



Cadarache a European site for ITER





Outline

- Background and framework
- Site characteristics
- The French offer, input to JASS
- Latest news from Tore-Supra
- The way forward

For more information see brochures and the web site

www-fusion-magnetique.cea.fr



Project milestones

- Early 1980 French fusion regroups in Cadarache
- 11 July 2000 Meeting CCE-FU
 - Ministry of Research + CEA propose to study Cadarache as a European ITER site
- July 2001 Engineering design completed
 - Comprehensive design made by international team. Site specifications established
- 7 December 2001 French proposal to the Commission
 - French Minister of Research proposes Cadarache and enquires on conditions
- 21 March 2002 European Council of Ministers
 - Answer of the Commission (Proposal for Cost Sharing in Europe)
- 3 May 2002 Confirmation of French Offer
- 4 June 2002 4th negotiation meeting
 - 4 sites confirmed



N4, the 4 delegations





French officials announce commitments



Commitment from government officials on required infrastructures, education, assistance to staff, transport of heavy loads, etc.



Public meeting of Conseil général des Bouches du Rhône (20 June 2002)

La Provence

VENDREDI 21 JUIN 2002 - 248, AV. ROGER-SALENGRO, 13902 MARSEILLE CEDEX 20 - TÉL 04.91.84.45.45 - FAX 04.91.84.49.95 - WEB <http://www.laprovence-presse.fr>

106 millions d'euros investis pour la fusion thermonucléaire

Contrat du siècle pour Cadarache ?

► L'énergie du XXI^e siècle pourrait être inventée en Provence avec des retombées considérables en terme d'emplois. Afin que Cadarache, en concurrence avec trois autres sites mondiaux, soit retenu

pour accueillir le réacteur thermonucléaire Iter, le conseil général des Bouches-du-Rhône s'apprête à débloquer 106 millions d'euros sur dix ans.

► En page 27, l'article de Robert ARNOUX

106 M€ for investments
+
< 46 M€ infrastructure
Total 1 GFr



Resources for Cadarache studies

- Coordination by EFDA
 - Involvement of Associations & CEA
 - Industrial contracts
- Substantial increase of CEA contribution to fusion activities
- Contributions from regional activities
 - Steering Committee chaired by regional authorities
 - Infrastructure and socio-economic aspects



Cadarache Site Main Characteristics

- **Large site:** (900 hectares fenced) established in 1959, 4000 persons in high tech research and operation (including 2400 CEA staff) of 18 nuclear installations, 4 new projects
- **France's centre for magnetic fusion** (320 p.), key contributions to TFR, JET, Tore Supra, ITER
- **Support from CEA 16000** persons includes all major technologies required for ITER, including tritium and waste management and storage

Tore Supra in 2002

Transformed (1.5 years) to study Tokamak physics and technology in very long pulses (4' 30") Everything actively cooled!

Good progress in coupled energy. Record extended to 730 MJ



Cadarache, an R&D Centre for the future 5 new projects!

- **RES:** a new nuclear reactor - prototype for naval propulsion, under construction
- **CEDRA, AGATE:** new waste processing and storage facilities



- **RJH:** a new experimental reactor to validate the nuclear fuels of the future - to be constructed

and... ITER!

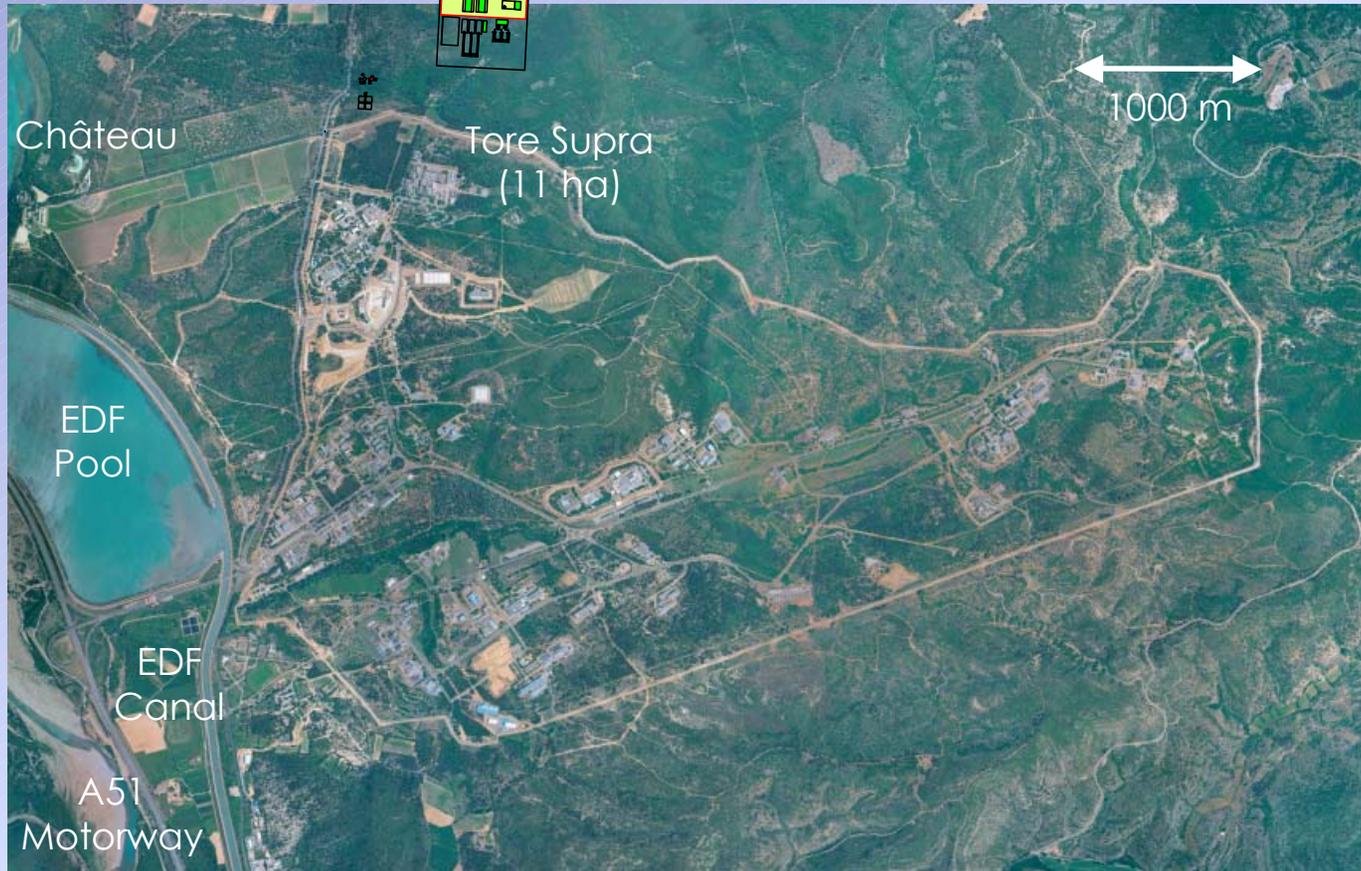
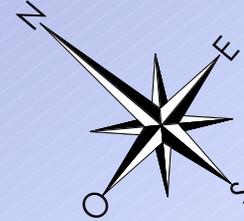


Cadarache satisfies all ITER requirements

Demonstration with detailed studies on:

- Site implantation and seismic studies
 - Call for tender for specific building design
- Electrical studies
 - Modest adaptation, all within CEA land
- Water supply and effluents
 - Water brought by gravity
- Transport and shipping
- Licensing

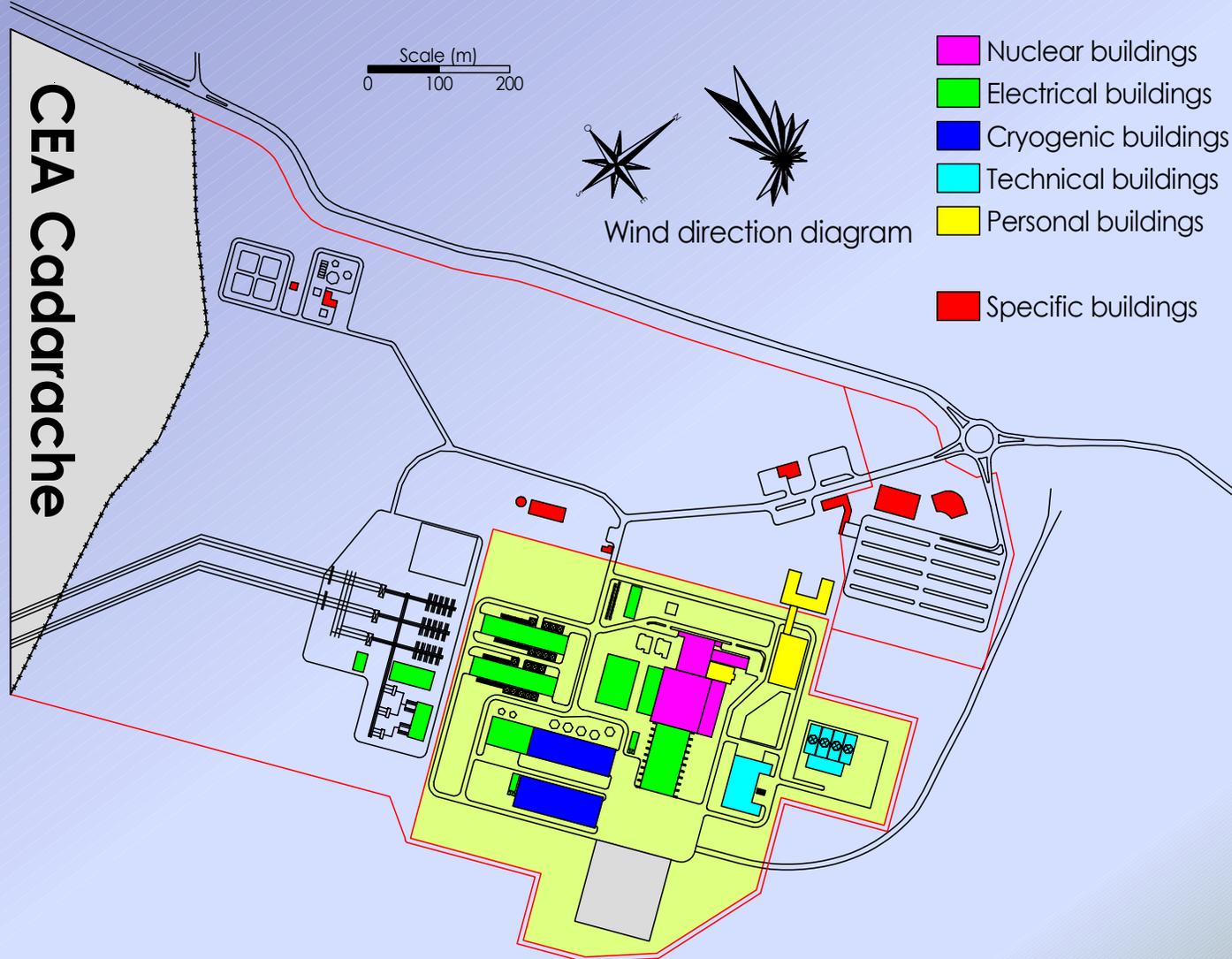
General Layout





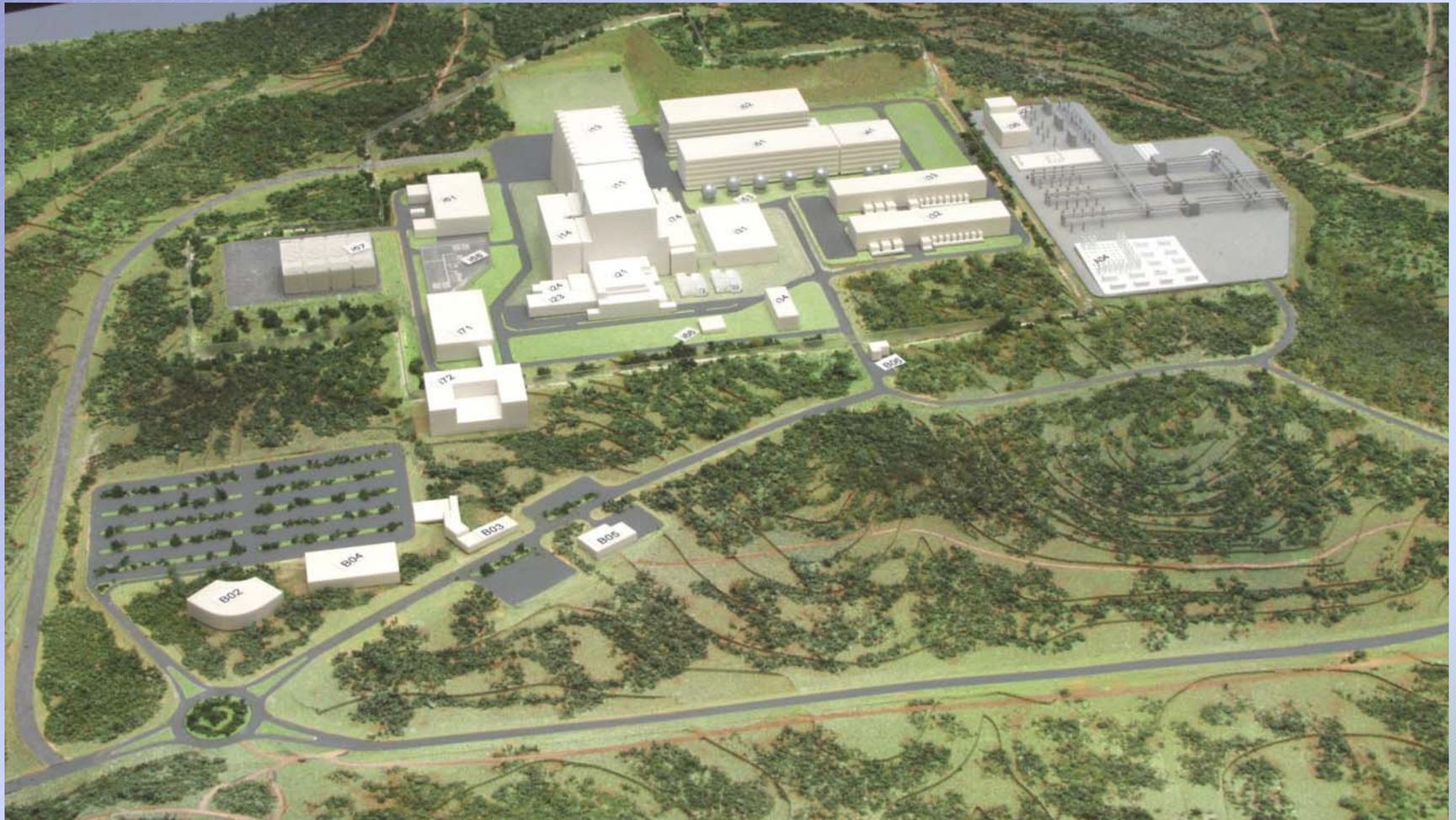


Detailed Layout at Cadarache

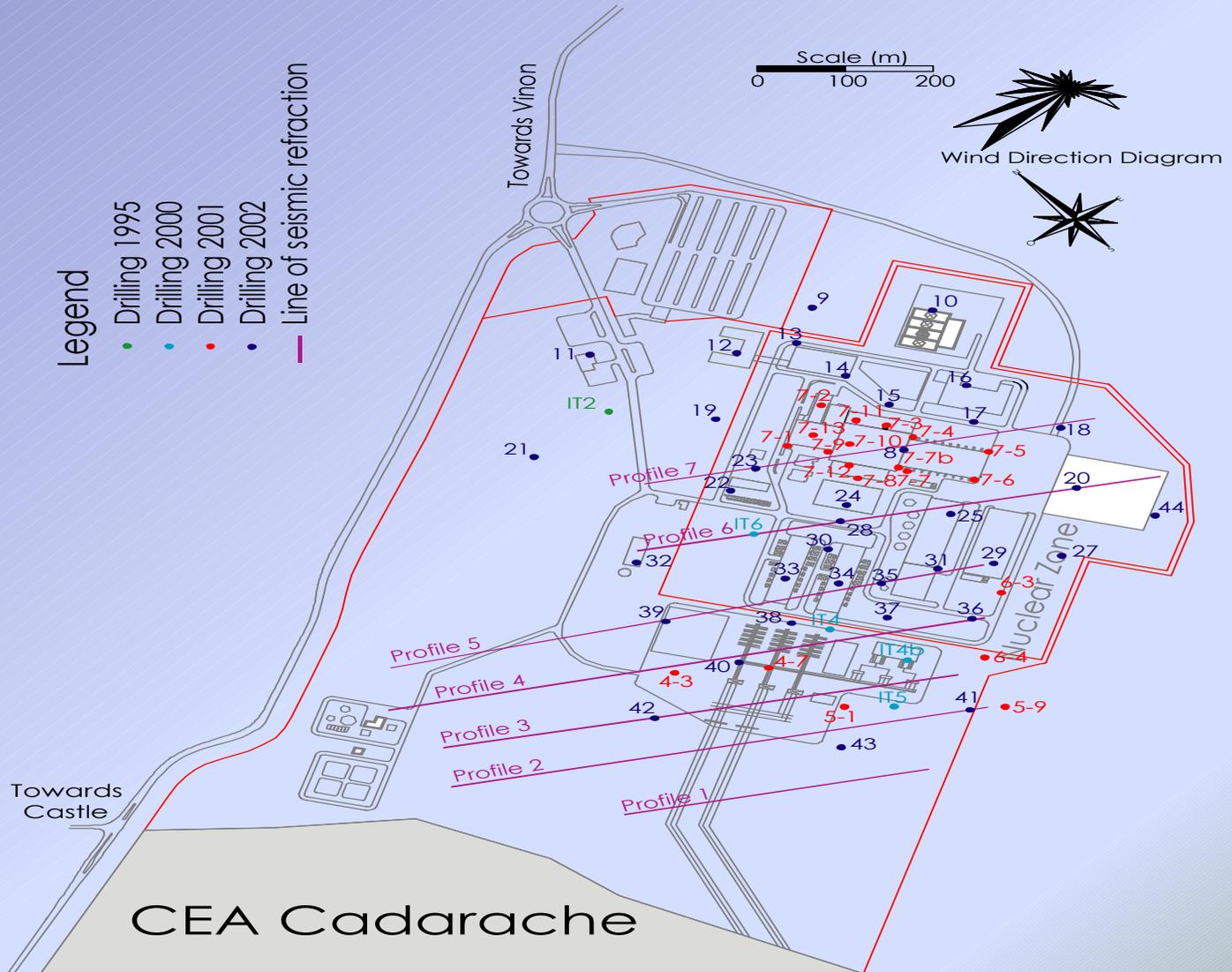




ITER buildings inserted in the site

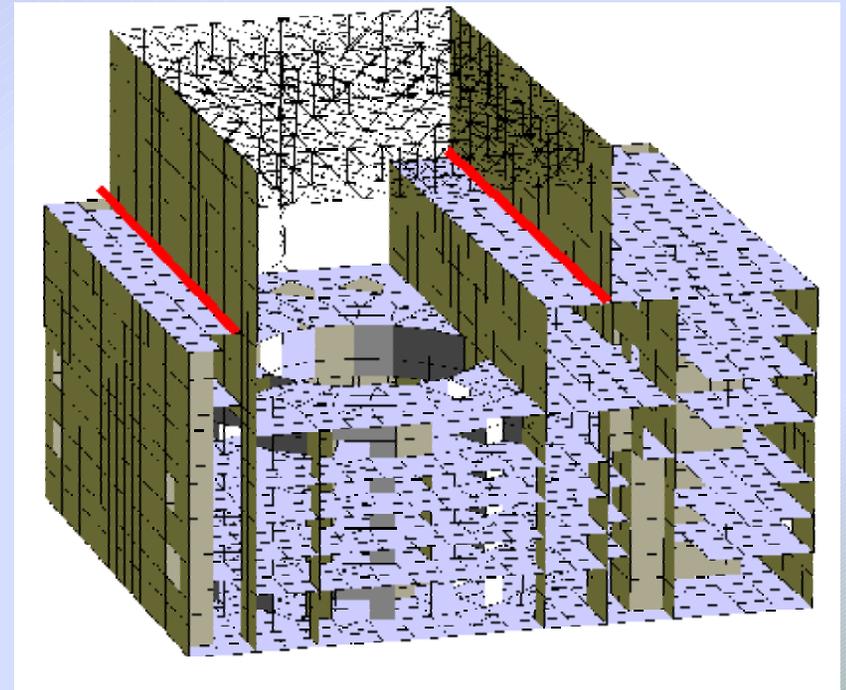


Drilling Programme

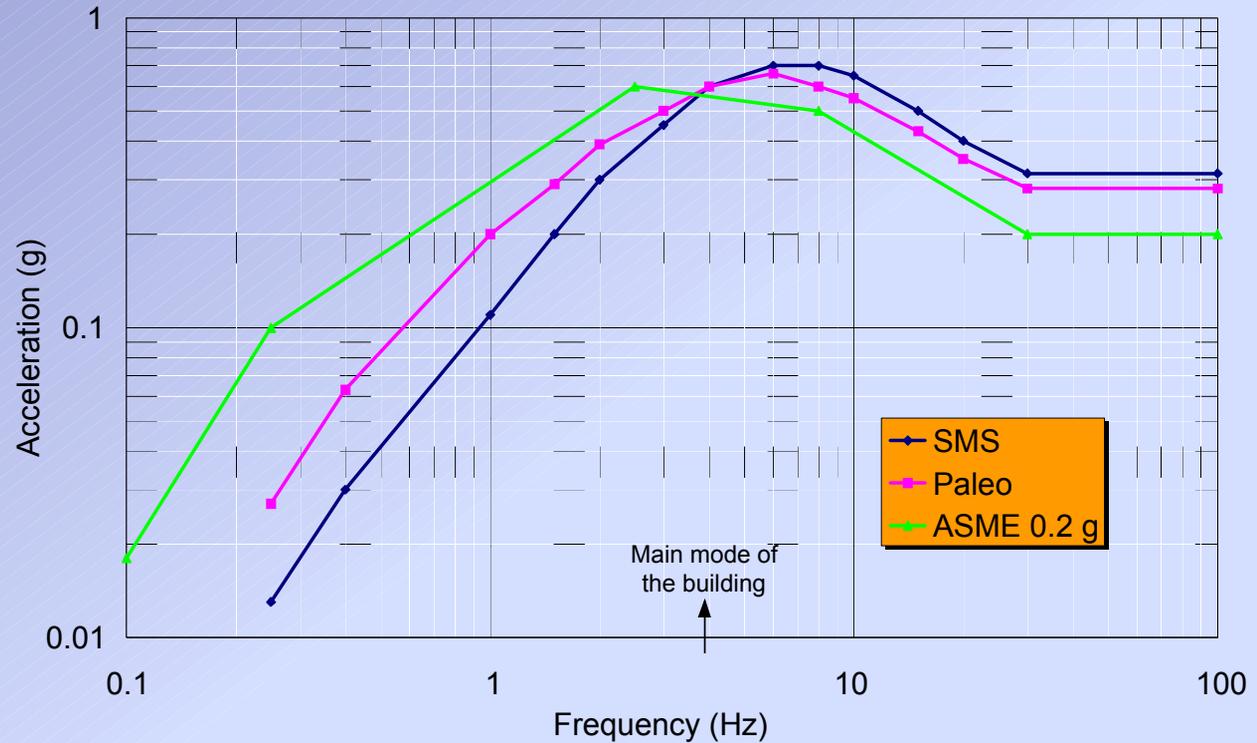


