5. Socio-economy

5.1. Introduction

One of the aims of the ITER project is to demonstrate the feasibility of magnetically confined nuclear fusion as an energy source for future generations. To evaluate the impact of fusion on the future energy system the SERF study (Socio-Economic Research of Fusion) was conducted jointly by the fusion associations with the financial support of the European Commission [1]. The results of these studies support the idea that fusion might become one of the corner stones of the future energy system. Especially the rather advantageous safety and environmental characteristics of fusion compare well with those of renewables.

Beside these rather general arguments to promote fusion in general and ITER in particular, the ITER project will lead to significant benefits for the region around Cadarache, for France and for the whole of Europe. These benefits are expected in a number of areas: political, economic, industrial, scientific, employment and skills, cultural and environmental [2]. Early communication with the local population is considered to be essential for the success of a project like ITER, and to obtain public acceptance of this new form of nuclear energy.

This chapter focuses mainly on the economic benefits expected for the region Provence-Alpes-Côte d'Azur (PACA), for France and for Europe and describes the social environment in Cadarache. A short review about work done in the past on public participation is presented.

The studies on economic benefits were elaborated by two French institutions:

- **IDEFI**, Institut de Droit et d'Économie de la Firme et de l'Industrie, CNRS laboratory at Nice-Sofia Antipolis,
- **IDEP**, Institut d'Économie Publique, CNRS laboratory of GREQAM, Groupement de Recherche en Économie Quantitative d'Aix-Marseille.

The characterisation of the socio-economic environment of the site was done by the CEA, with the strong involvement of French official institutions (sous-préfecture d'Aix-en-Provence, rectorat, statistic institute INSEE…).

5.2. Economic and industrial benefits of siting ITER in Cadarache

Economic development does not only lead to the production of greater quantities of the same goods and services but to the creation of completely new entities. In the described investigations both aspects of economic development triggered by the construction of ITER are investigated.

Former fusion projects have well demonstrated that the benefits of fusion are distributed all over Europe. This can be shown by JET and even the orders for the Wendelstein-7X experiment, which is still a national project – of course with strong European support – has distributed the major procurement packages all over Europe [3]. The same holds for

the procurements done in the course of the ITER EDA. A number of large prototypes of key ITER components were produced by the European industry, with the coordination of EFDA, the European partner team of ITER.

More detailed information on the economic tasks can be found in [4] and [5].

5.2.1. Qualitative improvements of the economy

Since ITER is not constructed yet, investigations have to focus on past experience. As an example the industry involved in constructing Tore Supra (TS) was researched. Obviously a one to one comparison of the two projects is not possible since size and organisation of the projects will be different. Nevertheless, a comparison is still very valuable so far, as key technologies like cryogenics, advanced magnetics, sophisticated electronics and so on are crucial for both projects.

Using a methodology that has been set up for evaluating economic effects of CERN and ESA (European Space Agency) activities [6], indirect effects are identified with the net value added that the firms working under contracts with CEA for the TS project would have not realised if these contracts had not been signed. A distinction is drawn between four different kinds of benefits – new, better and more diversified products; more advanced processes and improved management; positive commercial effects; increase in the efficiency of the labour force – and their respective time profiles will be traced, so as to get a hint of the dynamic process of innovation viewed as a distributed phenomenon. This study is a first step toward a better understanding of the way the economy reacts to a technical advance of the ITER kind.

The empirical base of the study was laid by interviews with thirty key industrial participants of the Tore Supra experiment. The core interview data have been enlarged with an opinion poll concerning the indirect impacts. The following types of spin-offs have been investigated:

- advances in scientific and technological knowledge;
- advances in expertise among core industries and related firms;
- creation and improvement of products and services that found a wider market;
- transformation in management and the organisation of labour resources;
- changes in the industrial and commercial networks linking suppliers, partners and customers.

Members of university and research institute teams (primarily the CNRS) have also been interviewed to determine the indirect effects of controlled fusion research on the relationships between industrial R&D on the one hand and fundamental research on the other hand.

This case study has provided very significant results. The most important one concerns advances in technological know-how. 14 % of the firms sampled consider those results to be either important or very important. The improvement of technological skills was particularly significant for small and medium sized firms because only 22 % import R&D from outside sources.

These positive impacts are concentrated in those sectors that are specific to controlled fusion technology. For example, in the realm of magnets and cryogenics, the indirect impacts were remarkable: 67 % of the companies enjoyed spin-off benefits from

advances in technological know-how ranging from important to very important. Still, the most significant spin-offs occurred in the creation of new products and services. Over half of all the companies surveyed, 52 %, saw either important or very important benefits flow from Tore Supra contracts in the form of new products and services put on the market (see Figure 5.1). The significance of these figures can be seen when they are placed in a national context: in France, 25.8 % of small and medium sized firms innovate in creating products new to the market and 35 % in creating products new to the company. These figures pale in comparison to the performances of companies, which participated in the Tore Supra project, as shown in Figure 5.1.

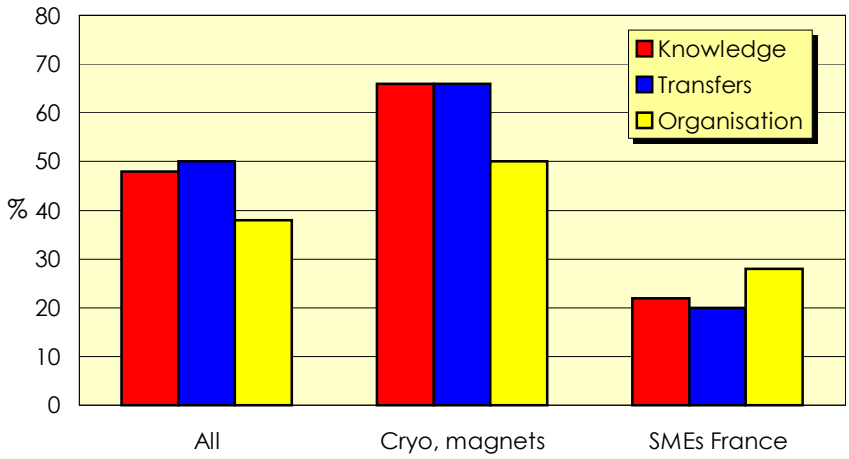


Figure 5.1: Results from opinion poll amongst firms involved in Tore Supra. The results proof that companies involved in Tore Supra could realise spin-offs and innovations far better than the French average. The result is especially pronounced for the cryo-systems and the magnets.

The spin-offs flowed from a constant interaction between Tore Supra engineers and the contracting firms. Participants needed to communicate specifications and to resolve the problems, which inevitably cropped up when completing orders. At the same time it has been demonstrated that innovation arose from the uniqueness of the contract specifications: the firms took advantage of this to create original products and services for a wider market. The markets created varied according to the technologies involved. In general, controlled fusion has created industries for the design and construction of superconducting magnets and their cryogenic systems, whose wider markets are in the fields of medical and biological equipment. This is a lucrative but narrow opening. For other sectors the markets are wider, for example, in scientific instrumentation, and information technologies, the latter of which profited from the processing and communication of the vast quantities of data such as Tore Supra produces.

