is a key sector with fast growing energy consumption, few energy efficiency measures have been implemented so far in Southern countries. In Europe, many measures have been implemented, such as various EU Directives (car labelling, label for tires, standard on CO_2 emissions for cars and commercial light vehicles), as well as national fiscal to tax inefficient and/or high emission new vehicles. In addition, vehicle inspections are implemented in many countries to ensure that vehicles comply with regulations on safety or emissions, or both.

Figure 51: Share of transport in final energy consumption



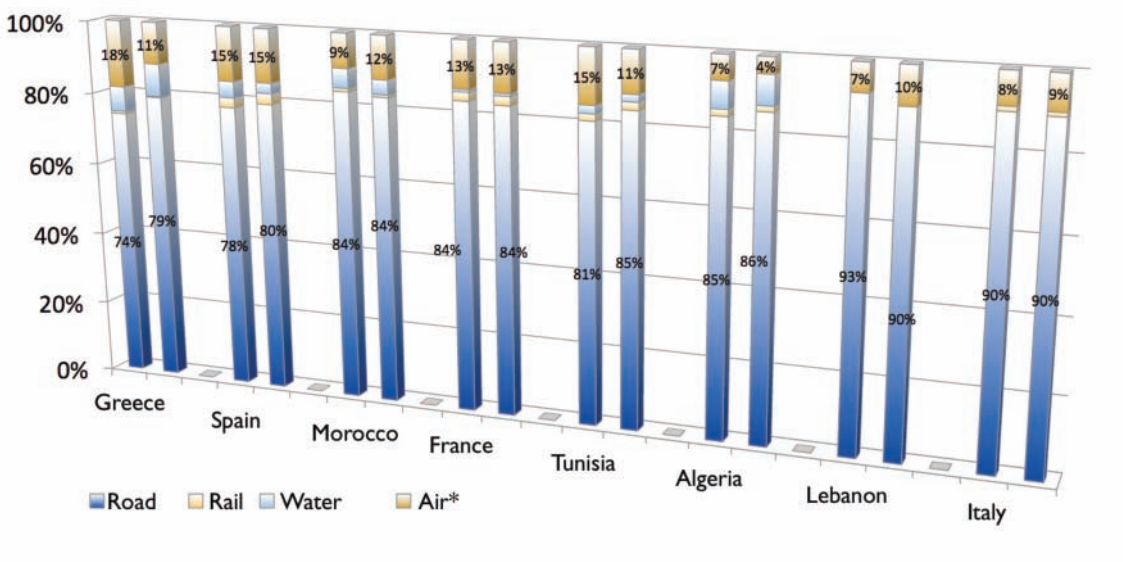
In most countries, except Morocco and Algeria, transport consumption grew less rapidly than GDP from 2000 to 2010, especially in Tunisia and Lebanon, and to a lesser extent in France, Greece and Spain. The intensity of transport (i.e. the energy consumption per unit of GDP) has therefore decreased everywhere except in Morocco and Algeria (***Figure 52***).

Figure 52: Trends in transport consumption, GDP and transport intensity



The growth in consumption is mainly due to road, which accounts for over 80% of the consumption in all countries. This share has however remained relatively stable since 2000 in most countries (except in Greece and Tunisia) (***Figure 53***).

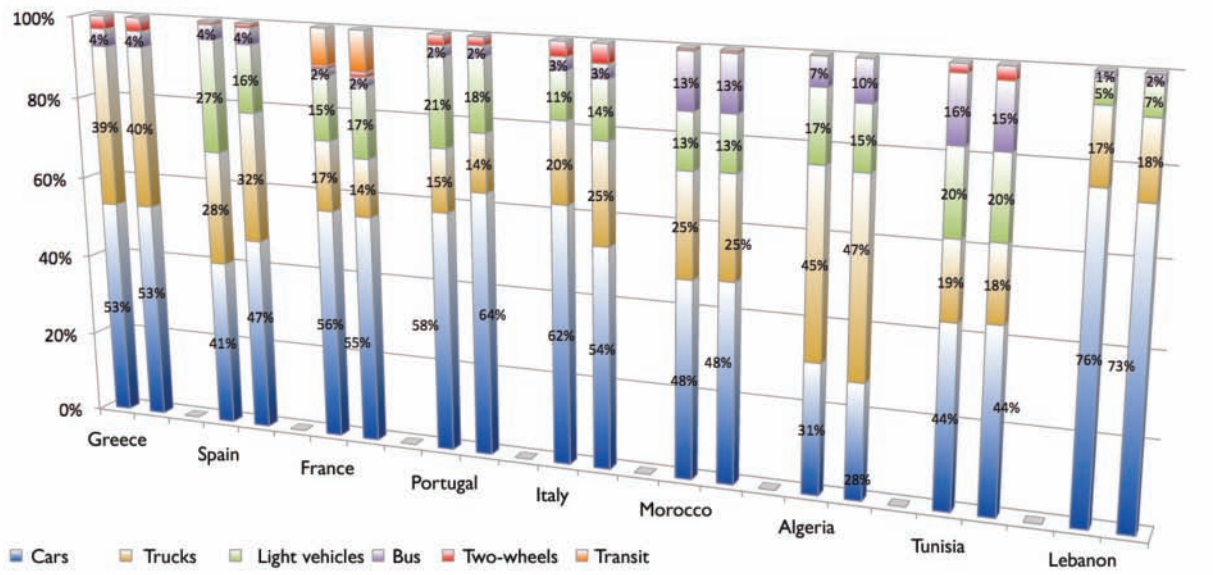
Figure 53: Transport energy consumption by mode (2000, 2010)



5.2. Road transport

Cars represent on average half of the consumption of road transport in the nine Mediterranean countries, with large discrepancies among countries: from 28% in Algeria to more than 70% in Lebanon (Figure 54). Consumption of road transport grew by 1.2% / year in Portugal, 2% / year in Tunisia and Greece and more than 5% / year in Algeria and Morocco. In France and Italy the consumption of road vehicles has been decreasing by 0.2% / year and 1.8% / year respectively, partly due to the economic crisis but also due to policies implemented and the strong substitution of gasoline by diesel.

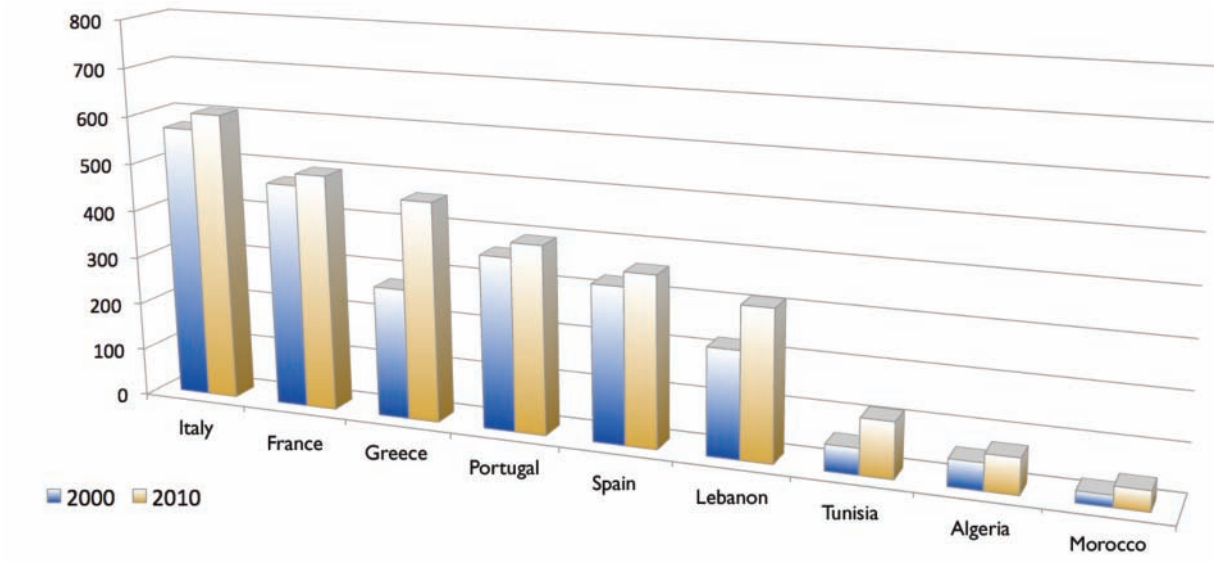
Figure 54: Road energy consumption by type of vehicles



Note : Greece: trucks and light vehicles together

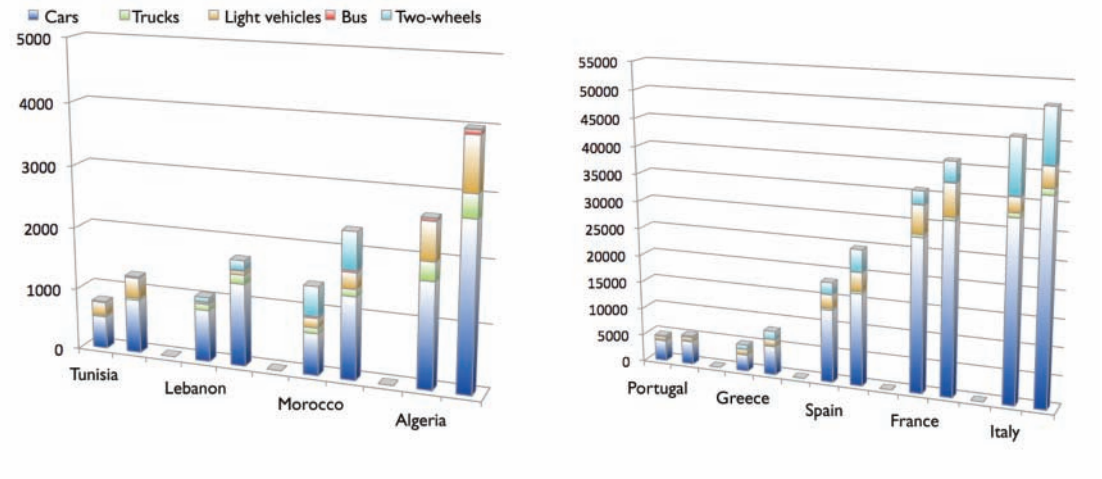
There exist significant discrepancies in the level of car ownership among countries, especially between EU countries and Lebanon on the one hand, and the other three southern countries on the other hand: 600 cars per 1,000 in Italy, 300 inhabitants in Lebanon and less than 50 in Morocco (***Figure 55***).

Figure 55: Number of cars per inhabitant



The fleet of vehicles is mainly made up of cars. In southern countries and Greece, the number of vehicles has increased by 5%/year on average between 2000 and 2010, by 3%/year in Spain and between 1.1 and 1.4%/ year in Italy, Portugal and France (***Figure 56***).

Figure 56: Stock of vehicles (2000, 2010)

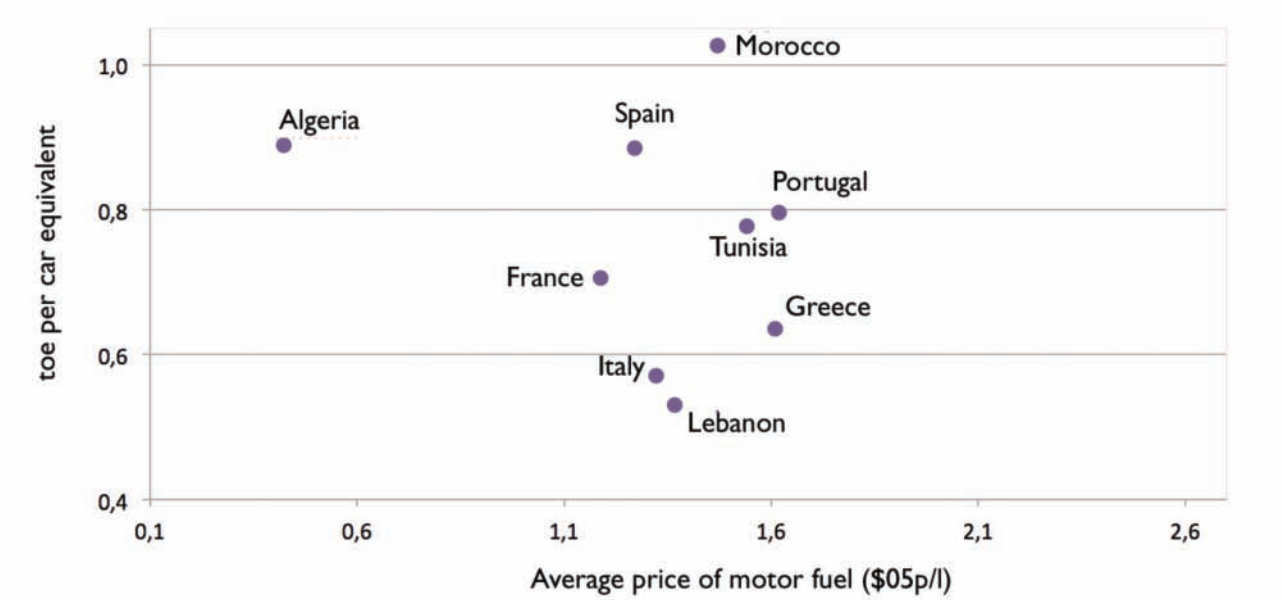


The energy efficiency of road transport can be evaluated by calculating average energy consumption per car equivalent, calculated as the ratio between the total consumption and the total fleet of road vehicles expressed in car equivalent[23]. There exist significant discrepancies in this energy consumption of road transport per car equivalent among countries with very similar fuel price: for instance, about 25% difference between Greece, Portugal and Tunisia, and around 60% between Greece and Morocco[24] (***Figure 57***).

[23] For each type of vehicle the stock is measured in terms of equivalent cars on the basis of their specific annual consumption compared to a car. If, for example, a bus consumes 15 toe / year on average and a car 1 toe / year, a bus will be equivalent to 15 cars. In this calculation the coefficients used are default values used for European countries in the ODYSSEE-MURE project: 0.15 car equivalent for two-wheels, 1.4 for a gasoline light vehicles, 2.6 for a diesel light vehicles, 15 for a bus and a truck.