Seismic Aspects

- Seismic characteristics are well known: Durance fault is 10 km away
- Seismic studies show that **generic ITER design fulfils French regulations (RFS 2000)**
- Para seismic bearings (400) are also investigated to ease specifications on equipments



Acceleration spectra



Main modes of the buildings in the horizontal direction are in the range of 3.6 to 3.7 Hz

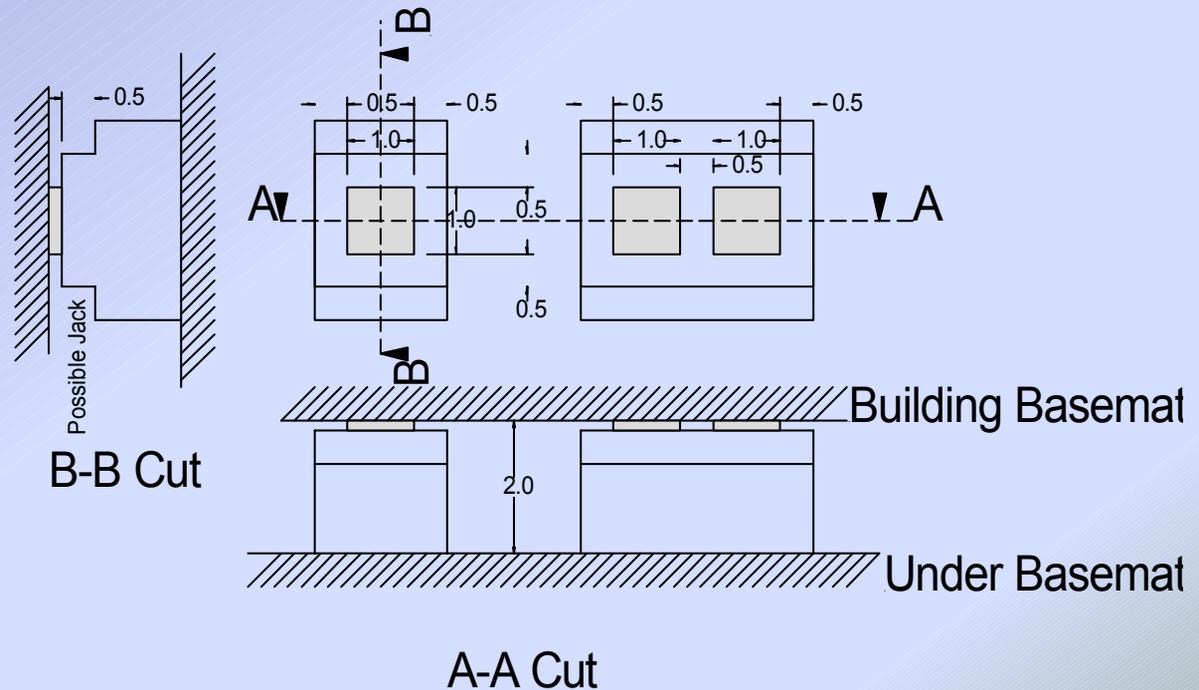
Cadarache conditions are similar to ITER generic assumptions

Para seismic bearings (under consideration)

Used in bridges, nuclear reactors...