As was proven by the Tore Supra experience Fusion is very well capable of triggering various innovations in the involved industries. The rate of these innovations is considerably higher than those produced by usual industry procurements. It is fair to expect that this finding will be even truer for ITER. The steady interference between project and industry representatives is one of the necessary prerequisites to assure the spill over effects. Siting ITER in Europe produces a short cut between European industry and ITER, which makes it for the European economy possible to realise numerous spin-

offs and innovations. European industry can learn from these studies how to organise themselves in respect to ITER to harvest a maximum of benefits.

5.2.2. Quantitative impact of the construction of ITER

The quantitative activation of the economy in total and the labour market in special has been analysed. Purchasing components for ITER, like the magnets or the buildings, will lead to numerous activities in the economy on various geographical levels. The construction company – just as an example – will order concrete, it will need fuel for the trucks and so on and in the end it will pay their worker who in turn will spend their salary to buy food and pay their rents. All these activities need to be accounted for. A way to do this is to describe the economy of the region, a nation or Europe in a highly aggregate way by defining sectors of the economy and households. The interchange between these sectors is then evaluated from empirical data, which is supplied by the various offices collecting national and international statistics (like INSEE in France).

The flows between each sector can be mathematically described by an Input-Output matrix. The rows and columns of the matrix represent the purchasing and the supplying sectors respectively. The purchases of ITER can be modelled with a vector that addresses an exogenous demand of the economy. Each entry of the vector corresponds again to the sector where the purchase is placed. The combination of this vector with the input-output matrix gives the demands that the sectors will address to the economy in order to satisfy the exogenous demand. This new endogenous demand, the direct effect, will create another impacts that will leads to successive demands. The limit of this process is the total impacts in the economic system.

To evaluate the employment effect, the employment productivity of each sector – again derived form empirical data – must be known. By multiplying the productivity by the activation and by summing over all sectors, the total employment effect is found. A general problem in economical studies is to value benefits that can only be realised in the future. The standard approach is to discount the future benefits. Central problem is to find the proper discount rate. In the described investigations a discount rate of 8 % was assumed. The results have been expressed in constant Euro of 1998, which take into account an estimated inflation rate of 3 %. These hypotheses can be considered as upper bound estimates. A 1-point decrease in the discount and the inflation rates gives a 9 % increase in the impacts.

The input data were derived from the ITER costing exercises, which were evaluated in the extension of the ITER-EDA. The data were made available through EFDA. Costing of the buildings, assembly, remote handling, cryoplant, power supply, heating and current drive, magnets, vacuum vessel, blanket and divertor were available. These orders will be in various economic sectors. Figure 5.2 shows a distribution of the sectors for roughly 80 % of the procurements. As the distribution proves, various parts of the industry will be directly involved (the distribution of salaries will involve many other sectors).

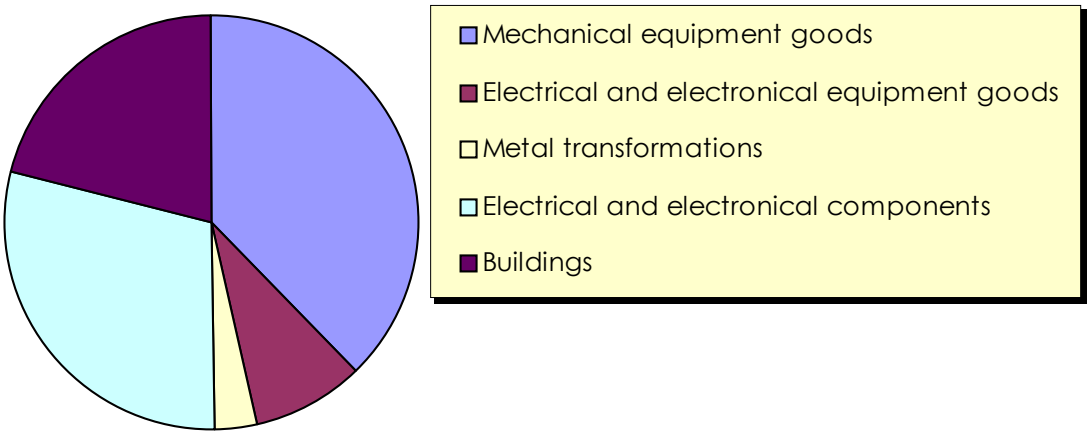


Figure 5.2: Distribution of the ITER procurements on the various industrial sectors (basis are 80 % of the procurements, where it is likely that they could be placed in Europe)

For the following investigations, the input-output matrix describing the French economy will be taken as a rough estimation to describe the European industry. Since it is at this stage not possible to give a clear indication on how the procurements will be distributed between the ITER partners only the relative effects are discussed.

The multiplication factors for the various industries are given in Table 5.1. The factor gives the total activity produced in the economic system by the spending of one Euro in the sector.

Sector	Multiplication Factor (MF)
Mechanical equipment goods	2.88
Electrical and electronic equipment goods	2.73
Metal transformers	3.01
Electrical and electronic components	2.64
Buildings	3.73

Table 5.1: The multiplication factors derived form the French input-output table. If 1 € is spent in one of the sectors, the whole economy is activated by MF €.

For Europe, an overall multiplication factor of roughly 2.9 should be expected. For an actual value of 10 M€ spent during the 11 years of the construction phase the discounted impacts on the production will be around 29 M€, and a yearly average of 23 jobs will be created. With some assumptions on the repartition of the sectors between France and the region PACA the multiplication factors for the region can be estimated around 2.8. The multiplication factor for the region is smaller than for the European level because of the specific economic structure of the region. For an actual value of 10 M€ spent during the construction phase, the yearly employment created is about 29 jobs. The higher jobs creation in the PACA region can be explained by the fact that the region will, in the construction phase, supply a lot of the low-tech parts like buildings that activate labour intensive sectors. The PACA region will benefit also from an extra revenue spending that comes from the mobility of workers involved at the

European level in the construction of ITER, and will stay in the region during installation of the components and on-site acceptance tests,

ITER construction will lead to a considerable activation of industry and employment and not only of those industrial sectors, which are directly involved.

5.2.3. A few remarks on public participation

Social scientists investigate possible mechanisms to include representative parts of the population from an early stage in the decision of the construction of large technical and infrastructure devices. Some of the procedures have found their way into the licensing procedures like the French "Enquête Publique".

No specific work in this direction was yet done for the site in Cadarache. It is one of the focuses of work in the second phase of EISS.

In SERF I and II some work in this direction was pursued by Italian and English groups. Main result of the Italian group was that they were able to install a successful participation process for an Italian city that could have been picked as site for ITER. The results of these studies are well documented in [7]

5.3. Social environment

This chapter verifies the compliance of the Cadarache site with the ITER site requirements and design assumptions, related to the socio-economic environment.