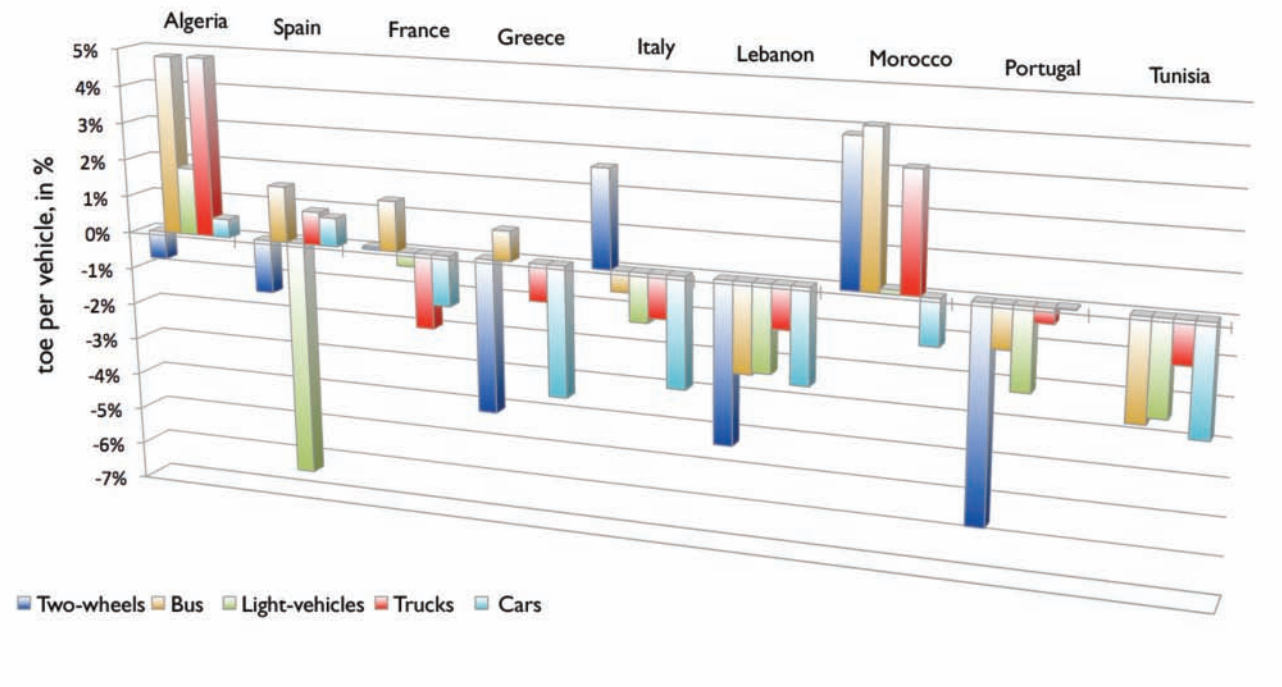
[26] Default values used to calculate the unit consumption per car equivalent may not be representative in Southern countries but were used due to a lack of national surveys. Consumption per car equivalent should be taken with caution in some countries; for example in Morocco the large share of taxis in the car stock have a higher specific consumption. In Morocco and Tunisia, consumption may be underestimated due to illegal fuel trade with Algeria. This was the case for Lebanon until 2007.

Figure 57: Consumption per car-equivalent and motor fuel prices (2010)



The energy consumption by type of vehicle gives us a first overview of the energy efficiency of each vehicle. Except in Morocco and Algeria, the energy consumption per vehicle has decreased in all countries. These trends may be due to technical progress with the introduction of efficient new vehicles in the market but also to the use of smaller vehicles (including cars) with consume less energy (*Figure 58*).

Figure 58 : Trends in consumption for road transport by type of vehicles (2000, 2010)



5.2.1. Cars

For cars, the most relevant indicator for measuring energy efficiency progress, especially related to technical progress, is the specific fuel consumption in litres per 100 km.

In all countries the specific consumption of cars has decreased since 2000, from 0.6%/ year in France, Spain and Portugal to 3.1%/year in Morocco. There are however large discrepancies among countries in specific consumption: from 10 l/100 km in Lebanon to 4l/100 km in Italy; the difference is mainly due to the size and age of cars, as in Italy cars are mainly small cars while in Lebanon, households have larger and older cars (12 years on average) (***Figure 59***).

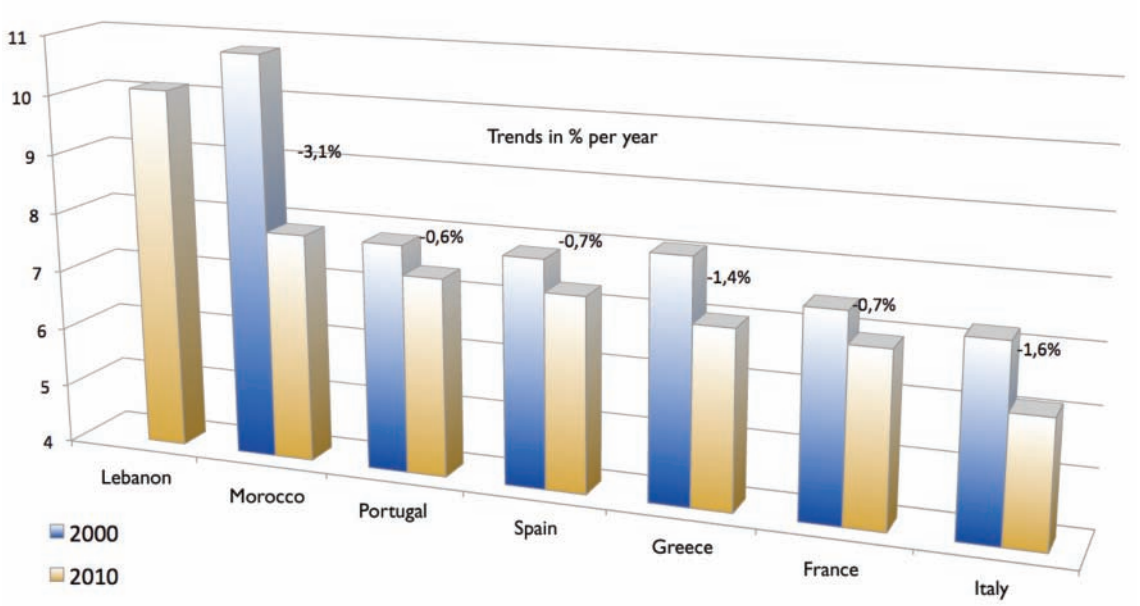
The implementation of policies to improve cars' efficiency is still in an early stage in southern countries. A first solution should be to promote new and efficient cars. In recent years, Morocco, Tunisia and Algeria have banned the import of old vehicles (over 3 to 5 years depending on the country).

Through the imports of new vehicles, Southern countries benefit also from the information on specific fuel consumption (and CO_2), from the mandatory European energy label.

Periodic technical inspection is now compulsory in all Southern countries. Tunisia has also developed a program to raise awareness of efficient driving for transport companies, public companies, driving instructors etc.

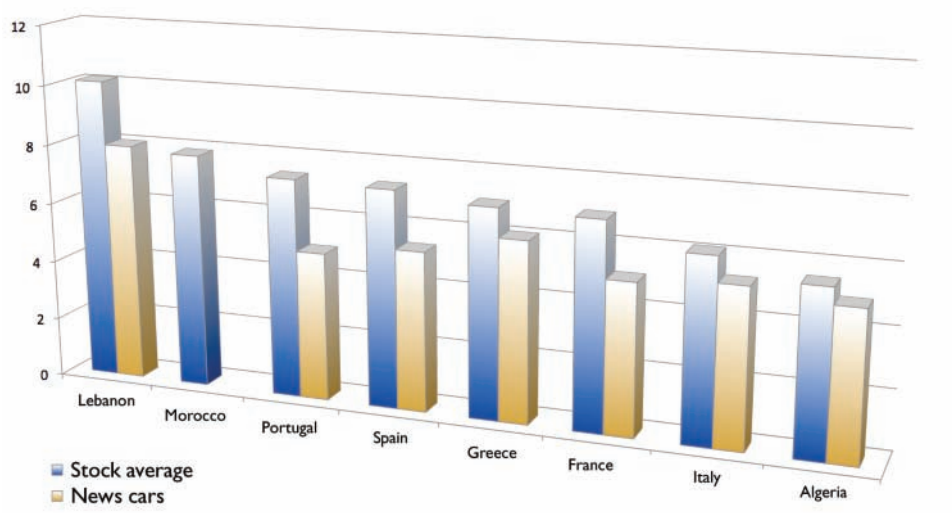
Another axis consists in promoting public transport in urban areas, with the definition of strategies for urban transport and investment planning. In Tunisia, the establishment of an urban mobility plan in large cities is now recognized as a key energy efficiency action. But its impact has not yet been evaluated.

Figure 59: Specific consumption of cars (stock average)



For new vehicles, the specific fuel consumption in litres per 100 km varies between 8 l/100 km in Lebanon and 5 l/100 km in Italy and Algeria. On average a new car consumes about 25% less than the fleet average. The gradual replacement of the existing fleet by more efficient vehicles will improve the average energy efficiency of the stock (***Figure 60:***).

Figure 60: Technical improvements for new cars (litre/ 100 km) (2010)

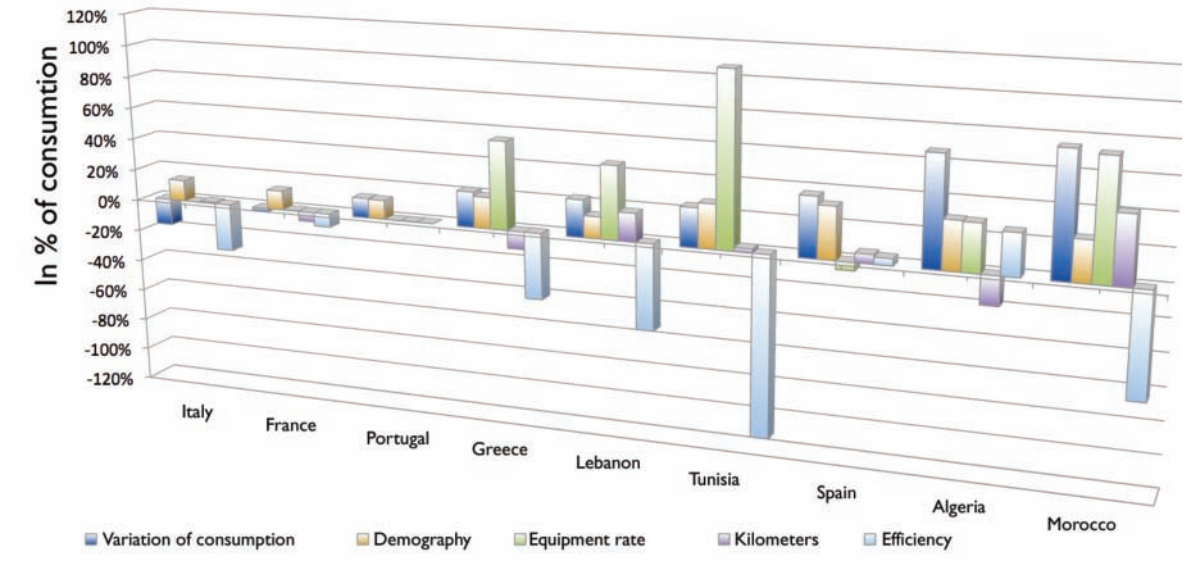


Given the rapid increase in the consumption of cars, it is interesting to identify which factors are responsible for the growth in consumption.

The variation in the consumption of cars can be explained by different factors: on the one hand, the growth in population, in the car ownership and in the distance travelled by cars and, on the other hand, lower specific fuel consumption (energy savings).

In all countries the increase in the number of households (population) contributes to the growth of the consumption of cars. The increase in the number of cars per household (equipment ownership) has a significant impact especially in Southern countries. Energy efficiency improvements, measured from the decrease in the specific consumption in litre per 100 km, contribute to limit in all countries the increasing fuel consumption. The distance travelled tends to increase the consumption in most countries (except in France, Greece and Algeria in the recent years) (***Figure 61***).

Figure 61: Decomposition of the variation of the consumption of cars (2000-2010)

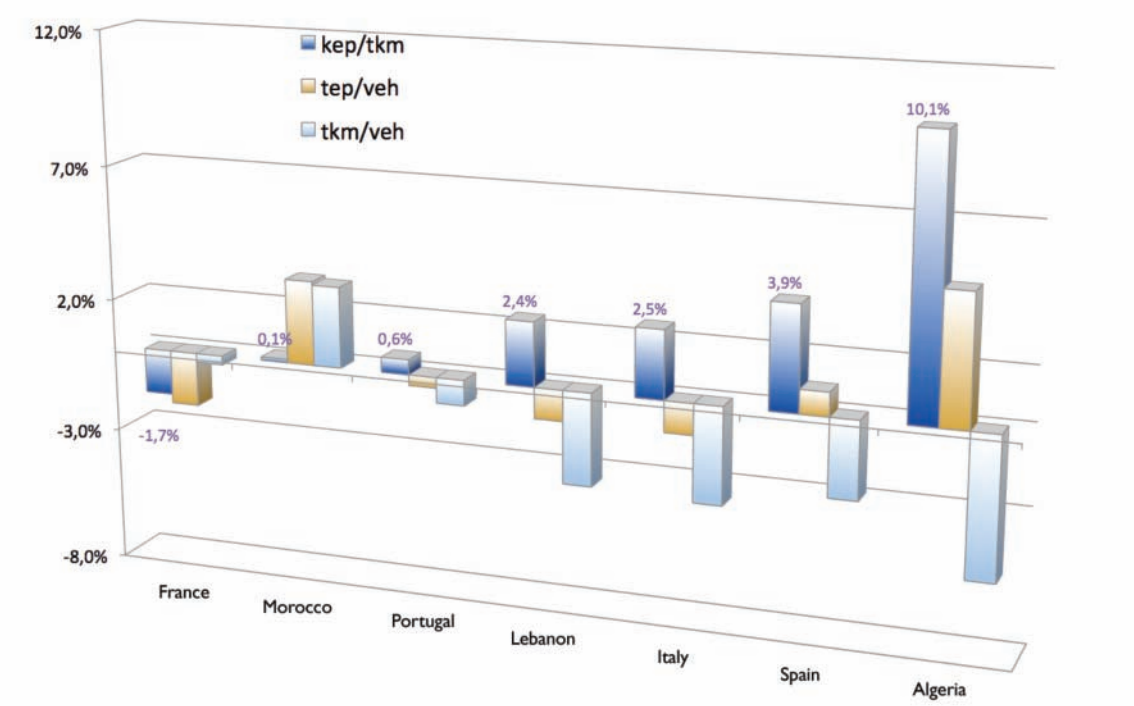


5.2.2. Trucks

The most relevant indicator for assessing the energy efficiency of trucks is the energy consumption per unit of traffic, measured in koe per tonne-kilometre (tkm). This ratio is influenced by two factors: the average annual consumption per vehicle on one side (toe per vehicle), reflecting energy efficiency, and the average load factor of trucks (tkm per vehicle).