Overall acceleration to the buildings decreased to 0.1 g

Savings on equipment





Transport and Shipping

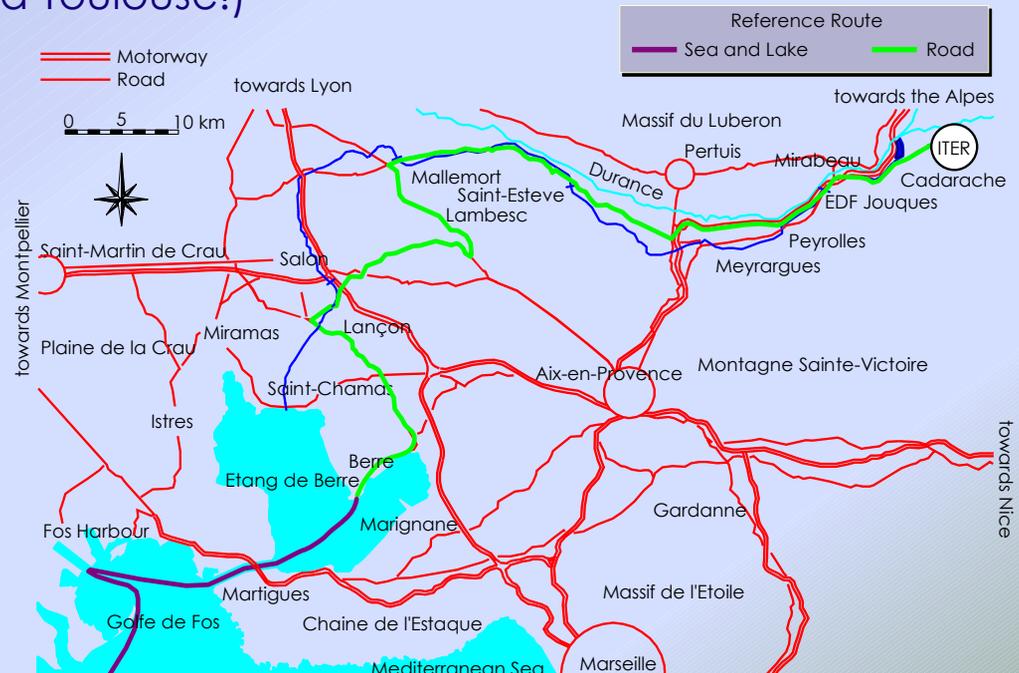
- Cadarache is 70 km from the large industrial harbour
- Solutions have emerged from detailed studies:
 - a) Loads arrive at Fos-sur-mer large industrial port
 - b) Transfer with existing barges through lake of Berre
 - b) Road uses existing itinerary for “convoi exceptionnel”
 - Some technical adaptations required (roundabouts and bridges)
- Guarantee through « décret d'utilité publique »

