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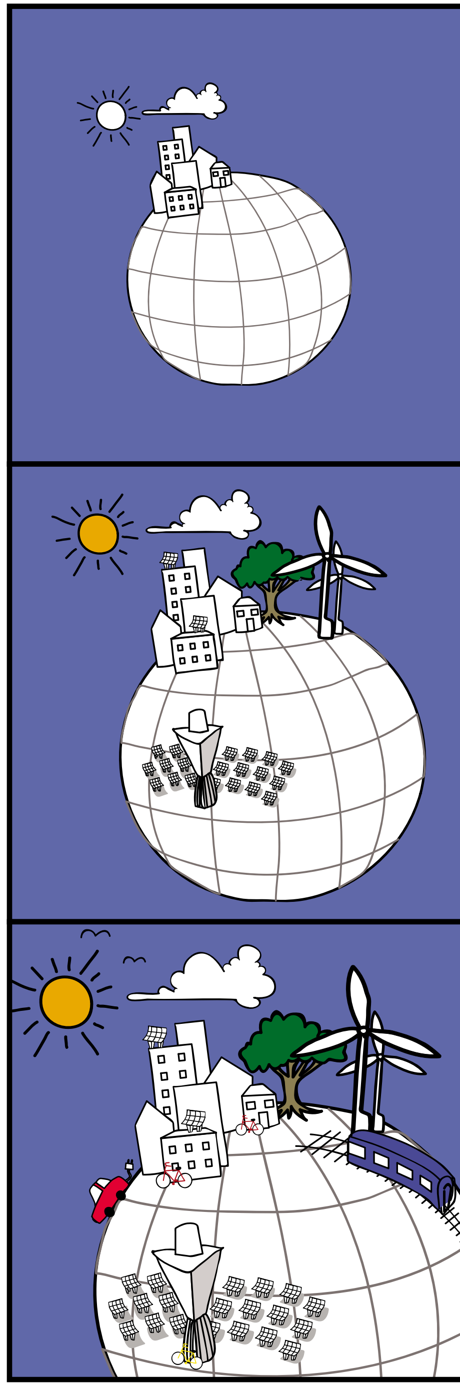
HELIOSTHANA,
A MEDITERRANEAN SUSTAINABLE ENERGY COUNTRY



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PROLOGUE

In 2010, we have reached a turning point in our history. Climate change is already creating tangible effects, thereby exposing the limitations, costs and dangers of fossil and nuclear fuels. The next ten years will be decisive in our commitment to a sustainable or quite simply a viable future for human beings and ecosystems. For our energy systems, this means a rapid transition to efficient, renewable energy sources. This is already possible using current practices and technologies.

The Mediterranean region has an important role to play. It is one of the regions the most vulnerable to climate change while enjoying high sunshine levels. The Mediterranean Solar Plan (MSP), the DESERTEC industrial initiative (DII) or funds supporting sustainable energy such as the World Bank's "Clean Technology Fund (CTF)" show that this potential is recognised by politicians and economic and financial decision-makers.

We believe that these commendable intentions are attainable but require a participatory and proactive approach by the Mediterranean countries. These major projects must be integrated into the national sustainable energy strategies of the partner countries, rather than the opposite occurring. In other words, we would like to see national integrated solar plans (energy efficiency and renewable energy) in each Mediterranean country, supported by the MSP, DII and CTF (and others).

This is why we have devised **"Heliosthana[1]",** an island-country somewhere in the Mediterranean, between the North and South. The government of Heliosthana took on board the energy and climate issues raised at the Copenhagen Conference at the end of 2009 and drew the necessary conclusions. This guide will enable you to follow the ambitious but realistic plans of action implemented by this pioneering country between 2010 and 2020, enabling it to take control of its energy in the future while contributing to global efforts to cut greenhouse gas emissions.

We hope that this guide will provide food for thought and serve as a source of inspiration.

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1 "Helios": the personification of the sun in Greek mythology and "sthāna": place in Sanskrit.

EXECUTIVE SUMMARY

This guide takes us to the island state **Heliosthana**, somewhere in the Mediterranean Sea, in the year 2020. It describes a decade-long harmonious transition towards a sustainable energy system that respects people and the planet, while sustaining balanced economic and social development. Heliosthana now combines low energy intensity (20% less than in 2010) with a promising share of renewable energy (20% of primary energy supply). Part of the renewable electricity is exported to neighbouring countries. Education, R&D and healthcare have benefited from the money saved due to reduced investments in fossil fuels.

This is in stark contrast with the situation prior to 2010 when there was a highly inefficient energy use and a significant dependency on expensive and polluting imported fossil fuels. Growing urbanisation paired with a rapid economic development, amongst other factors, fuelled a rapid increase in energy demand, which seemed out of control. High costs, uncertainty and multiple crises (fossil fuel price volatility and shortages) impacted on both people and companies.

Heliosthana has become a role model for its neighbouring countries in the Mediterranean. Through ambitious but realistic measures, described in 6 steps (a 7th step presents a final overview), the island is looking towards a fossil-free future and is an ideal partner for the Mediterranean Solar Plan (MSP). These steps are immediately applicable in most of the Mediterranean countries.

Heliosthana's main messages:

- **Strong national energy policy reforms** are needed to support energy conservation and renewables. Fossil fuel and electricity subsidies in particular form an entry barrier for these technologies.

- There are many economically interesting options to manage and **reduce energy consumption**, as well as to **produce renewable energy** in the region. But these options will only become reality provided a regulatory framework and tailored financial mechanisms are in place in the relevant countries.

- **The MSP is a tool to catalyse national sustainable energy plans.** MSP projects should be fully integrated into host countries' national strategies that combine larger and smaller projects.

- **The MSP should play the role of regional coordinator** and develop innovative support tools. It can help develop national solar plans, develop national capacity (through equipment production, maintenance, investment), spur cooperation with local and regional universities, facilitate and reduce the cost of environmental and social research, bundle smaller projects to make them interesting for large investors.

Heliosthana 2020's 6 steps are:

1. **A strategic country-wide vision**, in consultation with all major stakeholders. Its implementation requires a **structured institutional framework**, a clear separation of government roles between policy making, implementation, action plans (through agencies) and energy sector activities. Solid statistics and indicators enable better decision making.

2. 3 energy policy pillars: **an effective energy supply security system, guaranteed access to energy** (e.g. through a social tariff), and **phase-out** of **fossil fuel** and electricity **subsidies**.

3. Structural measures for an efficient energy use: **consumer behaviour** analysis, **efficient regulation** (e.g. standards and labels), accompanying measures and incentives, and adapted financial packages.

4. Assessment of renewable energy **needs** and **potential**, together with a **regulatory framework**, a **feed-in tariff** and **innovative finance mechanisms**.

5. A model partnership with the MSP: **diverse MSP projects** and electricity trading in the region are fully integrated in the **national energy strategy**.

6. **Long term urban plans** with denser and more efficient cities and buildings, connected with a reliable public transport scheme, and closer distances between working, living and leisure centres. The new vehicles combine low energy consumption and new energy sources, such as renewable electricity.

INTRODUCTION

At the end of December 2009, when the prime minister of Heliosthana returned from the Copenhagen Summit on Climate Change, he was convinced (despite the relative failure of the summit) of the urgency and climate risks and the new long-term opportunities offered by more sustainable forms of energy. He believed that the current situation reflected the failing of the States which are overly accustomed to managing their energy policy in a centralised and remote manner and to working alone (top-down approach). He therefore decided to propose a wide-ranging consultation process involving all public and private sector stakeholders and civil society representatives as part of the "**Heliosthana 2020**" forum. The main objective of the forum was to devise an overall strategy and an action plan in order to achieve a new sustainable, efficient and citizen-friendly energy strategy within a decade.

This guide, *Heliosthana, a Mediterranean country based on sustainable energy*, examines the wide-ranging, ambitious Heliosthana project via a retrospective approach, based on 7 complementary stages developed in parallel:

Stage 1: The fundamentals of sustainable energy
Stage 2: The three pillars and the principle of a sustainable energy policy
Stage 3: Low consumption or how to meet needs without creating waste
Stage 4: Sustainable and competitive renewable energy
Stage 5: A model EuroMed partnership: the Mediterranean Solar Plan
Stage 6: Sustainable urban planning and transport: "the intelligent city"
Stage 7: Overall assessment of a low consumption country based on renewable energy

This guide deciphers the necessary changes and keys to success, based on and illustrated by examples of best practices on the northern and southern banks of the Mediterranean. If the process primarily focuses on energy, in particular electricity in the main consumer sectors (residential and industry), it also covers the fossil fuels and mobility and urban planning sectors.

Stage 1: The fundamentals of sustainable energy

The first and crucial stage in the project identified by the Heliosthana 2020 forum was to establish the basis for a new **public energy policy**. This involved defining its objectives, priorities, means and action modes over 10 years, in harmony and in synergy with other public policies (e.g. mobility, urban planning and the environment).

This key stage consisted of three inter-dependent stages:

- preparing and adopting the *Heliosthana 2020* **energy strategy**;
- determining and establishing mechanisms and tools for **implementing** the strategy;
- creating and developing the **institutions and relay centres** with responsibility for determining, carrying out and assessing the strategy.

1. Heliosthana 2020 energy strategy

The new energy strategy, which was the founding element and cornerstone of a decade of transformation, was based on the following elements:

Objectives: identifying the challenges to be met and the fundamental issues, medium and long-term objectives, guidelines and priorities, choices and combinations of means and tools in order to make the Heliosthana energy sector competitive and sustainable.

Content: a detailed, in-depth diagnosis of the pre-2010 situation (see box 1 & 2), the vision of the **Heliosthana** objectives up to 2020 and even 2050, the sectoral and thematic priorities, an implementation schedule with institutional and sectoral responsibilities clearly separated. The strategy is adopted by the government and assessed every 2 years by the Parliament and the Institute for Sustainable Development (ISD) (see point 3 below).

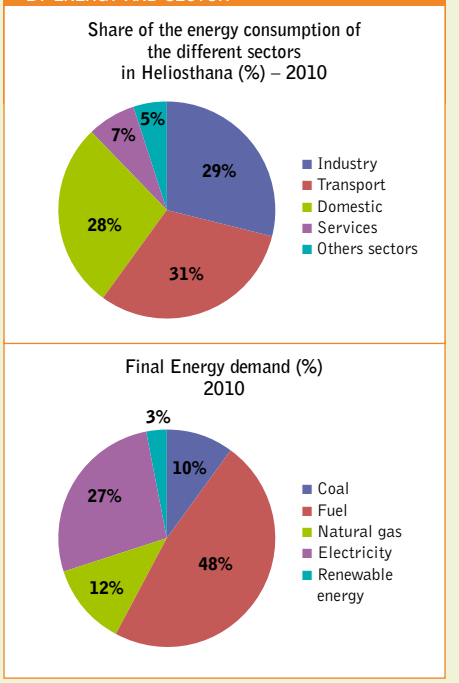
Implementation: the strategy's successful implementation depended not only on its participatory nature, involving all the stakeholders at the national and regional conferences, but also on the creation of sectoral and thematic working groups composed of experts and backed up by multidisciplinary teams established and supported by the Institute for Sustainable Development. This wide-ranging, transparent consultation, inspired by other experiences in the region (see box 3), made it possible to identify the issues and best practices and thereby helped to win the support of the various stakeholders as partners in the implementation of the strategy. In particular, through their Agendas 21 (integrated sustainable development action plans), the local authorities (cities and regions) act as interfaces and play a key role not only in the acquisition of information, best practices and feedback, but also in the implementation of the national strategy.

1 / Detailed diagnosis of the pre-2010 trend

Demand

- rapid and erratic increase in energy consumption (from 4 to 7% depending on the year – at a rate of 7% a year, demand will double in 11 years), in particular for electricity and fuel for transport;
- substantial losses/waste in the use of energy, in particular by residential and office buildings (ratio of 220 kWh/m²/year of primary energy, i.e. 3 times the average/best practice in the region);
- high total losses[2] from the electricity system (on average 72%, and as high as 80% for electric heating);
- transportation of people and goods dominated by road transport, requiring substantial and increasingly expensive infrastructure at the expense of public transport; sea and air-based modes of transport play an important role in the supply system but are high energy-consuming and dependent on imported petroleum products;
- the country's high energy intensity (0.3 toe/€1,000 of wealth produced).

CHART 1 : DEMAND PROFILE: BY ENERGY AND SECTOR



Supply

- very strong dependency on fossil energies (imported for the most part): coal for generating electricity, oil for road, sea and air transport and natural gas for the generation of electricity and direct use accounted for 94% of primary energy needs – the nuclear option was ruled out by several comparative studies, in particular owing to its high and non controllable total cost (investment, waste management and safety systems) and the seismic risk;

- high price volatility, with a dramatic effect on the trade balance (energy is the leading item in the external deficit and represents 20 to 25% of GDP[3]), the competitiveness of companies and household spending;

2 Losses during electricity generation (power plants), transmission (high voltage transportation network) and distribution (medium and low voltage transportation) presented in the form of a ratio between lost energy and total energy. Example: a coal-fired power plant whose output (efficiency) is 35% (range: 25%-42%), i.e. a loss of 65% for a transmission system loss of 7% and a distribution system loss of 10% (OECD Europe average for the two headings: 8%). For 100 GWh produced: losses during generation (65 GWh), losses during transmission (4.5 GWh) and losses during distribution (6 GWh), i.e. 75.5 GWh (**75.5%** of losses) without counting the losses during utilisation (negligible for direct use of electricity).