In all countries , the energy consumption per unit of traffic has increased significantly over the period 2000-2010 except in France; improvements in the energy efficiency of vehicles (toe per vehicle) was not enough to offset the lower load factor rate due to poor management of fleet in Southern countries and the economic crisis in EU countries (***Figure 62***).

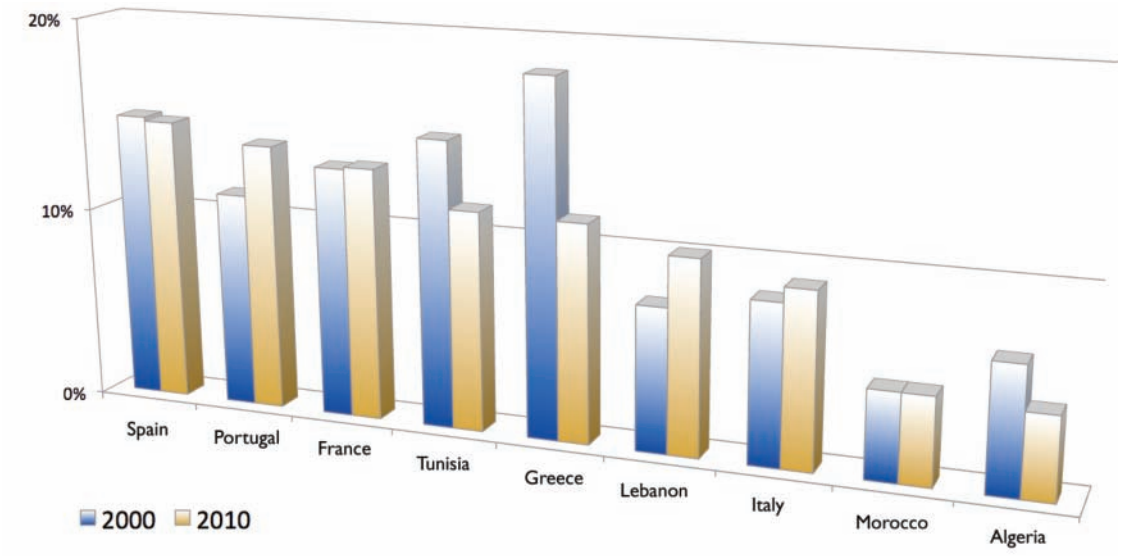
Figure 62: Trends in the unit consumption of trucks (%/year, 2000-2010)



5.3. Air transport

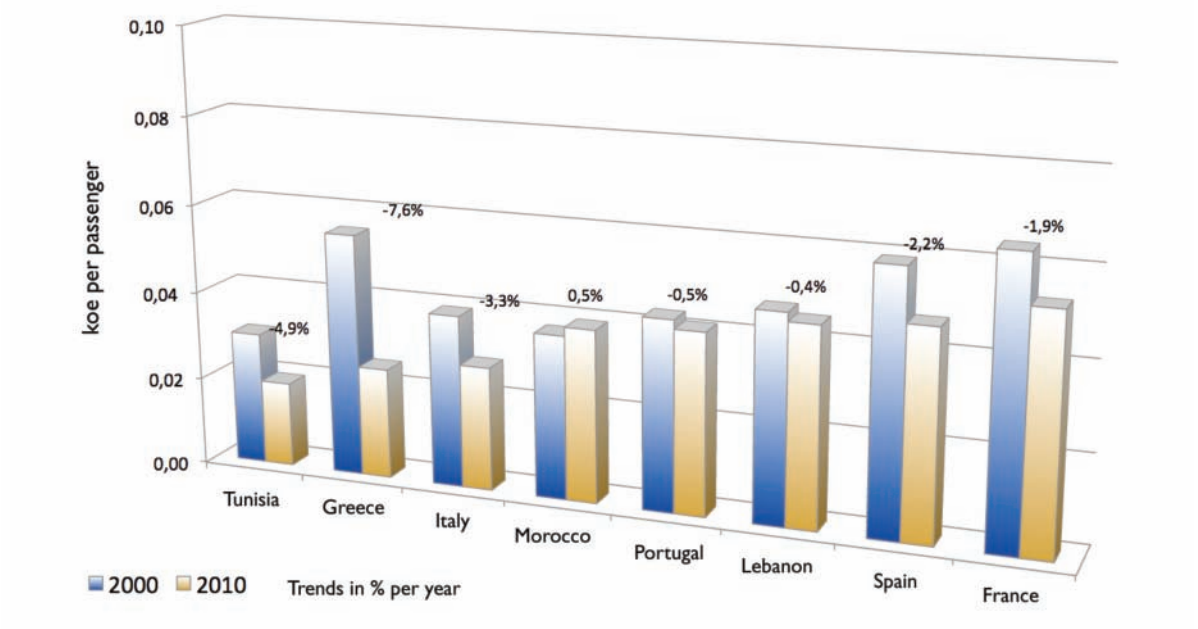
The share of air transport ranges from 5% of the consumption of transport in Algeria to more than 15% in Spain and Portugal. Air transport is closely linked to the development of tourism. In 2010, there was a fairly sharp decline for air transport in half of the countries due to the economic and financial crisis that affected many countries (***Figure 63***). Meanwhile in all countries, the number of passengers is growing rapidly: 8% per year for Morocco, 6%/year in Lebanon, 4.4%/year in Italy and Greece, 3.5%/year Spain and Portugal.

Figure 63: Share of air transport in energy consumption of transport



Unit consumption of air transport (defined as a ratio between the energy consumption and the number of passengers carried) tends to decrease in most countries, mainly due technical progress with new aircrafts (***Figure 64***).

Figure 64: Energy consumption of air transport per passenger (toe/passenger)

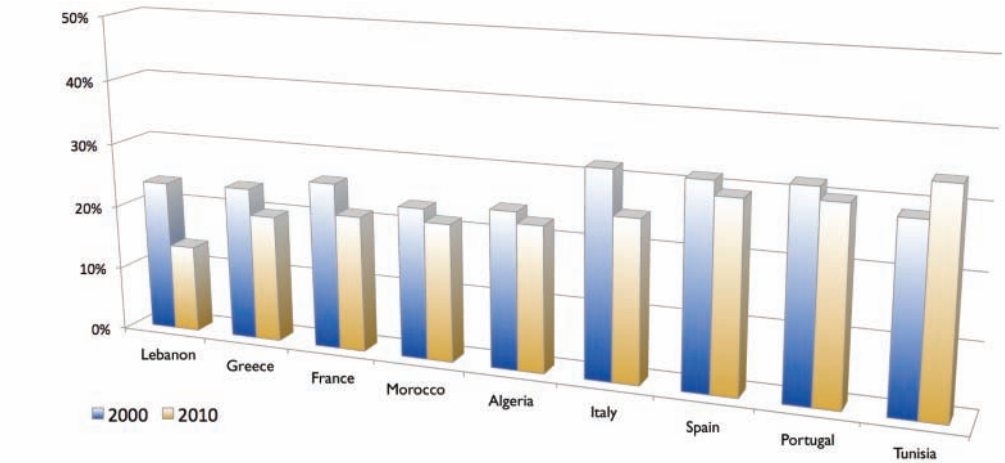


6. Energy efficiency in industry

6.1. Consumption patterns

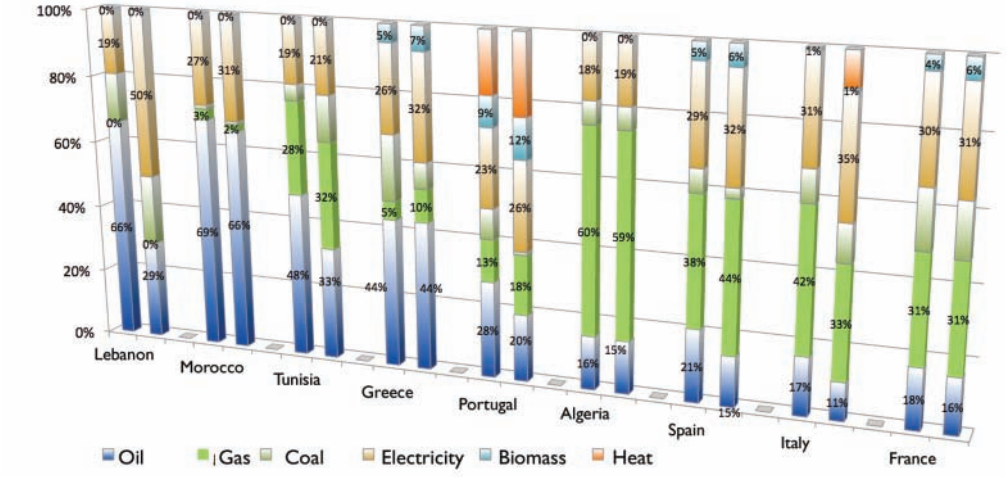
In all countries except Tunisia, the share of industry in the final energy consumption is declining. The contribution of industry is low in Lebanon (12%), because the activity of this sector is traditionally less developed; it is on the opposite high in Tunisia (35%). It fell sharply in Lebanon (-10 points), after the war with Israel in 2005-2006, with the destruction of many industrial infrastructures, and to a lesser extent in Italy, France and Greece due to the economic crisis and the increasing trend of the service sector (***Figure 65***).

Figure 65: Share of industry in the final energy consumption



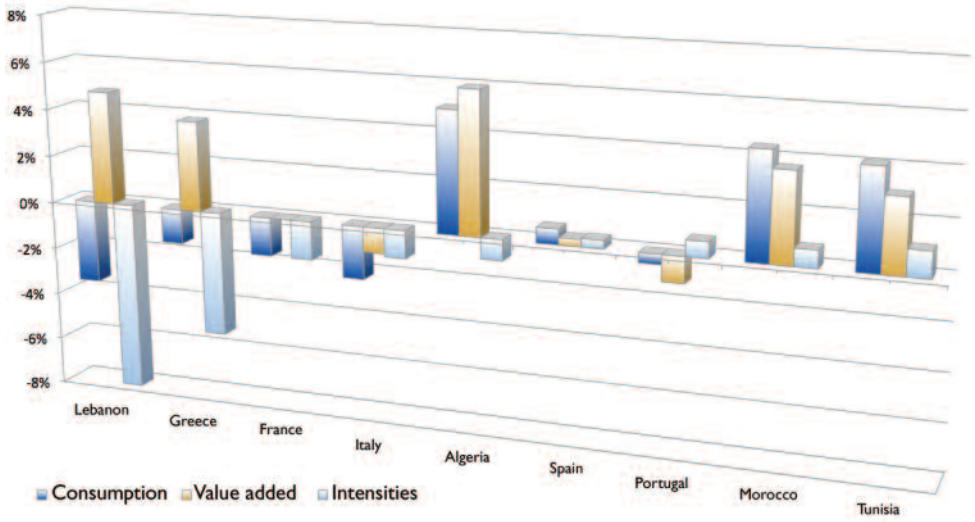
Oil is the main energy consumed in industry in Morocco, Greece and Tunisia (respectively 66%, 44% and 33%). In Algeria and Spain, natural gas has the highest market share (59% and 44%). In France and Italy, the mix between gas and electricity is more balanced (1/3 of consumption each). In Lebanon, electricity accounts for over 50% of the consumption, against only 20% in 2000 (Figure 66). The share of electricity has risen everywhere, especially in Lebanon, Greece, Morocco and Italy.