→ Specific cost to be borne by France

Transportation of Components

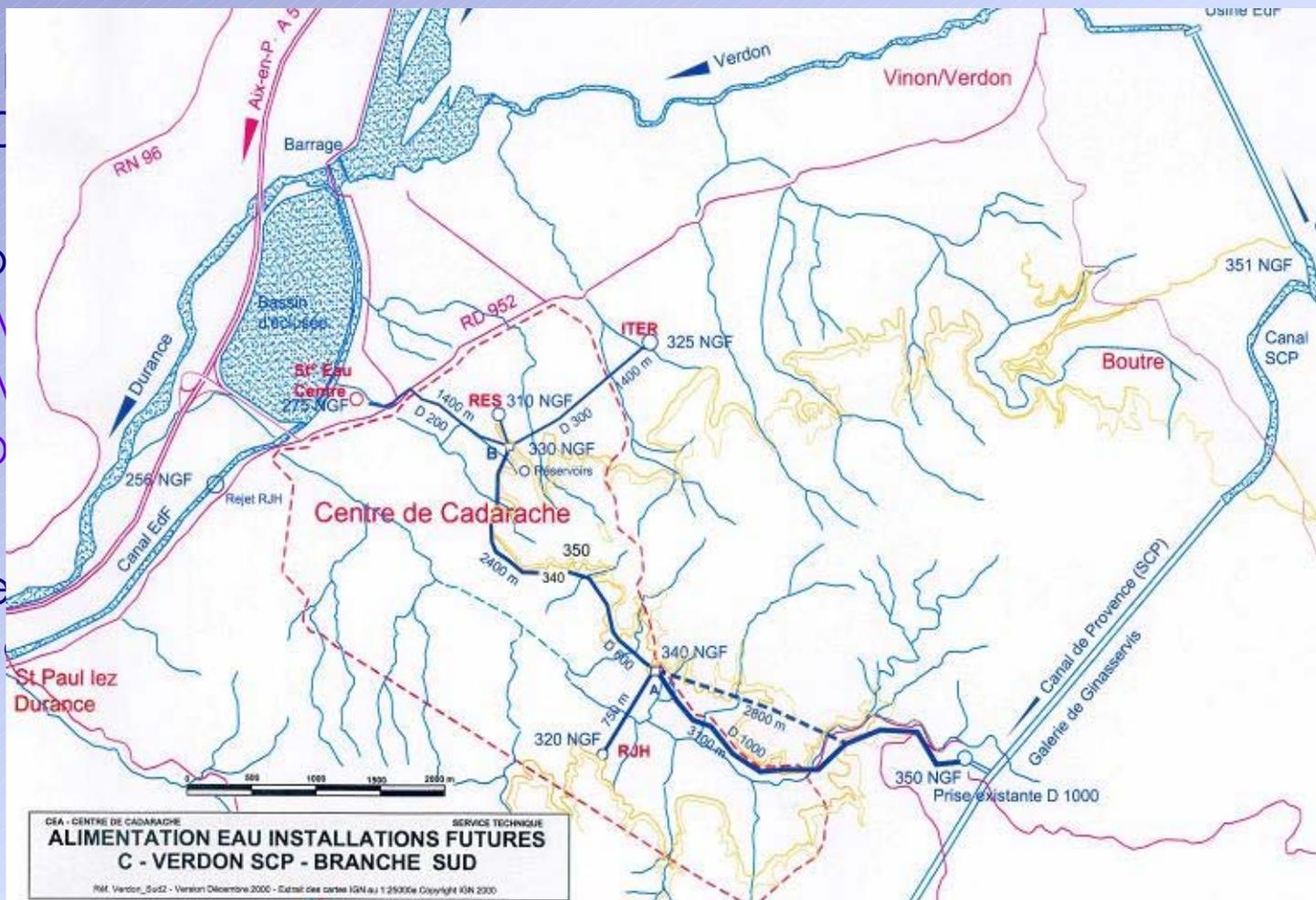
- Road is not straight, but:
 - Technical evaluation has been made, leading to a reference route by road
 - Detailed studies have started

- Procedure to be used similar to the one used for the delivery of A380 Airbus (300 km between Bordeaux and Toulouse!)
 - Warranty that necessary modifications of the road are completed when ITER Component delivery starts
 - Costs to be borne by France