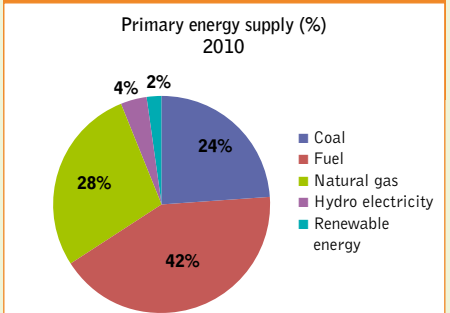
3 Jordan: 21% of GDP, i.e. USD 3.9 billion (2008).

• a concentrated, vertically integrated energy sector, lacking in transparency (private and public sector monopolies), which creates few skilled and stable jobs;

• bottlenecks throughout the chain, in particular as regards the generation and distribution of electricity in urban areas;

• marginal renewable energies: 6% of primary energy, chiefly large-scale hydro-electricity, while the most efficient technologies such as wind power and solar energy are at an embryonic stage or underdeveloped; biofuels.

CHART 2 : PROFILE OF PRIMARY ENERGY SUPPLIES BASED ON TYPE OF ENERGY



➜ The combination of the increase in energy demand, strong price volatility and supply disruptions generate:

• energy crises (shortages and cuts) and economic crises (burden of imports and investment in the energy production sector, increasing the level of debt);

• inequalities (poverty and energy insecurity);

• instability and economic, social and societal uncertainties;

• chronic pollution of the soil, the aquatic environment and the air breathed by inhabitants, and contribution to climate change.

"2020 trend scenario"

• continuing strong increase in energy demand +65% and electricity demand (x 2), in particular in the residential (+75%), transport (+64%), service (+70%) and industrial (+53%) sectors by 2020;

• increasing use of imported fossil energies and dependency;

• strong increase in CO_2 emissions: +80% and pollutants;

• despite fresh investment in renewable energies, their share remains marginal and may even decrease before 2020 because of the rapid increase in consumption and waste.

2 / Heliosthana 2020 objectives: a scenario of transition and a break with the past

• Reduction in consumption in comparison with the trend scenario of 30% and energy intensity of 20%;

• Renewable energies cover 20% of energy needs (gross final energy consumption) and 25% for electricity;

• Dependency on energy imports reduced from 94% to 80%;

• 30% reduction (compared with the trend scenario) in polluting emissions, in particular CO_2, as a result of energy and reforestation objectives.

3 / Sustainable development strategy in the region: consultation and vision

Morocco organised national energy conferences in November 2006, bringing together the sector's main stakeholders (administrations, energy companies and federations, consumers) during thematic workshops (security, sustainable development, competition and investment) and plenary sessions. This event under the patronage of the prime minister provided an opportunity for a wide-ranging assessment of the situation, issues and options as regards energy policy. In 2008 and in follow-up to this work, the government commissioned a strategy paper and signed an energy cooperation agreement with the EU including in particular establishing a twinning system between the Moroccan and European administrations covering a wide range of areas addressed by the conferences (statistics and forecasts, security and investment programming).

At the beginning of 2010, the **Lebanese** government adopted an objective of gradually increasing the share of renewable energies in the supply of primary energy from 3% in 2010 to 12% in 2020 as part of its energy plan. Action plans and ambitious sectoral programmes are currently being prepared.

Via its Ministry of Energy and Mineral Resources, in 2007 the **Jordanian** government updated its energy policy up to 2020. The EE&RE component was identified as one of the key elements leading to a specific RE law (target of 10% by 2020) which provides for the creation of an EE&RE fund (being implemented with the support of the AFD, World Bank and GEF).

The **Spanish** government's renewable energy action plan for 2011-2020 targets a 23% RE share in the energy mix in 2020 and 42% for electricity (2009: 8% and 29%) – some autonomous regions have already gone even further (in Navarra, in 2009, renewable electricity exceeded 65% of total consumption).

Once the Heliosthana 2020 strategy had been adopted, the priority was to determine and implement sustainable development policies and tools (part 2) and put in place an institutional organisation (part 3) as follows.

2. Mechanisms and tools for implementing Heliosthana 2020

On the basis of the strategy adopted, a crucial stage was to determine and establish mechanisms and tools to ensure its concrete implementation. This stage required special efforts to be made in order to ensure that all the means determined and used not only contributed to the strategy but could also be integrated with the other elements of the system. The analysis and coordination work carried out made it easier to optimise the range and content of the series of measures in an open, heterogeneous and changing economy and society. The transition to an efficient and virtuous energy system cannot be imposed but needs to be constructed according to a clear, flexible model with the support of all the stakeholders.

The main mechanisms and tools which contributed to the successful implementation of the Heliosthana 2020 energy strategy included:

a] A comprehensive **statistical tool** (see box 4) covering the whole of the energy system (demand/consumption and supply) providing reliable data and performance indicators (security of supplies, economic) as well as indicators in respect of CO_2 emissions, energy efficiency[4] based on sector, region/city and the penetration rate of renewable energies.

The statistical system, which is the cornerstone of the information provided to decision-makers and citizens, is open (accessible online, indicators and

4 e.g. energy intensity based on sector, energy bill/GDP ratio, GHG emissions factor, the sector's specific consumption of electricity generation, utilisation rate of power stations for electricity generation, specific consumption based on production unit per industry, specific consumption per m^2 of housing and by household, distribution of SWH based on m2/1000 inhabitants, penetration rate of RE per sector, etc.

changes published via professional and public media channels) and has helped to raise awareness of the constraints, problems and costs of the old "fossil" system. It also facilitates the monitoring and evaluation of progress/implementation of the strategy. The availability of a consistent and efficient energy information statistical tool was essential to establishing economic decision support tools.

b] Integrated Demand and Supply (D&S) **economic decision-making tools:** energy demand forecasting tools (based on sector and utilisation, at a given time of the year and day, etc.), least cost supply investment plan including the options of Demand Side Management (DSM) and total cost (investment, cost of fuels, maintenance and externalities[5]) and economic and financial calculation and optimisation modules (see box 5).

c] Sectoral action plans: operational implementation of the strategy, in particular energy efficiency and renewable energy (EE&RE) (see box 6) with an implementation schedule, performance indicators, responsibilities and resources allocated.

d] Creation of a methodology for **monitoring and evaluating** the energy policy and its components on a regular basis, in particular its action plans; development of a battery of evaluation indicators for the actual implementation and cost effectiveness of policies in order to assess the implementation and results of policies, to adjust or correct them and to allocate or reallocate the necessary resources according to requirements.

4 / Integrated comprehensive energy/ environment statistical tool

An efficient statistical system, based on the experiences of the European Union's MEDSTAT Energy and Environment I, II & III regional statistical cooperation programmes, launched in 1996, and inter-regional programmes, facilitated the launch of Heliosthana 2020 and provided ongoing support.

Objectives

➜ to satisfy the data and indicator needs of public and private sector users;
➜ to ensure the reliability, consistency and relevance of the data and allow access to it;
➜ to facilitate comparisons and evaluations of policies and measures between sectors (over time, between national, inter-regional and international geographical areas).

Means and accomplishments

➜ harmonisation and convergence with international standards (OECD, IEA, UNECE) and European standards (Eurostat, EEA) of the methods for collecting, processing, analysing and disseminating energy and environmental data; this information is useful for determining and monitoring policies and measures, regulatory and investment decision-making, the transparency and fluidity of markets, good resources management, public and corporate governance;

➜ creation of a multi-dimensional database (physical data, prices, flows, quantitative and qualitative indicators, etc), published by the National Office of Statistics in real time (via the intranet of the public administration and the Internet) and adapted to the requirements profile of each user. This energy information system combines an individualised scoreboard, a database and simulation calculations. Such an integrated tool has been established by the ANME in Tunisia and a similar model is being developed in Morocco.

5 Such as the impact on public health, the environment and the cost borne by the authorities to remedy it.

5 / Economic and financial calculation modules available in Heliosthana

Developed by the ISD, a range of online tools updated in real time provides decision-makers and consumers with exhaustive and clear information on the key decision-making parameters, in particular a simulation of gains and costs for a wide range of situations (energy consumption and substitution), cases and segments (electrical equipment and appliances, construction and renovation of buildings, vehicles). Each tool is coupled with a choice of appropriate "Eco-credit" type financial products and provides information on tax incentives (e.g. deductions for investment, eco taxes). If they want, users also have access to personalised assistance and a selection of approved professionals via local information points in the Info-Helios network installed within municipalities with the support of the ISD.

These modules coupled with energy labelling (energy classes, from the most efficient: A++ to the least efficient: E) and environmental labelling (CO_2 emissions induced) of most products and services as well as regulatory and tax incentives and appropriate financing enable consumers and decision-makers to be guided in a transparent and user-friendly way towards efficient and sustainable solutions.

The pioneering experience of the PROSOL programme in Tunisia on individual and collective SWH facilitated the launch of such a development as well as the development of integrated, bundled and guaranteed EE&RE products proposed by ESCOs.

6 / Heliosthana 2020's EE&RE action plans

The ISD has developed a series of coordinated EE sectoral action plans (construction, industry, services, transport, energy) with the Energy & Environment Agency (EEA) as well as RE and horizontal action plans (lighting, engines, etc.), targeting almost all energy consumption and production. It relied on the experience gained from the action plans implemented in several countries in the region, the most relevant of which included: Tunisia (EE in all sectors, especially construction and industry), Jordan (EE, 2004) and Spain (EE&ER, 2004 and 2010). They are noteworthy for the quality of their design, in particular the way in which they clearly identify:

- the initial problems and restraints, and the means of overcoming them;
- the lessons learnt from past and current policies;
- the role of the stakeholders and their coordination;
- untapped potential and opportunities;
- priorities and a precise implementation schedule with a clear allocation of responsibilities for each stakeholder, the resources implemented and implementation and performance indicators.

The EEA is responsible for coordinating the action plans while the ISD is entrusted with monitoring and evaluating them.

3. Institutional organisation

One of the keys to the solid and lasting success of Heliosthana 2020 was the creation and development of institutions and relay centres charged with determining, carrying out and evaluating the implementation of the strategy identified.

a] Public administration

I. A multi-sector ministry with responsibility for energy, infrastructures, construction and environment/climate[6]: the Ministry of Sustainable Development (MSD) is the "conductor", with the ultimate responsibility for the strategy, determining controls and monitoring their application. It is supported by the Institute for Sustainable Development[7], a public sector "think tank", which has responsibility for analysing and anticipating developments on an ongoing basis and evaluating policies.

II. Agencies: they support the MSD in the implementation of the strategy and/or controls/regulations in Heliosthana. The main agencies are the Commission for the Regulation of Energy and the Environment (CREE) which is responsible for the law enforcement, the national agencies (the Energy & Environment Agency: EEA[8]) and local agencies implementing the EE & RE programmes, the National Office of Statistics and training centres, including the centre dedicated to professions in the sustainable development sector. These agencies are interfaces and catalysts of initiatives targeting consumers and decision-makers. In addition, there are dedicated structures such as the designated national authority (DNA or carbon market unit) charged with validating the carbon projects of the flexibility mechanisms (Clean Development Mechanisms – CDM) and the "one-stop RE shop" with responsibility for coordinating/approving new RE projects. As regards electricity transportation and distribution networks, the operator of the national grid (ONG) (100% State owned without any financial connections with the electricity industry) has authority and responsibility for ensuring sufficient investment, the security of supplies, access to networks and markets, in particular for the region's other national grid operators, to ensure the correct functioning of the trans-Med network (or MEDRing).

III. Municipal and regional administrations : following the 2009 Copenhagen summit, given their networking experience and their greater awareness of the realities and needs of users, the major cities and municipalities in Heliosthana found themselves at the forefront of the energy project ("bottom up" approach). As a tool for preparing and implementing the Agendas 21 (integrated sustainable development action plans), these local entities set up local "energy and climate" agencies in order to develop their own expertise and to assist and advise consumers. These agencies were able to count on the financial support of the IEE programmes at the time they were set up and the development of joint regional projects with other agencies, in particular via the Energy-Cities and MEDHelios networks.

The key aspects of the institutional architecture include:

➜ Independent public authorities, but coordinated in accordance with sectoral action plans and solidly structured (human and financial resources evaluated, sufficient for several years). It was also essential to maintain strict **separation of the State's role**[9] between, on the one hand, policy-making (MSD), the implementation of regulations and programmes (agencies) and, on the other hand, the State's participating interests in the energy sector (via the Agency for Public Sector Participating Interests - APP).

➜ Close and constant coordination and interaction between the administrations with responsibility for energy policies and other public sector policies (transport, construction, protection of the environment, urban planning, etc.) via regular information, exchange and consultation procedures, in particular the annual sustainable development conferences and sectoral working groups.

b] SD private/professional sector

I. The development and implementation of an integrated SD strategy by Heliosthana has resulted in the emergence of a new highly skilled, high value

6 Denmark: Ministry of Energy and Climate-www.kemin.dk; France: Ministry of Ecology, Energy, Sustainable Development and Sea (MEEDDM)-www.developpement-durable.gouv.fr

7 Examples in Europe: Germany: Wuppertal Institute- www.wupperinst.org; Croatia: Energy Institute Hrvoje Pozar-www.eihp.hr, France: Institut du Développement Durable et des Relations Internationales- www.iddri.org

8 Member of the MEDENER regional network- www.cres.gr/medener/index_fr.htm

9 In order to limit possible conflicts of interest leading in particular to biased decisions.

added sector composed of: EE&RE service providers (advice, project audits, studies and evaluations, etc.) dealing with administrations, consumers and investors.

II. Designers and manufacturers of low consumption (LC) equipment and using/optimising renewable energy (RE) (Heliosthana being a leader in the solar water heaters (SWH) niche, biogas cogeneration, concentrated solar power (CSP) and sea energy).