The following points are treated:

- Accessibility;
- Scientific and industrial environment;
- Social environment;
- Education;
- Housing;
- Health;
- Leisure, sport and tourism.

Numerous contacts with local authorities (prefectures, chambers of commerce and industry, regional councils, Rectorat) have shown that the region has a big interest in the project and will support the construction of ITER; some studies and propositions still have to be completed, notably the study concerning the reception of foreign staff and their families.

Figures quoted in this chapter have been obtained from the "National Institute of Statistics and Economic Studies" (INSEE). Detailed information is available in [8].

5.3.1. Access to Cadarache

The site proposed to host ITER is very well equipped in the way of communication and transport. Access to the site is very easy; the international reputation of the Cadarache centre having contributed to the development of its accessibility.

The European site proposed for the construction of ITER is located in the southeast of France; it is next to the "Centre d'études de Cadarache" of the "Commissariat à l'Énergie Atomique" (CEA).

Such a choice is motivated by the fact that plenty space is available around the centre, which already possesses the infrastructure necessary for the reception of a project of this scale. The surrounding region has a strong industrial and scientific presence.

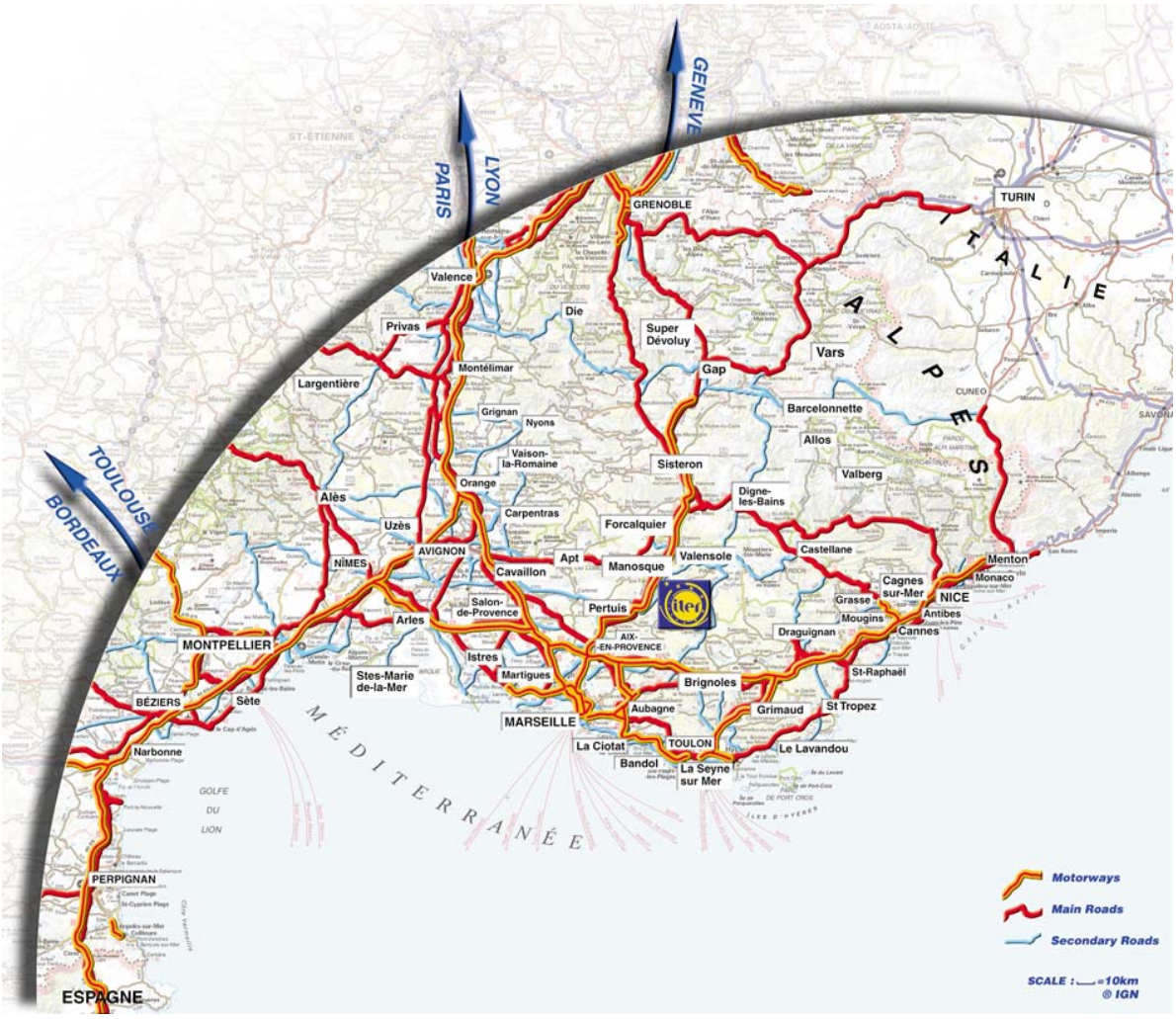


Figure 5.3: Main Roads and Motorways in the Region

The Cadarache site is located just south of the confluence of the Durance and Verdon valleys, near two major cities (Marseille and Nice).

Figure 5.4: Main Railways, Harbours and Airports in the Region

The site is well served by a network of roads and motorways (SA.D1), as well as by two railroads (SA.D3). The very recent construction of a French high-speed train line (TGV Sud-Est Méditerranée, June 2001) reduces the journey to French and European large cities (for example Marseille – Paris: 3 hours).

The region has four airports (SA.D2): two international (Marseille Provence and Nice Côte d'Azur) and two national (Toulon / Hyères and Avignon). Marseille and Nice are the two largest French airports outside Paris and assure an excellent connection towards the European big "hubs" such as Amsterdam, London, Paris, Brussels and Zurich.

Figure 5.3 and Figure 5.4 show access network in the region: main motorways, railways (including TGV), airports and harbours are illustrated.

5.3.2. Scientific and industrial background

Although the region (Provence Alpes Côte d'Azur) is strongly geared towards tourism, it possesses nevertheless a broad spectrum of industrial activities, ranging from heavy industry to high technologies. Some key figures:

- 40 % of the national microelectronics production;
- 1/3 of the French oil refining;
- 1/4 of the steel production in France;
- 10 % of the national chemical production;
- World's foremost producer of helicopters;
- World leader of the smart card.

Apart from the large groups that have set-up around Aix / Marseille and Nice / Sophia-Antipolis, the region has a dense fabric of small and medium-sized enterprises and is very much oriented towards the service industry. The rate of new business creations illustrates its dynamism. The region has a strong research potential, classed second French region in public research, with well-known universities and the presence of the main French research organisations. Private research is also strong, in particular in the field of high-tech microelectronics and telecommunications.

Finally, various structures take on the task of ensuring an interface between industry and research, to achieve a true synergy between innovative manufacturers and advanced research.

