2009 – 2012 Work Programme
Energy Tourism Interactions

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Introduction

Mediterranean tourism is booming and along with it comes high energy consumption, especially in seaside mass tourism destinations. Initiatives to improve energy consumption in the tourism industry, such as enhancing the quality of buildings and using transport modes that emit less greenhouse gases remain limited and somewhat insignificant. Consequently, the risks associated with tourism failing to adapt to energy changes must be evaluated, particularly within the context of adapting to climate change.

This economic sector is vital to the Mediterranean and has strong potential for energy efficiency policies to be implemented and the development of renewable energies.

Comparing the results of activity programmes conducted by Plan Bleu on "energy and the Mediterranean" and "tourism and sustainable development in the Mediterranean" highlights **the interdependencies of the challenges of Mediterranean tourism** and the new energy deal in terms of risks as well as opportunities:

- The difficulty in attaining greenhouse gas reduction rates (as part of reducing overall emissions by 80% by 2050) in the transportation sector and especially the airline industry could be an opportunity to develop decision-making tools that facilitate arbitration between transport modes at the destination level and the development of modal networks that reduce carbon impacts;
- Growth in the residential and tourist accommodation sectors generates substantial energy needs while accentuating local load variation problems. This growth could be used to bring about energy saving practices (the use of new materials, renovating older buildings, etc.) and alternative energy production, thus creating jobs, especially for young people in Mediterranean countries.

Evaluating **the overall carbon impact of a destination seems essential** and requires the following:

- The most detailed understanding possible of the factors that determine the energy demand issue through a bottom-up approach to information;
- **Organisation of territorial planning** of power generation and consumption in the tourism industry by building local governing areas;
- **Local observatories** to track the state of sustainability and planning in tourist destinations while taking energy into account.

Profound changes to the impact of tourism on energy will require all players concerned to change their behaviours. These players include those on the demand side of tourism (consumption practices) and those on the supply side (vision of short-term financial profit as opposed to vision of economic profits and local development integrated into the long term).

After outlining the **share of tourism in the energy balance** as well as the structure of related demand (Section I), the **two topics are compared** (Section II) to propose recommendations and **potential investment options** in the transport and building industries and in associated urban service infrastructures. Finally, Section III presents procedures supporting these recommendations with a need for implementation at the local level.

Table 1 - Comparison between studies of energy and tourism activity programmes

Studies conducted	Air transport and tourism	Cruises and recreational boating	Sustainability profiles of destinations
Change in energy demand scenario	Highlighting of consumption from tourism based transport in energy balances Potentials for new technologies in the airline industry (improvement of energy efficiency, fuel substitution) Optimisation of modal networks to improve energy consumption for each trip, or each modal transfer	Reduction of energy consumption (and related emissions) by ships at sea and docked ships (shore to ship plug) Potentials for new technologies on ships (improvement of energy efficiency, fuel substitution)	Evaluation and simulation of potential for energy efficiency and renewable energies in tourism infrastructures (identification of determining factors)
Building industry, energy and climate		Improvement of energy efficiency and deployment of renewable energies on dock-side buildings	Consumption of accommodations Consumption of infrastructures (related transport, urbanisation)
Water and energy interaction			Management of water and energy demand Pressure on local water resources and use of unconventional resources (desalination) and related energy impacts
Energy efficiency indicators	Definition of specific energy efficiency indicators for air transport with respect to other transport modes and for each destination (isoenergetic flights)		Comparison of energy and tourism indicators Definition of specific overall energy efficiency indicators per destination
Employment impact			Jobs generated by energy actions on a destination level (improvement of construction and equipment quality, improved management of flows, etc.)
Rising sea levels			Awareness and adaptation of destinations to rising sea levels

I. Interactions between energy and tourism

1. The key role of Mediterranean tourism

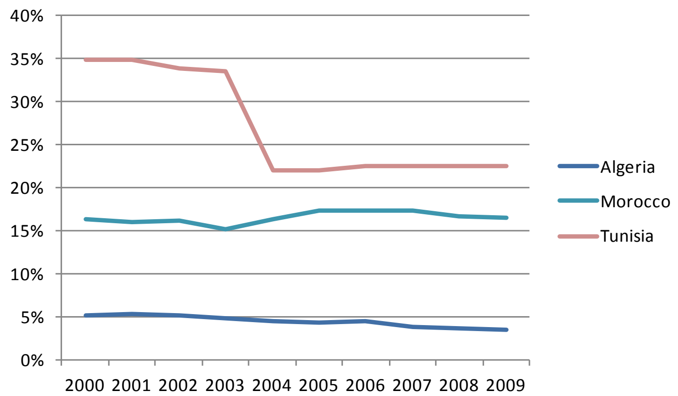
The Mediterranean remains one of the world's leading tourist markets with approximately 30% of international arrivals for more than 40 years. Mediterranean tourism has grown from 58 million international arrivals in 1970 to 271 million in 2009, i.e. a 366% increase over 40 years. Overnight stays spent by international tourists in Mediterranean countries increased from 540 million in 1970 to 1.3 billion in 2009, i.e. a 140% increase.

Energy consumption from tourism concerns mainly **transportation, construction and infrastructures** associated with urban services such as water treatment and desalination plants, public lighting, etc.

In the transport sector, over the last twenty years air transport has increased greatly on a Mediterranean scale. It increased from one quarter of international arrivals in the late 1980s to more than half (51%) in 2006. In comparison, over the same period arrivals by sea increased by just 2%, arrivals by rail was divided by three and arrivals by road decreased by one half, down from 60% to 30%. In terms of energy consumption, for a distance of 370 km, a jet airplane consumes 27 litres of fuel per passenger, a European car 18 litres and a turboprop airplane 16 litres.

As for infrastructures (accommodations, airports, etc.), tourism energy consumption can represent a large share of consumption from the tertiary sector, for instance, up to 25% in Tunisia.

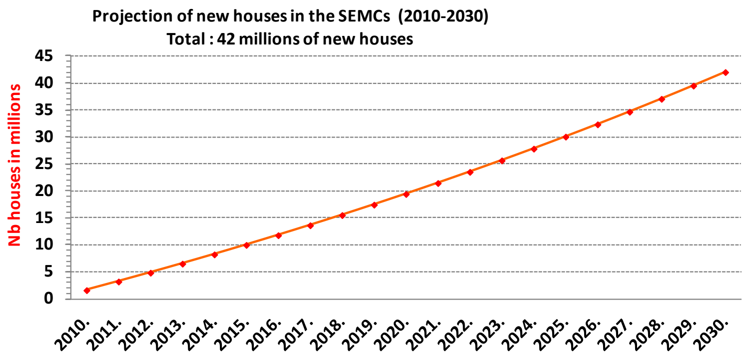
Figure 1 - Share of consumption by hotels in the final energy consumption of the tertiary sector



Source: Plan Bleu – national indicator studies, 2012

All the work carried out shows a significant increase in energy demand, particularly in Southern and Eastern Mediterranean countries (SEMC). This increase reflects the population and economic growth of countries together with raised standards of living and associated equipment rates. This has particular repercussions on the building and transport industries.

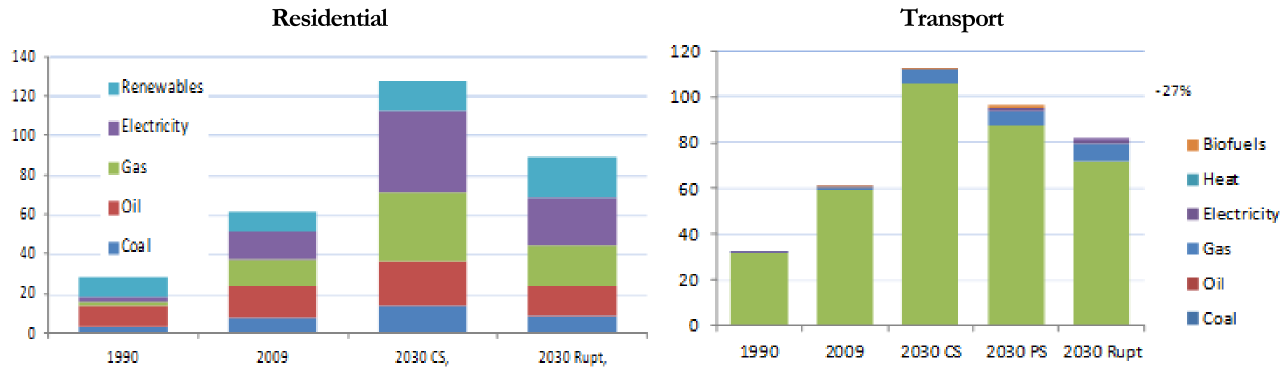
Figure 2 - Projection of the number of new dwellings in SEMCs (2010-2030)



Source: Plan Bleu – regional study on energy efficiency in the building sector, 2010

Work on energy forecasting has been key in coming up with a disruptive scenario based on ambitious deployment of energy efficiency and renewable energies. In the scenario, the change in demand could be reduced by 30% in the residential sector and 27% in the transport sector by 2030, compared to the business-as-usual scenario. The assumptions selected for reducing energy consumption are the same for each sector (building, transport, industry, etc.). There are therefore no specific objectives for the tourism industry.