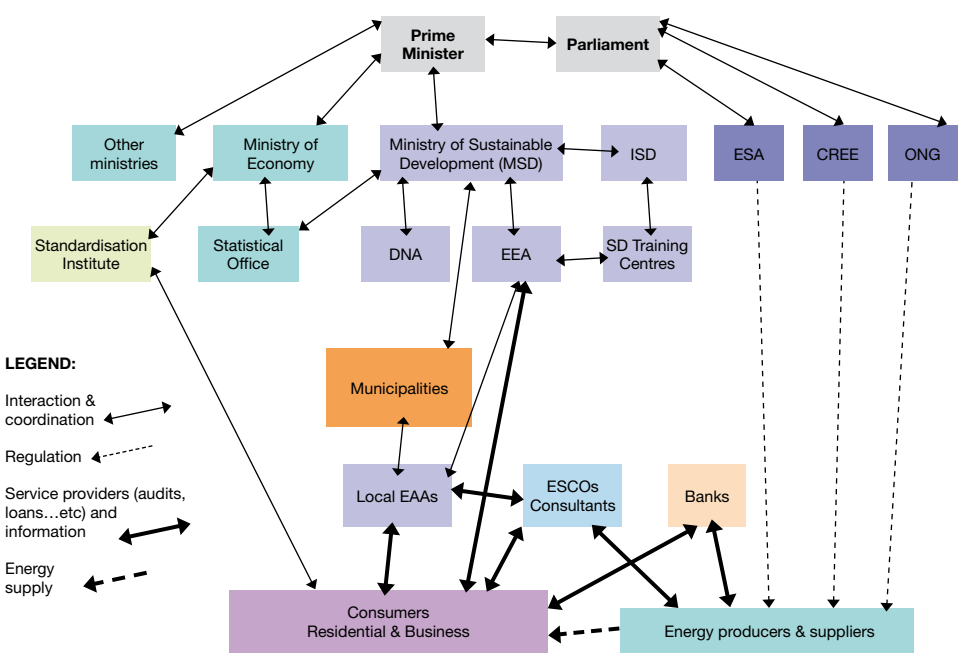
III. Sustainable financing and investment organisations: commercial banks, including those specialised in SD, bundled financial products (ESCOs and third-party financing).

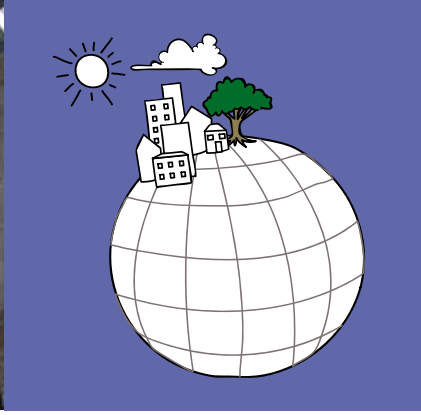
This diversified sector has rapidly achieved critical mass (quantitative and qualitative) in particular thanks to a range of university curricula and in-service training programmes (including those of the ISD), thereby giving credibility to, consolidating and extending the SD strategy.

c] Civil society

The involvement of international NGOs and the development of national NGOs and local associations in the field of SD have helped to fuel and stimulate the debate throughout the cycle of Heliosthana's energy policy (from the debate on the strategic priorities to monitoring methods). By acquiring credibility and specific expertise at national and/or local level, these NGOs have become relay centres and have helped to stimulate SD in Heliosthana and are a powerful and effective interface with citizens. The main NGOs include NégaJoule, the Friends of Helios, the Heliosthanian Fund for the Environment and numerous local associations for the protection and discovery of natural land, aquatic and sea environments.

ENERGY ADMINISTRATIVE ORGANISATION IN HELIOSTHANA





Stage 2. The three pillars and the principle of a sustainable energy policy

The priorities of Heliosthana's new energy policy are based on three pillars:

- ➜ security of energy supply;
- ➜ economic performance;
- ➜ environmental performance.

These pillars are themselves integrated and encompassed in the **NegaJoule** principle.

1. Security of energy supply including access to energy

Security of supplies can be divided into three pillars:

a] Diversification of:

- sources of energy: thanks to the increase in the share of RE in the energy mix from 6% in 2010 to 20% in 2020;
- origins: local RE, use of biogas for public transport and plastic waste for the production of biodiesel intended first and foremost for collective and sea transport and emergency services; diversification of sources of various imported fossil fuels (e.g.: gas pipelines and LNG for imported natural gas).

b] Specific energy security programme

- building up strategic and commercial fuel stocks (petroleum products, biodiesel and natural gas) in accordance with the standards and procedures of the IEA and EU countries. These stocks are stored or controlled by a dedicated public agency, the ESA (Energy Security Agency, which is also in charge of controlling the safety of installations). The level of stocks now represents approximately 100 days of the country's average consumption (excluding restrictions), protecting the country's economy and citizens from the impact of even an extended shortage in supplies;
- emergency plans: in the event of a continuing crisis (shortage of supplies or a surge in fossil fuel prices), the ESA can activate a corresponding emergency plan comprising limits on demand (e.g.: from vehicle speed limit reduction through to rationing) and a supply plan (priority given to emergency services) in accordance with international standards and in coordination with the region's countries, the IEA and EU countries.

c] Access to energy

Heliosthana's energy regulations grant citizens a right of access to energy for their vital needs (lighting, cooking and food preservation). This is implemented as regards electricity in the form of guaranteed minimum electricity supplies for the most vulnerable and poorest people. For a household composed of 2 people, this corresponds to a 2.2 kW supply contract for a maximum annual consumption of 1,500 kWh[10] at a so-called "low consumption" social rate, provided that the home is equipped with A or A+ class energy equipment, insulated in accordance with the standards in force and does not have electric heating. The system includes grants for renovating homes (insulation) and purchasing low consumption equipment (in

10 Thanks to the improvement in insulation and the performance of equipment, it has been possible to reduce the installed capacity gradually to 1.1 kW i.e. 750 kWh a year.

the same way as the "Warm Front Programme" launched in the United Kingdom in 2000).

Over and above the consumption of 1,500 kWh and for each 250 kWh band, the tariff increases by 15% for the first 2 bands, then by 5 additional percentage points (20% per band) for the following bands. A system of pre-payment by card or direct debit based on remote electronic meter readings provides consumers with real time information on their consumption and raises their awareness on limiting consumption to their needs.

All in all, the combination of this system of incentives with gradual tariff increases based on consumption and real time information about consumption enables users to control their consumption and bills while enjoying normal usage. Thus, the rate of unpaid bills and fraud is now negligible (1 to 3%) in contrast with other countries in the region which have chronically high unpaid rates (Egypt: 35%, Lebanon: 33%, Algeria: 15%) due to a combination of high, uncontrolled consumption, subsidised prices for all customers and an inefficient and non-transparent billing and payment system. In the Lebanon, general electricity price subsidies accounted for 17% of the public budget in 2007.

2. Economic performance

The cost of energy must be sufficiently affordable so as not to penalise economic and social development, without generating imbalances (deficits therefore debts and additional costs borne by consumers, as well as under-investment and supply risks).

a] Pricing under the control of an independent regulator (CREE) with the objective of achieving a balance between:

- covering the supply, transformation and distribution costs and infrastructure maintenance costs;
- meeting essential needs and raising awareness about use (quantity & quality): tariffs increasing in line with consumption (see above).

b] Gradual, programmed elimination of direct and cross-subsidies to fossil energies: the CREE supervised their gradual elimination between 2011 and 2013, replacing them with the "low consumption" social tariff.

3. Environmental performance

This involved increasing awareness of the costs of pollution and CO_2 and integrating them into the end prices of the various energy sources. This facilitated a certain balance between RE and fossil energies which had previously benefited from numerous tax exemptions (externalities) and subsidies.

a] Realistic pricing: externalities are now integrated into the end price of fossil energies, in particular through the introduction of a progressive carbon tax, which is, however, neutral from a fiscal point of view following an equivalent reduction of income tax. For individuals, the tax is levied only when the quota of emissions allocated on an individual **HelioCarbon**[11] card is exceeded. This quota corresponds to the individual average of Heliosthana and fell by 30% during the 2010-2020 decade.

b] Environmental evaluation (including "grey" energy) carried out for investment projects and the energy sectors (e.g. oil and petroleum products), used to calculate the carbon tax.

11 Whenever consumers make a purchase, their card is credited with the carbon equivalent calculated in accordance with a method developed in France using 11,000 staple products, which became operational in 2011. At the end of the year, a negative balance in relation to the annual carbon quota entitles the holder to a bonus in sustainable services (audit, training, etc.) whereas a positive balance requires this emissions surplus to be offset by financing EE & RE approved projects in Heliosthana.

NegaJoules: an integrated, virtuous approach

This is based on the negawatt (NW) concept developed and enhanced by the French NegaWatt association) (see box 7).

The IDD has adapted and enhanced it by adding the concept of **NegaJoules**. The combination of energy savings and efficiency with equal or higher quality ("more with less") is a pre-requisite for increasing the share of renewable energy on a sustainable economic basis. NegaJoules will contribute to the dynamics of reducing emissions by a factor of 4 or 5 by 2040.

7 / The negawatt approach

Définition : negawatts represent non-consumed energy thanks to a more restrained and efficient use of energy.

Concept : consuming better instead of producing more. This common sense approach facilitates the discovery of a new, hidden but huge resource.

The "production" potential of negawatts is higher than half of the current world production of energy with currently available and reliable solutions offering numerous related benefits: absence of pollution, decentralisation, creation of jobs, responsibility, solidarity, peace, etc.

The "NegaWatt approach" can be broken down into 3 phases:

1. cutting energy waste at all levels of organisation in our society and in our individual behaviour to eliminate careless and expensive waste;

2. improving the energy efficiency of our buildings, means of transport and all the equipment that we use in order to reduce losses, make better use of energy and increase possibilities;

3. finally, production using renewable energy sources, which by definition are inexhaustible and have little impact on our environment.

Benefits: Breaking with the practice of risks and inequality means a fourfold or fivefold reduction ("Factor 4 or 5") in our greenhouse gas emissions, eliminating our waste and accelerating our transition to energy efficiency and renewable energy.

Negawatts therefore characterise non-consumed energy thanks to a more sparing and efficient use of energy. This new approach gives priority to reducing our energy needs, without affecting the quality of life: *better consuming instead of producing more.*

Source : www.negawatt.org

Stage 3: Low consumption or how to satisfy needs without waste

The implementation of Heliosthana's new energy policy implied the development and implementation of wide-ranging energy management programmes based on:

➜ an in-depth analysis of the cultural and social context and the development of an "energy saving" culture;

➜ a detailed evaluation of demand based on sector and type of use (for example in buildings: lighting, cooking, heating, cooling, SWH, etc.), reduction of waste and optimal satisfaction of needs (technological and economical);

➜ supplying Low Consumption (LC) products, equipment, buildings, vehicles and services;

➜ putting in place appropriate financing systems.

These programmes were based on sectoral energy efficiency action plans, including standards & labels (S&L), tax incentives, national ("Energy and Environment") and local energy management agencies.

1. In-depth analysis of the cultural and social context and the development of an "energy saving" culture.

Behaviour is a decisive factor in the success of any energy management policy: *it is not only technology that "consumes" but also the way in which we use it. For example, almost half of greenhouse gas emissions in the residential sector result from decisions taken within the residential/family circle chiefly through heating, cooling, daily eating habits and travelling. Similarly, more than 20 to 30% of GHG emissions are related to the behaviour of drivers.*

Sectoral energy efficiency and renewable energy (EE&RE) programmes in Heliosthana have focused not only on supplying EE and RE technologies, but also on developing an "energy saving" culture from the primary school stage in order to encourage an energy management mindset and raise awareness. This fundamental action, as part of a wider environmental awareness raising approach, has facilitated the integration and development of more environmentally aware behaviour and profiles and helped to disseminate the culture of low consumption for a better quality of life.

In addition to this education in schools, efforts to promote such a change in attitude and the dissemination of "low consumption" best practices were based on actions intended to:

- promote this new culture by way of positive examples (rapid return energy performance): new and old low consumption or "positive energy" buildings, sustainable transport, efficient and affordable renewable energies;
- display the response to the greenhouse effect in the form of a calendar:
  - > prioritising possible actions over time,
  - > identifying actions which have immediate economic benefits and boost employment;
- generate a simultaneous across-the-board commitment: public bodies, companies and citizens;
- change mindsets and behaviour, placing the emphasis on innovation and a low consumption culture;

- eliminate ready-made, invariably "top down" solutions in favour of a pragmatic approach, based on identifying best practices through consultation and information;
- adopt a comprehensive approach by:
  - > integrating and activating all the components of the system: technology, the stakeholders (practices, courses of action, representations, etc,), social dynamics,
  - > action at different levels: from micro to macro,
  - > integrating local contexts and cultures.

2. Detailed evaluation of demand based on sector and type of use, reduction of waste and optimal satisfaction of needs

Demand/needs (lighting, cooking, heating, cooling, DHW, mobility, etc.) are assessed in detail and possible ways of reducing them are identified (technical, organisational and behavioural) and developed in an optimal way (EE & energy saving) and based on total cost (total investment, maintenance and consumption costs).

From a pre-2010 situation characterised by waste with an average electricity consumption of 4,200 kWh per Heliosthanian household (4 occupants) a year (excluding heating and air conditioning), the measures put in place have made it possible to reduce consumption to 1,325 kWh a year, while improving the quality of life at a minimal extra cost which can be recouped on average within 4 years.