5.3.2.1. Industry in the region

One finds, in this region strongly dominated by tourism, a large palette of industrial activities, with mixed zones of heavy industry and numerous poles of excellence in high technologies.

Although the region around Cadarache is dominated by the service industry, it has nevertheless a large industrial activity, and also other sectors such as construction and agriculture are present (see Table 5.2). The partition between the different sectors is in constant evolution.

Sector	Domains	Number of employees	Percentage
Primary	Agriculture, forestry, fishing, agricultural and food Industries	45,000	3 %
Secondary	Consumer goods, Car industry, Equipment Industry, Energy Construction	180,000 105,000	12 % 7 %
Tertiary	Transport, finance, property, services to companies, services to private individuals, education, health, administration, social services	1,170,000	78 %

Source INSEE 2000

Table 5.2: Distribution of Industrial Sectors in the Region

With a Gross Domestic Product (GDP) of 73,000 million euros in 1999, the region produces 7 % of the national wealth, and is classified in third place behind Ile-de-France (Paris) (29 %) and Rhône-Alpes (9 %).

In 1997, one counted 24,000 industrial establishments (not included building and civil engineering companies, see below), 60 % of which are found near the coast (Marseille and Nice). In the rest of the region (Vaucluse, Alpes-de-Haute Provence, Hautes Alpes) more scattered industrial centres are found (SA.F1).

The industrial fabric is changing rapidly, and all the fields are, in different degrees, represented in the region (see Table 5.3).

	Mechanics Metal Industry	Agro Food	Chemistry Pharmacy	Electronics Data-processing	Energy	Others[17]	Totals Industry	Total Employees
Establishments	3,387	6,679	1,104	2,107	623	10,295	24,195	
Jobs	25,506	26,019	23,450	15,888	17,083	61,008	168,953	1,327,200

Source INSEE 1996

Table 5.3: Distribution of main Industrial Activities in the Region

The building and civil engineering sector, very strongly present in the region, is very dynamic as a consequence of the important tourist industry. It is a rapidly growing activity in Provence: the region had in January 2000, 30,000 companies in the construction sector, which accounts for 10 % of the French companies. Most establishments employ between 1 and 9 people (15,000 small and medium sized enterprises) and almost as many craft companies (12,000) can be found. Large construction projects are divided between roughly a hundred companies.

For a period of a few years, the French economy caused a slump in building and civil engineering. The upswing in the economy experienced since 1997 has encouraged

[17] Naval, aeronautical, railway, wood, paper, minerals, Publishing, textile, equipment

investment, particularly by local government bodies, resulting in a significant increase in demand.

For example the construction site for the TGV Méditerranée (3,800 M€) strongly contributed to a return of growth. Local governments (departments, region, communes) have since 1998 increased their investment in construction. In years to come it will stay at an important level, because of current projects and because of those still to be finished.

The region has an important proportion of establishments of small size, which translates to its large capacity to start-up new businesses.

The region has a large number of innovative companies: it is the second region of France, after Ile-de-France, for the start-up of new businesses by researchers (about 30 per year). The activities of engineering service and technical studies are well developed in the region, presenting a strong potential in this domain.

Finally, it should be noted that the region, which has several exceptional natural sites among its assets, strives to apply a development policy that allows highly protected zones and zones for industrial use to coexist.


Figure 5.5: Sollac refinery by night – "Pont du Gard", close to Nîmes

5.3.2.2. Scientific resources

The region has in total 11,000 researchers. It appears in second place after Ile-de-France in public research (6,500 researchers) and in third place for private research (4,500 researchers or engineers) behind Ile-de-France and Rhône-Alpes(SA.F1).

- ***Public research***

  With about 700 M€, civil public spending on research and development (R&D) in the region represent 8.5 % of national expenditure. This is divided up between university research (28 %), the "Centre National de Recherches Scientifiques" (CNRS, 18 %) and applied public research organisations (54 %). Around a thousand public research laboratories insure about 7.5 % of the national production (theses and publications).

- ***University research***

  University research is well developed in the region. Distributed over 6 universities, and covering very different domains, it concerns 3,100 lecturers-researchers who dedicate half their time, as well as technical and administration staff (about 500 persons).

  The CNRS is present through two regional delegations in Marseille and in Sophia-Antipolis, near Nice, with in total 1,750 researchers, as well as technical and administrative staff (about 650 persons) and student researchers. The CNRS is present in all major disciplines, such as physical and mathematical sciences, nuclear physics and sciences of the universe, engineering sciences, chemistry, life sciences, sciences of man and society, etc.

- ***Applied research***

  Applied research is particularly well represented in the region (about 1,700 researchers and about 2,500 technical and administration staff). Indeed, practically all the large organisations for applied research are present in the region.

- ***Construction of large scientific instruments***

  ITER is not the first large research installation to be build in the region. For more than 40 years scientific instruments have been constructed, mainly in Cadarache. The CEA research centre is one of the important economic players in the region.

- ***Private research***

  With about 1,000 M€, the regional internal spending on R&D by private companies represent 5.8 % of national expenditure. Around 4,500 researchers and research engineers as well as about 4,000 support staff (technical and administration staff) are involved in the private research sector. The region accounts for 4.5 % of patents deposited in France.

- ***Technology transfer***

  Various structures encourage technology transfer between industry and research establishments in the region.

  Several regional technology centres exist, administered by manufacturing associations, covering a large variety of domains: automation, industrial production and data processing, electric engineering and electronics, electromagnetism and microwaves, electromagnetic compatibility, mass metrology and dynamic weighing, quality, metrology and non destructive testing, characterisation of materials, advanced material, etc.

  Cadarache has its own network of technological distribution: the Technical Centre of the Mediterranean Sea (CETREM) makes the know-how of the CEA available to small and medium size firms and small industrial firms in the region.

5.3.2.3. Professional resources, jobs

The region proposed to host ITER has a strong labour potential, in very varied disciplines. It is defined by the relative importance of trade activities (transport, business), reception and residence activities (hotel business, restoration, property) and industry. The region has a large public works industry, but the service sector remains dominant (SA.F2).

- ***Emergence of new economic activities***

  The economic recovery of the last few years has brought more prosperity to the region. It is clear that the evolution has brought changes at a structural level, both in the nature of the economy and the long-term prospects.

  Connected to the evolution of the national and international economy, the regional economy has undergone profound changes. There is also a geographic effect on the economy. The coastal region, with a strongly urbanised and rapidly expanding economy compensates for the rest of the region with a more traditional rural and slower evolving economy. However, in all parts of the region the service sector is rapidly expanding, particularly related to the tourist industry.

- ***New business creations: symbol of economic growth***

  The region saw in 1999 a large number of new businesses (19,956 new companies, 11 % of them French). The region also has seen an increase over the years in the number of new companies. In 1999, with 10.4 companies created for every 100 existing, the region had the strongest rate of growth in France.

5.3.3. Social aspect

The French social system is one of the most developed in the world. For the ITER project, local authorities suggest creating a coordinating structure for the reception of foreign staff, facilitating their social integration.