Figure 3 - Energy demand in the residential and transport sectors by energy source in SEMCs



Source: OME, 2012

Regardless of the scenario, the increase in electricity consumption reaches high levels meaning that production capacities, which still mainly generate high amounts of carbon, will need to be almost doubled.

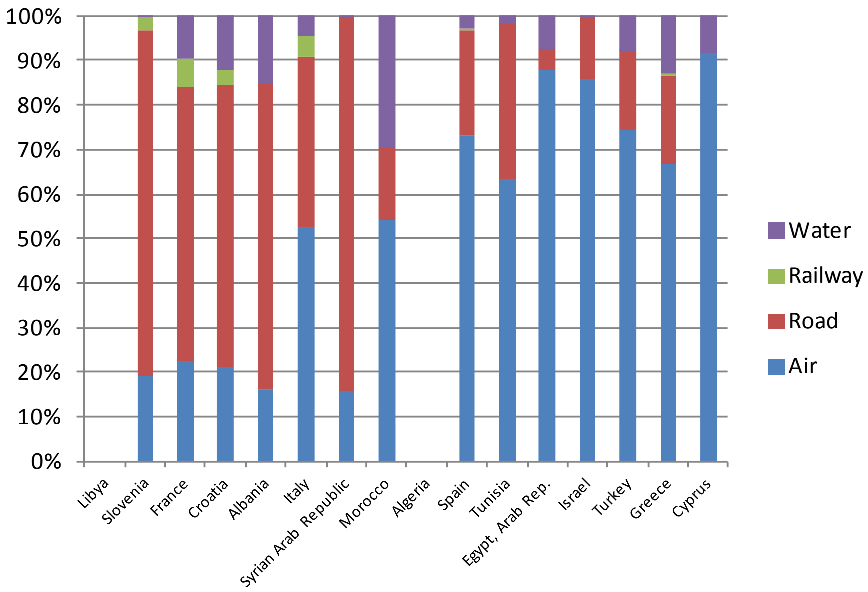
To reach these ambitious objectives, all activity sectors need to be involved. The tourism sector interacts closely with the transport and building sectors and is therefore a target sector for energy policies.

2. Challenges and opportunities in adapting tourism to the new energy context

2.1. Risk of the tourism industry not adapting to the new energy context

The tourism industry is booming, especially in certain SEMCs. Tourism transport (automobile or air transport) continue to have a strong dependency on petroleum products.

Figure 4 - Distribution of tourism transport modes by incoming country (%) (2006)

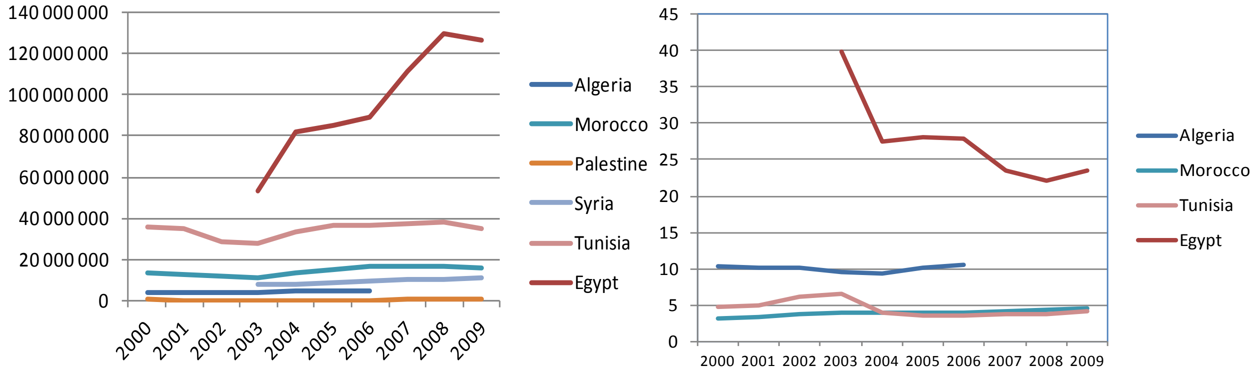


Source: Plan Bleu, 2010

Energy consumption is high in tourist accommodations and varies from country to country (in relation to their level of equipment and national energy policies: thermal regulations, pricing policy, etc.).

Some data collected during the study on energy efficiency indicators gives numbers on unit consumption in hotels per overnight stay. It seems to be stabilizing or even decreasing, partly due to higher occupancy rates in hotels.

Figure 5 - Total number of nights in hotels and energy consumption per overnight stay (kgep/night)



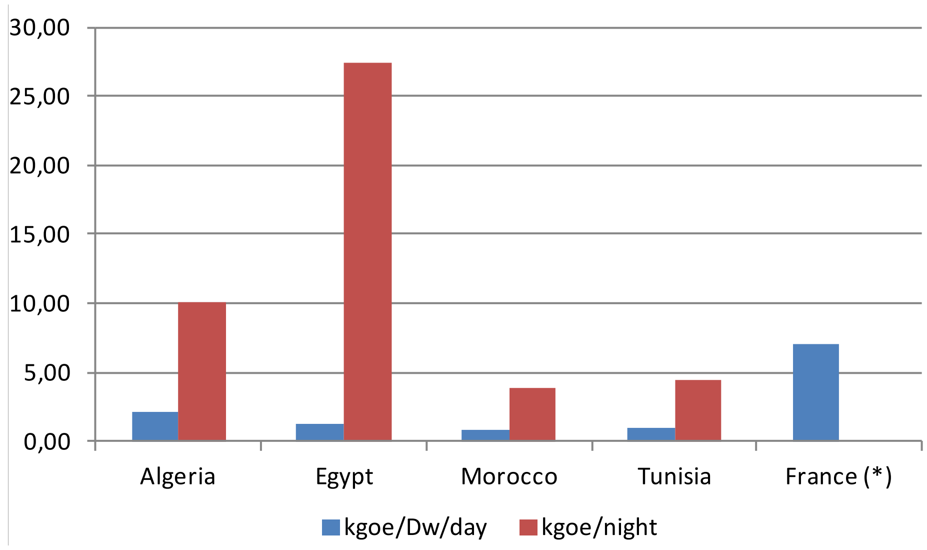
Source: Plan Bleu – national indicator studies, 2012

In a context of increasing overnight stays, **the relative improvement of energy intensity in tourism**, if it indicates a degree of optimization of the industry's energy footprint, raises the question as to the industry's ability to reduce its overall energy consumption and related emissions.

Its reliance on non-renewable resources, whose prices tend to be on the rise, makes it vulnerable and even unable to adapt. This problem must be taken into account in the medium and long term and be integrated immediately into the planning of tourism supply (transportation and accommodation).

This problem is combined with **inequality in the use of resources between local populations and tourists** as shown in Figure 6. The levels of consumption from tourism are similar to those in the residential sector in Northern Mediterranean countries (case of consumption per French household). Policies encouraging reduced consumption and differentiated from the local residential sector should be implemented even though given the differences in consumption, it seems that access to energy in these destinations is not yet a constraint.

Figure 6 - Energy consumption per household per day vs. energy consumption per overnight stay (kgep)

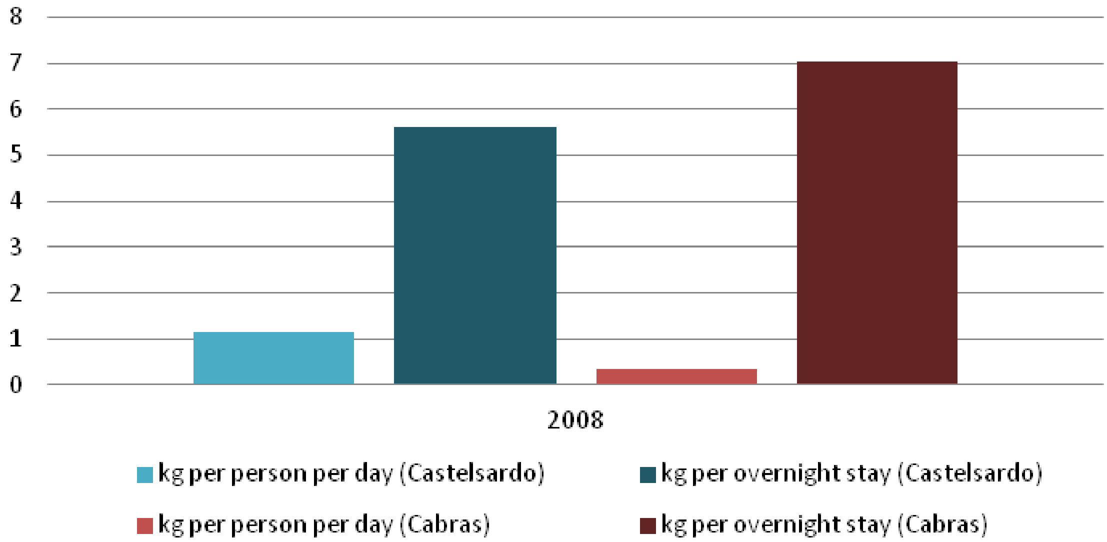


Source: Plan Bleu - national indicator studies, 2012

(*) For France, MEDDE data, Observation and Statistics Department, and assumption of an occupancy rate of 2.27 persons per household.