Table 1 :
Electricity consumption of an energy saving-aware family* (kWh a year, Heliosthana, 2020)

Lighting		**300**
Household electrical appliances[12]		**885**
Fridge-freezer	500	
Washing machine	200	
Iron	40	
Oven	100	
Coffee-maker	30	
Vacuum cleaner	15	
Other appliances (IT, stereo system, TV)		140
Total		**1 325**

*: of 4 people.

In addition, heating (of space and water) and air conditioning are the biggest users of energy and represented 11,430 kWh (electricity and fossil fuels) a year. The measures implemented made it possible to reduce them in 2020 to less than 2,900 kWh a year per home with thermal insulation, solar protection of openings, the use of solar water heaters and efficient heating equipment. Also, the wide-scale replacement of fuel and butane (LPG) with natural gas, solar power and biomass helps to reduce significantly GHG emissions. This reduces public subsidies granted to fuel and butane thereby making it possible to finance a "revolving" support fund providing low interest or zero interest rate loans and specific programmes (thermal rehabilitation, solar water heaters, etc.).

In collective housing, heating costs have been individualised to make users more responsible: all users pay for their actual heating consumption. The calculation is based on a fixed share (~30%) – fixed costs and heating of communal areas and a variable share (~70%) according to actual consumption. Electronic devices placed on each radiator and air-conditioning unit calculate and

12 Corresponding to the reference list of appliances: www.topten.info

display energy consumption. This information is centralised at the level of the housing unit's CTM (Centralised Technical Management).

In addition, "intelligent meters" transmit continuous information on levels and types of consumption via the electricity grid to the network manager (the operator of the national grid, ONG), thereby making it easier to ascertain and respond to demand requirements. In exchange, a discriminating pricing system makes it easier for consumers, thanks to the "intelligent meters", to obtain the necessary electricity supplies at the right time and at the best price (household appliances such as washing machines start automatically during low-tariff-off peak periods with a bonus for the supply of RE). This makes it easier to optimise and secure Heliosthana's electricity supplies while optimising the integration of RE.

3. Supplying low consumption (LC) products, equipment, buildings and services

a] Efficient and economical lighting

The ban on incandescent light bulbs and halogen lamps at the end of 2014 and the widespread adoption of low consumption lighting, including LED, in accordance with a progressive process in consultation with all the stakeholders helped to cut electricity consumption for lighting in Heliosthana by a factor of 4. A programme for the recovery of used low consumption lamps has been put in place to reduce and minimise the impact on the environment.

In public premises, the combination of presence detectors with light power regulated according to daylight and the widespread adoption of "electronic" ballasts and low consumption lamps, in particular LED lamps, have helped to halve lighting consumption, while improving quality and reducing light pollution. The installed lighting power is now < 9 W/m2 (compared to 17 W/m2 in 2010) which reduces the capacity used. Measures concerning lighting in residential and tertiary premises have made it possible to reduce the capacity used at the level of the country by 10%, i.e. 1,400 MW of the capacity of coal-fired power stations.

The national and local supervisory authorities have contributed to the creation of ESCOs (energy service companies specialised in EE and solar water heaters - SWH), in particular thanks to an appropriate/incentive based regulatory framework (in particular by authorising administrations to contract/take out an energy performance contract "EPC" over several years). The activity of the ESCOs has been extended to existing buildings which has contributed to the rapid penetration of SWH.

b] Buildings: a transition to sustainability and performance

I. Regulations

The adoption of new thermal regulations in 2010, revised and reinforced in 2015, based on energy performance certification programmes, as well as strict controls (off-plan, on-site and at the time of acceptance) concerning the application of the thermal (and seismic) regulations have made it possible to reduce by 70% the energy consumption of new buildings in comparison with existing buildings (i.e. now 66 kWh per m2 per annum). Common sense measures, based for example on the solar orientation of buildings and dominant wind directions, combined with good thermal and phonic insulation (with natural and local products), have made it possible to achieve this result at the lowest cost. These buildings benefit above all from free, natural heating and ventilation.

II. Energy performance labels and low consumption buildings

The introduction of the "High Energy Performance" label and the low consumption building (LCB) label (complementary to major national and international levels such as LEED, BREAM, DGNB, Effinergie/BBC, Mediterranean Sustainable Buildings (MSB), EuroGreenBuilding), which concern not an elite group of buildings but all projects, have enhanced credibility and facilitated the construction of new, high-quality, efficient buildings. Their consumption is 50% below the requirements of the thermal regulations which entered into force in 2010.

III. Thermal rehabilitation of existing buildings

The rehabilitation of existing buildings has proved to be a strategic challenge for the management of energy demand. Although the country lagged considerably behind some other countries in the region in 2010, Heliosthana was determined to accelerate thermal rehabilitation and reverse the situation. Thermal rehabilitation programmes accompanied by flexible financial mechanisms (third-party financing and EPCs proposed by the ESCOs) and the choice of suitable technologies, materials and components, with the strong involvement of companies, facilitated the thermal and energy rehabilitation of 80% of public buildings (administrations, schools, hospitals, municipal centres, etc.) and 40% of residential and private tertiary sector buildings. This trend has been underpinned by the introduction of environmental performance labels (energy, water, CO_2) for all housing.

The putting in place of compulsory energy audits (benefiting from a tax credit of 30% to 50%) for tertiary buildings combined with programme contracts (subsidies of 20 to 40%) for the implementation of energy saving measures identified by the audit have made it possible not only to achieve energy and water savings of between 25 and 45% in these buildings but have also contributed to the creation of hundreds of new jobs.

c] Low consumption equipment and services (LC)

Energy and environmental performance labels (water consumption, polluting emissions including CO_2) applied to public procurement contracts for equipment, buildings, vehicles and services have been a powerful tool for integrating clean production methods and their exemplary nature has been a powerful lever.

The certification and labelling of household electrical appliances: since 2010, it has been compulsory by law for all household electrical appliances[13] to be certified and bear an energy performance label. The applicable regulations also provided for a gradual ban on poor performance appliances (joint decree of the ministers of industry and trade of 25 October 2011). Thus, since 2013, the sale of household electrical appliances in an energy class above C has been prohibited in Heliosthana. This approach has also been applied for air-conditioning units which represent an increasing share of the energy consumption of households.

The reduction then the elimination of the standby mode function for electrical and electronic appliances (TV, DVD, modems, etc.) has helped to reduce the electricity consumption of such equipment by 10 to 15%.

d] Energy efficiency in the industrial and service sectors

Heliosthana has put in place a regulatory framework and an action plan for managing energy demand in the industrial sector, which was characterised by its high energy intensity. In the trend scenario, energy demand in this sector was expected to increase by 50% between 2010 and 2020. The following measures were put in place:

- obligation for a periodical energy audit every 5 years for establishments consuming more than 300 toe a year;
- technical assistance in examining and implementing energy efficiency measures at the level of industrial processes and installations (boilers, compressed air engines, cold production, etc.);
- prior consultation obligation (evaluation of the project's energy efficiency by an approved certification body and authorisation of the EEA) for new industrial projects consuming more than 600 toe a year.

An energy audit grant and subsidies for the costs of energy efficiency measures are paid by Heliosthana's EE Support Fund, combined with subsidised loans ("energy efficiency" subsidised loans, as in Tunisia). A grant is paid to cover 20%

13 Corresponding to the reference list of LC appliances: www.topten.info

of interior connection installation costs and of the cost of converting equipment to natural gas "NG", as well as of cogeneration installations (simultaneous production of electricity and heat). Moreover, the ONG is required to purchase excess electricity produced by cogenerators at an attractive rate (higher if using RE).

➜ *Impact of the energy efficiency programme on industry*

The energy efficiency programme in industry has helped not only to generate energy savings of 30% in relation to the 2020 trend scenario but has also improved the competiveness of companies. The sector's energy intensity has fallen by 33%. The sector's total energy savings over 10 years amount to 15.8 Mtoe, i.e. a saving of 11.7 billion euro for an investment of 3 billion euro with the creation of 6,200 jobs. This is an example of a successful public-private partnership based on a "win-win" approach.

8 / Example of the thermal rehabilitation of buildings: France, 2009/2010

Tax credit for an EE investment

➜ 25% for buildings after January 1977

➜ 40% for buildings completed before 1st January 1977

Backed up by:

- **Zero interest rate loans**
- **Bank eco-credits offered by various banks**
- **Interest rate subsidies** from the regions and cities

State commitment for its own buildings (approximately 50 million m^2) and public establishments (70 million m^2)

- an energy audit to be carried out before the end of 2010
- rehabilitation of a third of surface areas by 2012 with a reduction target of at least 40% of energy consumption and at least 50% of greenhouse gas emissions within eight years.

4. Specially adapted EE & RE financing

In 2010, the investment costs for EE and RE were sometimes substantial and the direct benefits (energy savings) were often delayed. In addition, energy tariff distortions reduced the cost-effectiveness of the investments for the end consumer.

Heliosthana has put in place a range of specially adapted, tailored financial and regulatory mechanisms for EE financing, combining several types of measures:

➜ indirect fiscal measures (including a reduction of taxes such as VAT lowered to 5.5% and customs duties) and targeted tax credits for investments in LC labelled equipment and RE production, elimination of direct and cross-subsidies for fossil energies;

➜ zero interest rate loans via banks[14] for EE & RE investments;

➜ bank eco-credit with a sufficiently long repayment period with annual payments based on the financial savings achieved in order to cushion payment capacity constraints;

➜ putting in place integrated, bundled ("all in one") technical and financial products with initial assistance (energy diagnosis), labelled and guaranteed by the public operator, such as the KfW[15] fund in Germany for residential housing;

➜ help for contracting parties: the EEA grants aid (up to 70% of the research costs) for the development of innovative or pioneering EE & RE projects;

➜ international financing: carbon credits, Clean Development Mechanism (or equivalent) and CDM policy approach (adapted to buildings, e.g. carbon thermal rehabilitation fund in the Czech residential sector with Japanese funding) and international aid from the "Copenhagen 100 billion".

14 Also developed in France: www.pret-ecologique.com/eco-ptz.html & http://ecocitoyens.ademe.fr/financer-mon-projet

15 Integrated approach including a thermal regulation component (EnEV) and RE component (EEWärmeG) bundled in a programme of the KfW public financial groups (Marktanreizprogramm or MAP, Market Incentives Programme); sources: WWF *Scorecards on best and worst policies for a green new deal*, 2009; "Energy-Efficient Rehabilitation" (www.kfw-foerderbank.de/EN_Home/Programmes_for_residential_buildings/Energy-Efficient_Rehabilitation.jsp

9 / PROMO-ISOL: roof insulation programme (Tunisia, 2010)

- AFD line of credit (currently under examination)
  - ➜ Interest rate: subsidised
  - ➜ Amount: approximately 20 DT per m^2 of roofing rehabilitated (€1=1.89 DT)
  - ➜ Loan period: 5 to 10 years
- Public subsidies
  - ➜ 20% to 30% ceiling per m^2
  - ➜ Surface area of roof with ceiling
- Reduction of indirect taxes
  - ➜ Exemption from VAT on insulation materials
  - ➜ Customs duties: minimum rate (10%)

➜ *Energy service companies*

The energy efficiency programme in the industrial and service sectors (public buildings) has led to the emergence of around thirty energy service companies (so-called ESCOs). ESCOs have access to lines of credit to make energy efficiency investments (so-called third-party financing) in these sectors and are remunerated on the basis of the savings achieved. The ESCOs also offer energy performance contracts (EPCs). The use of EPCs has become very widespread. Heliosthana's Renewable Support Fund guarantees the bank loans of the ESCOs. Similarly, suppliers of EE industrial equipment have developed a leasing type selling system. Some 600 jobs have been created at ESCOs and several industrial sectors in Heliosthana have become more competitive than those of neighbouring countries as a result of the reduction of the proportion of energy costs in their overheads. This has led to a 35% increase in exports.

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Stage 4: Sustainable and competitive renewable energy

Supplying sustainable and competitive renewable energy (RE) is central to Heliosthana's new energy policy. The following steps were implemented to achieve this objective:

- ➜ evaluating the technico-economic potential of RE;
- ➜ analysing the constraints and solutions to overcome obstacles to the development of RE;
- ➜ developing an offering of high-quality equipment and services;
- ➜ support financing and tariff measures.

1. Evaluating the technico-economic potential of RE

According to the electricity company's projections (trend scenario), Heliosthana needed to significantly increase its total generation capacity in future years. The installed capacity of 7,500 MW (including 8% of hydropower plants) in 2010 needed to be increased to 14,000 MW in 2020 (chiefly coal-fired power plants, plants relying on heavy fuel and imported gas) to meet the increased demand in the absence of a demand management policy (the most cost-efficient way of satisfying growing needs). However, a combination of increased production equipment imports and fuel imports has a very unfavourable impact on the country's investment capacity and balance of payments.

Noting the volatility of oil prices and the boom in renewable energy sectors (equipment and energy supplies), in particular in Europe, Heliosthana opted for a change of direction. Before taking the decision to develop a RE sector, the Heliosthanian government commissioned a preliminary study to assess its economic, social and environmental implications and the optimal conditions for its development. In addition, a comparative study of the overall cost of electricity production by an RE sector was carried out in 2010 to validate the investment priorities.

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Table 2 :
Characteristics of the main RE electricity sectors in Heliosthana in 2010

Sector	Life (in years)	Investment (in €/kW)	Annual operating and maintenance costs (as % of the initial investment	Annual generation of electricity (in kWh/kW)	Electricity production costs (in €cents/kWh)
PV (roofs and façades)	20	3000	1.5%	2000	18.9
PV plants	20	5000	2%	2400	24.5
Wind power	20	1300	1.5%	2200	4.8
CSP*	25	3500	3%	2800	17.3
Large hydropower	40	1800	3%	7000	2.2
Small & medium-sized hydropower	40	2000	4%	6000	3
Micro hydropower	20	2500	2%	5000	3.5
Geothermal energy	30	4600	4%	5000	8
Biogas	20	3000	3%	5500	4.6
Biomass	20	2000	3.5%	6000	4.7

* CSP: Concentrated solar power plants (here costs without energy storage system).