5.3.3.1. Society and daily life

- ***French administrative breakdown***

  France is split in 100 departments, divided into districts (arrondissements), every district in cantons and every canton in communes (36,679 in total, administered locally by "mairies").

For example Cadarache falls in the commune of St Paul-lez-Durance, part of the canton of Peyrolles, in the district of Aix-en-Provence of the department of the Bouches-du-Rhône.

Each department has a Prefecture (example Marseille for the Bouches-du-Rhône) and a variable number of sub-prefectures, situated generally in the other large cities within the department. Every department has a chamber of commerce and industry and an agricultural chamber, which are public establishments and help with economic planning.

The French departments are regrouped in 22 metropolitan regions and 4 overseas regions. The president of the regional council exercises executive power. The region has extensive jurisdiction in economic, social and cultural development.

Cadarache is situated at the crossroads of 4 departments in the region "Provence-Alpes-Côte-d'Azur", which has 6 departments and a total of 4.500.000 inhabitants (see Table 5.4).

- ***Population***

The Region has a strong attractive power. Population growth is the largest France. Immigration into the region remains above the national average.

Departments	Num	Population (Thousands)	Surface km²	City (Prefecture)
Alpes-de-Haute Provence	04	139.6	6925	Digne
Hautes-Alpes	05	121.4	5549	Gap
Alpes-Maritimes	06	1011.3	4299	Nice
Bouches-du-Rhône	13	1835.7	5088	Marseille
Var	83	898.4	5973	Toulon
Vaucluse	84	499.7	3567	Avignon
Region	**PACA**	**4506**	**31400**	**Marseille**
France		*56600*	*544000*	*Paris*

Table 5.4: Size and Population of the Departments of the Region

- ***Main living areas***

Large cities in the region are Marseille (800,000 inhabitants), Nice (342,000), Avignon (86,000) and Toulon (168,000).

Near Cadarache, one finds the city of Aix-en-Provence (photo, 35 km, 137,000 inhabitants) and two medium sized towns: Manosque (15 km, 20,000) and Pertuis (25 km, 18,000). These are the main places of residence for the staff employed at Cadarache. These cities have a well-developed commercial infrastructure (trading estates, supermarkets, etc.)

and are important employment centres.

For those that prefer a more rural lifestyle many villages, 500 to 5,000 inhabitants, are located around Cadarache. Also these villages have all necessary commodities, mainly due to the importance of tourism.

- ***A multi-cultural region***

  As it is open to the sea, the south east of France has since long been a region of trade and commerce. Being at the crossroads of trade routes puts the region in a privileged position. Being a cosmopolitan region, it welcomes numerous foreign communities, many of which originate from southern Europe.

- ***A welfare system of high quality***

  The French welfare security system is one of the most developed in the world. Part of the salary is automatically transferred every month to a health insurance system. This allows a reimbursement of most medical expenses: doctors, medicines and hospital.

  A large number of mutual organisations exist allowing additional refunds in special cases.

  Welfare aid exists for the elderly (meals at home, medical help, etc.). The state also provides help to families, calculated according to the family income and the number of children. It is also possible to obtain help from the Social Security Office: for example for isolated relatives, rent allowances, etc.

5.3.3.2. Welcome of international ITER staff

The sub-prefecture of Aix-en-Provence will organise the reception of international ITER staff. Help with administrative issues and practical matters will be provided (SA.F3). Multilingual personnel, specialised in reception and information, will staff the reception centre. They will be in direct contact with the main governmental organisations and agencies. Four specialised groups will be created:

- *Residence Group*

  Housing demands will be centralised and the best possible solutions will be found if required. This group will also have a planning function: taking into account he ITER staff planning the group will study and propose the necessary real estate investments.

- *Partner Employment Group*

  This group will study the possibilities of jobs for partner of ITER employees; it will coordinate the search for positions and will perform an individual analysis of personal circumstances.

- *Education Group*

This group will help families with registration at a school, university, or other educational establishment. It will ensure centralisation of demands and will take care of registrations. It will assure, according to the ITER planning, the necessary adaptation of the educational establishments.

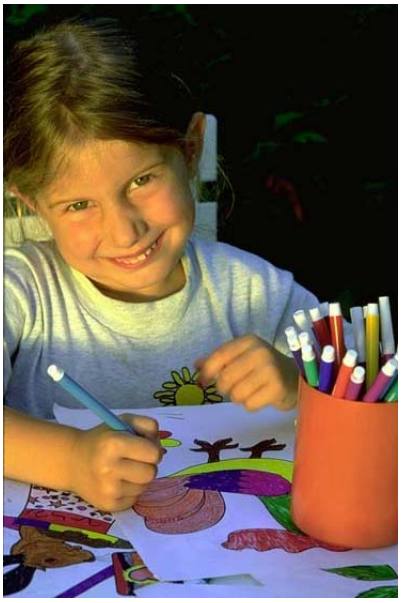
- *Administration Group*

  The prefecture of the Bouches-du-Rhône will constitute a group of civil servants specialised in administrative matters. It will manage statutory procedures concerning ITER employees. In particular, this group will ensure residence permits and work permits for foreign staff. Its mission will be, with respect to French legislation, to facilitate and to accelerate the acquisition of any license necessary for employees and their families.

5.3.4. Education

A study is currently underway by the Rectorat of the Academy of Aix-Marseille (Ministry of Education) to propose evolution or adaptation of the existing educational infrastructure, with possibly the construction of a new international establishment. The aim is to assure the continued education for the children of foreign ITER staff (SA.F3).

5.3.4.1. French school system



In France, schooling is compulsory from the age of 6, with a minimum duration of 10 years. Public and private structures are both available. In the public establishments, which are the most numerous, education is non-religious and free of charge, until a secondary school diploma has been obtained.

There are also numerous private establishments, for which a financial contribution is often asked from the families. Some follow a foreign educational programme (American, Japanese, English for example).

International secondary schools, or international sections in secondary schools also exist and nothing opposes the establishment of new international schools or sections.

- ***0 to 3 years: nurseries and pre-school playgroups***

  One of the objectives of French social and family policy has always been to provide day care for children of pre-school age. In all cities and often even in villages, there are establishments to look after young children all day, from morning to early evening, including a meal. This service is aimed at children from 3 months to 3 years whose relatives work. Staff at these establishments is required to have a special qualification.

- ***3 to 6 years: nursery school (maternelle)***

Education in the French system can start in nursery school. These public schools are aimed at children from 3, sometimes even starting at the age of 2, to 6 years. Education at this age is optional and free of charge.

- ***Primary school (école primaire)***

Compulsory schooling starts with a period of 5 years of education given in elementary schools. The day-to-day running and investment (including non-teaching staff) are guaranteed by the communes, the educational programmes and the teaching staff fall under the responsibilities of the state.

- ***Secondary school (collège)***

Pupils who have finished elementary education pursue their education for a period of 4 years at the first part of secondary school (collège). At the end of these 4 years a diploma ("brevet") is obtained.