The difference between the energy consumption of the local population and that of tourists is also seen in other sectors such as water and waste, as shown below (Figure 7) at the level of tourist destinations.

Figure 7 - Difference in daily waste production between the local population and tourists in Cabras and Castelsardo (Sardinia, Italy)



Source: Plan Bleu, 2011

2.2. Can the tourism industry bear a share of energy efficiency and renewable energy development policies?

The tourism industry has high unit consumption rates. Just as in the building sector in the broad sense, there are many potential ways of making energy savings. They could present minimal reduction costs that would be lower than those in the local residential sector. This situation must incite energy policies to focus on tourism infrastructures, and even more so that **it is easier to implement investments than in the residential sector for the following reasons:**

- Identified decision-makers that can easily collaborate and who have access to investments;
- The organisational ability of decision-makers to integrate energy efficiency and renewable energy development actions;
- More limited technical fields.

Improved synergy between the needs of the tourism sector and local resources also creates opportunities. The use of **local resources** (materials, food supplies, etc.) could reduce the energy footprint (by reducing the supply chain) and could generate economic activities that create local jobs.

However, this high unit consumption combined with **load capacity problems** forces some regions to develop supply infrastructures (production tools and related transport and distribution networks) to meet consumption demand.

This is reinforced by other additional energy needs required to manage other resources. In the case of drinking water supply, the use of unconventional resources (such as desalination) are highly energy consuming (desalinating 30 million m^3 of water per day is equivalent to 5,000 MW of electrical power, i.e. 8 to 10 combined cycle gas turbines or 4 to 5 nuclear units). At the least, these additional energy needs must be taken into consideration in an **"energy neutrality"** perspective by relying on a combination with renewable energies and upstream management of water demand.

2.3. Energy, tourism and load variations at the local level

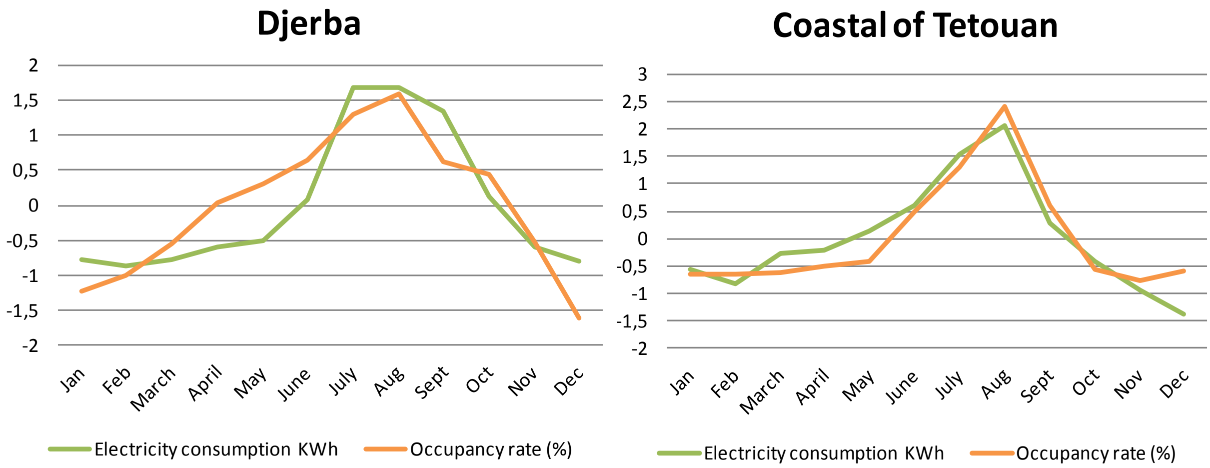
In the case of mass tourism, the development of tourist destinations generates needs that have a high energy impact (airports, accommodations, leisure activity infrastructures, etc.) and that are designed based on maximum tourist flow (i.e. the **seasonal peak** of the destination).

A major issue comes up in the search for a balance between the identified needs and the availability of local resources: the **"load capacity of territories"**, as highlighted by Stefanos Fotiou, Tourism Coordinator of the United Nations Environment Programme.

The question must therefore be raised as to how this load can be managed in order to spread it out more evenly over time without increasing the maximum load value at the risk of creating negative impacts on the environment of the destination. This is even more crucial as local populations with increasing needs may end up suffering the consequences.

For example, in Torremolinos (Spain), electricity consumption (of which tourism accounts for about 40%) increased by 160% between 1989 and 2008, rising from 124 to 322 GWh per year. In Alanya (Turkey) during the period 2000-2008, total electricity consumption (to which tourism contributes 21%) rose from 199 to 615 GWh, i.e. an increase of 208%. On the Tetouan Coast (Morocco), electricity demand doubles in the summer. In Djerba, electricity demand triples during the seasonal peak in August (Figure 8).

Figure 8 - Seasonality of electricity consumption vs. monthly occupancy rates on the Tetouan Coast (2010) and Djerba (2008)



Source: Plan Bleu, 2011

This maximum load problem is concentrated in space and time and is similar to the problem in the water and waste sectors. The design of supply and treatment facilities and determining the related investments will result from the ability to regulate and **spread out the load** in order to decrease maximum power (peak effect). Regulating this load poses problems in arbitrating between uses in different sectors (tourism, energy, agriculture) and in terms of users (tourists, local population).

One solution involves **spreading out tourist traffic** and thus the impact on resources. Accommodation and resource management infrastructures could be designed on a smaller scale while maintaining the destination's total annual capacity. Diversification of the tourist product will also be necessary in order to adapt to activity periods spread out more evenly over time.

II. Transport and the building sector: avenues for energy improvement for tourism

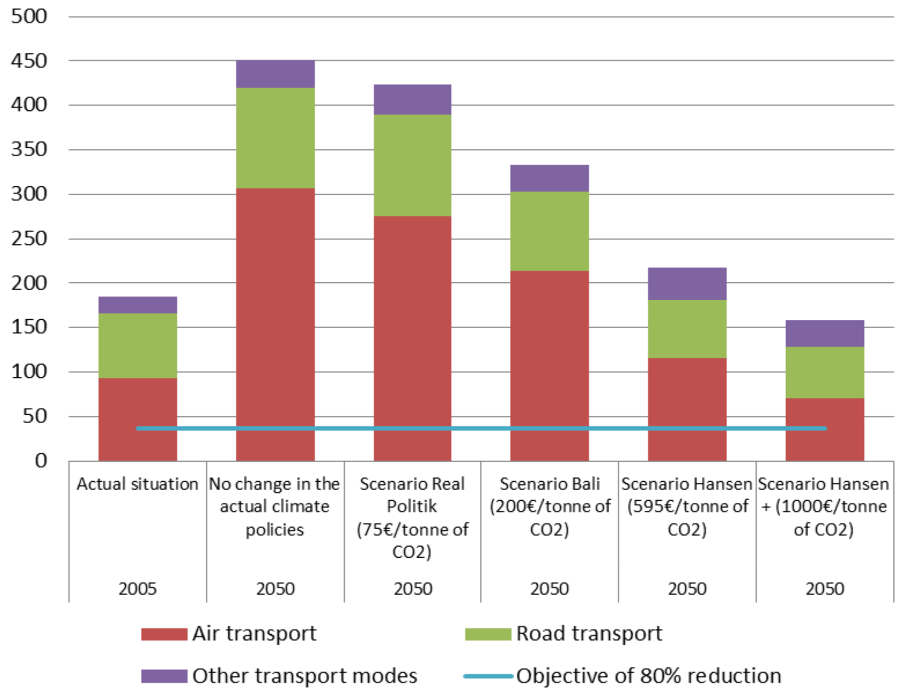
1. Transport and tourism: a (non)-reducible need for energy?

Prospective work on "carbon" issues related to air transport and tourism was carried out on a Mediterranean level[1]. The recommendations proposed for reducing air transport greenhouse gas emissions generated by tourism are as follows:

- Optimising the seat occupancy rate on aircraft;
- Promoting modal networks;
- Promoting domestic tourism with residents in SEMCs.

Change scenarios for emissions were formulated according to several hypotheses based on the choices of energy policies and regulation of greenhouse gas emissions shown in Figure 9.