Note: average cost of electricity generation in Heliosthana in 2010 = 7.7 €cents/kWh (excluding externalities such as pollution control costs).

Sources: summary of specialised RE literature, internally produced data.

The Heliosthanian government has undertaken, over and above the priority given to managing electricity demand, to promote energy substitution (replacing heavy fuel and coal with natural gas for the production of electricity) and the efficiency of transformation and transmission/transport as well as the production of renewable electricity (solar, wind power and biogas). In its electricity planning, based on an integrated demand-supply approach in terms of total cost (see table 2 above), the government has set a target of 1,165 MW of new RE installations for its 2011-2015 plan and an additional 1,785 MW for its 2016-2020 plan (see table 3 below). As Heliosthana's geothermal potential is weak, this source of energy is used only for thermal applications (hot water). The measures put in place to manage electricity demand in the various sectors (residential, service, industrial, public, agricultural and water pumping) have helped to cut electricity demand by 30% (see stage 3) in comparison with the benchmark scenario, i.e. a reduction of 4,200 MW by 2020.

Table 3 : Installed RE capacity (in MW) in Heliosthana (2010-2020)

Plan	Wind power	Biogas	Bio-mass CHP	PV	CSP	Hydro-power (before 2010)	Sea energy	Total
2010-2015	350	20	95	250	450			1165
2016-2020	450	30	105	550	550		100	1785
Total RE	**800**	**50**	**200**	**800**	**1000**	**500**	**100**	**3450**

In 2020 the installed generation capacity is 9,855 MW, including 35% in renewable energies (and approximately 25% of electricity generated). In addition, 4,400 MW of heavy fuel or coal-fired thermal power stations have been converted to natural gas. The environmental gain is considerable: CO_2 emissions have decreased from 735 gCO_2/kWh in 2010 to 305 gCO_2/kWh in 2020. The emissions thereby avoided owing to electricity generated using renewable sources of energy and the conversion of electric power plants to natural gas amount to 19.2 $MtCO_2$ a year. In addition, industries which are major consumers of electricity and large tertiary buildings (hotels, hospitals) have started their own production, especially cogeneration and trigeneration (production of electricity, heat and cold), taking advantage of the availability of natural gas via connecting networks with neighbouring producer countries and incentive mechanisms for biomass. The installed capacity (cogeneration and trigeneration) at the end of 2020 amounted to 180 MW (80 MW of which will begin operating in 2021) for an investment of €200 M. This situation has enabled Heliosthana to have 500 MW (1,500 GWh) of renewable electricity (of guaranteed origin) intended for export to neighbouring countries on the north bank of the Mediterranean during the peak winter period and to neighbouring countries on the south bank of the Mediterranean during the peak summer period.

To achieve its renewable electricity development targets, the government has encouraged independent producers, including industry and services (large and small-sized alike), to inject their surplus into the national grid. Thus, the ONG (Operator of the National Grid) undertakes to guarantee these producers priority access to the grid as well as transport via the national electricity grid of the electricity produced to consumption points and to purchase the surplus produced and not consumed by auto-producers at attractive prices.

Heliosthana has been so successful in preparing the ground for renewable energies that the country is becoming a favourite destination for energy-intensive clean industries traditionally based in Asia, Europe and the United states. Here they benefit from fixed-price, reliable energy (renewable electricity and high temperature gas obtained from biomass). Given the harmful effects of fossil and nuclear fuels and the social and environmental impact of large hydropower power plants, these industries and services are on the look-out for vast renewable energy sources. An IT company has recently installed a large part of its servers near a solar thermal plant, which provides it with round the clock electricity. Also, the 2021-2025 plan provides for the installation of an additional 800 MW of clean electric power plants to take account of the new demand from these industries for renewable electricity.

2. Analysis of the constraints and solutions to overcome the obstacles to the development of RE

a] Regulatory constraints

Heliosthana did not have an established regulatory framework for the development and implementation of RE projects. However, the CREE, the regulator, has now been mandated by the government to regulate (i) the system for awarding licences for RE projects, (ii) the national grid interconnection rules and (iii) the tariff system (based on incentives using a degressive system of feed-in tariffs).

The European Union has had several noteworthy successes with renewable energy tariff systems (feed-in tariffs), which typically involve user subsidies, and this approach has enabled Heliosthana to sell solar electricity to neighbouring north bank countries with sales contracts with tariffs between €0.25 and 0.35 per kWh.

b] Institutional constraints

The absence of an arbitral mechanism between the national operator and private operators in case of a dispute, especially in the case of disagreements regarding the interpretation and application of regulations, represented a legal risk. It was therefore necessary to set up an electricity regulatory authority, with the necessary mandate to interpret and ensure compliance with the laws and regulations governing the RE sector.

c] Technical constraints

The ONG did not have the necessary experience in integrating renewable energy into the grid, in areas such as developing and putting in place planning tools to anticipate, manage and monitor the integration of wind or solar generated electricity into the national grid. Heliosthana therefore turned to international technical assistance within the framework of the MSP to overcome these obstacles.

The government has fixed a 50% local content target for wind power and CSP (Concentrated Solar Power) projects. Companies in Heliosthana have therefore taken advantage of this experience to position themselves on the wind power, biogas and CSP markets of neighbouring south and north bank Mediterranean countries.

3. Successes: developing a national offering of high-quality RE equipment and services

Special attention has been paid to developing renewable energy production systems:

- ➜ remote and not connected to the electric grid,
- ➜ pumping systems for water supply systems,
- ➜ production systems connected to the electricity distribution network.

a] The widespread changeover to solar water heaters

The changeover to individual and collective solar water heaters (with guaranteed solar results) in residential and tertiary buildings, backed up by gas or biomass (non-electric) boilers has become more pronounced with an average increase of around 70% a year. In 10 years the penetration rate has increased from 37 m^2/1,000 inhabitants to 301 m^2/1,000 inhabitants (at the same level as Greece but still a long way behind Cyprus at 650 m^2/1,000 inhabitants). This represents an “annual saving” of 0.14 toe per m^2 of installed captors (given the replacement of the electricity used in part for heating water) and a 60% reduction in water heating needs using fossil fuels or electricity. In total, the replacement of expensive electric water heaters (“cumulus”) by solar water heaters (SWH) with non-electric back-up (or programmable electric back-up to work outside peak hours) has helped to reduce the capacity charge by 5%, in particular during peak periods (relieving at the same time production capacities and the grid). For users, the SWH cost is paid back in 5 years over a lifespan of at least 15 years. In addition, users pay for the labelled SWH installations over the same period through their electricity bills (no cash disbursement - inspired by the Tunisian “PROSOL” programme (see box 10). In the residential and tertiary sectors (including tourism), this wise system has facilitated considerable long-term growth of SWH while developing local manufacturing, installation and maintenance capacities. Moreover,

the "Solar 2011 Order" law requires tertiary buildings to have an SWH installation covering 50 to 75% of hot water needs according to the climatic zone.

"Helios", the national SWH dedicated programme has thus made it possible to initiate a real transformation of the SWH market in the country, since the annual rate of installations has increased from 80,000 m² in 2010 to 650,000 m² of captors in 2020. The number of approved suppliers has increased from 10 in 2011 to around a hundred in 2020. It should be remembered that the programme's target was to install 5 million m² of solar captors during the period 2011-2020 in order to save a total of 10.56 Mtoe over the estimated life of 15 years of an SWH, i.e. € 7.2 billion for an investment of € 2.5 billion. The programme created 1,000 jobs.

10 / PROSOL programme for the changeover to solar water heaters (Tunisia, 2005-2009)

The SWH is installed by an approved supplier/fitter who completes the file, has it signed by the customer, approved by the ANME and then transmits it to the STEG and the bank. The beneficiary in principle does not have to pay any advance. The arrangements are as follows:

Bank loan, reimbursable via the STEG (electricity company) bill
- ➜ Interest rate: TMM[16] +1.5%
- ➜ Amounts (choice): 750 DT[17], 950 DT or 1,150 DT
- ➜ Period of the loan: 5 years

Public subsidy
- ➜ 20% limited to 100 DT/m²
- ➜ Financed by the National Energy Management Fund (FNME)

Reduction of indirect taxes
- ➜ VAT at 0%
- ➜ Customs duties: minimum rate (10%)

2005-2009 objectives
- ➜ To achieve an installation rate of 100,000 m² a year.
- ➜ Total primary energy savings: 620 ktoe (over the life of the SWH installed)

Carbon financing by the CDM policy

b] Photovoltaic solar energy in Heliosthana: a significant back-up

I. Benefits of the operation

Heliosthana considered that it was important to combine the installation of photovoltaic panels on buildings with low energy consumption measures for these buildings: this ensures consistency between "clean" energy production and managed energy consumption. Thus RE feed-in tariffs for private individuals in Heliosthana are subsidised when the home and domestic equipment is Class A (see details below). A wide range of actions have been implemented within the framework of this approach: replacement of traditional light-bulbs with low consumption lamps in appropriate places, efficient electrical appliances, energy management, etc. Heliosthana has made it compulsory for companies to take back photovoltaic panels at the end of their life. A "recycling" tax is paid by PV buyers for this purpose.

II. Direct effects

The PV action plan implemented in buildings in Heliosthana has enabled 295 MWc of PV modules to be installed within 10 years, either superimposed, placed on the ground or integrated into the building's structure, i.e. 2.5 million m2 of PV. The annual electricity production generated by building integrated PV in 2020 was 708 GWh (i.e. 1.5% of the total) which represents 521 $ktCO_2$ of emissions avoided a year (given the country's energy mix) and a substantial reduction in fuel imports of 210 ktoe a year (or €155.4M). On the basis of an

16 Monthly average money market rate.
17 Tunisian Dinar: 1€=1.89 DT.

average price for a barrel of oil, which will surely increase over the next 25 years (life of the installations) (2020-2045), the 5.25 Mtoe saved over 25 years is an important economic issue for the country (cutting the country's energy bill by 4 to 6 billion euros over 25 years). The cost-effectiveness and environmental benefits of this programme are obvious. In addition, the number of new jobs created by the sector, i.e. 2,000 jobs over 10 years, including manufacturing jobs, is noteworthy.

The large-scale solar electricity programme launched by Heliosthana has helped to cut the prices of installations. The average price of €4/Wc over 10 years (given also the potential for sunshine in Heliosthana and the fact that the installation costs are lower than in the majority of countries in the region) represented a total investment of around € 1 billion over 10 years for an overall pay-back period of 9 years (given the sale of clean electricity at an average price of €0.3/kWh to neighbouring countries). Thus Heliosthana deserves its "sunshine country" name.

It is to be noted that a large number of installations have been designed to supply electricity at 12V without the need for an inverter (hence an additional saving); houses have been equipped with a supply system of 12V and lighting and equipment which also works on a 12V system. An independent 230V circuit supplied by the network's electricity is used to supply certain equipment.

In new buildings, the installations have been integrated into the design phase. The installations are now part of the building's architecture and are becoming an aesthetic element: photovoltaic windows, awnings, photovoltaic cells integrated into double glazing, roof sealing (amorphous silicon solar cells), canopies, car park roofs, façades (irrespective of whether it involves a curtain wall), railings, etc. These design effects also help to enhance the image of the buildings in which the modules are installed.

III. Specially adapted tariffs: attractive purchase tariffs (whether or not the PV is connected to the grid)

Photovoltaic electricity tariffs (€0.3/kWh in 2010 reduced to € 0.15/kWh in 2020 with a premium of €0.1/kWh for low consumption housing, i.e. less than 50 kWh/m²/per year and also equipped with at least Class A household electrical appliances) have facilitated the penetration of PV in the residential and tertiary sectors. Moreover, the "2011 Solar Order" law makes it compulsory for tertiary buildings of more than 3,000 m² to have a photovoltaic (PV) electricity production installation covering at least 10% of the building's total consumption. In 2020, total photovoltaic electricity production (centralised and decentralised) represents 3.5% of total electricity production.

c] Wind power: solid growth

At the beginning of 2010, world wind power production capacity was 158.5 gigawatts. It increased to 409 gigawatts in 2014[18] (i.e. 2.5 times higher). Wind power also has the advantage of allowing decentralised or centralised energy production: a wind farm with blades of forty meters long can cover the household electricity consumption of two thousand people.

Heliosthana was inspired by the example of China which has become, in a very short period of time, the world's second biggest producer of wind power, and capitalising on the island's windy sites it launched a vast programme for the development of this source of energy. As noted above, the installed capacity reached 800 MW in 2020 and the 2021-2030 plan provides for the installation of an additional 1,200 MW. The arguments put forward by the Heliosthanian government when its wind energy plan was adopted in 2010 included the following comment: *"Heliosthana's decision to opt for wind power and to reject the nuclear energy choice is based on the country's economic, ecological and energy interests and takes into account the interests of future generations…. Wind power is a pillar of our energy policy whose objectives are*

18 Global Wind Energy Council.

to promote energy efficiency and reduce energy waste. Wind farms are the visual symbol of this energy future".

The institutional and regulatory framework for renewable energies contributed to the development of wind power while preserving the environment (animal and plant life, landscapes). Purchase tariffs were guaranteed up to 2020. Investment in this sector reached € 1 billion from 2011 to 2020. The majority of these wind farms have been opened up to co-investment by citizens, with priority being given to citizens living in a wider neighbourhood. Heliosthana's wind power approach has been guided by overall performance, integration and sustainability considerations.