- ***Secondary school (lycée and professional lycée)***

Secondary schools (lycée) prepare the pupils in 3 to 4 years for the baccalaureate. The general and technological lycée offers three general courses (Literature, Economy and social, Scientific) and several technological courses. The professional lycée offers education corresponding to different jobs in the economic sectors. The baccalaureate allows entrance to French higher education.

- ***Apprentice schools***

After the collège pupils can join apprentice school oriented towards trades and crafts, providing them with a professional qualification in 2 or 3 years.

- ***Higher education***

To enter French University it is necessary to have a baccalaureate or an equivalent foreign diploma. The student can obtain a DEUG ("Diplôme d'Etudes Universitaires Générales") in two years, followed by a "licence" in the third year, and a "maîtrise" in the fourth year. After that a student can envisage a DEA ("Diplôme d'Etudes Approfrondies") followed by a doctorate or a DESS ("Diplôme d'Etudes Supérieures Specialisées").

To be admitted to an engineering school or a business school (3 year course), it is necessary to pass a very selective entrance examination, prepared for in 2 years in the CPGE ("classes préparatoires aux grandes écoles").

Students wishing to enter the medical profession must complete 7 years of education after obtaining their baccalaureate.

5.3.4.2. Educational establishments in the region

- ***Nurseries***

For those younger than three years, the zones of Aix, Pertuis and Manosque have 1,128 crèche places and 397 day-nursery places available. In the region, a total of 24,339 places are available. The extent of the facilities is well above the national average.

- ***Kindergarten***

A satisfactory network of public nursery schools is present around Cadarache. It is possible to open supplementary classes in the concerned communes if the current accommodation facilities turn out to be insufficient.

- ***Primary and secondary schools***

Cadarache is a part of the academy of Aix-Marseille, which covers 4 departments: Bouches-du-Rhône, Alpes-de-Haute Provence, Hautes-Alpes and Vaucluse. Most of the communes have a primary school. Collective transportation is organised for those living in more rural areas.

A considerable number of establishments for secondary pupils exists in the Cadarache zone: as example 8 in Aix-en-Provence, 2 in Manosque, 2 in Pertuis, 1 in Peyrolles, 1 in Tour d'Aigues, and 1 in Riez. New schools are planned in Vinon and Sainte-Tulle.

Manosque has one general and technological secondary school and one professional school (a third general secondary school will open in 2004). Pertuis has also one general and technological school. Aix-en-Provence has a total of 5 secondary schools, professional and general and technological, including the international school in Luynes.

- ***Universities and engineer schools***

The Academy of Aix-Marseille is a great university place, with around 100,000 students, French and foreign. Higher education and high quality research with an international reputation are well established.

Six universities are located in the region; they are situated in Aix-en-Provence, Marseille, Avignon, Toulon and Nice.

Offered subjects cover all domains: sciences, law, literature and social sciences, languages, medicine, art education.

The region has highly rated engineering schools; in the nearby regions, the cities of Grenoble and Montpellier, also provide a wide selection of establishments of higher education.

5.3.4.3. Integration of pupils and foreign students

The children of families arriving from abroad must find a schooling possibility that is suited to their needs and their ages.

- ***International Secondary Schools and International Sections***

They may receive schooling either free of charge in public establishments that already exist in the national education system, or in fee-paying private establishments. All children, regardless of their nationality, can benefit from the pre-school structures, i.e. nurseries and playgroups, as well as kindergartens.

The international sections in France have been established to host foreign pupils (25 to 50 % of the total number of pupils in the section) and to facilitate their integration in the French educational system and their return to the educational system of origin. The international section give at the same time the opportunity to French pupils to learn a foreign language at a high level.

For this purpose, French and foreign teachers, often provided by the state of origin, work together. The foreign teachers provide education in their language in history, geography and literature of the country concerned, following educational programmes established in co-operation between the French and foreign educational authorities. For this reason, international sections are a good example of international educational programmes. The international sections are open to those pupils that have proven to the school that they have the proper linguistic ability as well as the required level of education.

The education given can be characterised as follows:

- *Primary education*: 3 to 6 hours of education in the language of origin;
- *Secondary education*: 4 hours per week on history-geography of which 2 in the mother language. Minimum 4 hours per week on foreign languages in the mother tongue on top of the normal hours in the mother tongue given in the section.

The sections prepare the pupils for the "collège brevet", international option and for the baccalaureate with international option.

French legislation allows the establishment of private, fee-paying school. Under certain circumstances, such establishments can enter into contract with the state, which then undertakes to pay the salaries of the teaching staff. The state inspects the classrooms and the educational programme provided to the pupils.

- ***European Schools***

The European schools are educational establishments controlled collectively by the member states of the European Union. In the countries where they have been established they enjoy the same legal status as public schools.

In the different member countries the duration of the primary and secondary education varies between 12 and 13 years. Pupils at European schools have a pre-school education for 2 years, a primary education for 5 years and secondary education for 7 years. At the end of the secondary cycle the pupils obtain a European Baccalaureate, which is recognised in all countries of the European Union as well as in a certain number of other countries. This diploma provides them with access to universities and other establishments of higher education.

Education is provided in the official languages of the parties allowing education to continue in the mother tongue. As a consequence each school has several linguistic sections. With the exception of the tuition in the native language, the programme of education is identical in every section. Next to the education in the mother tongue, general subjects are thought in one of the working languages of the community (English, French and German), promoting the integration of pupils into a European society.

It might be possible to add non-European language sections such as Japanese or Russian.

- ***Complementary Courses***

French schools can set up courses on Wednesday and/or Saturday in foreign languages for the children educated in the establishment. These classes are called "additional courses". At the request of a non-French-speaking community, the children have courses in their mother tongue. These courses concern the language and general education in the mother tongue.

The university of Provence offers, in Aix-en-Provence French as foreign language courses. The courses are aimed at foreign students who follow studies in other departments of the university. The courses are also available to foreign adults who do not follow other courses at the university. At request courses can also be provided outside the university, for instance on-site in Cadarache. The courses can be used for the foreign ITER researchers and their partners and can also be used by their children to follow their studies at Aix-Marseille in excellent conditions.

Numerous associations of volunteers, private organisations as well as public structures in secondary schools organise "French as a foreign language" classes for adults. Many possibilities for "education at distance" exist as well in France.

5.3.5. Accommodation

The region proposed to host ITER has a large and very varied housing pool, with a high level of availability due to the large number of secondary residences and the regular influx of tourists on long stays (SA.F3).

5.3.5.1. The housing market in France

The property sector in France has undergone a strong expansion since the 1990's, consolidated by economic recovery. This tendency has become more marked, with a highlight in 2000, and continues in 2001, notably thanks to favourable conditions for loans due to governmental measures.

The market for older property is most dynamic. The craze of the French for rural life in the country has allowed the property sector to grow. Encouraged by the national measures of help for the improvement of the environment, many French dash into the renovation. This allows a development of property holdings. Furthermore, economic recovery has reinstated a strong purchasing power. Therefore French build, move, and rent in a very fast way.