Figure 9 - Change in CO_2 emissions under scenarios and economic contexts in the Mediterranean (million of tonnes)



Source: Plan Bleu, 2012

In order to facilitate decision-making and optimise potential investments in infrastructures, a deeper understanding must be achieved of the interaction between mobility supply and demand in the tourism industry. The issue in this case would not be to challenge the freedom of movement of individuals but to re-evaluate the transport modes used and different ways of travelling.

A tool that can be applied at the level of tourist destinations could be developed. Its aim would be to evaluate the energy content of several routes for the same trip using several transport modes (ones that already exist or that result from developing a modal network that limits the energy impact). It would be used by decision-makers on the tourism supply side and tourists on the tourism demand side.

[1] *Management of energy, air transport and tourism in the Mediterranean.* Final report, TEC, Plan Bleu, 2011.

It would be based on the number of monthly arrivals by distance class according to the carbon intensity of the transport modes used. Using this data at the level of a destination would provide answers to the following questions:

1) What are the determining factors of carbon intensity associated with the transport modes used by tourists in a given destination, knowing that:
   - is the relationship with energy taken into account by tourism demand? By tourism supply?
   - what is the elasticity of supply to variations?
2) Based on the distance class and use by tourists, what transport mode should be promoted, particularly in terms of infrastructures, in order to reduce greenhouse gas emissions?

Calibration of the tool would also need to include:

- Several choices of basic hypotheses for the model: desired total travel time (travel time and vacation time), financial cost, greenhouse gas emissions produced, etc. that would allow the energy footprint of a destination to be quantified (in its entirety, starting point – destination approach);
- A few pilot cases distributed according to a typology of destinations in order to use references on the potential improvement of the energy and carbon balance of targeted destinations;
- Optional modules to offset some of the constraints (time, cost) of one transport mode compared to another: develop a supply of services associated with rail travel, joint ticketing for several transport modes, more diverse type of accommodation, luggage transport, etc.;
- For continental connections, modal transfer from road and air to rail transport for tourist travel would increase rail transport demand. This would justify the choice of decision-makers to invest in rail infrastructures and urban and interurban transport rather than airports. This approach is one of the commitments made by the European Union within the framework of transnational transportation networks;
- For connections where the Mediterranean needs to be crossed, various travel scenarios should be drawn up and include a specific module where the maritime transport option would be introduced.

Simulations of **"isoenergetic destinations" could be conducted and distributed**.

Once calibrated, the tool would allow decision-makers (local, national and European Community elected officials) and investors (notably banks) to simulate investment plans based on various hypotheses of choices of infrastructures.

It would then be possible to concretely evaluate the leverage opportunities to be developed and integrated into an approach that Ban Ki-moon resumes as follows: "we must change our lifestyles and rethink the way we travel".

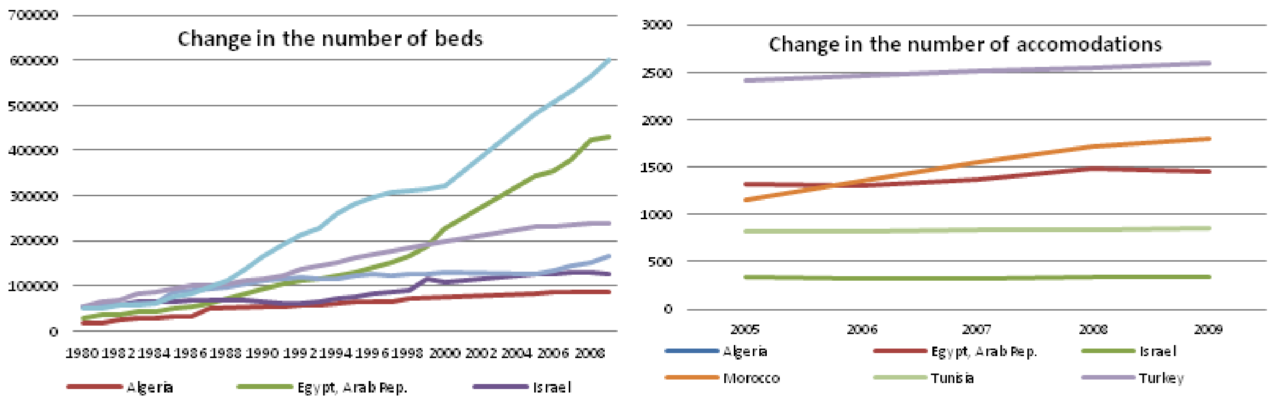
2. The tourist building industry: energy, environmental, economic and social opportunities?

2.1. The key role of the building industry

The Mediterranean basin is home to some 450 million people, who consume almost 1000 million tons of oil equivalent (Mtoe) of energy each year, i.e. around 8.2% of global demand. Cities constitute the hub of energy consumption, particularly in the SEMCs, where « fossil dependency » is in excess of 90%. The building industry accounts for about 38% of final consumed energy, with the residential sector consuming between 21% and 51% of national electricity production, depending on the country. According to Plan Bleu studies, approximately 42 million new dwellings should be built in SEMCs by 2030, increasing from 66 million in 2007 to nearly 108 million. The priority is to meet the urgent needs of populations, which creates vast construction sites where the energy issue is actually sometimes considered secondary. In addition to this rapid construction context is the existence of a large informal sector in SEMCs.

Within this housing dynamic, the tourist industry generates significant construction demand in SEMCs, as shown in Figure 10.

Figure 10 - Change in the number of beds and number of accommodations in the main SEMC tourist countries



Source: Plan Bleu, 2012

In the hotel industry, the number of beds increased by 513% between 1980 and 2009 for all SEMCs. On a country level, over the same period, the most significant rates of change were in Egypt with 1,346% (increase from 29,664 beds in 1980 to 429,000 beds in 2009) and in Turkey with 1,119% (increase from 49,267 beds in 1980 to 601,000 beds in 2009).

The numbers point to the growth and dynamics of the tourism industry. It represents significant market share of the construction industry in both new-builds and renovations.

More ambitious objectives could therefore be established by type of tourist construction (category of hotels, camp grounds, resorts, houses, apartments, etc.). They could come from regulations as well as proactive measures by the tourist industry itself. The cost-efficiency of measures, associated transaction costs, the specific constraints of the tourism industry (building and construction regulations, land issues, construction periods working around the tourist season, etc.) for the construction sector must be evaluated in each country and for each type of construction.

Finally, even more so than the residential sector, the adaptation, optimisation and even **renovation of the existing stock**, particularly hotels, must be studied closely given the average age (20 years for developing destinations and 30 years for mature destinations) along with the initial construction processes used.

2.2. Energy efficiency measures and development of renewable energies in tourism construction

2.2.1. Energy efficiency

An evaluation of the potential for energy efficiency in the residential sector was carried out based on the introduction of five technical measures:

- efficient shells;
- thermal renovation;
- solar water-heaters;
- efficient lightning;
- efficient electric household appliances (air conditioning and warming).

The following rates of penetration targets were selected:

Table 2 - Rate of penetration of EE measures in the residential - Horizon 2030

	Existing residential			New residential		
Large-scale disseminated measures	**2010**	**2020**	**2030**	**2010**	**2020**	**2030**
Large-scale dissemination of efficient shells for new buildings				13%	50%	80%
Thermal renovation of existing buildings	1%	10%	30%			
Efficient lighting	20%	100%	100%	20%	100%	100%
Dissemination of efficient electric household appliances, heaters and air-conditioners	10%	50%	100%	10%	50%	100%
Dissemination of solar water heaters	7%	20%	30%	5%	25%	35%

Source: Plan Bleu – regional study on energy efficiency in the building industry, 2010

Penetration targets still remain to be applied to the tourism industry. They will depend on the ability of tourism operators to invest in these techniques. Creating a database of the building stock of the tourism industry and primarily the formal hotel sector would contribute t**o simulating the potential energy savings associated with a range of energy efficiency actions**. This would make it easier to break down the rate of penetration targets as close to reality as possible.

Just as for the residential sector, rates of penetration must also be adapted based on the following:

- The geographic location of facilities and associated weather conditions;
- The use of buildings and associated energy needs, noticeably different during tourist stays from local daily life.

A solution to thermal comfort needs that is based solely on equipment (heating, air-conditioners) would increase already high energy consumption in SEMCs.

As a key priority for action, energy efficiency in buildings depends on the following:

- The design/renovation of building shells;
- The use of high performance equipment;
- How the occupants of buildings use energy.

For the last two points, the tourism industry is often affected by one-upmanship with respect to equipment and therefore electricity (air-conditioning, appliances, etc.).

Performance levels must be proposed for different types of buildings whether new or existing. They should be consistent with the aim to spread out the tourist season.