In 2020, 1,500 direct and indirect jobs were created in Heliosthana for the manufacture of components, preliminary studies, the construction and maintenance of wind farms. The choice of the sites for the farms was subject to an evaluation of not only the wind power potential but also all the ecological aspects, including bird migratory routes. The ISD has developed potential maps and put in place wind power development zones.

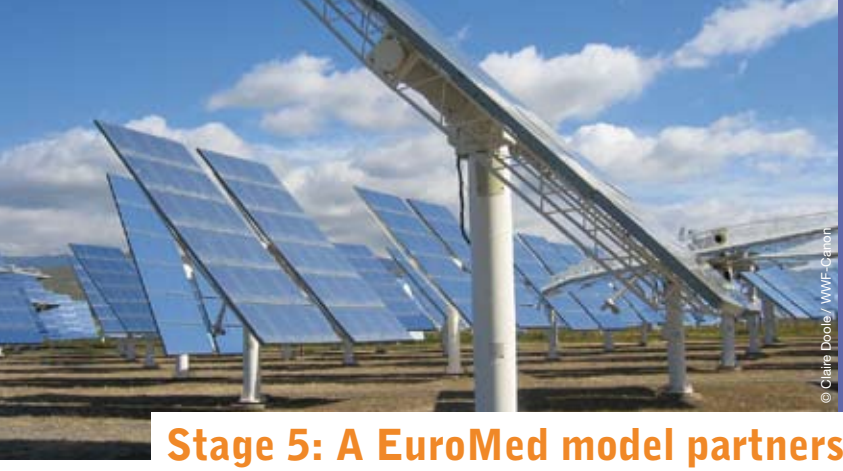
d] Biomass and forestry: a potential to be harnessed

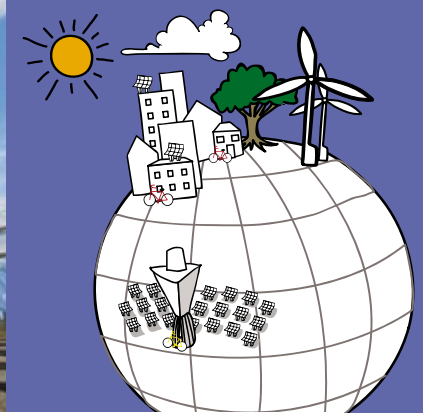
In 2010, Heliosthana put in place a forest and tree plantation (with low water needs) development programme, under which waste is recycled as a source of energy. In 2020, forests covered 3% of the country's surface. A plan to intensify the use of biomass (including agricultural waste) was also put in place. Thus, feed-in tariffs for electricity produced from biomass and biogas (from household or agricultural waste), facilitated the installation of 105 wood-fired cogeneration boilers and 80 agricultural waste-fired boilers (e.g. straw, olive residues) for a total of 200 MW. This avoids emissions of 20,000 tCO_2 a year. Also, the use of high output hot water and electricity micro-generation equipment (95% and above) is spreading rapidly in the residential and service sectors. The biomass sector has to date led to the creation of 500 jobs and the potential for forestry, which is in its start-up phase, seems promising.

e] Sea water power: a new frontier

The power of sea currents, swells and waves has always impressed the inhabitants of Heliosthana. Since the first experience of the tidal power station in La Rance – France (in 1966) technologies in this domain continue to develop and improve. A "Helio-blue" plan[19] was adopted by the Heliosthanian government in 2015, with a target of installing equipment with a capacity of 300 MW by 2025. In 2020, 100 MW had been installed. Measures have been taken to avoid these underwater installations causing any disruption to the ecosystem of the marine environment. More than 20 MW are generated by underwater turbine generators capturing the power of the tides, without a fixed infrastructure. 55 MW are generated by generators with blades (marine current turbines) harnessing the sea currents of the tides. PWP (Pelamis Wave Power) type machines with a total capacity of 25 MW generate electricity from sea swell. In addition, certain types of seaweed are cultivated to supply biodiesel, biogas and products to the "green chemistry sector" while ridding marine waters of pollution.

19 Inspired by the "blue energy" plan drawn up in France after the debate of the "Grenelle de la Mer" in 2009 and which set a target of 6,000 MW installed by 2020.





Stage 5: A EuroMed model partnership: the Mediterranean Solar Plan

In 2010, Heliosthana announced its participation in the Mediterranean Solar Plan (MSP) within the framework of a summit of the Union for the Mediterranean. The Heliosthanian representative delivered this visionary speech to the summit: "We are improving our future by taking control of our energy today. Our national energy objectives are sustainable, ambitious but achievable. *We would also like to promote trade in renewable electricity in the region by way of a reinforced electricity grid. However, we will only be able to implement this positive development with the support, in particular financial, of public and private partners. That is why we would like to join the MSP as well as the partners of the DESERTEC initiative. The MSP will reinforce our national efforts and will enable us to optimise our energy mix, while harnessing solar, wind power and biomass as sources of revenues and development by exporting clean electricity".*

It is worthwhile revisiting this speech which summarises clearly Heliosthana's approach and the contributions of the MSP and DESERTEC. This approach enhances the international dimension of the country's energy strategy.

1. National objectives reinforced by the MSP and DESERTEC

Heliosthana did not adopt a passive position in the MSP discussions and emphasised its innovative viewpoint (see box 11). The country did not wait for investors to express their interest but prepared its own energy plan, "Heliosthana 2020". This balanced mix of energy efficiency and renewable energy projects, including decentralised and centralised, small and large scale projects, benefited the country's inhabitants and companies. To ensure the relevance of "Heliosthana 2020" in an international context linked to major projects, grid connections and major project objectives were drawn up not only for 2020, but also for 2030, 2040 and 2050 since the networks and major solar and renewable installations are planned on a long-term basis.

Heliosthana then shared this plan with the neighbouring countries, IRENA, the MSP and DESERTEC in order to identify areas of common interest. Cooperation with neighbouring countries facilitated the planning of the grid and electricity production. Withn the framework of the MSP, some major projects were intended, at least partially, for the export of electricity. This concerned mainly large wind farms (800 MW in 2020), large solar photovoltaic fields (notably concentrated) and 1,000 MW of concentrated solar power (CSP) plants (see box 12). In addition, the secretariat of the MSP helped Heliosthana to group together small projects, in particular those covering individual and collective SWH projects for the residential and service sectors and biomass in order to make them more interesting for large banks and investors.

11 / Heliosthana's 10 recommendations to the MSP

1. Clarity of the MSP's objectives: "20 GW" does not make it possible to grasp the quantity of electricity delivered as well as the connection of installations to the grid. It is therefore desirable to express the objective in electricity available (therefore in GWh) excluding large hydropower installations and the north bank countries. It is also essential to express an energy efficiency target in negawatts (and GWh) and to set post-2020 renewable energy and negawatts targets.
2. Promote the development of National Solar Plans with a mix of small and large-scale projects (including SWH, wind power, biogas cogeneration, etc.) for local markets and exports (as in Tunisia).
3. Give renewable energies priority access to the grid between the EU and neighbouring countries, as in the EU. Facilitate cooperation between grid operators.
4. Bundle small projects into more important financial projects, in order to make them attractive for large banks and investors.
5. Facilitate cooperation between the European Union and neighbouring countries.
6. Facilitate and pool environmental research and socio-economic research in important areas, such as the creation of jobs, desalinisation or the water needs of CSP plants.
7. Propose a programme for recovering and recycling solar panels in partnership with industry.
8. Promote a partnership between north and south bank companies and universities.
9. Defend the interests of the partner countries and the financing of the MSP in international negotiations on climate change.
10. Encourage the EU to increase its renewable energies target in order to permit renewable electricity imports from neighbouring countries.

Trade with neighbouring countries and other countries within the framework of the MSP has been fruitful. A reinforced electricity grid has facilitated electricity trading with neighbouring north and south bank countries, thereby optimising the use of the energy mix. Such cooperation has also promoted lasting peace. Numerous trade agreements have been subsequently signed in a climate of confidence.

Cooperation with the European Union has proved interesting since it has enabled the latter to eliminate expensive nuclear and coal-fired power plants by taking advantage of the Mediterranean region's sunshine, in combination with energy efficiency and electricity savings. For its part, the EU has been able to pay a higher price since this renewable electricity helps some of its member countries to achieve their 2020 renewable energy targets.

The results of this approach are now visible in 2020 in the close consistency between the MSP and Heliosthana's National Solar Plan, the electricity supply and demand match (in terms of volume, season and over the short term) and the long-term sustainability of major electricity projects.

12 / Principles, advantages and challenges of Concentrated Solar Power (CSP)

The principle of this technology (concentrated solar rays heat a fluid which activates an electric turbine/generator), which has been known since the 1960s, has developed on the basis of several processes (1). It has the advantage of being able to develop important capacities (currently around 50 to 150 MW per power plant) and therefore to generate significant quantities of electricity, including at night time (using a fluid storing the solar heat received). Its cost is attractive (feed-in tariff of € 27c/kWh in Spain in 2010) and is, moreover, falling thanks to economies of scale.

Also, CSP developed rapidly in the 2000 decade, in particular on the north bank. In Spain, a first power plant was commissioned in 2007, followed by numerous projects with

total capacities of 850 MW in 2010 with 2,400 MW planned by 2014 (under construction or in the project phase). On the south bank, the first projects have been developed in Algeria (site of Hassi R'mel with 25 MW in CSP at a natural gas combined cycle plant of 130 MW), Morocco (Ain Béni Mathar: also 25 MW in CSP and 472 MW in gas) and Egypt (Kuraymat: 20 MW in CSP and 135 MW in gas).

Heliosthana closely followed the commissioning of CSP plants in the region and also rapidly understood the potential benefits for its electricity mix (2010 production cost: €17c/kWh given the surplus sunshine). In May 2010, the Minister of Sustainable Development declared at a regional conference: *"With 3,000 hours a year of sunshine equivalent to a radiation density of 5.3 kWh/m² a day, Heliosthana is well equipped to be able to build large concentrated solar power (CSP) plants"*. The other conditions necessary include important shadow-free surfaces near electric transmission lines. When plants use water cooling towers, the volumes of water needed are important (as in any thermal power plant). On the other hand, air cooling systems avoid the use of water but reduce the performance of CSP plants. The use of heat transmission oils makes it necessary to avoid leaks and requires waste processing.

Depending on the conditions of several sites chosen in desert areas in Heliosthana (without agricultural or urban use, near the electric grid) and following a cost-benefit analysis, the MSD, the CREE and the ONG drew up CSP specifications (impact studies, construction and operating conditions, including the management of fluids and damaged panels, a minimum local share in the supply of equipment, labour for the construction and management of power plants). Then, an international call for PPP[20] projects for the implementation of the initial CSP projects (with air cooling system given the scarcity of water resources) of 150 MW each was launched in 2011. It specified an attractive, degressive feed-in tariff guaranteed for 20 years (accompanied by carbon finance when the electricity is not consumed in the European Union). Three power plants began operating between 2013 and 2015 and two others of 150 MW and 250 MW respectively were added, to reach 1,000 MW in 2020, producing 3,000 GWh of solar electricity, thereby avoiding emissions of 2,200 $ktCO_2$ a year. Some 600 MW of CSP plants are envisaged in the 2021-2025 plan. The amount invested was € 4.2 billion.

Heliosthana has thus reinforced the security of its electricity supplies and has been able to supply renewable electricity to other north and south bank countries thanks to its strategic geographical situation, its developed electrical interconnections and its renewable electricity exchange. The country has thus positioned itself as a real platform in electricity trading between the two banks of the Mediterranean.

(1) Cylindro-parabolic captor stations (50 to 250 MW): numerous rows of cylindro-parabolic captors serving as reflectors (placed in east-west rows, around a hundred metres long). The thermal energy received at the focal point is absorbed by a metal pipe inside a vacuum glass tube. The fluid (synthetic oil), which flows inside the pipe, is heated to 400°C in order to produce the superheated steam which operates an electric turbine/generator.

Other CSP technologies currently in use:

- Tower (10 MW to 50MW)
- Stirling engine dishes (10 kW to 1,000 MW)
- Linear Fresnel panels (R&D at 6 MW)

Details on the site of ESTELA (European Solar Thermal Electricity Association): www.estelasolar.eu

20 Public Private Partnership, here on a BOT basis: "build operate transfer", i.e. the operator takes responsibility for the construction of the power plant, its management then at the end of the contract its transfer to the host country.

2. Sustainable energy targets

Renewable energy has numerous potential benefits. Energy efficiency and renewable energy projects reduce greenhouse gas effects. They also enable Heliosthana to reduce its dependency on fossil fuels, such as coal and petrol or nuclear, which are subject to price fluctuations. In addition, thermal power plants require important volumes of water for cooling and can represent a threat for the country's already limited water resources. Renewable energy and energy efficiency also help to create interesting long-term jobs (from R&D, manufacturing, installation to maintenance and recycling) and make it possible to launch new training programmes and new university curricula, etc.

In order to benefit as much as possible from renewable energy sources, negawatts and exports of renewable electricity, Heliosthana organised a consultation with a consortium of R&D centres, industrialists and NGOs within the framework of the MSP and the launch of its national forum, in order to discuss the environmental and socio-economic effects of the production of renewable energy. Heliosthana has implemented the consortium's recommendations.