Figure 66: Energy consumption of industry by energy source (2000, 2010)



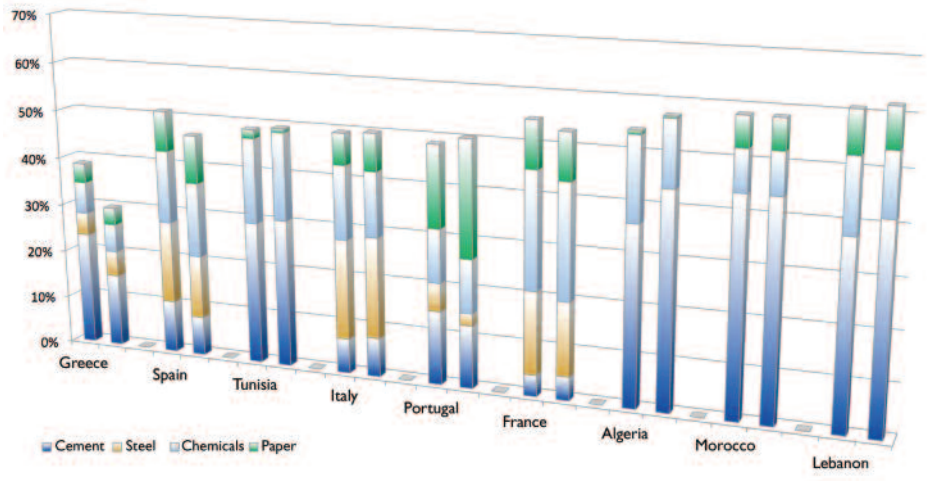
The energy intensity of industry, calculated as the ratio between the energy consumption and the value added, decreased in five countries (by more than 5%/year in Lebanon and Greece, between 1 and 1.6%/year in Algeria, Italy and France) (*Figure 67*). In Spain and Portugal, the intensities have been increasing (by respectively 0.5% and 1% a year), and especially since 2008 due to the economic crisis (+2.8% per year); during a recession, energy consumption does not follow the decline in the industrial activity because of a lower efficiency of equipment that are no longer operating at full capacity and because part of the consumption is not directly linked to the activity. The economic crisis has severally hit industry in Europe, especially energy intensive industries (primary metals and non metallic minerals).

Figure 67: Energy intensity trends in industry (%/year, 2000-2010)



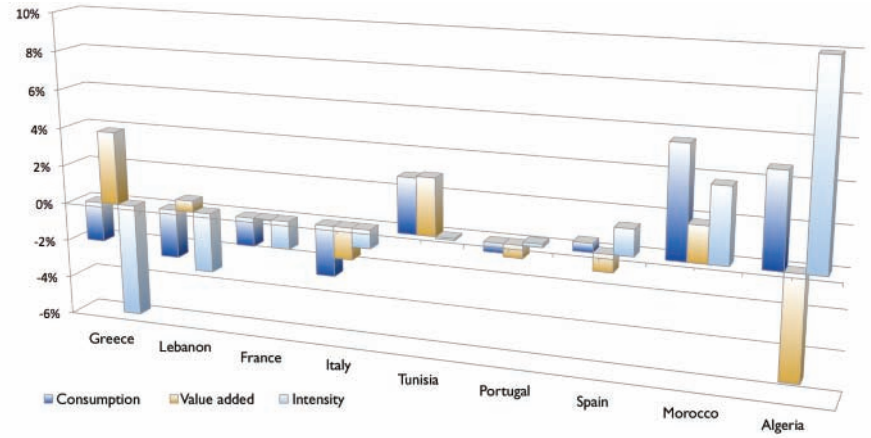
The share of energy intensive branches in industry consumption varies from 30% in Greece to over 60% in Lebanon (50% on average in the 9 countries). This share fell sharply in European countries hit by the economic crisis (-9 points in Greece, - 5 points in Spain and -2 points in France). In Southern countries, cement is by far the dominant branch (30-45%) with an increasing share (*Figure 68*).

Figure 68: Energy intensive branches in industry (2000, 2010)



The energy intensity of manufacturing has been decreasing in Greece, Lebanon, France and Italy (***Figure 52***). On the opposite it increased in Spain, Morocco and significantly in Algeria. The variations observed for the total industry (***Figure 69***) are smoother than for manufacturing because of the construction sector, which has a significant weight in the industrial value added but a low energy consumption.

Figure 69: Trends in manufacturing industries (2000-2010)



Trends in the energy intensity of the manufacturing industry are influenced by the decrease of the intensities at branch level (chemicals, minerals non metallic, food processing, textiles, etc. ..) which corresponds to energy savings, but also by changes in the structure of value added by branch ("structural effect"); in countries with an increasing share of energy intensive branches in the value added, the energy intensity should, all things being equal, increase. On the opposite, a greater specialization towards less intensive branches such as textile or electrical equipment will reduce the energy intensity.

6.2. Sectoral intensities

The variations in energy intensity by branch should reflect the impact of energy savings from policies and measures implemented.

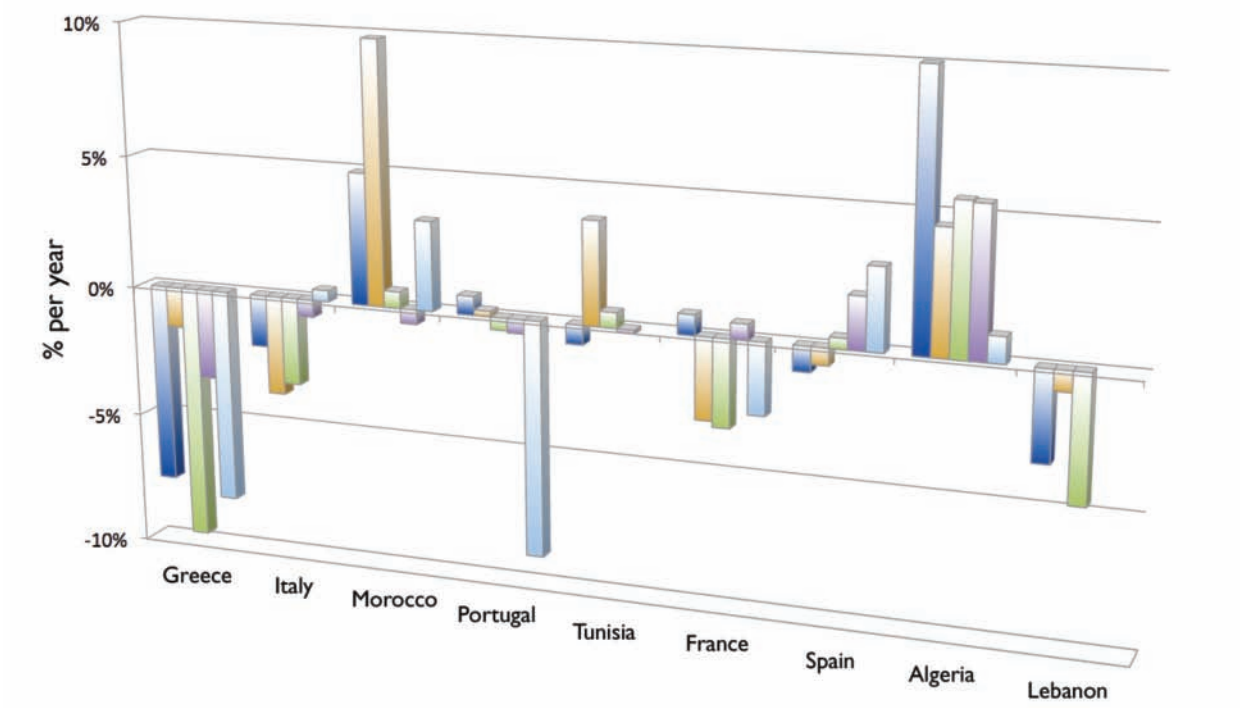
In southern countries, only Tunisia and Algeria have implemented measures in the industrial sector. Tunisia has since many years implemented various measures for large consumers with programme contracts, including financial subsidies for energy audits and investments, mainly financed by a national fund, FNME. In Algeria, mandatory audits and grants for audits are planned in the national Law.

In Europe, the measures implemented in industry mainly consist of financial support to support energy efficiency investments, of voluntary agreements (with tax exemption, especially in the northern EU countries) or market mechanisms (CO_2 emissions quotas).

In Europe and Tunisia, energy service companies (ESCO) offer a wide range of solutions to realize energy savings (audit, designs and implementation of energy savings projects); they get reimbursed for their investments through the financial savings on the energy bill according to conditions fixed in a contract.

Over the period 2000-2010, the sectoral intensities have decreased in Greece, Italy, France and Lebanon in most branches, at different rates according to countries or branches (***Figure 70***). In Spain, Algeria and Morocco, trends are reversed[25].

Figure 70: Energy intensities by branch (%/year, 2000-2010)



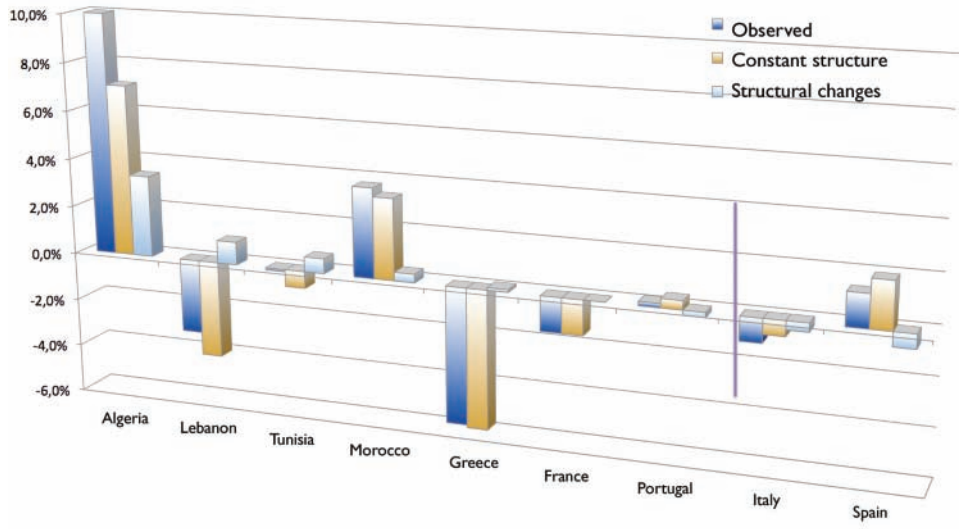
[25] In Algeria and Morocco, energy intensities by branch should be taken with caution. In Algeria, the incomplete coverage of the private sector overestimates the intensities. In Spain, the crisis is mainly responsible for the deterioration of the energy efficiency in some branches.

6.3. Impact of structural changes in manufacturing

As explained above, changes in the energy intensity of manufacturing reflect both the effect of changes in sectoral intensities but also the impact of structural changes, i.e. changes in the contribution of each branch in the value added of manufacturing. To separate the impact of these two factors, an intensity at constant structure has been calculated; it represents a fictitious intensity that would have been observed if the structure of the value added between the different branches had remained constant. The variation of the intensity at constant structure better reflects energy efficiency progress. The difference between trends in the actual intensity and the intensity at constant structure measures the effect of structural changes.

In southern countries, structural changes led to an energy intensity increase, because of a growing contribution of energy intensive branches: in Algeria, structural changes account for around one third of the intensity increase; in Tunisia structural changes cancelled the effect of the reduction in sectoral intensities. In France and Greece, the structural changes have been marginal (*Figure 71*).

Figure 71: Structural effect in manufacturing industry (%/year ; 2000-2010)



6.4. Specific consumption of intensive industries: case of cement

Energy-intensive industries (steel, cement, phosphates) represent on average 50% of the consumption of the 9 countries.

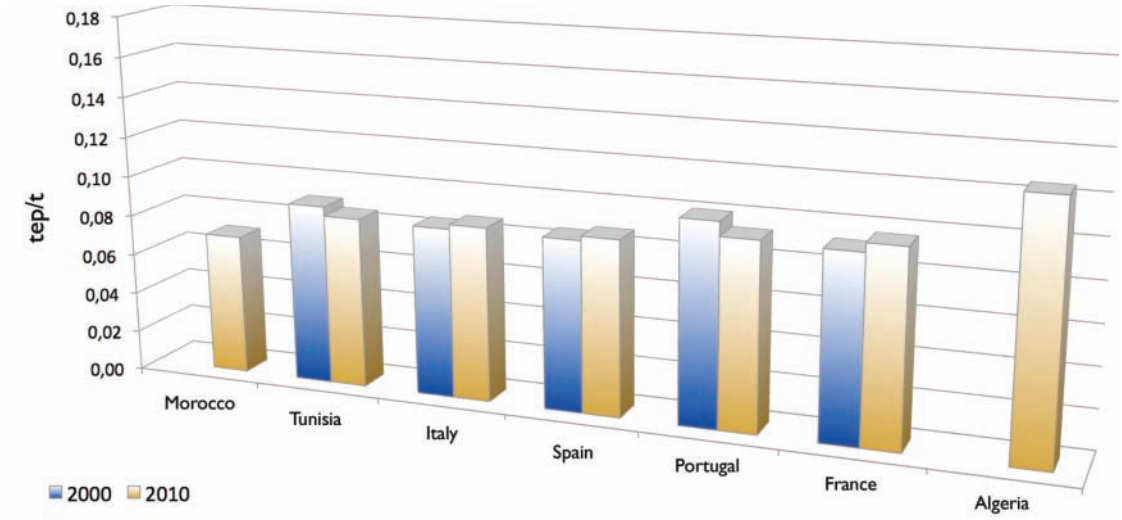
The specific consumption per tonne of cement is defined as the amount of energy consumed to produce one ton of cement. In the cement industry, the energy intensive component is clinker[26].

Morocco appears as the benchmark, with

[26] Cement results from a mixture of clinker (80-90%) and additives, such as ashes. The clinker results from the cooking of a mixture made up of approximately 75% of limestone and 25% of silica and its production in kilns is the main source of energy consumption in cement production; the remainder is the consumption of electricity for grinding the clinker and the additives.

the lowest consumption per tonne (0.07 toe per tonne). Trends are very different among the countries: decreasing specific consumption in Tunisia and Portugal; increasing values in Italy, Spain and France, because of the economic crisis in 2008, which, on the one hand, reduced the production without cutting the fixed consumption, and deteriorated the efficiency of the kilns which did not work at full capacity[27] (***Figure 72***).