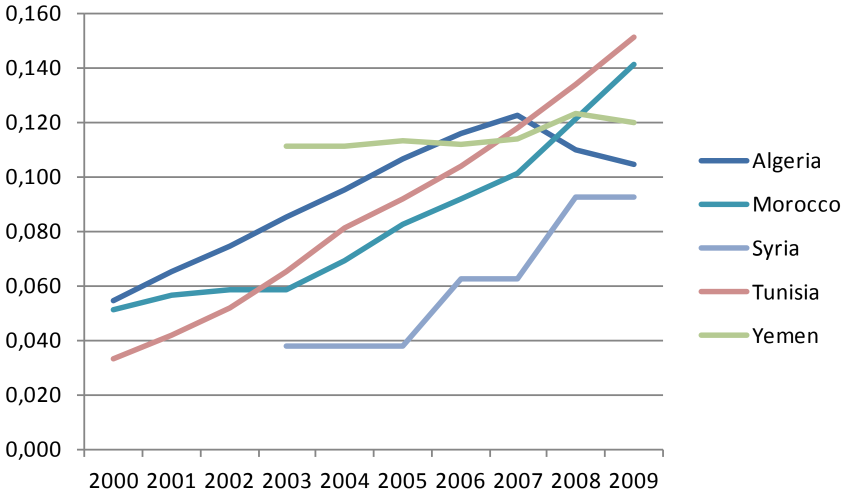
Actions on building shells should aim to achieve thermal comfort in the summer and winter while requiring minimal external energy needs. Actions on equipment will concentrate on improving the performance of units, particularly electrical appliances. Air-conditioning and heating systems must be designed once the building shell is optimized.

Although there is no precise data on the rate of penetration of air-conditioning in the tourism industry, it can be imagined that it is much higher than the average in the residential sector, especially in the hotel sector. The systematic use of air-conditioning clearly influences the demand for electrical power at the local level. When buildings are designed, alternatives to electric air-conditioning should be encouraged and targeted temperature recommendations should be revised.

The tourism industry could play a leading role in integrating all of these measures in both new-builds and renovations.

In SEMCs, particular attention must be paid to the role of the informal sector in construction (up to 60% of new-builds). However this role must be balanced given regulatory controls. Tourism construction can therefore be considered as one of the primary sectors to be made a priority for energy efficiency policies.

Figure 11 - Change in air-conditioning in the residential sector (unit/dwelling)



Source: Plan Bleu – national indicator studies, 2012

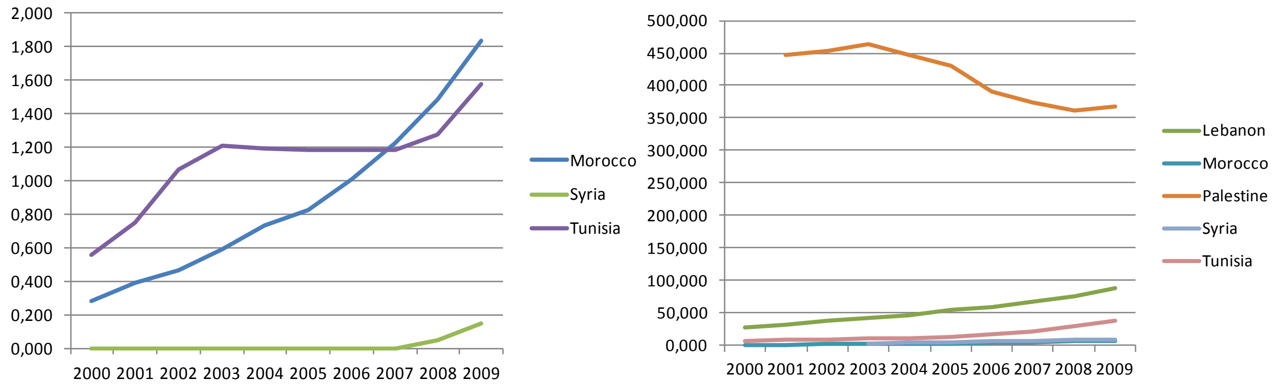
2.2.2. Use of renewable energies

The use of renewable energies can be considered:

- **In construction** in order to meet electricity (photovoltaic) and heating (solar, biomass) needs;
- **On tourist sites** to contribute to the production of local renewable energy (photovoltaic, small wind turbines, geothermal energy, biomass).

In SEMCs, and particularly coastal areas benefitting from high sunlight and mild weather conditions, domestic hot water needs could be met by solar heating. This sector is growing with variations from country to country depending on energy pricing.

Figure 12 - Change in the use of solar hot water in tertiary and residential sectors (m²/1000 persons)



Source: Plan Bleu – national indicator studies, 2012

Tourism real estate and particularly collective accommodations must integrate into this dynamic or even draw from the local equipment market. Shared supplies and facilities between sites could contribute to the local structuring of a market combining the supply and even the manufacture of renewable power generation equipment and the installation of systems by specialized local businesses. With the major international tourism operators, corporate policies stemming from their sustainable development commitments must be implemented and systematically aim to use renewable energies in construction.

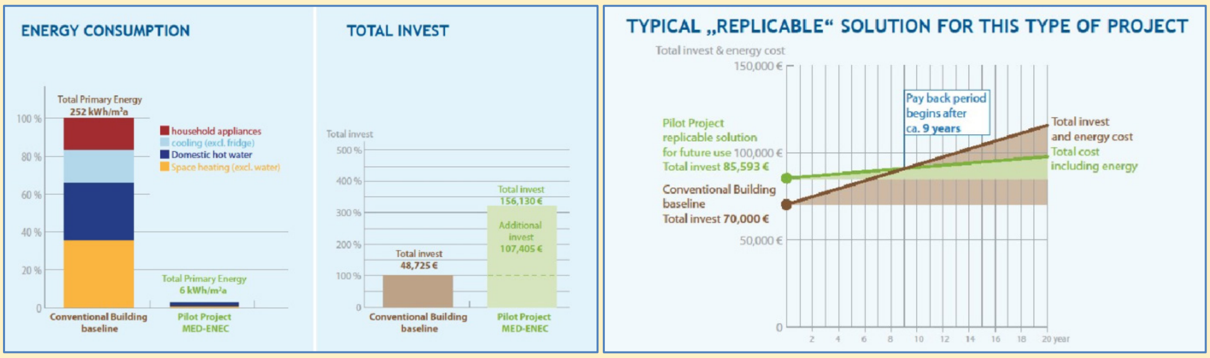
Onsite production using renewable energy sources, particularly electrical, must be considered based on the local resources: sun, wind, hydraulic, biomass, geothermal energy, etc. Development of this type of power generation must be supported through decentralized production that limits the use of substantial production and transport infrastructures. For certain types of tourist projects, systematic evaluations of renewable power generation opportunities must be encouraged. The practices used in island destinations[2] could be applied to continental destinations **in a sustainable energy territory approach, meaning a territory that is able to meet controlled energy needs by making local renewable resources a priority with the aim of achieving sectoral energy self-sufficiency.**

However, it must noted that the economic balance of facilities will depend on local pricing and regulatory conditions for production integration. An economic model that makes tourism a stronger factor (compared to regular local players) in the decision to finance equipment should be considered. The positive impact on reducing the electrical load in distribution grids should also be taken into account in the overall analysis of facilities.

Example: The Green Hill Project in Tunisia (Energy Globe award 2007)

This demonstrative project backed by MED-ENEC (European project, Plan Bleu partner on building and energy efficiency indicator issues) aims to build an eco-tourism complex set to open in 2013.

Numerous energy efficiency techniques have been put in place. Energy consumption compared to traditional buildings was significantly reduced by using sophisticated technical resources. This type of project could potentially be used on a widespread basis and would lead to a return on investment in less than 10 years.



More information at:

http://www.greenhill-tn.com/

http://www.med-enec.org/fr/building-projects/pilot-projects/tunisia/pilot-project-tunisia

In summary, the tourism building sector can both:

- Damage the local energy situation, by increasing load constraints associated with seasonality;
- Present an opportunity to launch a local investment dynamic that relies on energy efficiency and renewable energies while driving other sectors in the building industry.

[2] Malta and the Balearic Islands have been developing alternative power generation methods in the hotel industry since the 1980s. These alternatives use other energy resources for local needs such as desalination, etc. See BOYE, Henri. 2008. *Water, energy, desalination and climate change in the Mediterranean.* Regional study. Sophia Antipolis: Plan Bleu.

III. Opportunities and implementation of specific energy policies in tourism

1. Opportunities for job creation in tourist destinations

The tourism sector interacts closely with the local economy. It can account for up to 10 to 15% of a destination's GDP. Financial riches generated by tourism could be used in the construction industry and create a ripple effect in mobilising local economic players and improve the quality of the local building sector.