- *For each renewable energy project of a certain size[21], an EIA (environmental impact assessment) in accordance with EU standards is compulsory.* These assessments must, for example, reveal whether a wind farm is on the migration route of migratory birds, whether a proposed solar thermal power plant is to be constructed on fertile agricultural land or land occupied by a local population already facing water shortages, whether the recovery and processing of toxic waste is necessary and whether measures need to be taken to absorb a sudden population growth in some regions. An impact assessment can also lead a solar thermal project to choose an air cooling system, which is more expensive but feasible owing to the solar output which is higher than in other countries. This EIA must include a consultation process and companies must prove that the recommendations have been taken into account. The Heliosthanian government has decided to put this into practice (an EIA was already a compulsory condition for all infrastructure projects in the country) and it has also requested renewable energy companies to use the Gold Standard methodology[22], applied to CDM projects but valid for all renewable energy or energy efficiency projects. This methodology is therefore part of the EIA for major renewable energy projects. This methodology helps to ensure that projects have environmental and social benefits.

- *The government must also carry out a prior regional strategic EIA, in order to gain a clearer understanding of the combined impact of the various projects.* In practice, the government has decided to go even further and optimise the selection of sites suitable for large solar and wind power stations, while facilitating the work of industrialists, by designating Renewable Energy Development Zones (REDZ). This decision was influenced by the successful planning of zones for the development of offshore wind farms in Great Britain. Planning in Heliosthana takes account of climate conditions (sun, wind, biomass, etc.) and the strategic EIA, including any human presence in the region, biodiversity, the fertility of the land, cooling water resources for solar thermal plants, the presence or absence of electricity grids and infrastructures, the closeness of centres of consumption, etc.

- *Desalinisation options have been analysed further.*
Given the country's limited water resources, solar thermal plants could provide desalinisation opportunities.[23] However, the Heliosthanian government has adopted a cautious approach. At the time there were no solar thermal power plant related commercial desalinisation projects and it was not certain that such a solution would be viable. In addition, the government wanted to check whether all necessary preventive measures had been taken to save water

21 The installation's size threshold will depend on the technology chosen
22 www.cdmgoldstandard.org
23 See for example http://www.menarec.org/resources/CSP+for+Desalination-MENAREC4.pdf

before opting for desalinisation, which is expensive and not impact-free[24]. Heliosthana requested that the MSP and DESERTEC carry out the necessary research at regional level as a basis for its decision.

- *Providing for the recycling of photovoltaic and thermal solar panels*

Although panels have a lifespan of 20 years or more, the country planned for a recycling programme for panels at the end of their useful life from 2010. The companies which sell panels are responsible for taking them back. Customers pay a premium when they purchase a panel. Customers can recover this premium when they return the panel. This means that it is the consumer's interest to return the panel. It also enables the manufacturer to recycle expensive raw materials. Manufacturers have undertaken to recycle almost all panels, within the framework of the MSP.

- *Promoting the creation of local, national and international high-quality jobs*

Although jobs are created directly when new renewable energy projects are implemented, the geographical situation, the quality of the jobs, etc. are not clear.

Heliosthana already had a clear renewable energy development plan and long-term support mechanisms and accordingly attracted large and small-sized companies which decided to establish a long-term presence on the island. The parts for the initial installations were manufactured in Spain and Germany, but since then a large part of the components have been manufactured on the island and are also exported from Heliosthana to other countries in the region.

In response to the consortium's recommendations, the government also adopted some additional measures. It has awarded grants to the country's three main universities to enable them to develop curricula in the field of renewable energies and energy efficiency, in particular in cooperation with national and European research centres. The technicians of tomorrow's power plants will be trained in Heliosthana and will give the country an additional selling point when it comes to attracting investors. Missions from Heliosthana to Iceland and the Philippines have enabled the country to gain a better understanding how these countries have become leaders in the field of geothermal technology for the supply of heat and electricity, with engineers who are among the best trained in the world. Within the framework of DESERTEC and the MSP, member companies have agreed to work directly with universities.

The government has also undertaken to pursue its efforts in the area of worker protection, in the framework of its cooperation with the International Labour Organisation (ILO) and its "Decent Work"[25] agenda. It also requires companies to comply with strict standards as regards their employees and recommends them to demonstrate their commitment via the social accountability standard SA 8000.[26]

Finally, when designating renewable energy development zones (REDZ), the government ensures that the infrastructures benefit local communities, by promoting hotels, restaurants and local tourism. The secretariat of the MSP has undertaken to help Heliosthana and other countries through environmental and socio-economic research in order to reduce its cost for the region.

3. Financial support of public and private partners

In its "Heliosthana 2020" plan, the government put together programmes and projects of different sizes involving a range of technologies. Some programmes, for example for the promotion of solar water heaters, are cost-effective after several years and, moreover, reduce the public deficit since they are less expensive than the subsidies granted for a quantity equivalent to that saved in fossil fuels.

24 See the WWF report http://www.panda.org/index.cfm?uNewsID=106660
25 http://www.ilo.org/global/About_the_ILO/Mainpillars/WhatisDecentWork/lang--en/index.htm
26 http://www.sa-intl.org/_data/n_0001/resources/live/Standard08FAQS.pdf

Other programmes are more expensive, such as large-scale solar projects for the production of electricity. For these projects, Heliosthana carefully examined the financial options with its partners in the MSP and DESERTEC, as well as with major banks such as the EIB and the World Bank.

The consultation highlighted the fact that without economies of scale, large-scale photovoltaic or thermal electric projects remained expensive - too expensive for Heliosthana. They therefore needed international support. The country and its partners explored and used several ideas.

- *Reducing then eliminating subsidies to fossil fuels.* This helps to create a more level playing field between renewable energies and fossil fuels. Heliosthana had already adopted this decision in its 2020 plan.

- *Internalising the cost of carbon is an additional stage following the elimination of subsidies to fossil fuels.* This helped to take account of the pollution of sources of electricity and therefore to make renewable energies more competitive. Heliosthana was thinking of using this idea, at least for certain categories of consumers.

- *Accelerating the reduction in national energy demand,* facilitating more substantial savings for the government in subsidies for fossil fuels which could be invested in renewable energies, while reducing renewable energy needs in order to enable the government to reach its renewable energy target of 20%. Heliosthana had already taken ambitious energy efficiency decisions in its 2020 plan.

- *Reducing import taxes on clean technologies,* making it possible to reduce the cost of renewable energy and energy efficiency projects.

- *Not relying solely on solar electric technologies* for large power plants, but rather combining them with cheaper sources such as SWH and wind farms. This mix applied by Heliosthana has helped to reduce the subsidies granted to the sector, pending a further fall in solar prices.

- *Using multilateral soft loans from banks* in order to reduce the capital cost of power plants. The soft loans of the EIB and the World Bank finally enabled Heliosthana to construct large-scale solar projects.

- *Using carbon credits for electricity which is not intended for export to Europe.* Heliosthana was well placed to obtain an additional premium for these credits given that it requires project promoters to use the Gold Standard methodology and Gold Standard certified projects obtain higher payments than the market for conventional credits, as they are considered as more credible. However, these credits were far too small to make a solar project cost-effective, even in combination with soft loans. This solution was combined with other solutions.

- Exporting electricity to the European Union at a higher price (and stable price in the framework of long-term contracts), equivalent to the amount that European governments pay for their solar energy. However, it is not obvious to persuade a European country to import electricity at such a price, since most of the countries in question expect to achieve their 2020 targets on their domestic market, while creating jobs and opportunities for industry on their territory and ensuring their energy independence. EU countries can also make a “statistical transfer” with another European country if the quotas are not achieved. Heliosthana, the secretariat of the MSP and the multilateral lenders discussed possible solutions with the European Union, which in the end agreed to support the Heliosthanian project by setting a renewable energy import target in addition to its 20% renewable energy target. This target has contributed to trading, peace and development, while improving the grid’s capacity to absorb variable electricity sources. But such electricity trading required legislative and legal clarification, involving the MSD, the CREE and the ONG. Heliosthana and the EU are currently discussing going further with an Electricity Free Trade Agreement.

The European Union too had to set binding sustainable energy targets for 2030, 2040 and 2050 in order to provide investors and partner countries with greater transparency, above all as regards networks and major export related solar projects.

• Finally, the International Climate Change Fund facilitated the decisive decisions in favour of major solar projects in Heliosthana. This fund, discussed in Copenhagen at the end of 2009, made it possible to cover the difference between the cost of the projects and the amount that investors in Heliosthana could put on the table, with the help of soft loans. In setting energy efficiency and renewable energy targets and by bearing a large part of the financial burden of this strategy, Heliosthana was well placed to obtain international support which enabled it to carry its projects through without financially crippling itself.

4. Reinforced electricity grids

Electricity trading throughout the region would not have been possible without regional cooperation with the aim of optimising the management and planning of electricity grids. After numerous discussions with its neighbours and the European Union, Heliosthana implemented the following measures:

• *Putting in place a Regional Initiative for Electricity Grids (RIEG).* Inspired in part by the discussions between North Sea countries in the framework of the "Northern Seas Offshore Grid Initiative", Heliosthana proposed to its neighbouring countries that they should work together on the regional planning of the grid, in order to optimise the energy mix and the planning of lines. This initiative established ties between the Heliosthanian ONG, European operators and ENTSO-E as well as with south bank operators. The ONG has also joined the "Renewable Grid Initiative"[27] facilitating discussions with transmission system operators in favour of active cooperation.

• *Proposed connection to two European Union countries.* Following the European Union's firm commitment to import renewable electricity, two connection projects with "HVDC"[28] cables were planned. Heliosthana insisted that transit priority should be given to renewable electricity as opposed to non-renewable electricity. A reliable system facilitating traceability made this objective possible. One of the planned underwater cables enabled several offshore wind farms to be connected on the route, as a way of taking advantage of the cable and reducing total costs.

27 http://www.renewables-grid.eu/
28 High Voltage Direct Current; http://en.wikipedia.org/wiki/High-voltage_direct_current

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Stage 6: Sustainable urban planning and sustainable transport: "the intelligent city"

1. Sustainable urban planning: a comprehensive plan

In Heliosthana as in the other Mediterranean countries, cities have become a major issue in the key areas of sustainable development as a whole due to their importance in the economy and society. Furthermore, the city is the administrative level that is the closest to the vast majority of citizens.

a] The logjam of the extensive approach

Although Heliosthana has vast areas of natural space, the majority of its population and its economic activities are concentrated in the country's urban centres. The two most important urban centres are Heliopolis, the business capital, and Eolis, the political and administrative capital. Because of this concentration and the rapid and spectacular development of economic activity zones and residential areas, before 2010 cities represented a predominant and increasing share of energy consumption and polluting emissions. The continuous increase in distances between home, the workplace, retail outlets and leisure centres for inhabitants and between places of economic activity for companies, in the context of a neglected public transport network, had increased the number of vehicles on the road (cars, two-wheeled motor vehicles and trucks) and therefore the number of traffic jams. The illusions of single family dwellings (with a garden and swimming pool) for everyone and of disproportionate business centres and shopping malls were confronted with the problem of transport bottlenecks and high real operating costs and a mediocre quality of life (lack of nearby services and social spaces, isolation and impersonality, violence).

These sprawling cities without real centres suffered from a twofold lack of consistent urban planning and public transport, resulting in high, increasing extra costs (in particular for road, energy, water supply and treatment infrastructures, and health because of the air pollution and stress) borne by residents. These problems also made them less attractive.

b] Sustainable development: density and integration

In response to this spiral of failures (with a risk of no return) and the limits on resources (space, water, energy and biodiversity), the main municipalities decided, within the framework of Heliosthana 2020 (the national energy strategy), to re-examine every aspect of their urban planning policy. The problem was how to switch from a deteriorating situation and the expensive treatment of the impact of this situation to quality-based sustainable improvements, at the lowest possible cost. The solutions needed to go beyond a succession of partial technical measures and move towards fundamental, comprehensive approaches, reflecting ecosystems. The new urban planning policies also integrated consultations and a flexible, long-term planning approach.

The policy overhaul began with forums that mirrored and were organised in parallel with the Heliosthana 2020 consultation. As a result, each city launched an Agenda 21, implemented by a local action plan. The common points between the main actions plans in Heliosthana included:

- **a review of urban planning law** to promote sustainable development and redevelopment, en-

couraging and targeting proximity and synergies between residential areas, the workplace, retail outlets and leisure centres. The principles of decentralisation and densification of space include an overall quality approach favouring small to medium-sized districts and buildings. Based on a sustainable long-term vision, urban planning is organised in consultation and makes it possible to conceive a consistent overall framework and anticipate changes;

- the application of the new **thermal regulation** and design rules, such as the orientation of the land, have favoured passive free solar contributions as well as natural transversal ventilation. Low consumption and the integrated design approach thus facilitated the installation of a wide range of integrated RE (PV, SWH, geothermal heat pumps on a water-bearing layer[29], biomass micro-generation) in urban areas, buildings and housing (see also the NegaJoule principle in part 2);

- **the role model of municipalities:** the practical implementation of these principles logically required the implementation of action plans at the level of the municipalities themselves: energy audit and carbon assessment identifying the thermal rehabilitation priorities by ESCOs of public buildings (now approved according to the DISPLAY[30] model), employee mobility plans, purchases of goods and services with an eco-label. This enabled important cost reductions to be achieved rapidly, thereby enhancing the credibility of the approach among the public and companies. In addition, each city developed a wide-ranging plan for the development of green spaces and plants on roofs and walls, thus helping to improve the living environment, enrich biodiversity and reduce heat peaks and air-conditioning needs;

- one of the fundamental principles of urban planning in most cities in Heliosthana was to favour the creation of a network of new **eco-districts** from existing districts, benefiting from small and medium-sized collective buildings

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characterised by their low consumption, quality and sustainability. A national programme developed a network of the cities implementing this process together with northern and southern European eco-districts.[31] The experience acquired from this participatory, consultation based approach highlighted the need for intensive work on the fundamental issues upstream of the consultation and discussions with all the stakeholders (municipal authorities, developers, architects, builders, consultants in urban planning and sustainable construction, landlords/owners and tenants) for each operation involving the creation of an eco-district. Each operation is coordinated to ensure, on the one hand, that it is implemented, monitored and evaluated in a consistent way and, on the other hand, that it complies with the **eco-district certified label.** This label enables the stakeholders to integrate from the design phase an overall, sustainable

29 www.geothermie-perspectives.fr/Doc_LOR/GuidePACLorraineFEV08.pdf ;
30 www.display-campaign.org
31 From Malmo to Cadiz, taking in Fribourg, Culemborg, BedZed, Grenoble, EcoZac in Paris, etc. members of the European network of eco-districts-www.eco-quartiers.fr

approach, for example: a layout ensuring the optimal orientation of buildings according to sunshine and dominant winds (two important climate factors in Heliosthana), thermal and sound insulation optimised at the level of Class A performance, waste recycling and processing, recovery of rain water, "soft" transport networks (pedestrian and bicycle lanes) and dedicated public transport lanes (buses, tramways), service centres (retail, health and cultural) and green spaces;

- the gradual transition to denser, low consumption urban planning (developed sites, mobility and modes of transport) has reduced structurally and on a lasting basis waste and energy and carbon intensity at a ratio of 3 to 4 times in comparison with the initial situation. Semi-collective housing constructed in accordance with "bioclimatic, common sense principles" emits 2 tCO_2 a year (0.9 tCO_2 for the housing + 1.1 tCO_2 for travelling) compared with 4.5 tCO_2 a year for traditional urban housing and 7.9 t for a detached suburban house.