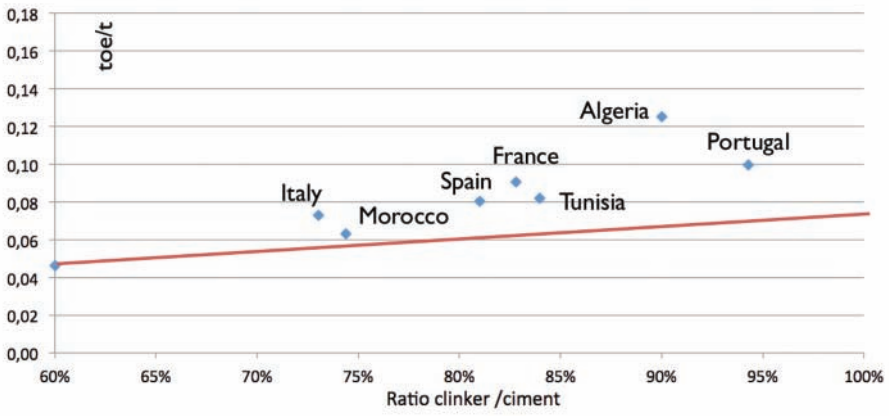
Figure 72: Specific fuel consumption for clinker production



*Algérie: 2005

The energy performance of cement production is linked to the share of clinker produced in the country in relation to the cement production: the higher this ratio, the higher the specific energy consumption. Distance to the red line (best practice) indicates the potential of energy savings (***Figure 73***).

Figure 73: Specific consumption of cement (2010)



Note: the red line represents the best practice

[27] An empirical study on cement factories in Thailand during the 1998 economic crisis showed that a fall of activity of 40% involved a rise of specific consumption per ton produced of 25% (and of 40% for a fall of activity of 60%) (Source W Eichhammer, Fraunhofer ISI).

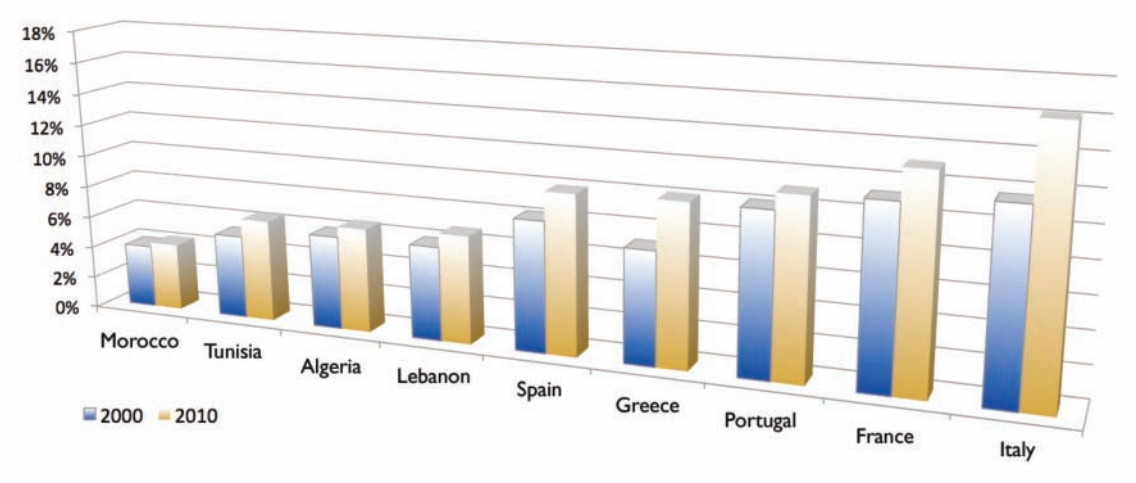
7. Energy efficiency in services

The service sector, also called tertiary or also commercial and public sector, is made of different activities, including trade, tourism (hotels, restaurants), education, health, administrations, offices (financial institutions and other private services). Public lighting is also included in the consumption of this sector.

7.1. Overall trends

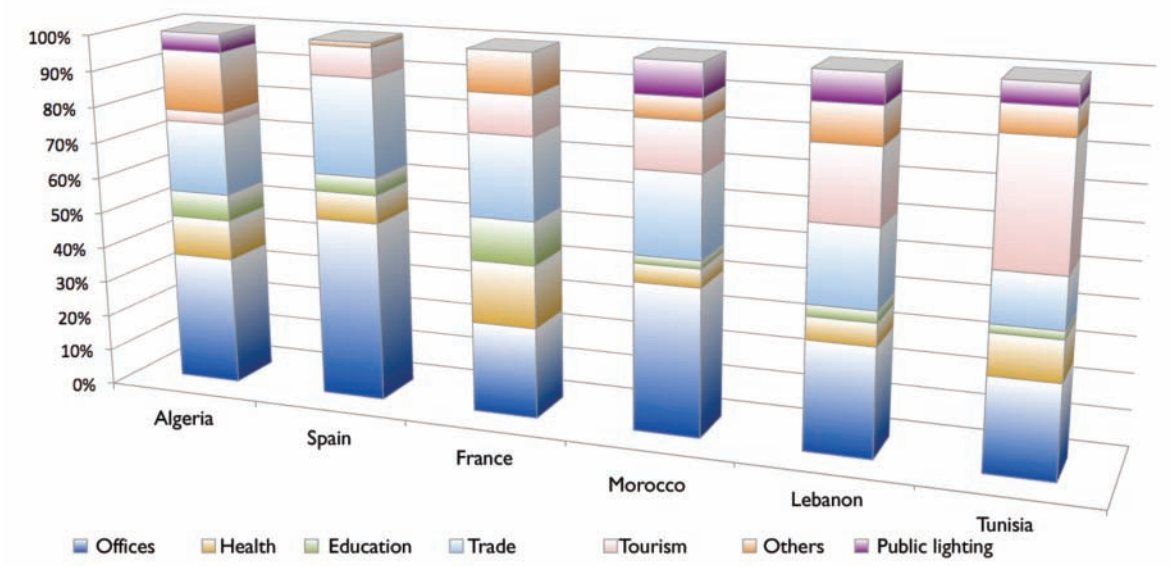
The energy consumption of the services sector has been increasing rapidly, especially for electricity. Therefore, the share of the tertiary sector in the final energy consumption grew in all countries between 2000 and 2010, and in particular in Spain and Greece (***Figure 74***). In southern countries, the share of the tertiary sector is significantly lower than in EU countries: about 6% of the final consumption (4% in Morocco), against 10-16% in EU countries.

Figure 74: Share of services in final energy consumption



Trades and administrations represent a large share of the consumption of the tertiary sector in all countries: around 35% in Algeria, Lebanon and Tunisia, 50% in Morocco. In Spain, administrations and private offices represent around half of the consumption in 2010 (25% in France). Tourism (hotels and restaurants) represents over 20% of the consumption in Lebanon and one third in Morocco (***Figure 75***).

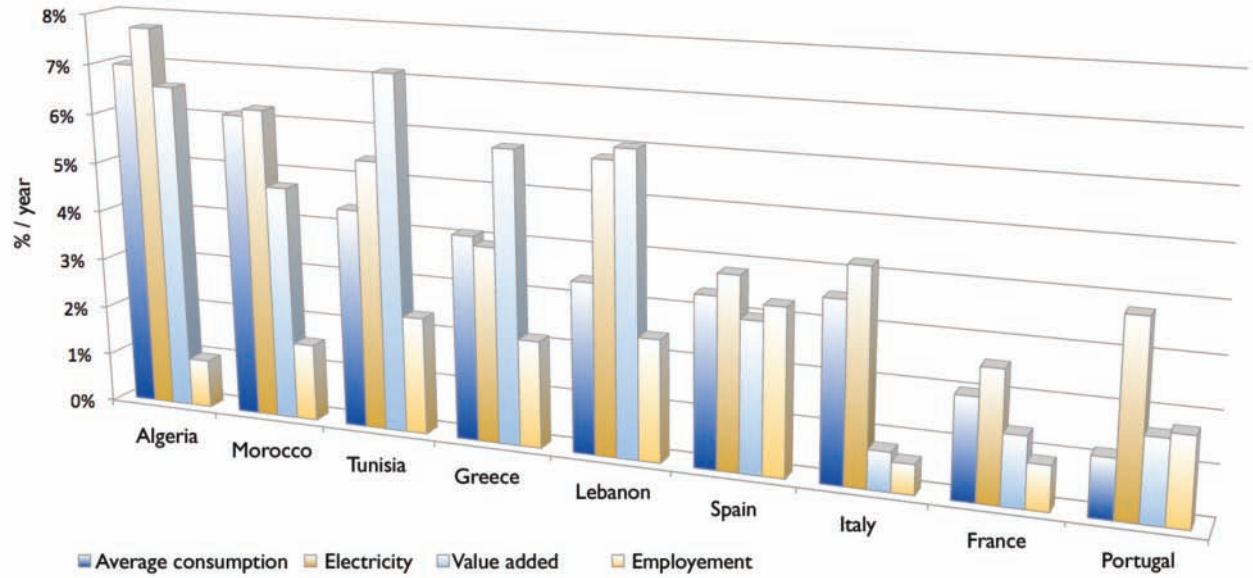
Figure 75: Energy consumption of services by branch



Note : France, Spain : private offices are included in "public offices" ; public lighting including in « others ».

In Algeria and Morocco, the energy consumption of the tertiary sector grew very rapidly (respectively by 7 and 6%/year since 2000), at a higher rate than the value added (respectively 6.5 and 4.5%/year), while employment rose slightly (1.5%/year). In Tunisia, Greece and Lebanon, consumption grew between 3.5 and 4.5%/year while the value added increased more rapidly, by 6%/year for (2.5%/year for employment). In these countries, tourism (Tunisia, Greece) and the financial sector (Lebanon) are two sectors that pull up consumption, mainly because of air conditioning and other specific uses of electricity. In EU countries, the energy consumption in services kept on growing rapidly in Spain and Italy, in particular for electricity, while in France and Portugal, consumption increased less rapidly (respectively 2%/year in France, 1.2%/ year in Portugal) (Figure 76).

Figure 76: Energy consumption, value added and employment in services (2000-2010)

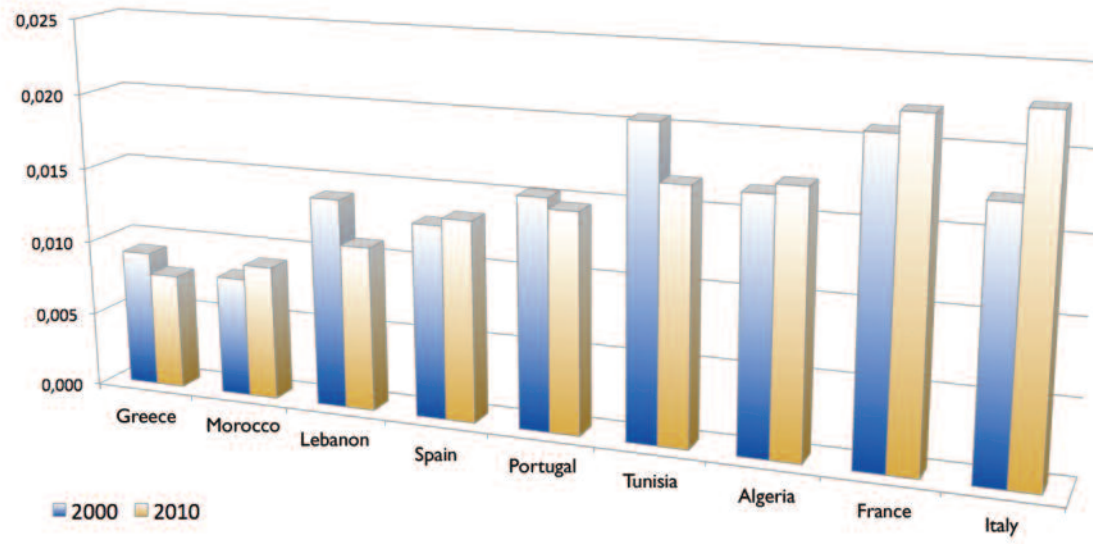


In all countries, electricity is the main energy source consumed: the share of electricity in the total energy consumption is around 40% in France, Italy and Algeria and even represents 3/4 of the consumption in Portugal, Greece and Morocco (2010). Trends in the electricity consumption can be explained in all countries by the diffusion of new office equipment and communication tool (internet, new types of telecommunications) as well as by the increasing use of air conditioning.

Electricity consumption has however declined in Greece and Spain since 2008 (respectively by 4.4%/year and 1.1%/year) because of the economic crisis; for the other European countries, the electricity consumption growth has slowed down because of the crisis but also thanks to energy efficiency measures implemented in buildings (thermal regulations, energy audits, energy performance contracts, etc.). The new European Directive on Energy Efficiency (EED) puts more emphasis on energy efficiency in the tertiary sector, with a particular focus on the leading role of the public sector.

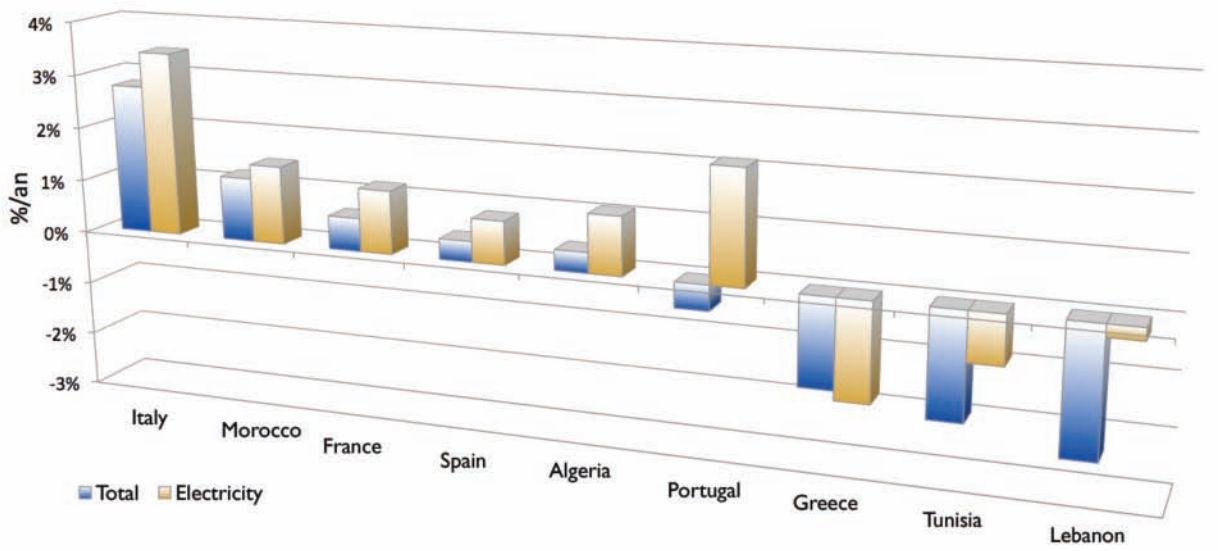
The energy intensity of service varies greatly from one country to the other; there exists a factor 2 of difference between Greece and Morocco which have the lowest intensity, and France and Italy, which have the highest intensity, in particular because of greater heating needs in both countries (***Figure 77***).