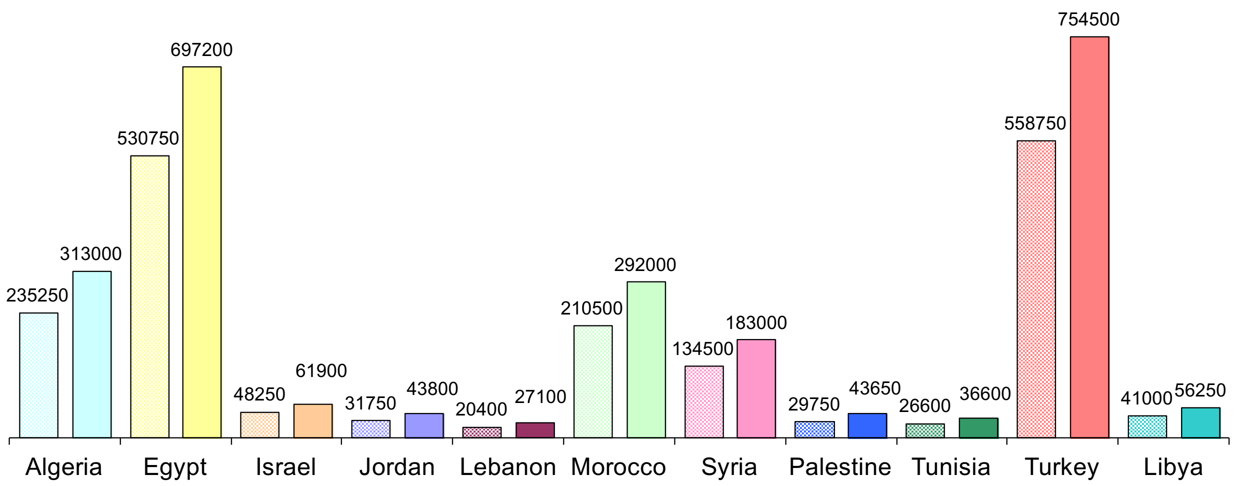
In some cases construction and renovation volumes generated by tourism could be the first step in structuring certain local sectors (materials, for instance). In terms of employment, the following can be distinguished:

- Jobs associated with investments: materials, equipment manufacturing, construction, etc.;
- Jobs associated with the operation of tourism amenities: managers, energy managers, etc.

Economic aspect of implementing these measures in the tourism industry

The building industry is booming in SEMCs and it is particularly sensitive to energy efficiency and renewable energy use measures, as shown in the Plan Bleu study on the impact of energy policies on employment and training. Approximately 2 million new jobs (in addition to the 14 million jobs in the construction sector) could be generated by improving energy efficiency in buildings. In the country breakdown shown below (Figure 13), it would be relevant to identify in the job creation potential of the residential sector how much corresponds to tourism needs in terms of infrastructures and accommodation in the new-build sector as well as for renovations (a technical field not integrated exhaustively into this study).

Figure 13 - Total potential for job creation in SEMCs from energy efficiency measures in the residential sector for 2030 (upper and lower case scenarios)



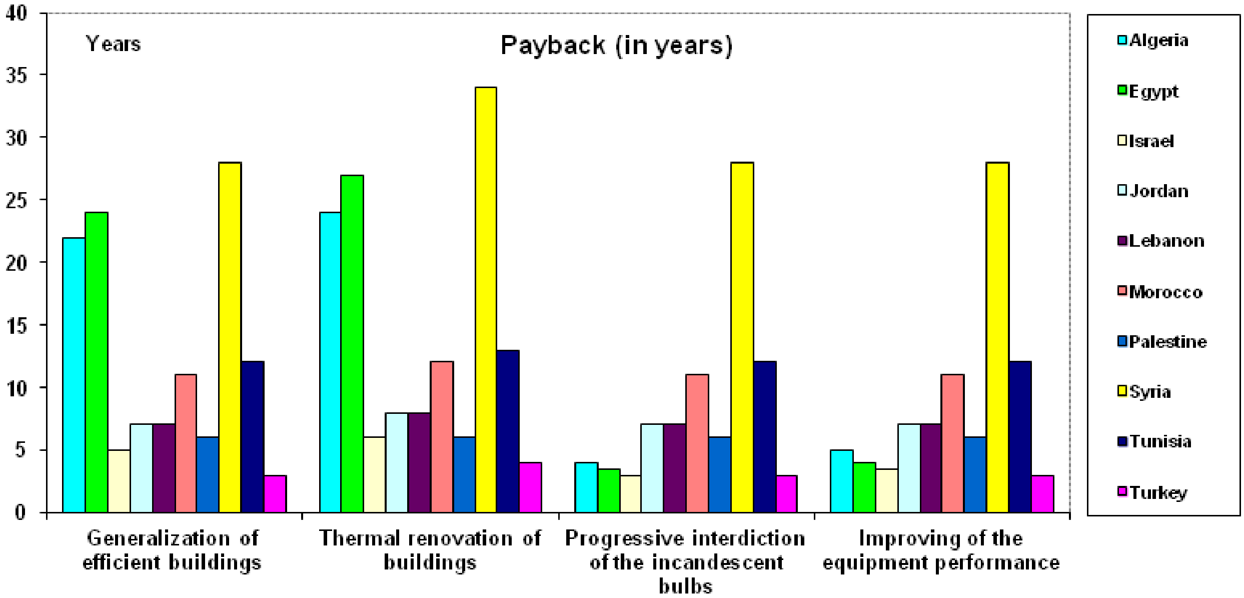
Source: Syndex estimates

In this perspective, **industrial opportunities** could emerge from the market generated by tourism needs. **Geographic networks must be defined** around a project or a group of projects (for example, hotel resort areas) in order to put construction groups in place enabling associated material needs to be shared and through economies of scale, to contribute to structuring a local construction sector. This rationale could also be applied to energy equipment in the building sector.

A programme-based approach to future projects in the tourism industry would help correlate them with the construction needs of the host destination. This collective approach to managing human resources would also facilitate the integration of tourism infrastructures.

Progress made in energy efficiency in the building sector shows that based on the structure of the energy sector in the country (pricing, maturity of the equipment market, etc.) the speed of return on investment varies depending on the technical measures adopted. The tourism sector likely fares better than other building sectors in terms of the profitability of energy efficiency measures, particularly for large-scale accommodations (hotels, residences).

Figure 14 - Speed of return on investment of energy efficiency measures by country



Source: Plan Bleu – Building sector, energy and climate change study, 2010

Precise knowledge must be gained of economic balances for each country, climate zone and type of project in order to facilitate the integration of these measures into the tourism industry. Investors would then be able to prioritize building projects, whether they are new-builds or renovations.

2. Territorialising the tourism industry: redefining sector governance on a local level

Improvement of the energy performance of tourism infrastructures (building alternative power generation sources, renovation and construction in the building sector, etc.) and organisation of political decision-making must be coordinated on one or several administrative levels. Energy performance must also be improved by reconnecting tourism with the territory on which it operates as part of its logical development.

Firstly, tourism activities must be strategically **planned** in consistency with other activities and the economic, social, environmental and cultural potential of the destination. This type of planning would enable projects to be developed with the goal being to **balance the energy needs of the destination** and its population (housing, employment, mobility needs, energy poverty, etc.) **with its energy resources** to achieve overall social economic and environmental improvement (local employment, training, artisan work, industrialisation of certain processes, supply chains and related logistics, etc.).

In order to strengthen the synergy between the tourism building sector and the local building sector, they must be **coordinated with the geographic fabric of the tourism areas**.

Regional planning methods adapted to tourist destinations could integrate a component aimed at optimising consumption (reduction) and power generation (increase) based on the resources available (natural resources, infrastructural resources and human and epistemic resources).

At the local level, **areas of governance** bringing together public and private players from tourism, energy and other sectors (water, solid and liquid waste, building sector, natural areas management, etc.), could also be put in place. The goals of these areas of governance would be to share and validate assessments of the state of sustainability of tourist destinations, as well as to collectively map out their potential futures and develop an action plan aimed at enhancing local areas of potential.

3. A common need for a bottom-up approach and scenarios

The overall consumption of the tourism industry is not identified as such in national energy balances. Its contribution is a combination of various areas of consumption: building stock, transport associated with tourist flows and movement.

The tourism sector must therefore be able to rely on **standardised methodologies** in order to avoid any energy accounting errors (e.g. doubling the energy footprint of a destination in the transport between outgoing and incoming destinations).

It is also extremely difficult to measure the share of energy consumption from tourism in the infrastructures sector and therefore difficult to measure how tourism influences its load capacities. This is also combined with the issue of varying consumption due to the seasonal nature of tourism.