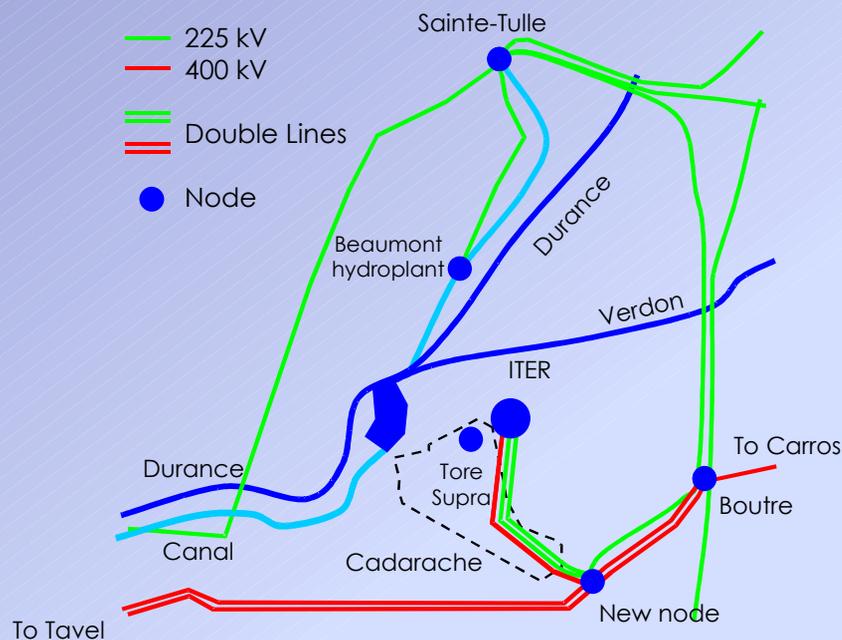
Water Supply Route

- ITER i.e. C
- Prop
 - W
 - W
 - D
- Syne high

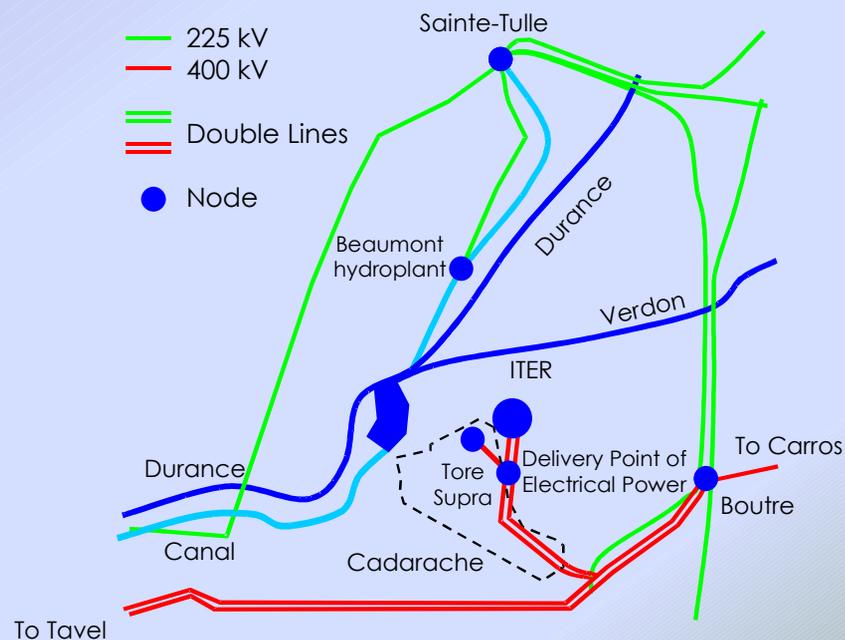


XF3: Electrical Supply

- No Problem with Power Supply and HV Line (already exists for Tore Supra)
 - 900 MW active power available for 500 needed
- Optimisation Possible by replacing two 225 kV lines by one 400 kV



Basic Solution



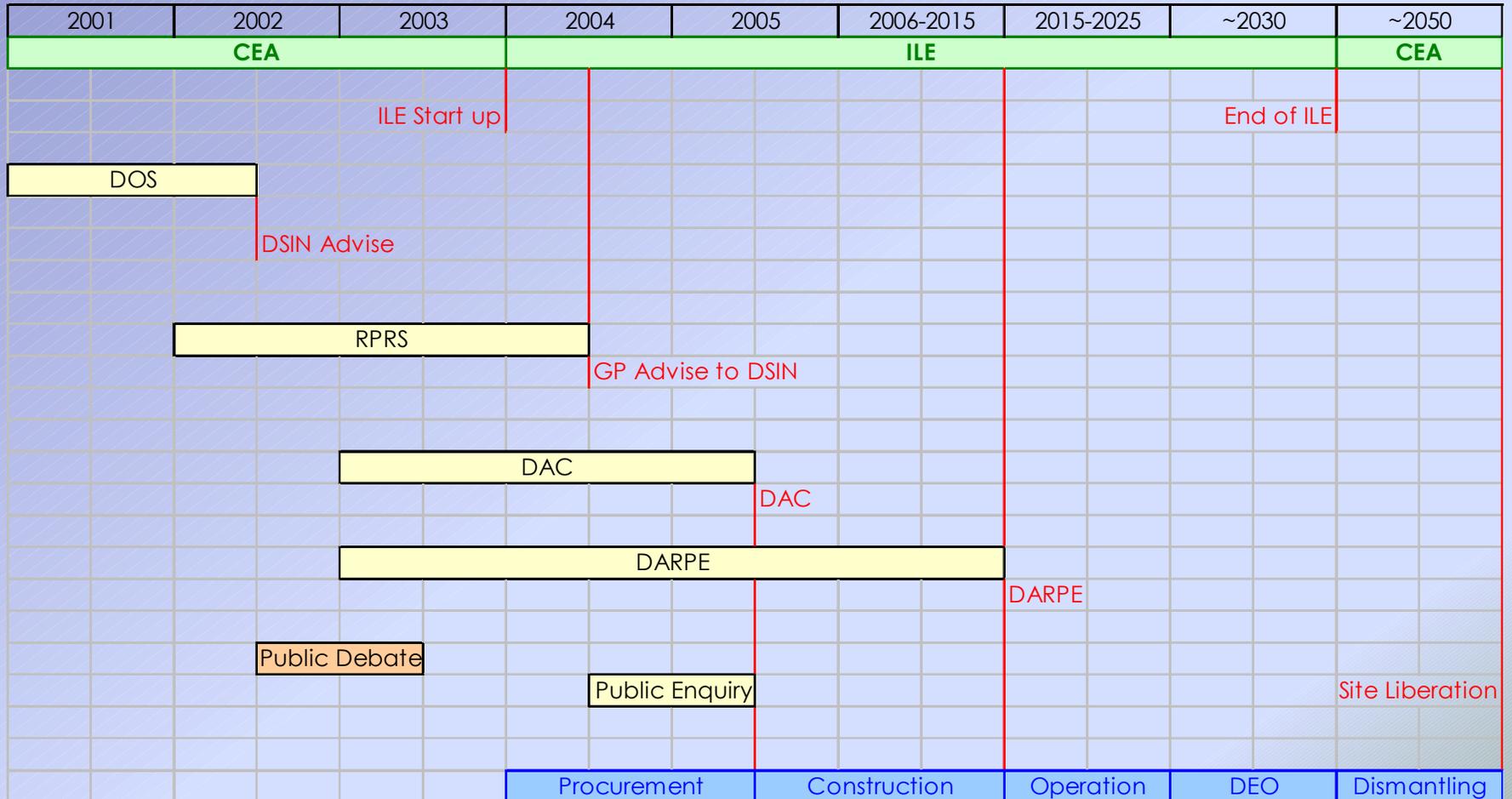
Double 400 kV Solution



Licensing Procedure

- Safety objective report (DOS) formally submitted by CEA to Safety Authorities
 - Internal CEA review and approval of the technical basis by the international team
- Preliminary Safety Report (RPrS) is started to be completed next year
- Procurement of long delivery items could start in early 2004 and construction in mid 2005

Licensing Roadmap in France





Education

- **FREE** pre-school, primary, secondary, university education
- Commitment from authorities to take into account ITER specific needs
- 59 establishments with **international education** within the Aix Marseille area



Health

- Strong health programme (**1st place in WHO report**)
- Regional medical system above French average
- Renowned medical research



Education

ITER staff to be proposed a choice among 3 possibilities

- International schools within the French system
- European school scheme as for JET with classes extended to Japanese and Russian
- Schools (Japanese, Russian...) under the responsibility of country of origin as in Strasbourg. Infrastructures could be shared with European school