The market for new houses is also growing. A total of 30,000 construction sites was started in 1999.

The increase of tourism, notably from abroad, has maintained the increase in the property market. Many wish to buy in France, either a holiday home or a more permanent house.

5.3.5.2. Housing in the Cadarache region

The region has more than 2,5 million homes (1999 data). This total can be divided between main homes (75 %) and secondary homes (25 %). Most of the permanent housing is in the form of apartments (43 %) and detached houses (32 %).

In a synthetic way, the region is divided into 5 residential zones. These zones correspond to the main regional agglomerations.

Prices vary from 220 to 2,200 € per one constructed square meter.

The prices for old houses fluctuate between 230 and 600 k€), depending on size, location and maintenance state. The well-balanced market for rental accommodation offers dwellings from one-room apartments to 3 and 4 bedroom houses. Demand for luxury and large apartments remains steady.

In Aix-en-Provence for example, with a constant population growth since 1990 and with the arrival of the TGV, the property market is particularly very buoyant. The demand for new houses is steady, but is met by a sufficient number of new housing projects. With regard to smaller dwellings the market is increasing as well. The market for smaller new houses is almost non-existent, but the market for older houses has seen numerous sales. Average prices are around 180 k€.

The levels of rent in the suburbs of the large agglomerations are representative for average prices in other communes, notably those around Cadarache. However, prices vary with demand.

5.3.6. Health care

As stated by the World Health Organisation in 2000, the French health care system is one of the best in the world. In Provence, the available equipment and health care staffing levels in the region are even above the French average. The system will have no problem coping with the arrival of ITER personnel and their families (SA.F3).

5.3.6.1. The French health care system

The quality of the health system is very good in France. This capacity has just been underlined by the World Health Organization, which has just classified France as the most successful health system in the world (WHO report 2000).

The French health system is based on the "Sécurité Sociale", a government organisation, which has as objective to insure and respect solidarity amongst the insured without distinction of age, income or health.

The Social Security is financed for three quarters on the basis of employers and employees' contributions.

The current health insurance, covers more than 80 % of the working population for risks connected to disease, industrial accidents, professional diseases, incapacity, death and assures coverage of maternity expenses.

The insured benefit from an almost complete refund for health care without limitation on the number of consultations or prescriptions. However, certain care (aesthetics for example) is partially or totally charged to the insured, who can take-out additional insurances from private companies (mutual insurance).

People suffering from severe and/or long-term afflictions can be completely exempt. The refund by the Social Security is then 100 % throughout the disease or for life, according to the severity of the situation.

In France, the insured can choose his doctor and his pharmacist and is free to search for a second opinion. He can also chose freely to consult specialists as often as he wishes and he can, under certain conditions, seek hospitalisation himself.

5.3.6.2. Health care in Provence-Alpes-Côte d'Azur

The region has more than 43,000 hospital beds and places for adults in health establishments, for care of short, average and long duration. There are 2 regional hospital establishments, each including a medical research centre, and 38 classic hospital complexes. The presence of medical research centres allows the patients to benefit from the latest techniques and equipment, increasing the chances of recovery.

The region is ranked third in France in terms of medical equipment. It distinguishes itself notably in surgery, medicine, obstetrics, follow-up care and rehabilitation.

In 1999, the region had a total of 23,153 beds in medicine, surgery and obstetrics, that is 5 beds per 1,000 inhabitants. These beds are divided between 55 public and 119 private establishments, i.e. a total of 174 establishments for short-term care.

There is no shortage medical staff. The region counts 8,227 general practitioners and 8,627 specialists, i.e. a total density of 267 doctors per 100,000 inhabitants. This is higher than the national average (198 per 100,000 inhabitants).

The region has 32 public and 25 private maternities. 21 maternities have units for premature babies offering a total of 228 beds. Specialised children's hospitals are found in Marseille in Nice (269 beds).

Large medical equipment is available in the region in accordance with French national guidelines and provides all the needs for the population.

Because of the quality of care in the region, patients from outside the area (6 % of the patients in the bordering regions) come here for their health care.

5.3.6.3. Around Cadarache

The sector around Cadarache can be divided into two large "health" zones: in the south, the zone of Aix and Pertuis, covering 56 communes, and in the north, the zone of Manosque and Forcalquier (65 communes).

The zone in the south includes two public establishments (hospital complex in Aix and local hospital in Pertuis), a private establishment providing services to the public system, and six private clinics, three of which with a capacity of more than 100 beds.

In Aix, there are 348 beds in medicine, 190 in surgery and 51 in obstetrics. In Pertuis, there are 37 beds in medicine, 19

in surgery and 24 in obstetrics.

The zone in the north offers two public establishments (hospital in Manosque and local hospital in Forcalquier) and four private establishments. A total of 61 beds in medicine, 45 in surgery and 20 in obstetrics are available.

The Medical Service, present in Cadarache, also provides emergency care. On account of the good motorway network installed around the research centre, access times to the casualty wards are even shorter. The ones furthest away are in Marseille, Toulon and Nice, in which case helicopter transport is used. However, for the zone under consideration, the services of these sites are only called on to deal with extreme cases involving acute drug intoxication or requiring immediate neurosurgery for babies, children or adults. The establishments in Aix, Pertuis and Manosque deal with all other emergency cases. The community hospitals (or local hospitals) located in Valensole, Oraison and Forcalquier also deal with first-degree emergencies.

5.3.7. Art of living

Art of living in the Region Provence-Alpes-Côte d'Azur is characterised by the exceptional climate, the extraordinary variety of landscapes, the wealth of culture, the cheerfulness of its inhabitants and their love of the outdoor life. This region offers a very high quality of life, known all around the world.

Its traditions and history make the region a very welcoming area where everybody finds one or several reasons to settle down for a little while or for life (SA.F3).

5.3.7.1. The country

Provence and the Mediterranean coast (the famous "Côte d'Azur") are always perceived as the country of sun and blue sky. The exceptional period of sunshine (on average 2,500 hours a year) shines from the Mediterranean in the south to the mountain climates in the north.

The climate is one of the foundations of the quality of life in the region because it allows the practice of many different activities, every season offering its palette of opportunities.

The region Provence-Alpes-Côte d'Azur offers very varied and contrasting landscapes from the sea to the mountain through hilly landscapes with large forests and lavender. Going through the region, one discovers a variety of sites such as Montagne Sainte-Victoire, the massif of the Luberon, the Porquerolles islands, Embiez and Port Cros.

The exceptional light in the region brings out the colours inspiring artists and painters in particular.

Natural species, whether animals or plants, in many cases unique, have found favourable conditions for their development. The natural zones of ecological interest for their fauna and flora cover more than a million hectares. They form the habitat for more than 230 protected species and more than 400 animal species.

National and regional parks allow the protection of landscapes, sites and species in the region. The region contains three national parks and four regional parks.



This region has learned how to provide, in harmonious way coexistence between traditional, tourist human activities and environmental protection.