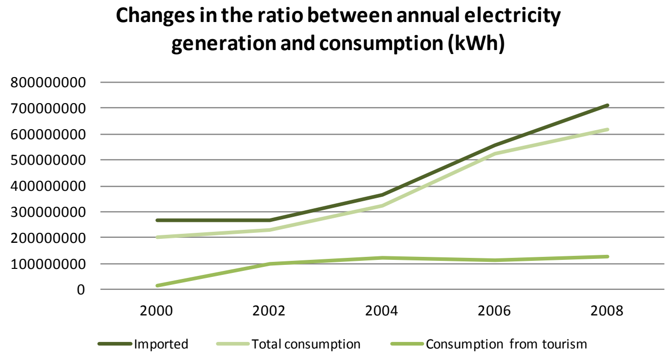
The following could be achieved on a sub-national level from obtaining this data:

- Optimisation of the load capacity of infrastructures based on both tourism energy needs and the energy needs of the local population;
- An answer to a major question regarding the interest of becoming a tourist destination in order to become equipped with infrastructures: if tourism enables a destination to gain infrastructures, how much energy production would go to the use of the local population and how much would supply tourism infrastructures (accommodations, leisure activities, etc.)?

To demonstrate the relevance of a bottom-up approach to producing data, the work carried out on "Profiles of sustainability in some Mediterranean tourist destinations" applied on a NUTS 3 or NUTS 5 analysis level produced important data concerning:

the contribution of tourism (mainly in terms of accommodation) to the electricity consumption of destinations and the dependency of some of them in terms of a source of supply (importing);

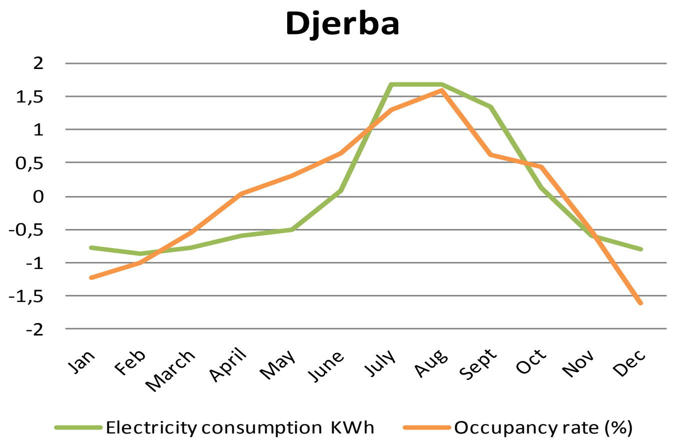
Figure 15 - Alanya (Turkey)



Source: Plan Bleu, 2011

the monthly electricity consumption of the hotel sector.

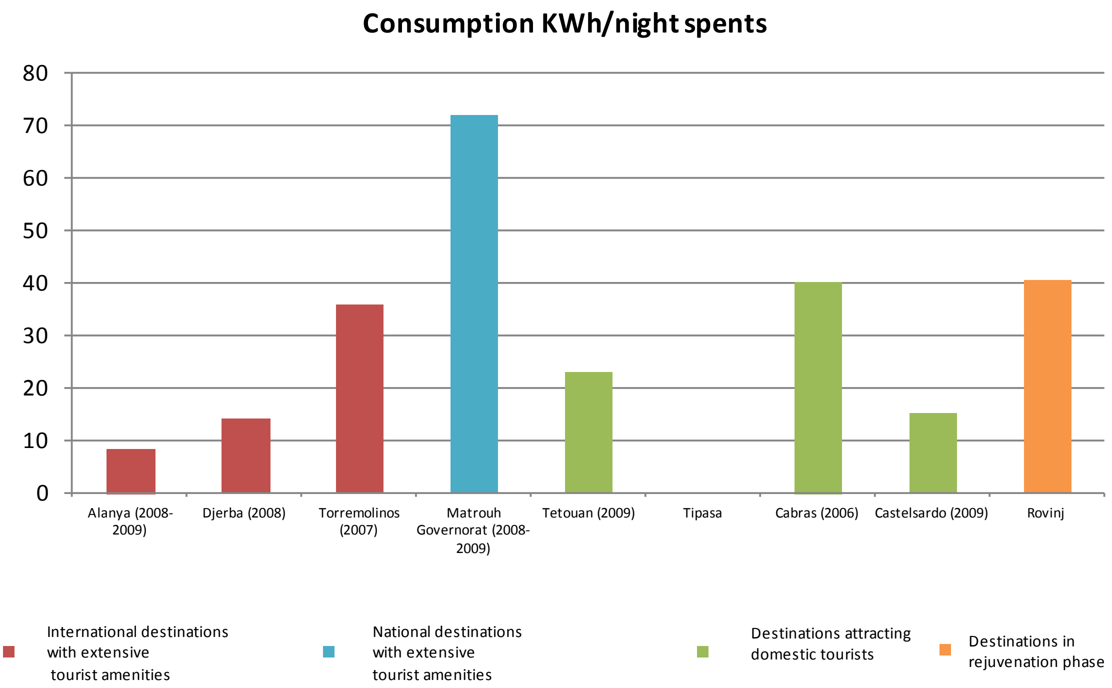
Figure 16 - Djerba in 2008 (Tunisia)



Source: Plan Bleu, 2012

The work made it possible to compare the differences in electricity consumption per overnight stay between the different types of tourist destinations studied. It is very clear that highly equipped international tourist destinations such as Alanya in Turkey and Djerba in Tunisia consume less electricity per overnight stay than other destinations in the sample studied (Figure 17). Therefore even though electricity consumption is increasing significantly as an absolute value (from 199 Gwh in 2000 to 615 Gwh in 2008), the energy efficiency of electricity consumption is improved through the number of overnight stays.

Figure 17 - Electricity consumption per overnight stay in studied tourist destinations



Source: Plan Bleu, 2012

3.1. Improving knowledge through a bottom-up approach

The search for data on the interaction between tourism and energy highlights the need to use a bottom-up approach that could initially fill in the gaps in supplying databases on tourism and energy at a pilot site level. A set of indicators on these two topics has been identified using work conducted by Plan Bleu. These indicators could constitute the basis for a common information system.

As an illustration, the approach used within the framework of the component "Profiles of sustainability in some Mediterranean tourist destinations" makes it easier to determine electricity consumption from tourism (see the list of indicators selected in the Appendices, Table 5) in the overall evaluation of the sustainability of a tourist destination.

The energy efficiency indicators that were developed are organized by type (general indicators on energy production and consumption, energy bills, energy intensity, carbon, etc.) and by activity sector concerned.

Combining tourism and energy indicators could rely on “macro” (Appendices, Table 6), “energy transformation” (Appendices, Table 7), “tertiary” (Appendices, Table 8), “residential” (Appendices,Table 9) and “transport” (Appendices, Table 10) indicators.

Once their local reliability is established, these energy indicators could contribute to qualifying the sustainability of a destination. In this case, it is important to develop an information system where common indictors are used.

Table 3 - Selection of common tourism and energy indicators

Indicator Origin	Abbreviation	Indicators	Unit
Energy	EDR	Energy dependency rate	%
Energy	RFEPE	Ratio of final energy consumption to primary energy	%
Energy	REB	Ratio of local energy bill to GDP	%
Energy	AECH	Average primary energy consumption per capita	ktoe/1000 persons
Energy	AELCH	Average electricity consumption per capita	MWh/capita
Energy	FEITS	Final energy intensity for the tertiary sector	toe/LC
Energy	TEBR	Ratio of energy bill to added value in the tertiary sector	%
Energy	TELSR	Ratio of public subsidies for electricity to added value	%
Energy	HECNG	Energy consumption per night per guest	kgoe/night/guest
Tourism		Percentage of energy consumed by the tourism industry compared to the total quantity of energy consumed	%
Tourism		Energy Consumption in luxury hotels (5 Stars) per night	kWh / capita / night
Tourism		Energy consumption in superior category hotels (4 Stars) per night	kWh / capita / night
Tourism		Energy consumption in standard category hotels (3 Stars) per night	kWh / capita / night
Tourism		Energy consumption in tourist category hotels (2 Stars) per night	kWh / capita / night
Tourism		Energy consumption in budget category hotels (1 Star) per night	kWh/ capita / night
Tourism		Energy consumption in rental apartments (all categories included) per night	kWh / capita / night
Tourism		Energy consumption in all other dominant types of tourist facilities in the studied area (all categories included) per night	kWh / capita / night
Energy	UEICD	Unit electricity consumption per dwelling	kWh/Dw
Energy	SCEIM²	Specific electricity consumption per m²	kWh/m²
Energy	RIPE	Intensity of residential sector	toe/LC
Energy	RDRSHR	Distribution rate of solar water heaters in the residential sector	m²/1000 persons
Energy	ERACR	Equipment rate of air-conditioning in the residential sector	Unit/Dw
Energy	ERFR	Equipment rate of refrigerators in the residential sector	Unit/Dw
Energy	TrFEI	Final energy intensity in the transport sector	toe/LC
Energy	EUCC	Average unit energy consumption of vehicles	kgeo/vehicle/year
Energy	EUCC G	Average unit energy consumption of vehicles (gasoline)	kgeo/vehicle/year
Energy	EUCC D	Average unit energy consumption of vehicles (diesel)	kgeo/vehicle/year
Energy	AEFTS	Average emission factor of the transport sector	$teCO_2$/TOE
Energy	MR	Motorisation rate	persons/vehicle
Energy	ICO_2	CO_2 intensity in the transport sector	$teCO_2$/LC
Energy	SCRW	Specific consumption of rail transport	kgeo/ p.km
Energy	SCAT	Specific consumption of air transport	kgeo/ p.km
Energy	SCMT	Specific consumption of maritime transport	kgeo/ t.km
Energy	SEAT	Specific emission factor of air transport	$kgeCO_2$/p.km
Energy	SEMT	Specific emission factor of maritime transport	$kgeCO_2$/t.km

3.2. Developing scenarios and producing simulations: a key to sustainable planning in tourist destinations

Inputting data, maintaining and updating tourism and energy databases on a sub-national level would:

- Enable **simulations to be carried out on a local level** (for instance as part of planning exercises conducted by local decision-makers and of interest to investors in the tourism industry);
- Contribute to **regional prospective** work (through comparisons between destinations within the scope of sustainability profiles).