Figure 77: Energy intensity of services



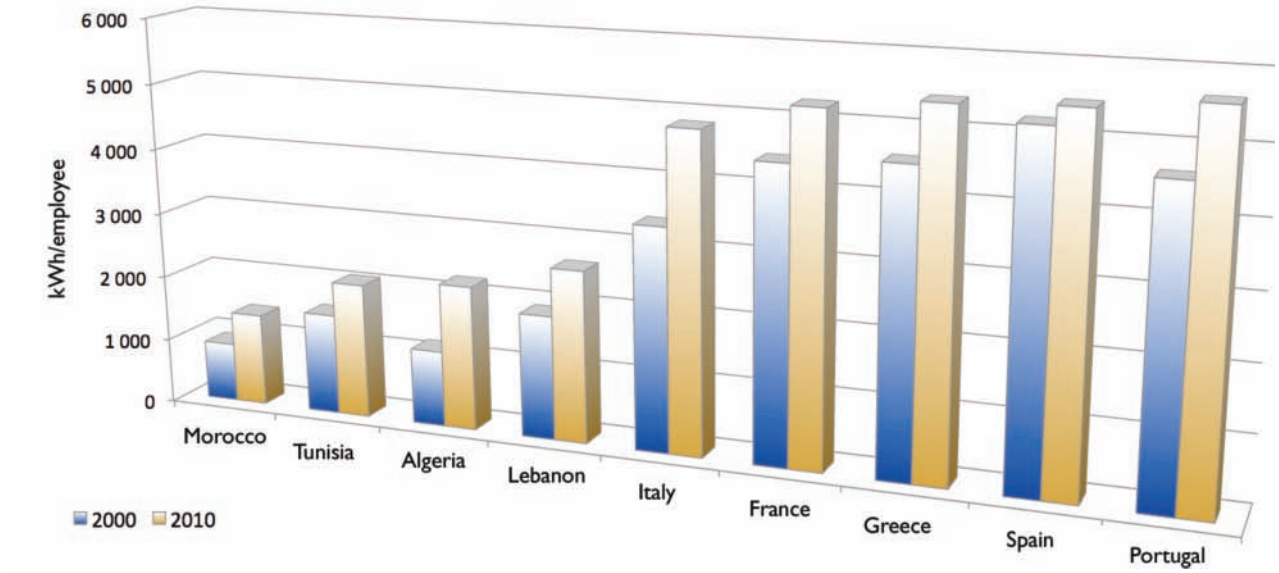
Changes in intensities are very different according to countries: strong increase in Italy and Morocco, slower growth in Spain, Algeria and France or, on the opposite, decreasing trends in Tunisia, Lebanon, Portugal and Greece. In most countries, electricity intensity tend to increase more rapidly than the total intensity, except in Greece, Tunisia and Lebanon, where electricity intensities has been decreasing (Figure 78).

Figure 78: Trends in energy intensity of services (2000-2010)



The electricity consumption per employee in the tertiary sector increased in all countries, driven by improved comfort and the rapid development of information technology and communication (ICT), particularly related to internet (*Figure 79*). There exist important discrepancies in the levels observed: Morocco has the lowest consumption per employee (1200 kWh/employee in 2010), while, on the opposite, EU countries reach a level of approximately 5000 kWh/employee. Even if energy consumption per employee is currently much lower in the South, it also grows much more rapidly driven by the rapid economic growth.

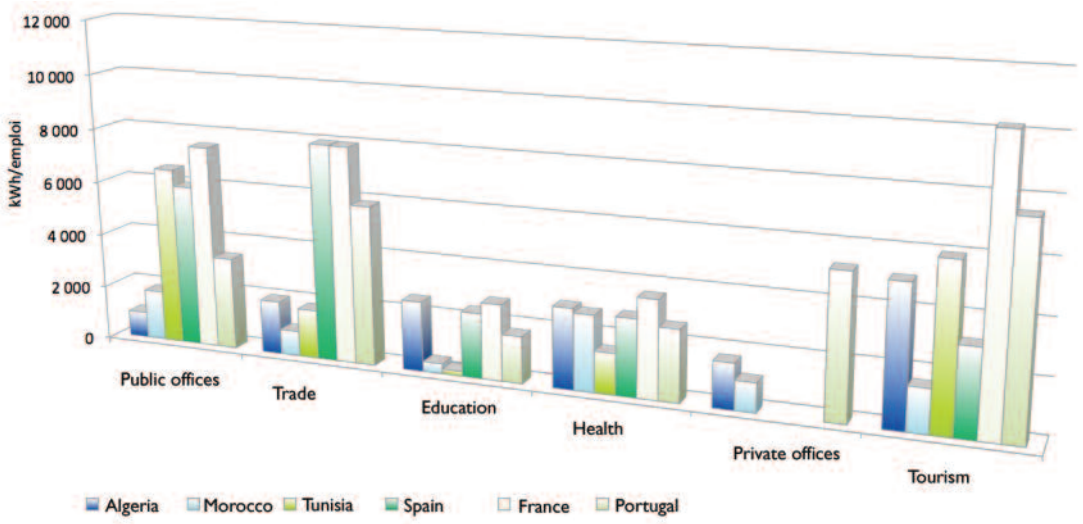
Figure 79: Electricity consumption per employee (kWh/employee)



7.2. Unit consumption by branch

consumption by employee. In administrations, there is a factor 3 difference between Morocco (2000 kWh/employee) and Tunisia (6000 kWh/employee) or France. This factor reaches 6 if we consider Algeria which has a very low consumption (1000 kWh/employee)[28]. For trade, the difference between Southern countries and EU is very clear, with a factor 4 difference between the average unit consumption of the 2 sub regions. The only branch which has more homogeneous results is health, with an average consumption of 3000 kWh per employee in most countries (except in Tunisia with 1800 kWh) (***Figure 80***).

Figure 80: Electricity consumption by branch and per employee (2010)



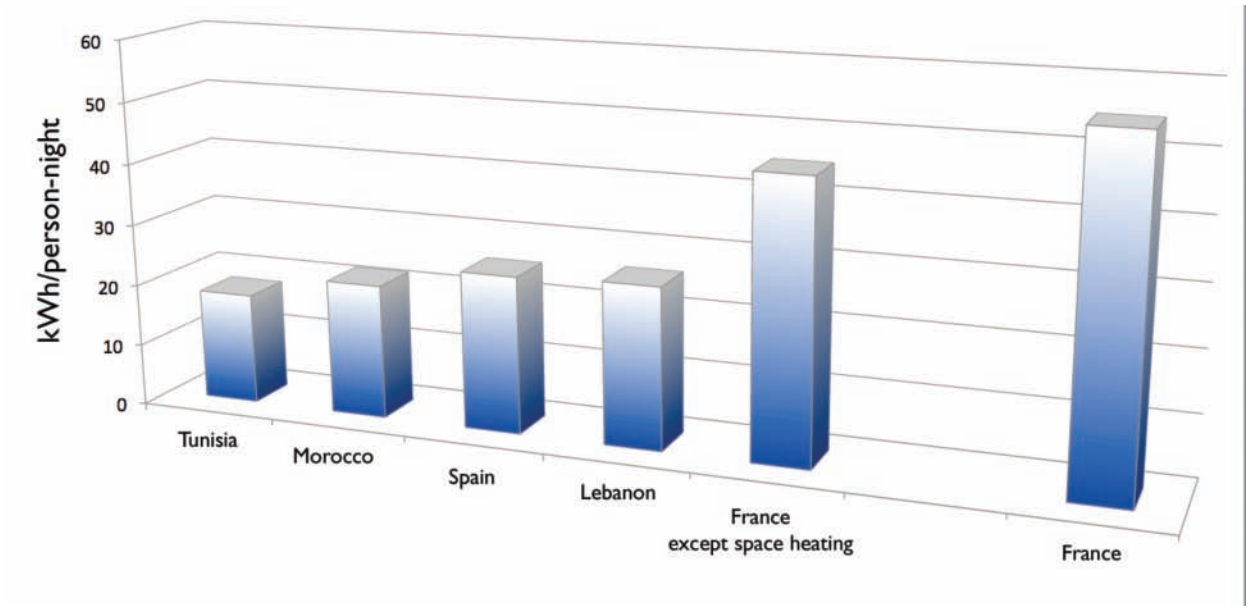
7.2.1. Tourism

The tourism sector is a key sector in Southern countries. The most relevant indicator for this sector is the ratio between the energy consumption of hotels, restaurants and the number of person-nights, since the consumption of hotels is dominant.

For countries for which information is available, the electricity consumption per person-night reaches on average 25 kWh/person-night, except for France where it is around 54 kWh/person-night. There is a factor 3 difference between the country with the lowest consumption per person-night (Morocco with 18 kWh) and France (this factor is reduced to 2.5 if electricity consumption for heating is removed for France, as electric heating represent 6% of the consumption of the branch) (***Figure 64***). These figures are still very heterogeneous according to the type of hotel as energy consumption is related to the category of hotel and the services they offer.

[28] Comparisons by branch should be considered with caution. In fact, the data on employment in Southern countries seem to be underestimated.

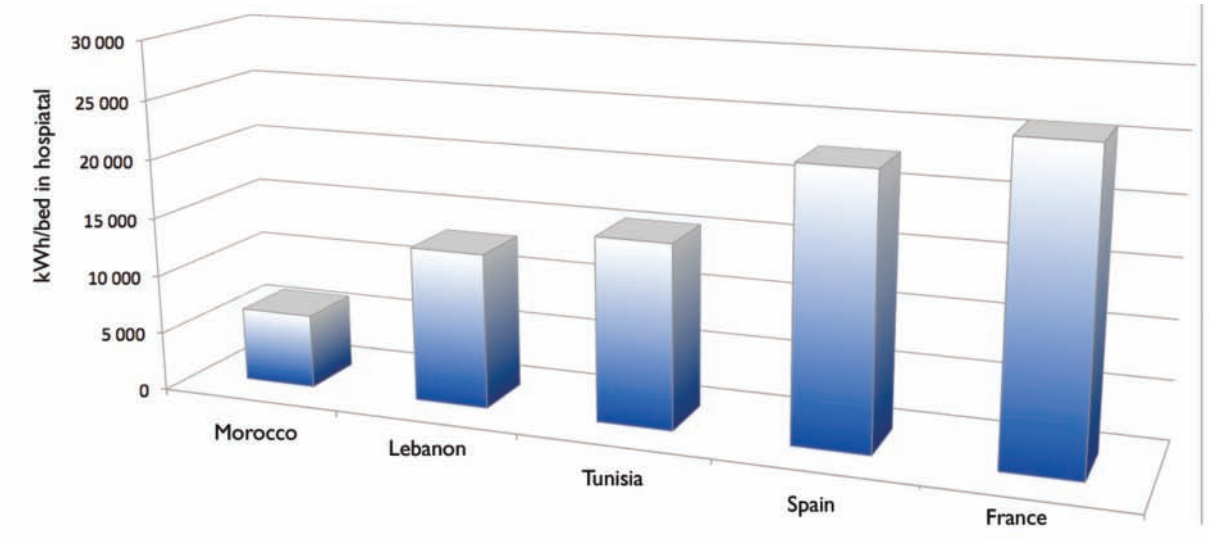
Figure 81: Electricity unit consumption of hotels-restaurants per person-night (2010)



7.2.2. Health sector

In the health sector, the most important indicator is the unit consumption per bed, because of the dominant consumption for hospitals (***Figure 82***). There is a factor 4 difference between the electricity consumption per bed in Morocco (6300 kWh) and France (26,000 kWh). Such differences are mainly linked to the category of establishments: public hospitals, private clinics and types of structure (general health, specialized institutions etc.).