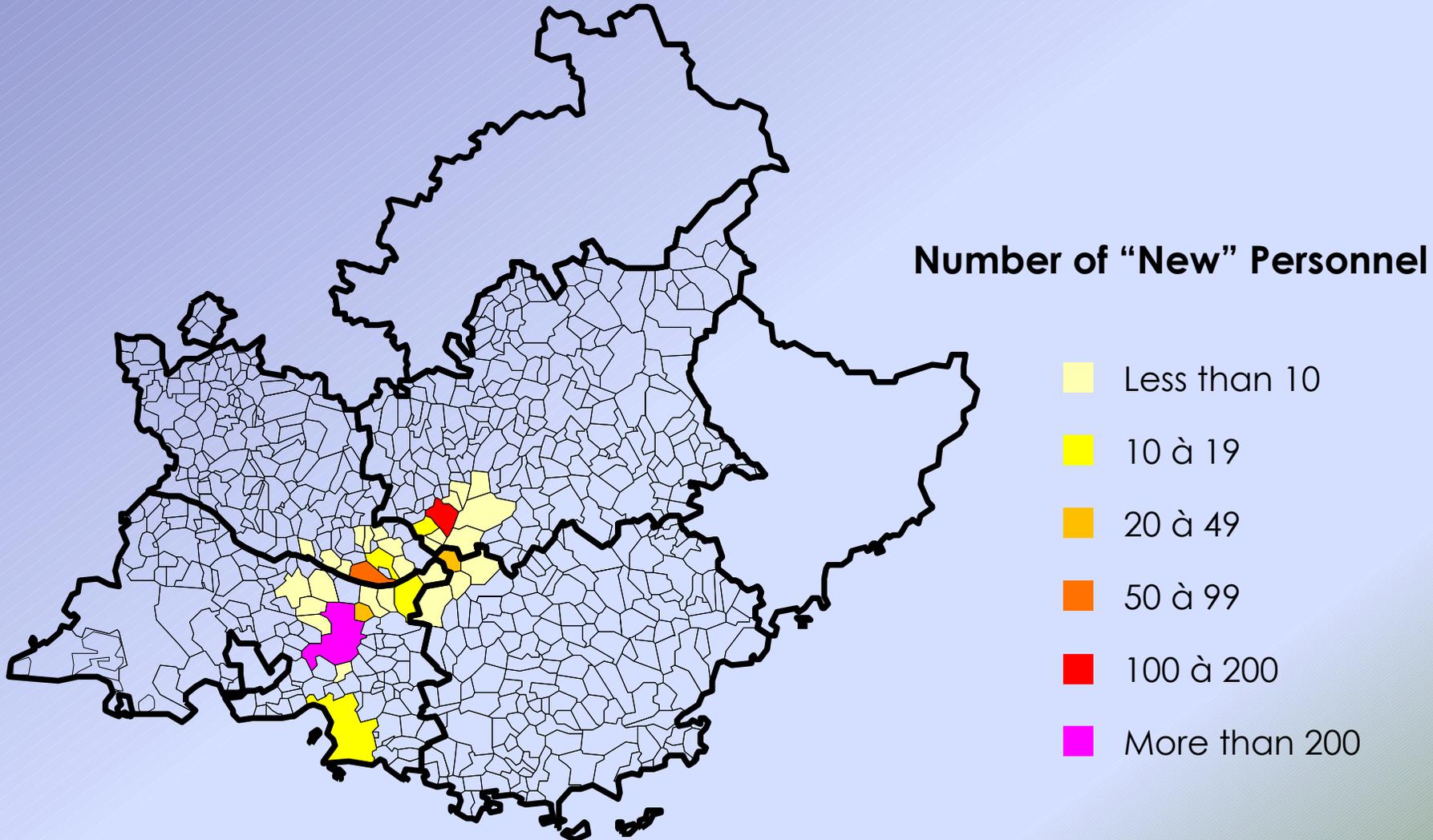


Living Conditions

- Staff expected to choose living in Aix, Manosque, Pertuis, Marseille
- Guest House and « Le Hameau » for visitors
 - Capacity to be increased
- Permanent bureau for assistance to ITER staff
 - Administrative paper work, dwelling,
 - Job opportunity for spouses
 - Associative life, community activities
- Experience with welcoming new comers
 - Transfer of 300 people in 1982-1984 to Cadarache
 - Large international staff (30-50 Euratom since 1959) and other overseas collaborators (no court case!!)

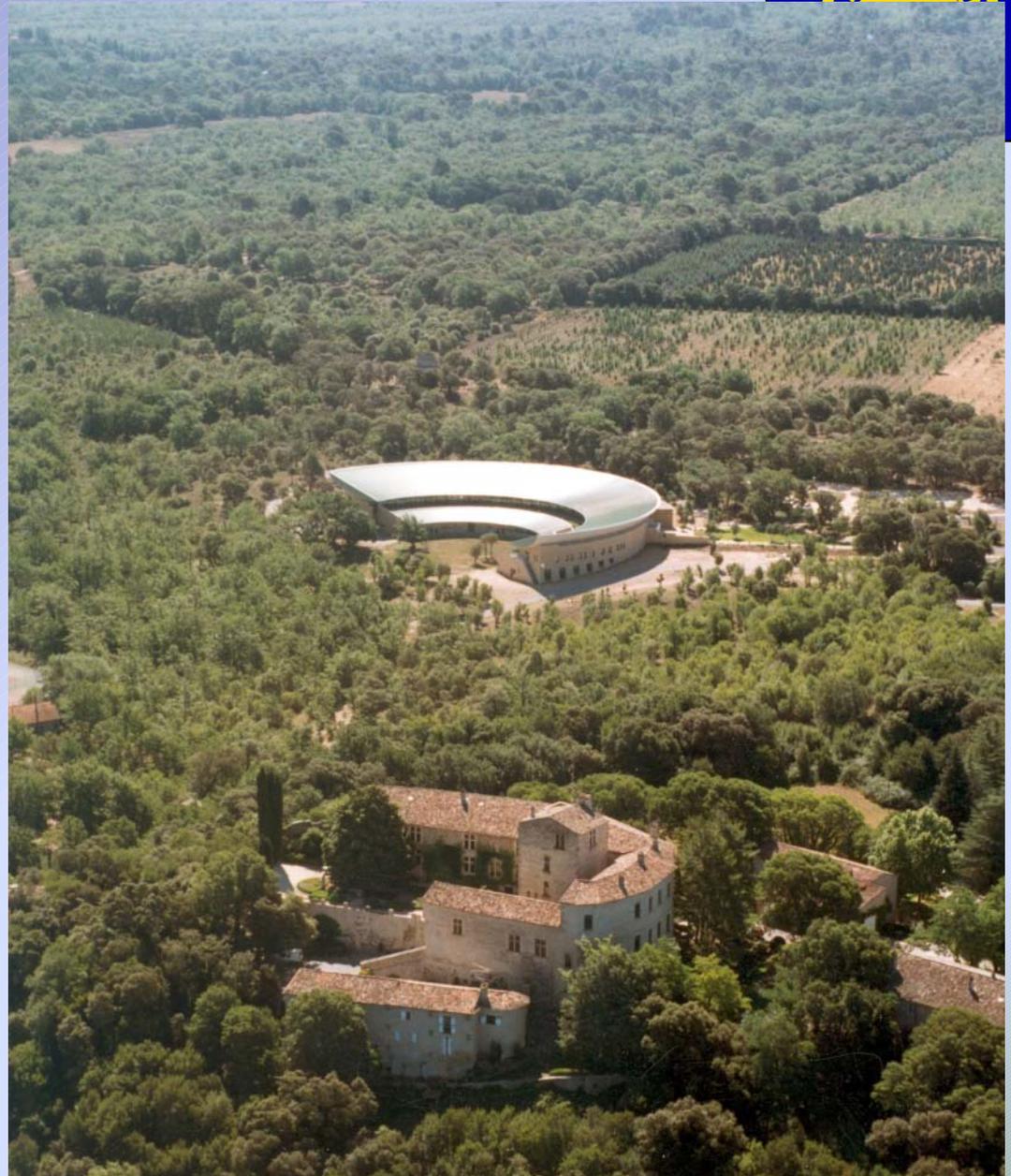


Foreseen distribution of ITER staff





Guest House and Conference Centre (INSTN)