The development of **energy scenarios for the tourism industry** could be based on a business-as-usual hypothesis correlating consumption in the industry with the general growth trend for energy demand. Secondary hypotheses must then be integrated into scenarios and simulations (sensitivity to climate change, to demographics, to the economic context, to energy prices, etc.).

Based on these hypotheses, **three scenarios** could be proposed:

- A business-as-usual scenario reflecting the impact of tourism on energy consumption (based on current trends, i.e. with a tourism industry that is affected little by regulations);

- An intermediate scenario based on investments that improve the energy performance of tourist accommodations and transport, leisure, drinking water supply (desalination plants, etc.) and waste water treatment infrastructures without actually diversifying energy supply sources;
- A breakdown scenario: the energy supply of tourist accommodation structures and tourist infrastructures would be completely autonomous, particularly through the use of alternative energy sources, which would free up energy power consumed by tourism to supply basic urban service infrastructures. In the transport sector, means with less carbon intensity would be mobilised using adapted infrastructures.

3.3. Tracking changes in the state of destinations' sustainability: using observatories as decision-making tools

Carrying out this type of work requires **associated organization** in order to collect and process data. It is important to rely on existing programmes and players in order to put their work to use but especially to create a network of local sectoral observatories.

Existing work (such as in the case of the Odyssee Project http://www.odyssee-indicators.org), could be used for projects on common indicators and the management of related data. An approach such as INSPIRE (European Directive 2007/2/EC - Infrastructure for Spatial Information in the European Community) could even be explored. **Tourism could become a pilot sector**.

As for creating a network of sectoral observatories and databases associated with pilot destinations, a comprehensive database could be built (for instance within the framework of a regional and/or multi-national information system).

4. Coordinating labels/certifications and standards with local specifications: a sign of quality and sustainability

Tracking indicators would facilitate the analysis of changes in energy consumption of destinations in order to modify regulations and standards in effect. On the other hand tracking "label and certification" specifications, particularly in the tourist accommodation sector, would feed the databases of local sectoral observatories.

In a wider context of improving the sustainability of Mediterranean tourist destinations, feeding data into energy and tourism databases would contribute to:

- Defining a reliable state of sustainability of tourism, particularly in terms of energy consumption;
- Depending on the state of sustainability, defining objectives to improve tourism in the form of an ethical and political commitment within a charter and of a political and technical commitment within the scope of local specifications such as Agenda 21.

Improving the energy performance of a tourist destination would reduce energy costs currently covered by public authorities. Reducing energy dependency on both the sub-national and national level would generate local revenue that could then be put towards job creation to improve tourism sustainability.

Table of illustrations

Appendices

Table 4 - Reminder of interactions raised within the framework of the study "Energy and climate change in the Mediterranean", 2008, Plan Bleu

Adaptation and contribution to reduction approach	2035 reduction scenarios	Identified leverage tools
Environmental management of facilities and systems	Four scenarios relying of changes to transport modes (improvement of energy efficiency), modal transfer	Use technical advances to achieve improved energy efficiency in transport and the building industry
Diversification of tourism supply (3S)		Reduce air transport to reduce related emissions through air transport taxes
Reduction of seasonality		Improve local climate forecasting
		Promote proximity tourism

Table 5 - Indicators used in the study "Profiles of sustainability in some Mediterranean tourist destinations" to measure energy consumption from tourism for a destination

Indicators	Units
Energy consumption in Luxury Hotels (5 Stars) per night	kWh/person/night
Energy consumption in Superior Category Hotels (4 Stars) per night	kWh/person/night
Energy consumption in Standard Category Hotels (3 Stars) per night	kWh/person/night
Energy consumption in Tourist Category Hotels (2 Stars) per night	kWh/person/night
Energy consumption in Budget Category Hotels (1 Star) per night	kWh/person/night
Energy consumption in rental apartments per night (all categories included)	kWh/person/night
Energy consumption in all other dominant types of tourist facilities in the studied area (all categories included) - type to be defined	kWh/person/night
Percentage of energy consumed by the tourism industry compared to the total quantity of energy consumed	%

Table 6 - Energy efficiency macro indicators

Macro indicators		
Abbreviation	**Indicators**	**Unit**
EDR	Energy dependency rate	%
IPE	Primary energy intensity	toe/LC
IFE	Final energy intensity	toe/LC
RFEPE	Ratio of final energy to primary energy consumption	%
REB	Ratio of national energy bill to GDP	%
RPSE	Ratio of public subsidies for energy to GDP	%
AEF	Average emission factor	$teCO_2$/toe
ICO_2	CO_2 intensity	$teCO_2$/LC
AECH	Average primary energy consumption per person	ktoe/1000 persons
AELCH	Average electricity consumption per person	MWh/person

Table 7 - Energy efficiency indicators in the transformation sector

Energy transformation		
SREC	Share of installed RE electricity capacity	%
URIC	Utilization rate of the installed power generation capacity	%
AETS	Apparent Efficiency of Energy Transformation Sector	%
PGEFF	Power generation efficiency of thermal power plants	%
SCFFP	Specific consumption of thermal power plants	toe/GWh
PGF	Power Generation Efficiency	%
SCPG	Specific Consumption of Power Generation	toe/GWh
TDEE	Transmission and Distribution Electricity Efficiency	%
PGEF	Power Generation Emission Factor	$teCO_2$/GWh
ESEF	Electricity Sector Emission Factor	$teCO_2$/GWh

Table 8 - Energy efficiency indicators for the tertiary sector

Tertiary Sector		
FEITS	Final Energy Intensity of the Tertiary Sector	toe/LC
TDRSHR	Diffusion rate of solar water heaters in tertiary sector	m^2/1000 persons
TEBR	Tertiary Energy Bill Ratio	%
TELSR	Ratio of public subsidies for electricity to added value	%
TESRGB	Ratio of public subsidies for energy to government budget	%
HECNG	Energy consumption per night per guest	kgoe/night/guest
$TICO_2$	Intensity of CO_2 in the tertiary sector	$teCO_2$/LC
TAEF	Average emission factor	$teCO_2$/toe

Table 9 - Energy efficiency indicators for the residential sector

Residential Sector		
UCED	Unit Energy Consumption per Dwelling	kgoe/Dw
$SCEM^2$	Specific energy consumption per m^2	kgeo/m^2
UEICD	Unit Electricity Consumption per Dwelling	kWh/Dw
$SCEIM^2$	Specific Electricity Consumption per m^2	kWh/m^2
RIPE	Intensity of residential sector	toe/LC
RELSR	Ratio of public subsidies for energy to private consumption	%
RESRGB	Ratio of public subsidies for energy to government budget	%
RAEF	Average emission factor	$teCO_2$/toe
$RICO_2$	Intensity of CO_2 for the residential sector	$teCO_2$/LC
RDRSHR	Distribution rate of solar water heaters in the residential sector	m^2/1000 persons
ERACR	Equipment rate of air-conditioning in the residential sector	Unit/Dw
ERFR	Equipment rate of refrigerators in the residential sector	Unit/Dw

Table 10 - Energy efficiency indicators for the transport sector

Transport sector		
TrFEI	Final energy intensity of the transport sector	toe/LC
STEHE	Share of household expenditure for transport	%
EUCC	Average unit consumption of vehicles	kgeo/vehicle/year
EUCC G	Average unit consumption of gasoline vehicles	kgeo/vehicle/year
EUCC D	Average unit consumption of diesel vehicles	kgeo/vehicle/year
AEFTS	Average Emission Factor of the Transport Sector	$teCO_2$/toe
MR	Motorisation rate	person/vehicle
ICO_2	CO_2 intensity in the transport sector	$teCO_2$/LC
SCRW	Specific consumption for railways	kgeo/ p.km
SCAT	Specific consumption for air transport	kgeo/ p.km
SCMT	Specific consumption for maritime transport	kgeo/ t.km
SEAT	Specific emission factor for air transport	$kgeCO_2$/p.km
SEMT	Specific emission factor for maritime transport	$kgeCO_2$/t.km