The animal parks offer visitors the chance to have surprising encounters with caimans at a crocodile farm, marine animals, seals and dolphins at Marineland, land tortoises in the village of turtles and animals from all over the planet in the region's many zoos.

The gardens in the region offer innumerable possibilities of beautiful walks and discoveries: French and Italian formal gardens in castle grounds, exotic and Mediterranean gardens by the seaside, aromatic gardens, oriental gardens and bamboo plantations, as well as arboretums and orange groves.

Numerous amusement parks and theme parks offer joy to young and old alike.

5.3.7.2. Tradition and culture

History has left its mark on the region, dating back to pre-historic times. Numerous Greek and Roman archaeological sites can be found. A multitude of monuments, abbeys and castles give evidence of the varied and rich history of the region.

The historic hearts of cities like Aix-en-Provence and Manosque as well as most of the villages remind people of the wealth of Provencal history. The "Palais des Papes" in Avignon still bears witness to the stay of the Popes in the 14th century. The history of the Port of Marseille always been connected to discoveries, trade, and large projects such as the opening of the Suez Canal.

Culture and traditions are today the evidence of this rich history.

Provencal tradition and its language, still practiced today, show the deep love the inhabitants have for their roots.

The harbour of Marseille, nicknamed "Gateway to the East", has seen the arrival of many different cultures. This has fed a melting pot of populations providing a unique integrated culture today.

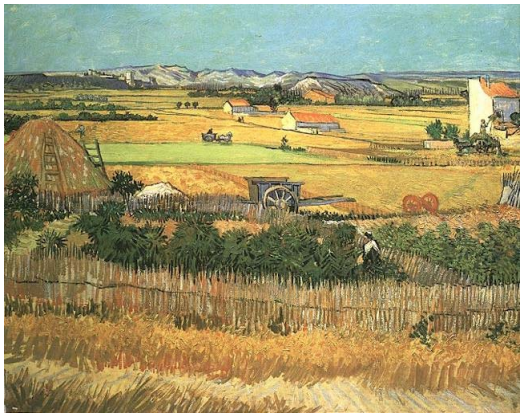
From the Rhone, where Spanish customs took root, to the borders in the east influenced by Italian customs, the region is fed from the sea with African, Asiatic and Arabic influences.

The wealth of history, cultures and traditions also expressed itself through artists of all the times.

The region Provence-Alpes-Côte d'Azur has numerous museums that show its traditions, its culture and its history. There is also an exceptional cultural, musical and choreographic development with many festivals organised throughout the year (let us list the three most prestigious of them: "festival de Cannes", "festival d'art lyrique" at Aix-en-Provence, and "theatre festival" in Avignon).

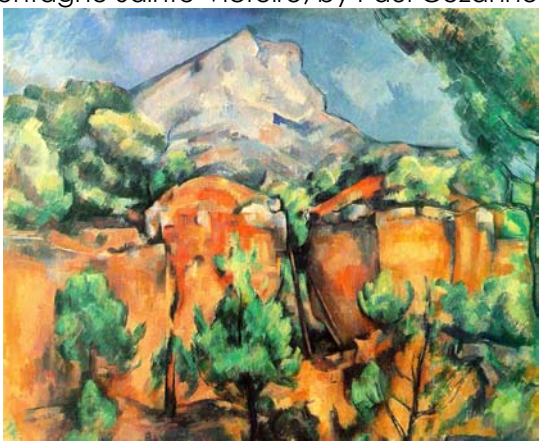
Literature is present in the libraries and media libraries of the region. Aix-en-Provence has a special "town of the book" distinction. One can find works from all countries, all authors and in foreign languages. International bookshops are also available.

The landscapes have seduced numerous painters who have tried to capture the unique light and colours of the region.



Moisson, by Vincent Van Gogh

Montagne Sainte-Victoire, by Paul Cézanne



Finally, the region is known worldwide for its high quality festivals. Numerous cities and villages from the smallest to the largest show their taste for art in this way.

5.3.7.3. The people

Leisure activities of the people in the region are organised by many associations: sport, entertainment, creative, cultural, humanitarian and social activities. One finds musical associations with choirs and amateur musician groups, as well as artistic associations that offer drawing, painting pottery and classes. Environment, preservation of the countryside, heritage and international exchanges are also represented in the associative life, as well as associations that help the most deprived. In the numerous associations present in the region's cities and villages one can pursue photography, riding, cycling, touring and dozens of other activities.

Variety, cultures, traditions, all senses of identity are reflected in the Provencal kitchen, in its colours, smells and flavours of the territory. It makes abundant use of the natural resources of the region.

Wine is obviously very present in the Provencal cuisine with 9 "appellations contrôlées".

The numerous restaurants in the region do not offer only the traditional Provencal cuisine. The Mediterranean delicacies, as well as other French regional ones, are represented, without forgetting flavours from around the world. All five continents are represented.

5.3.7.4. Sport and leisure activities

The sports opportunities on offer in the region are important and varied.

From the high mountains to the sea, in the air and in the water, all possibilities are offered to all people. Recently, one has seen a multiplication of the sites of mountain climbing and paragliding.

New activities have also been established over the last years: rafting on the alpine torrents and "canyoning" in the calcareous rock formations.

Training in sports professions is very developed. More and more qualified personnel offer therefore proper guidance in all sports.

Many of the rivers and lakes, as well as the sea offer numerous sporting opportunities and nautical activities during most of the year.

Ports, islands and creeks are destinations that can be rediscovered over and over again.

Numerous mountain stations offer during the summer gliding, paragliding, hang gliding and other mountain related activities. During the winter there is a large choice of ski stations both for cross-country and downhill.

Cities and villages alike offer to their inhabitants sports facilities such as swimming pools and stadiums.

It is therefore understandable that the region is one of the most popular tourist destinations in the world, however it is still possible to find a quiet spot as well.

The region around Cadarache opens great perspectives in the development of the most different activities: cultural, tourist, sports of all kinds.

Accommodation facilities are plentiful and available in the form of hotels, hostels, campsites, bed & breakfast rooms and rural shelters, where the traveller can get acquainted with the wealth of the region along many varied routes.

5.3.8. Conclusions

This chapter has shown that the socio-economic environment of Cadarache, the European site proposed for ITER, is particularly rich. Scientific and industrial resources are widely available, and the region provides also a rich variety of schools, medical care, housing, leisure and cultural activities. The infrastructure, with existing roads, motorways, trains and airports, fulfils all possible needs. There is a constant investment in the region to improve the already high quality of life for its inhabitants.

Local and governmental authorities, as well as local organisations and associations, by their constant implication in this project have shown a great interest for the implementation of ITER at Cadarache. In particular, the region will organise at Saint-Paul-lez-Durance a specific welcome office for ITER employees, in order to facilitate their life and integration.

Furthermore, and this is not to be forgotten, it is a region where it is good to live, with a particularly pleasant and renowned climate. The famous "Côte d'Azur" and the Provencal country behind it, attract many tourists every year.

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