Scientific

- 2nd French region in public research
- 10 Universities within the Provence region.
- Heavy construction, high tech and nuclear industries
- Fast train and motorway connexions



JET Colloquium - 23 September 2002

Life style

- Variety of landscapes:
 - Regional, national parks
- Cultural events and rich historical attractions
- Sports facilities:
 - 1 hour to sea, 1½ hours to ski-slopes
- Very nice climate and popular tourist area



Pascal GARIN



Landscapes of Provence



Nature and wildlife parks

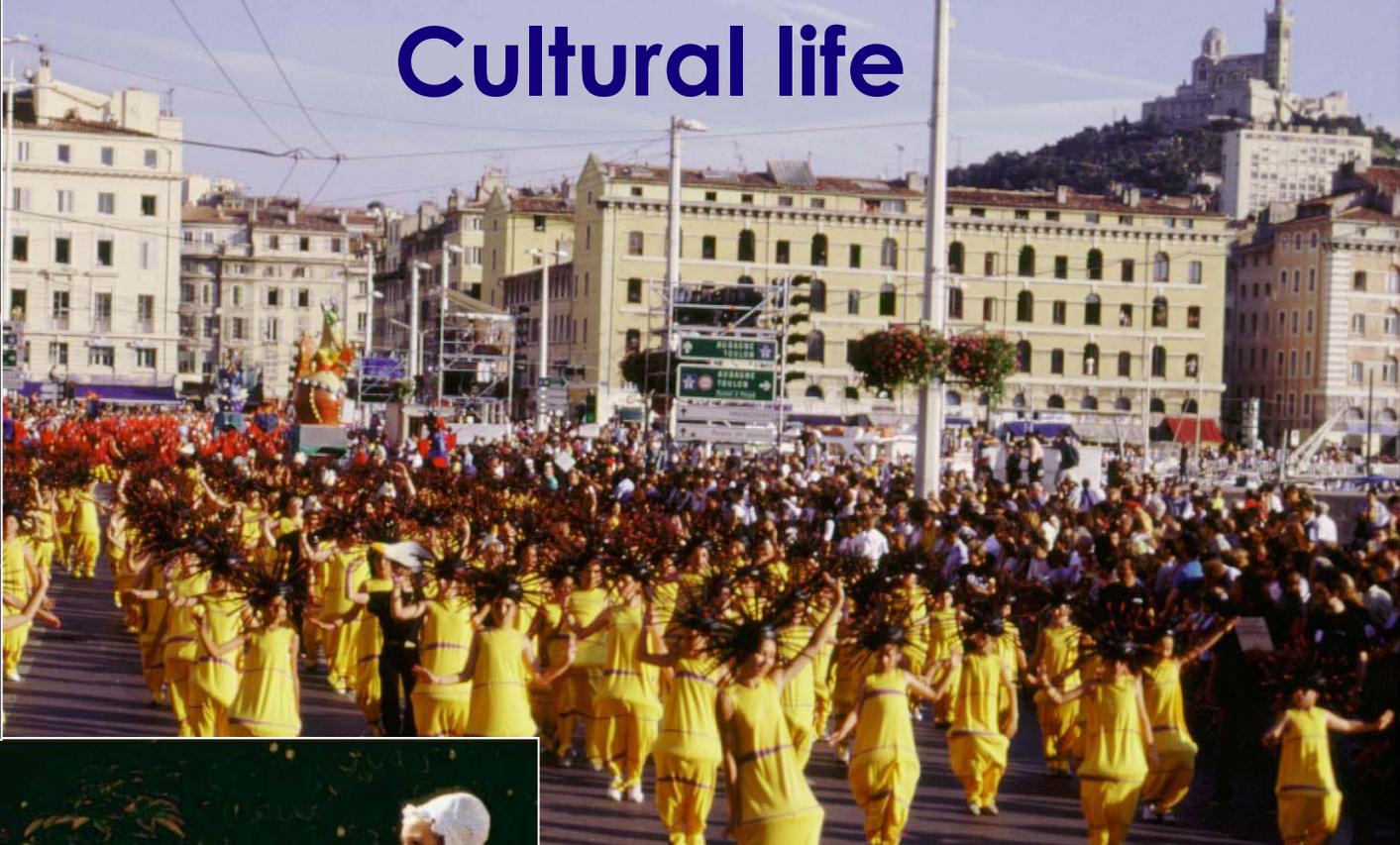


SCALE : 10km
IGN

Outdoor activities



Cultural life



Motorways of Provence



-  Motorways
-  Main Roads
-  Secondary Roads

SCALE : 1 cm = 10 km
© IGN

New TGV connection to northern Europe





Summary

- **Cadarache fulfils all ITER requirements offering in addition:**
 - **Unique supporting base** in fusion science, nuclear and high level technologies
 - **A licensing procedure** well established and accepted
 - **Substantial savings** from sharing an existing infrastructure: logistics, medical, safety, security, scientific, electricity rates, TS infrastructure etc.
 - **An 'Art de vivre'** celebrated from antiquity
 - Will attract top level scientists and engineers

France's national and regional authorities are eager to host ITER



The way forward

- Input to JASS (Include requests from partners)
- Evaluation of French input by negotiators (Dec 2002)
- Select a single EU site (contacts France Spain)
- EISS tasks
 - Licensing (DOS, RPrS)
 - Specifications, buildings, transport
 - Public debate



Yes! And More...





D Alpe-Conchy (CEA), S Andre (CEA), R Andreani (EFDA), A Aytekin (NNC), L Baker (UKAEA), P Bergegere (CEA), F Blanc (CEA), T Bonicelli (EFDA), G Borelli (ENEA), J-M Bottereau (CEA), F Briscoe (UKAEA), J-D Cardettini (CEA), C Carpenter (UKAEA), W Cette (CEA), A Chevalier (NNC), A Coletti (ENEA), JJ Cordier (CEA), B Couturier (CEA), A Delorenzi (CNR), D Desprez (CEA), J Dumesnil (CEA), S Dupuy (CEA), J Elbez (CEA), A Fardeau (CEA), P Garin (CEA), A Girard (CEA), J-P Girard (CEA), M Glugla (FZK), C Gordon (ITER IT), O Guérin (CEA), R Guérin (CEA), W Gulden (EFDA), R Haange (ITER IT), J Hay (UKAEA), C Icard (CEA), J Jacquinot (CEA), X Jardi (IBERTEF), JY Journeaux (CEA), K Lackner (EFDA), C Lathuile (Novatome), B Le Bodo (EDF), A Le Bris (CEA), P Libeyre (CEA), A Maas (CEA), D Maisonnier (EFDA), JR Mandine (CEA), G Marbach (CEA), JL Minguet (Technicatome), P Montreuil (EDF), D Murdoch (EFDA), S Nordlinder (STUDSVIK), L Patisson (CEA), A-L Pecquet (CEA), MT Porfiri (ENEA), D Protas (CEA), S Raboin (CEA), V Regola (ENEA), G Rey (CEA), L Rodriguez (CIEMAT), S Rosanvallon (CEA), F Rychen (IDEP), G Sable (Framatome), GP Sanguinetti (Anslado), A Santagiustina (CEA), M Santenelli (ENEA), P Sardain (CEA), V Suolainen (VTT), N Taylor (UKAEA), S Vuori (VTT), T Zylbersztejn (Technicatome)