Figure 82: Unit consumption for the health sector per bed in hospitals

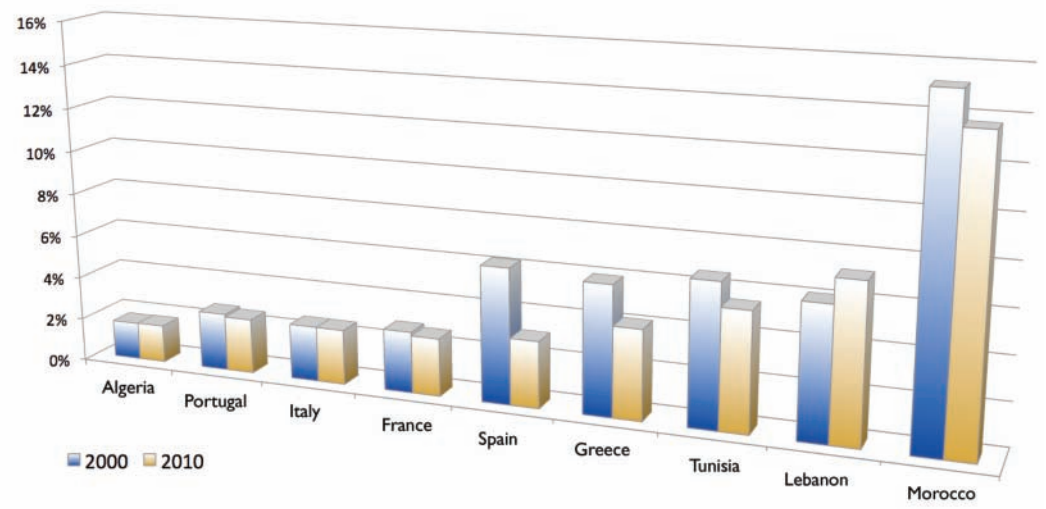


8. Energy efficiency in agriculture

8.1. Overall trends

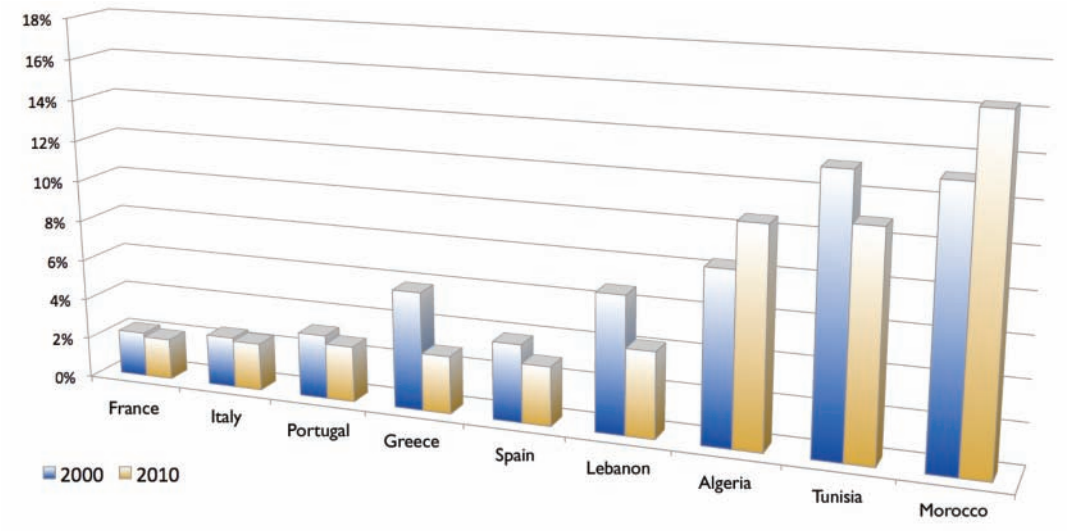
The consumption of agriculture, fisheries and forests generally represents a small share of the final energy consumption, around 2-3% in the EU (except Greece where it is around 4%) and Algeria. It is more significant in Morocco with 14%, and to a lesser extent, in Lebanon and Tunisia (6-7%). In all countries except Lebanon, the contribution of agriculture is declining, especially in Spain (-3 points), Greece and Morocco (-2 points) (***Figure 83***).

Figure 83: Share of agriculture in final energy consumption



Agriculture however, plays an important economic role in southern countries: its value added represents more than 10% of GDP in Algeria, Morocco and Tunisia (16% in Morocco in 2010) even if this share tends to decrease (except Tunisia) (***Figure 84***). In Morocco and Tunisia, the value added of agriculture grew by more than 6%/year from 2000 to 2010.

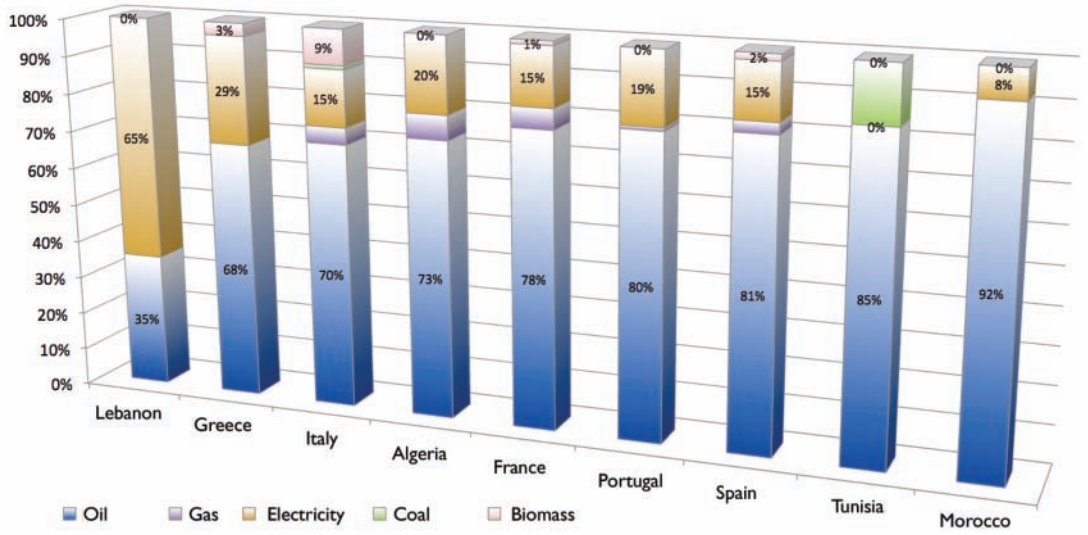
Figure 84: Share of value added of agriculture in GDP



Oil is the main energy consumed in the agriculture sector, with fuel for tractors, fishing boats and pumps (diesel and LPG) (from 35% in Lebanon to 92% in Morocco). Electricity is used mainly for livestock farms and water pumps for the irrigation of cultivated area (*Figure 85*).

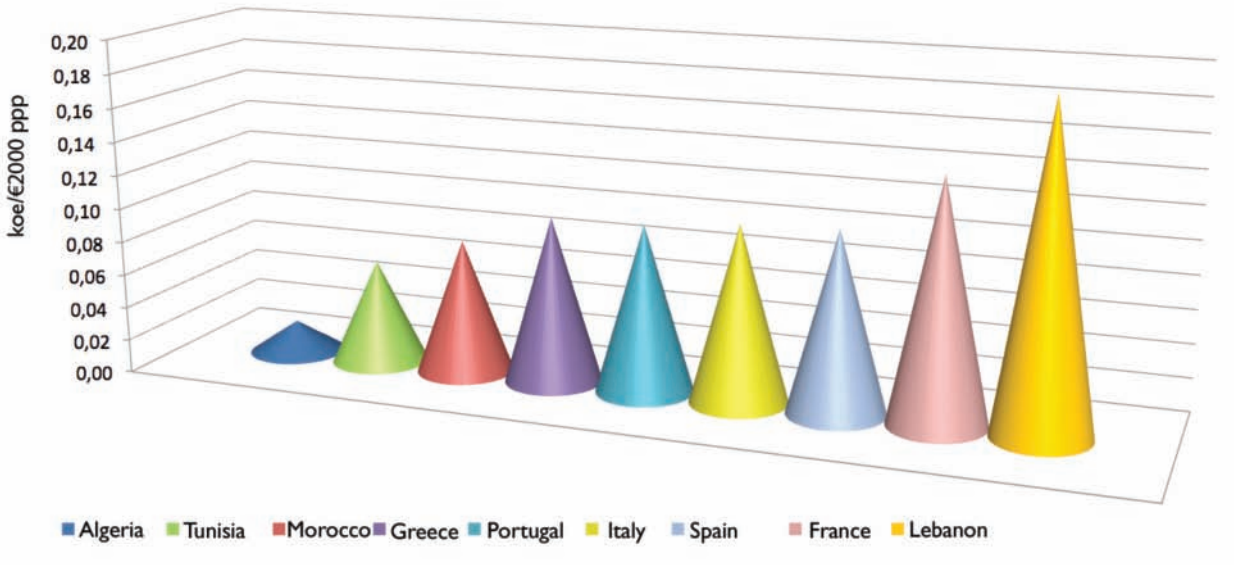
Agriculture, which includes farms, livestock and irrigation, is the most important part of the agricultural sector in tem of energy consumption. In Tunisia, fishing represents approximately 20% of the consumption of agriculture, against 2% to 5% in Lebanon and Morocco (2010).

Figure 85: Consumption of agriculture by fuel (2010)



The intensities of agriculture are relatively similar in most EU countries. Agriculture is very intensive in Lebanon due to irrigation (more than half of the agricultural area is irrigated) and France. Algeria has a very low intensity, because this sector is still underdeveloped (*Figure 86*).

Figure 86: Energy intensity of agriculture



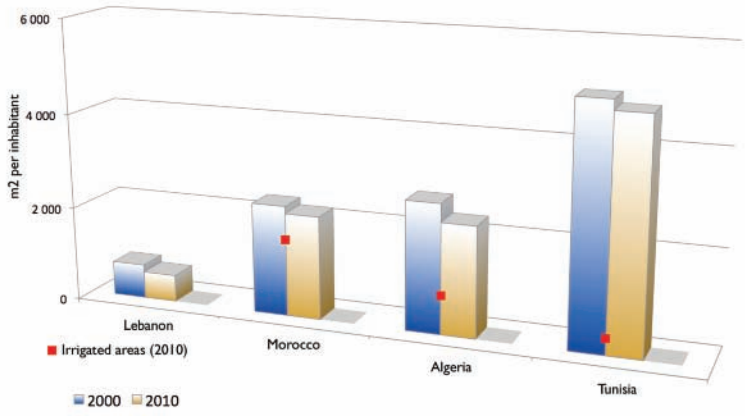
8.2. Indicators by branch

The analysis of the energy efficiency performance has been mainly done for the southern countries, as the weight of this sector is marginal in the EU, both in terms of energy consumption and value added[29].

8.2.1. Agriculture[30]

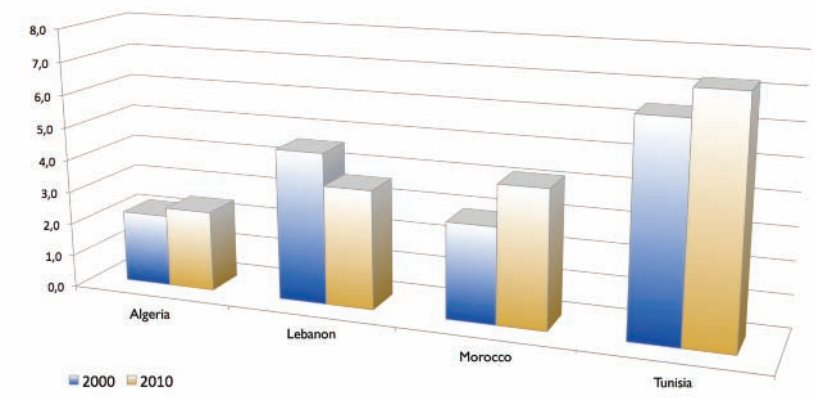
The agricultural area per capita is five times greater in Tunisia than in Lebanon (5000 m2 per capita against 1000 m2/inhabitant) and 2.5 times higher than in Morocco and Algeria. Between 2000 and 2010, the agricultural area per capita declined in all countries. Irrigated areas are significantly greater in Lebanon, with consequent high energy and water consumption, which explain the high energy intensity level of for this country (***Figure 87***).

Figure 87: Cultivated area per inhabitant and % of irrigated area



Tunisia has the highest number of tractors per capita with more than 7 per 1000 inhabitants, against 3.5-4 for Morocco and Lebanon and 2.5 for Algeria (***Figure 88***).

Figure 88: Number of tractors per 1000 inhabitants

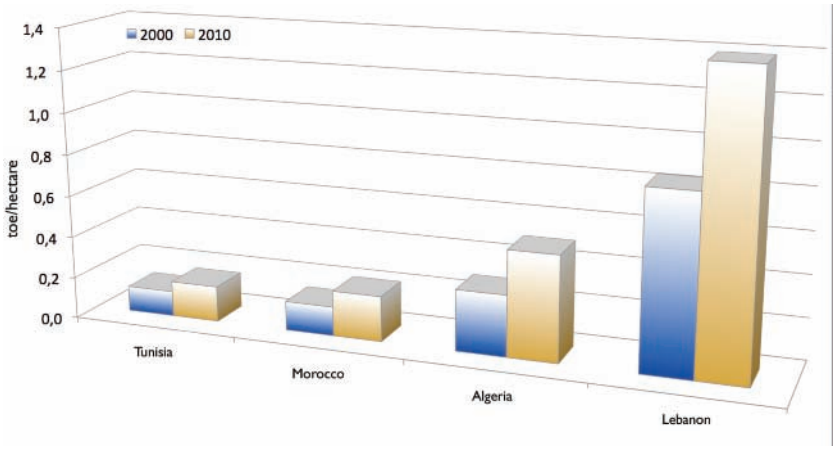


[29] Any detailed data on agriculture are collected in the EU project ODYSSEE MURE.

[30] Without fishing.

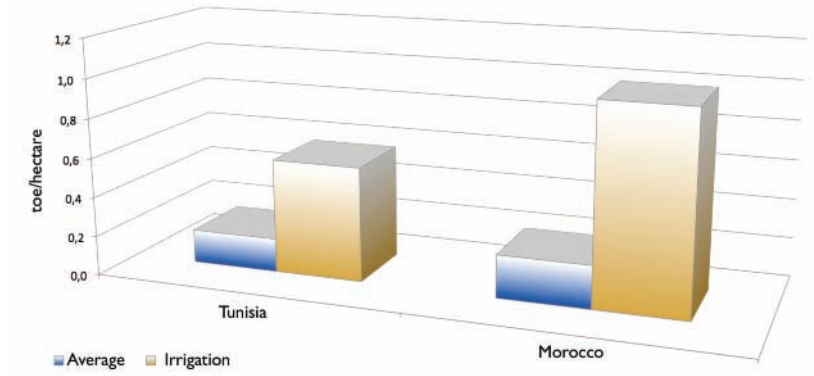
Energy consumption of agriculture per area sown varies greatly from one country to another; this ratio is roughly the same in Tunisia and Morocco (0.2 toe per hectare in 2010), 0.5 toe in Algeria and 1.4 toe in Lebanon, that is to say a factor 7 difference with Tunisia and Morocco (***Figure 89***). Such results can be explained by the higher proportion of irrigated area in Lebanon (50% of the sown area in 2010)

Figure 89: Energy consumption of agriculture per hectare (toe/ha)



More significant differences between countries can be observed for pumping. Energy consumption for pumping is close to 1 toe/irrigated hectare in Morocco against 0.6 toe in Tunisia (***Figure 90***). Although irrigated agriculture consumes more energy, it is a top-priority of the government to alleviate poverty and ensures food security.