2. Sustainable transport: interconnected networks and services to promote fluidity

In order to develop and establish the credibility of a sustainable urban planning strategy, it was necessary to put in place efficient and reliable urban and extra-urban transport systems.

a] Urban transport

- **Mobility and transport plans:** for each medium and large city in Heliosthana, the detailed analysis of transport needs (passengers and goods) set out in the urban transportation plan enabled an overall, multimodal ("soft", public and individual) and adaptable mobility plan to be drawn up. Under this plan, public transport now has a preponderant place offering a wide choice for users as an alternative to private cars, thanks to a dense network, an efficient fleet of vehicles and dedicated public transport lanes, with timetables adapted to demand. Furthermore, other additional measures have been adopted: positive incentives (fixed price multimodal transport tickets depending on the holder's personal situation and income), free travel at weekends for other people, tax credits for buying a bicycle, switching to home working, the development of e-shopping combined with intelligent logistics (GPS), the HelioCarbon card and responsibility raising measures (inner city congestion charge and increased parking charges during peak hours and days, individualised mileage taxation based on satellite data). A progressive tax system based on carbon emissions (French "bonus-malus" type system) for private and company cars led people to switch to more economical vehicles (40 to 70 gCO_2/km for light vehicles). From 2014, the sale of vehicles exceeding 170 gCO_2/km was prohibited.

- **Modes of transport and intermodality:** the municipalities and public transport companies promote intermodality by installing a vast network for renting traditional, folding or electric bicycles, LC or electric scooters and vehicles, including car sharing (HelioCar car sharing). This network of secure bicycle garages with car parking spaces at the entrance, supplemented by car sharing networks, offers users a wide choice of transport options in real time (including taxis) and routes provided by a system of terminals, available via a mobile phone or over the Internet.

- **Fuel, the transition to sustainability:** the transition from transport's total dependency on petroleum products to the use of more sustainable fuels involved a combination of several means:

a] public transport (suburban trains, trams, trolleybuses, buses and taxis) the 100% use of electric and/or hybrid vehicles, biodiesel (from waste) and biogas vehicles (the diversity of fuels and sources is also a guarantee of the security of supplies as for emergency services);

b] vehicle fleets of administrations and companies and privately owned vehicles: incentives (tax calculated on the vehicle's power and mileage via satellite positioning) and regulations to accelerate the transition to LC vehicles and alternative energies (electric and/or hybrid) – a standard battery exchange network is also included among the charging options (dedicated sites, service stations).

Eco-driving combined with a system displaying real time and annual consumption has become the norm, thereby providing an additional energy saving incentive.

In 2020, sales of electric cars in Heliosthana represent 6% of the market and 20% of cars on the road are hybrid vehicles (combining a thermal engine and an electric engine). The market penetration of electric vehicles has been boosted by lower battery prices and new recycling technologies giving a second life to batteries. At the same time, Heliosthana has installed infrastructure for charging (above all during the night) in work places, in residential districts and along main roads. With an electric vehicle it takes only 20 kWh to travel 100 km. The 150,000 electric vehicles on the road consume 450 GWh a year, i.e. the annual electricity production of a wind farm of 150 MW. The development of electric cars has boosted demand for solar electricity, which Heliosthana will take into account in its solar electricity development plan.

The supply of electricity for transport purposes is therefore combined with charging rates intended to encourage users to charge their vehicle at off-peak times in order to promote the priority utilisation of RE and the base of cogeneration plants during the night. It is essential to provide electricity with a low carbon content available at off-peak times to avoid increasing, on the one hand, dependency on fossil fuels and imports and, on the other hand, CO_2 and other polluting emissions from power plants. Heliosthana therefore intends to decarbonise the electricity used in transport. In addition, decentralised wind power and PV systems can be used to charge batteries directly.

b] Extra-urban transport

Between cities and for outside links, Heliosthana has also adopted a sustainable, pragmatic and progressive approach for the transportation of:

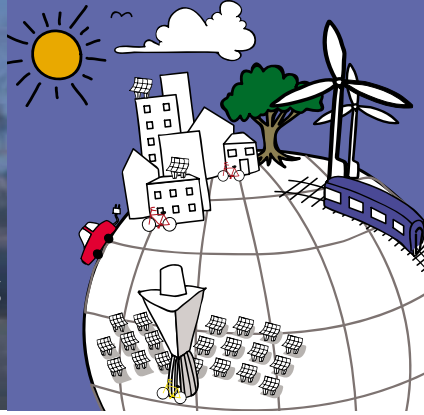
- *Goods*

On the island, the government has promoted rail freight thanks to a night-time service with multimodal platforms distributing deliveries using hybrid low consumption vehicles. A tonne/km transported by rail consumes 30% less than by road and uses electricity rather than fossil fuels. Sea transport combines the use of lighter vessels, light, folding containers and a mixed propulsion system (biodiesel and "Skyte" sails).

- *Passengers*

The rail network handles most travel between cities thanks to the frequency, quality and price of rail services (90% of the train network is electrified, the rest is hybrid). Passengers can complete their journey through a combination of taxis and HelioCar at a fixed-rate price. Air transport is used only for flights abroad and its annual emissions are subject to a quota which encourages companies to make fuel savings (reductions of flight time and taxiing time, lighter loads) and research into bio-aviation fuel. Only sail and/or solar-powered pleasure boats can berth in Heliosthana.

All in all, the combination of incentives, an optimised collective transport system, eco-driving behaviour and more efficient vehicles has enabled Heliosthana to avoid 35 billion of km annually, i.e. 24% of total transport emissions for an energy saving of 30% compared with the benchmark scenario. The response to mobility needs has enabled the country to switch from an approach based on personal vehicle ownership (under-used and expensive) to a services-based approach (transportation of persons and goods based on the overall quality: time, price and impact).



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Stage 7: Overall evaluation of a low consumption country based on sustainable energy

In May 2020, Heliosthana carried out an evaluation in order to take stock of and learn the lessons of a rich and busy decade, during which the country put in place a sustainable energy policy, on an efficient, effective and long-term basis, thanks to low consumption and renewable energies.

Faced with an initial deteriorating situation marked by waste and a negative spiral, the Heliosthana 2020 strategy was ambitious but succeeded, stage by stage, in generating a new *virtuous, consensual dynamic* responding to the country's real needs. The lessons leant from this proactive, transparent and structured approach are useful both for the next decade and for the other countries in the region. They include within the 6 previous stages of Heliosthana 2020 the following key measures:

1. The fundamentals of sustainable energy: a long-term strategic vision and structured implementation

- A solid energy strategy integrating a diagnosis of the situation and problems, long-term objectives and sectoral and thematic action plans based on detailed calendars.

- A structured institutional framework with a solid administration coordinated by a dedicated ministry (the MSD), "the manager" of the process, and supported by specialised agencies (statistics, regulation and EE&RE).

- A clear separation of the State's role between, on the one hand, policy-making (MSD), implementation of regulations and programmes (agencies) and, on the other hand, participating interests in the energy sector.

- Consultation during the implementation and evaluation of the strategy with all the stakeholders, in particular the municipalities.

- The availability of reliable statistics and indicators to optimise decision-making (macro and micro) and assess the impact and effectiveness of the strategy.

2. The pillars of Heliosthana's energy policy: 3 priorities and 1 principle

- An effective system of security of supplies (diversification, stocks and emergency plans).

- Guaranteed access to energy, accompanied by a low consumption (LC) social tariff.

- The elimination of subsidies and internalisation of the costs of carbon in order to establish a level playing field between EE&RE and fossil fuels.

- The energy savings and efficiency of the NegaJoule approach help to increase the share of renewable energies on a long-term basis and economically.

3. Low consumption or satisfying needs without waste: the fundamental measures

- A comprehensive, integrated upstream approach: combination of LC design, technological innovation and integration of consumption mindsets.

- Regulation (LC standards and labels for appliances, buildings, vehicles, products and services) as an effective structuring tool.

- Support measures and incentives (assessments/ audits, appropriate tax measures, carbon card).

- Integrated bundled financing (ready-made guaranteed solutions: eco-loans for LC and renovation).

4. Sustainable, competitive renewable energy: targeted, key incentives

- An assessment of the potential of resource and LC needs, generating priorities.

- A comprehensive regulatory framework for investment, production and sale of RE, one-stop shop procedures.

- Feed-in tariffs (electricity and heat) as a medium-term incentive and subsidies for PV when buildings and equipment are LC (class A).

- Innovative financing (RE fund, tailored PROSOL type financing for SWH).

5. MSP partnership: optimising synergies

- A solid, diversified national solar plan integrating small, medium and large-scale projects and a wide range of economic techniques (including SWH and biogas), and ambitious but realistic targets in terms of volumes of electricity (GWh) and capacity (MW), and energy efficiency (in negawatts).

- The application of international quality standards in impact assessments.

- Guaranteed significant domestic (equipment and services) and R&D investment.

- Putting in place sustainable, balanced mechanisms for co-financing investment (production and network sites) and regional energy trading.

6. Sustainable urban planning and transport: towards "the intelligent city"

- A structuring approach to urban and transport planning based on consultation and flexible, long-term plans.

- Urban design and mobility upstream, based on overall quality: denser, more efficient cities, districts and buildings (both from an energy point of view and economically) and better linked by a reliable, efficient public transport system.

- Closer residential areas, work places, retail outlets and leisure centres, interconnected by intermodal networks with a vast range of collective and on demand transport, switching to a services-based approach (not owning a vehicle); public transport supply boosts demand.

- New fuels (2nd generation biodiesel and renewable electricity): gradual transition based on niche depending on the limits of resources, need to decarbonise electricity-transport to avoid new fossil dependency and pollution.

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LIST OF ABBREVIATIONS

AFD	French Development Agency
ANME	National Energy Management Agency (Tunisia)
CDM	Clean Development Mechanism
CO_2	Carbon dioxide (greenhouse gas)
CREE	Commission for Regulation of Energy and the Environment (Heliosthana)
CSP	Concentrated Solar Power
DHW	Domestic hot water
DNA	Designated National Authority
EEA	Energy & Environment Agency (Heliosthana)
EEA	European Environment Agency (EU, Copenhagen)
EE&RE	Energy efficiency and renewable energy
EIB	European Investment Bank
EPC	Energy Performance Contract
ESA	Energy Security Agency (Heliosthana)
ESCOs	Energy Services Companies
EU	European Union
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GJ	gigajoule (1 joule x 109; equivalent of 0.0238 toe)
IEA	International Energy Agency (OECD, Paris)
IRENA	International Renewable Energy Agency (Abu Dhabi)
ISD	Institute for Sustainable Development (Heliosthana)
Ktoe	thousand toe
kWh	kilowatt-hour (one kilowatt × one hour or one watt × one hour ×1000; equivalent of 0.0859 toe or 3.6 GJ).
LC	Low consumption
LCB	Low consumption building
LNG	Liquefied natural gas
MEDENER	Association of Mediterranean EE&ER Agencies
MSD	Ministry of Sustainable Development (Heliosthana)
MSP	Mediterranean Solar Plan
Mtoe	million toe
MWc	megawatt peak (PV)
OECD	Organization for Economic Cooperation and Development (Paris)
ONG	Operator of the National Grid (Heliosthana)
PV	Photovoltaic
R&D	Research and Development
SD	Sustainable Development
STEG	National Electricity and Gas Company (Tunisia)
SWH	Solar water heater)
TOE	tonne of oil equivalent (the equivalent of 41.868 GJ)
UNECE	United Nations Economic Commission for Europe
WWF	World Wide Fund for Nature

For more informations about this project:

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption

The Heinrich-Böll-Stiftung is part of the Green political movement that has developed worldwide as a response to the traditional politics of socialism, liberalism, and conservatism. Our main tenets are ecology and sustainability, democracy and human rights, self-determination and justice. We place particular emphasis on gender democracy, meaning social emancipation and equal rights for women and men. We are also committed to equal rights for cultural and ethnic minorities and to the societal and political participation of immigrants. Finally, we promote non-violence and proactive peace policies.

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