*Figure 90: Energy consumption of agriculture per hectare: average and irrigated area (2010)**

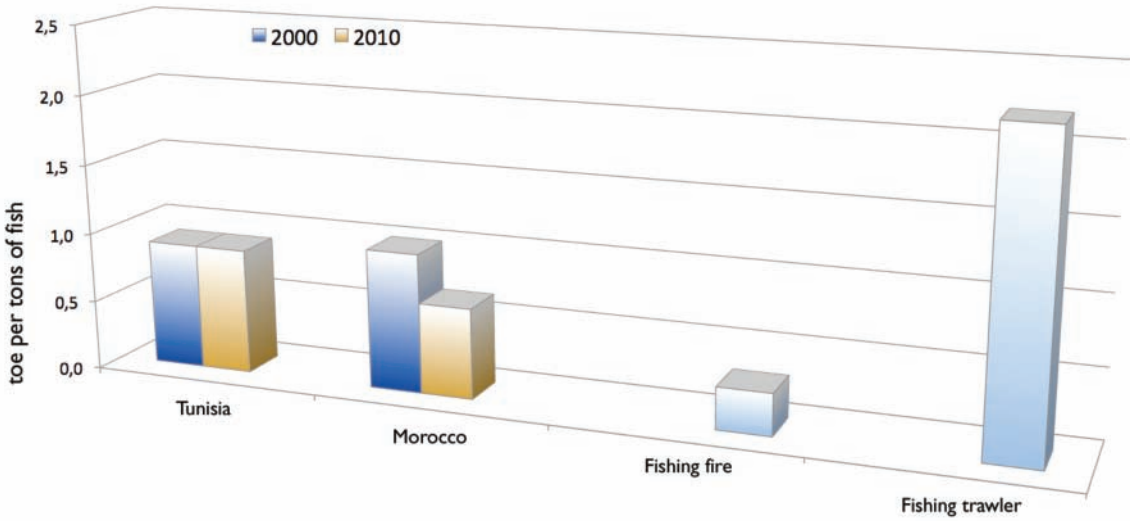


Note : 2008 for Tunisia

8.2.2. Fishing

For fishing, the most important indicator is the energy consumption per ton of fishes. This ratio reaches 0.9 toe/t in Tunisia and 0.65 toe in Morocco (2010). A study from the Tunisian Agency ANME demonstrates that this ratio greatly depends on the type of fishing: for example, in Tunisia, the energy consumption for fishing fire is around 0.3 toe / ton against 2.2 toe / ton for a fishing trawler (*Figure 91*).

Figure 91: Unit consumption per tonne of fish



Note : Data for Tunisia from ANME (2007)

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  http://www.odyssee-indicators.org/publications/publications.php

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  http://www.est-testnet.net/servlet/getDoc?sort=-1&cid=96&m=3&id=82903&ref=&nocache=yes&p1=111

10. Annex : Organization of the MEDENER project on energy efficiency indicators

The MEDENER project on energy efficiency indicators has four main objectives:

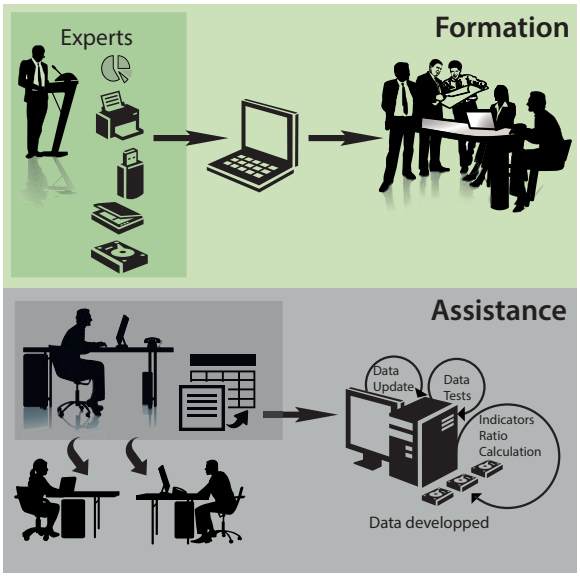
- train experts from national energy agencies, especially for Morocco (ADEREE) and Lebanon (ALMEE); the other agencies in Tunisia (ANME) and Algeria (APRUE) already have a good knowledge of energy efficiency indicators .
- organize data collection and interpretation of energy efficiency indicators.
- create two databases for Morocco and Lebanon on energy consumption by sector and their determinants; Tunisia and Algeria have recently benefited from the assistance of ADEME on this purpose.
- Disseminate through the database and reports, and present energy efficiency trends in the Southern and Eastern Mediterranean countries.

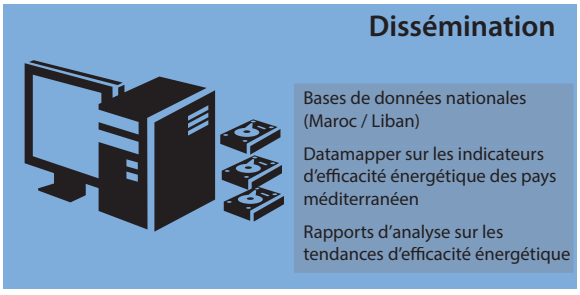
Formation

- Training experts from national agencies on energy efficiency policies
- Training materials available since the beginning of the project

Assistance

- Assistance in data collection (on-site visits, hot line)
- Support to the interpretation of energy efficiency indicators (seminars, missions)
- Assistance in the preparation of national reports
- Assistance in organizing and structuring data with the creation of two national databases on energy consumptions and their determinants for the two countries which have no databases (Morocco, Lebanon)





a) Training

Training of different experts in charge of the project was a first step. Training materials adapted to the Mediterranean context were produced by the technical coordinators (Enerdata and Alcor) which have a solid experience in energy efficiency evaluation in different countries around the world, and by ADEME who brought its experience on indicators.

A first training was organized close-to-close to the first workshop, with a presentation of the main energy efficiency indicators usually used that will be also developed under the project. The training was designed for experts that had little knowledge on energy efficiency indicators, or to enhance the knowledge of other experts. All the presentations were done with Powerpoint, organized by sector presenting key performance indicators which can be relevant for the Mediterranean area , with emphasis on definitions and concepts and illustration through several case studies.

The first training covered the following points:

i . Usual descriptive indicators (energy intensity, specific fuel consumption), focusing on their interpretation and limits.

ii . Measurement of energy efficiency savings and gains, based on the methodology developed several years ago in the framework of the ODYSSEE-MURE project on indicators and the European Directive ESD; this part of the training has been introduced and has been further developed during the second seminar .

iii . Adjusted indicators for international comparisons (why and how adjustments are made ?).

A second training was conducted on data collection during the second meeting of the project. The objective of the training was to describe in detail the useful data by sector to analysis energy demand and calculate energy efficiency indicators.

The other project meetings also enabled the teams to strengthen their capacity, analysis and interpretation of indicator trends. In particular, agency representatives were asked to prepare several presentations based on the results for their countries with the assistance of the technical coordination for reviewing.

Finally, assistance was provided by the technical coordination for the preparation of the national reports by providing a very detailed template.

Training on indicators has been continuous throughout the project through an hot line service proposed by the technical coordination.

b) Data collection

The collection of data required for the calculation of indicators began with the creation of an Excel template. This file is based on the file available for the EU countries in the framework of the European model ODYSSEE MURE project, but adapted to the energy situation of the Mediterranean countries. Energy agencies have been guided throughout the project to fill in this file by collecting information in their country , or by applying methods of estimation/modeling in case of missing data (eg consumption of energy use in the residential).

All the indicators are calculated in the Excel template and are clearly visible.

The teams were throughout backed by the technical coordination of the project, either through on-site visits or hot lines through emails to help identify existing data sources, organize, collect information. Several meetings have been held in Lebanon and Morocco to monitor progress and assist them in modeling none available data

c) Creation of national databases

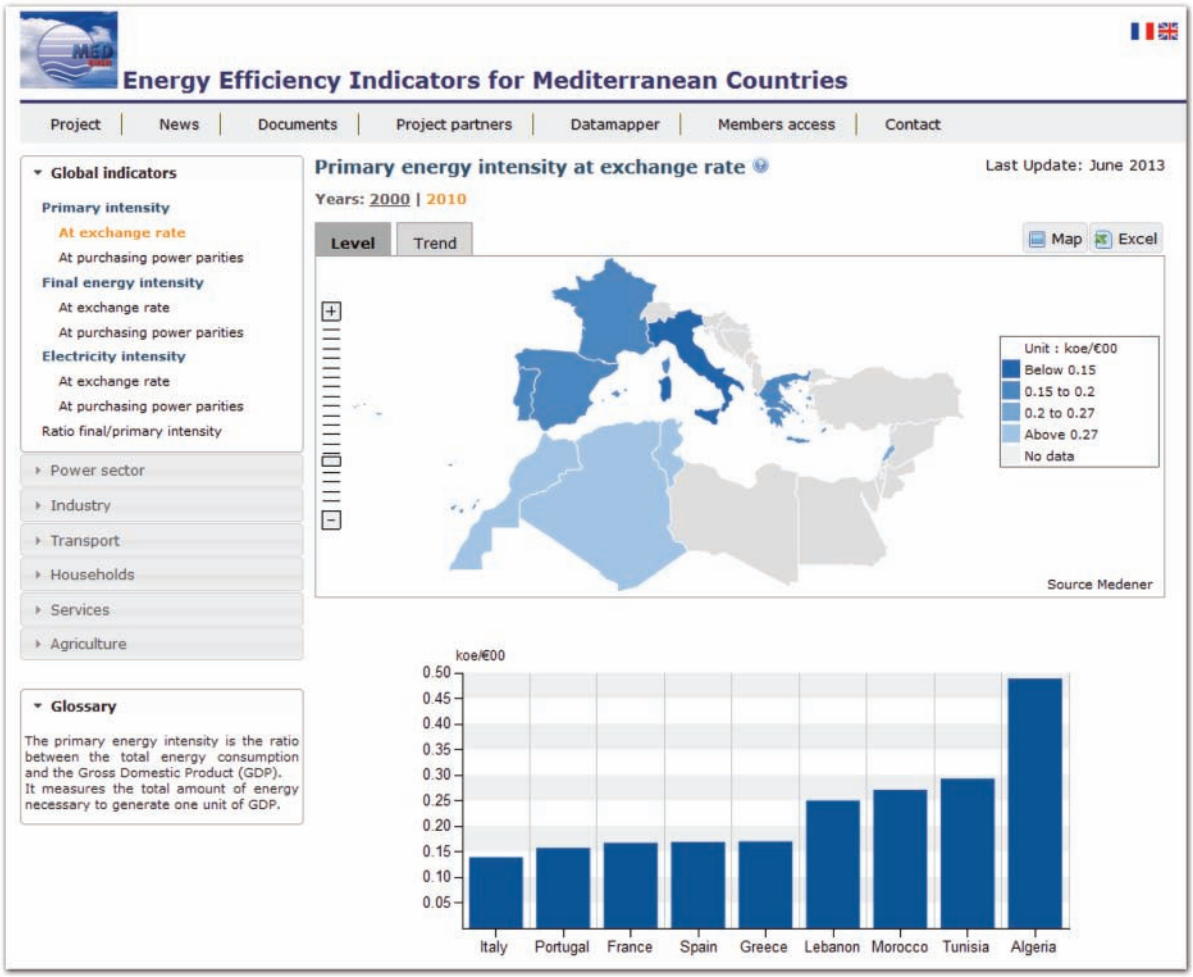
For Morocco and Lebanon, Enerdata has developed two national databases, which has been adapted to the specificities of each country. These databases were transferred to the two agencies, which are responsible for managing and updating them. These databases are protected by a password, which guarantees the confidentiality of the information contained in the interface. These databases are user-friendly and easily accessible and are a good way to communicate and disseminate information collected as part of this project.

Screenshots of homepages for the national databases for Lebanon and Morocco

d) Dissemination

An interactive database has been developped; main indicators are presented through maps ("**DataMapper**") and available on the website.

Datamapper on main energy efficiency indicators for 9 Southern and Eastern Mediterranean countries



Founded in 1997 as an international non- profit organization, it brings together 12 national energy efficiency agencies, around the Mediterranean. In enlargement perspectives, the association is bound to extend to other countries such as Turkey and Egypt.

MEDENER, regional platform of expertise, aims to promote exchanges of experiences and best practices, know-how transfer and methods for energy efficiency and renewable energies. It also supports the development of sector programmes, regional pilot projects and adaptation of tools and standards in the field of energy management. The association participates in the work carried out within the Union for the Mediterranean (UfM), including the Mediterranean Solar Plan, and has thus become a key player in the energy transition in the Mediterranean. MEDENER network is chaired for two years alternately on a rota basis by the agencies of North and South of the Mediterranean.

As part of its support and energy policies monitoring activities, MEDENER has established a regional observatory for monitoring energy efficiency trends in the Mediterranean based on the expertise of national teams in the country.

For two years (2012-2014) first MED-IEE (Energy Efficiency indicators for Mediterranean countries) project was carried out by the MEDENER network teams. Through this first regional report, trends in energy efficiency in the Mediterranean region are illustrated, through the work undertaken in this project that was coordinated by ADEME and ANME. It has allowed the establishment of similar national and regional databases on energy efficiency indicators for Morocco and Lebanon, as well as the development of common indicators for all Mediterranean countries in an accessible regional basis. The interpretation of the evolution of these indicators has also been national reports.

A second phase will be initiated with new countries, in which more detailed indicators will be established, including climate indicators.

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