Association INSTITUTS CARNOT
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« Les instituts Carnot »

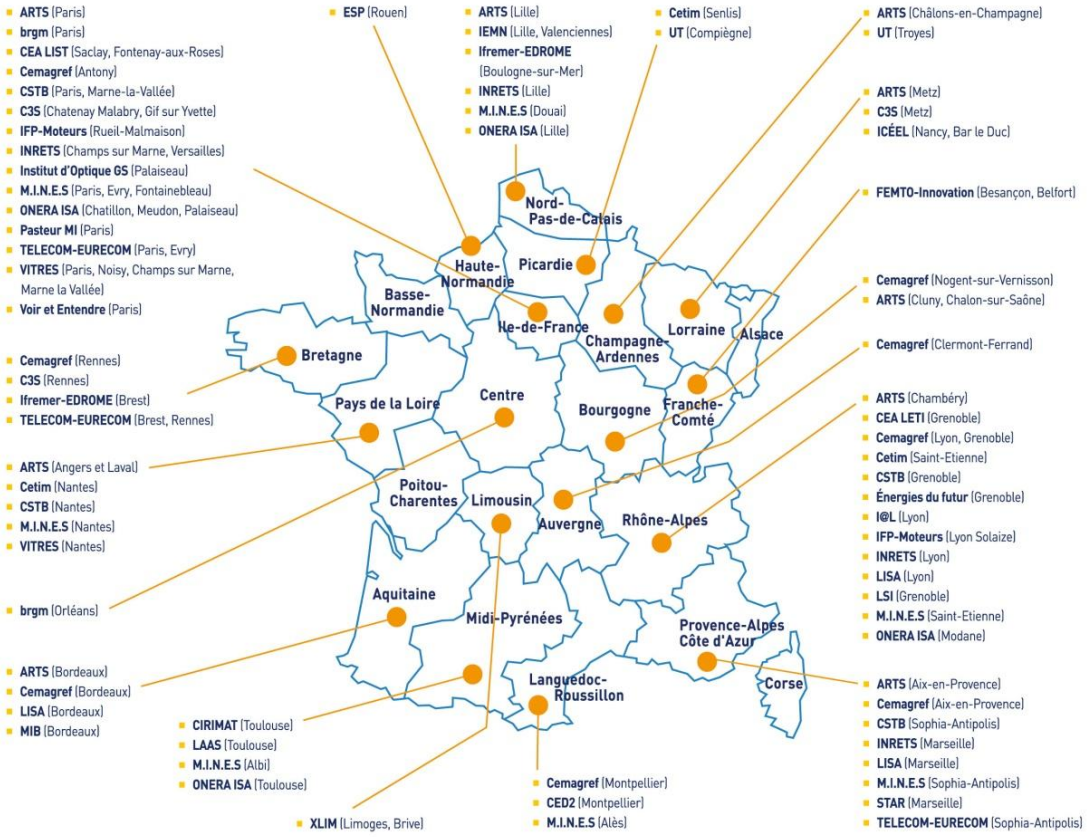
Carnot institutes :

the French gateway to partnership research

Association INSTITUTS CARNOT

The Carnot institutes network

A multidisciplinary research network dedicated to technologies transfers and industrials partnerships.



33 Carnot institutes

13 000 researchers

7 000 PhD students

1 300 M€ budget

530 M€ partnership research total sales

A structured network led by AiCarnot

The Carnot institutes Network was created in 2006

Goal : development of partnership research to the enterprises benefits

- A system set up by the French research Ministry
- Management and control from the French research national agency
- A network led by AiCarnot

→ 2 highly selective calls for candidatures

→ Carnot institutes labeled for a 4 years renewable period

→ Specific financial public support for each institute

→ A controlled medium term objectives for each Carnot institute

→ The Carnot Chart : the Carnot's network spirit & ethics

→ **A structured network** (with Carnot Alliances).

Carnot institutes and French research policies

The Carnot network is a significant actor of the national research strategy, and a key player for the development of the public-private partnership, from academic to industrial research :

- 24 universities are involved in the Carnot network, with a privileged relationship between valorization cells and the concerned C.i.
- C.i. are present within 8 Campus operations out of 10 currently running.
- C.i are very often involved within research calls (ANR, FUI, PCRD...).
- C.i. are greatly active within 54 French clusters « Pôles de Compétitivité ».
- The C.i. network runs a volunteer policy towards SMEs.
- C.i. are part of most of the local and regional structuring actions.
- C.i. are formalizing the research & innovation needs into scientific schemes able to mobilize academic laboratories.

The Carnot institutes network plays a leading role among the rest of the academic research laboratories to better fit the socio-economical needs.

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A multidisciplinary network

In order to fit the main economical & societal challenges …

- Transport, mobility,
- Information and Telecommunications,
- Sustainable energy,
- Health & assistance to the persons,
- Security.





… 6 main fields of expertise

- Energy, environment and transport,
- ICT, micro & nano technologies,
- Mechanics, materials & processes,
- Life sciences, health technologies,
- Earth sciences, natural resources exploitation,
- Building, civil engineering, land use planning.

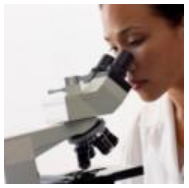
A common approach for a market oriented research

→ **Research at the service of companies :**

We promote innovation, technology transfers and partnerships between public research laboratories and socioeconomic partners

→ **Scientific and technical excellence :**

To anticipate tomorrow's innovations



→ **High level of professionalism looking for partners' satisfaction :**

We set up Carnot standards in best practices, IP, contracting policy…

→ **We work in synergy within the network :**

Multidisciplinary research solutions, optimization of the means and the quality of our offer, any entry point allows to gather the right team,…

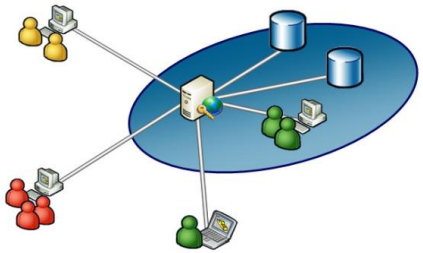
The Carnot institutes network

A structured and integrated network, led by AiCarnot (Association des instituts Carnot), for :

- **The set up of alliances, gathering market oriented competences and offering good visibility and attractive size**
  (Information and Communications Technologies – Micro Nano Technologies, Mechanics – Materials and Processes, Sustainable Construction, Transports...)
- **An offer based on complementary thematic and a short term/long term positioning, from academic concepts to industrial developments**
- **Establishing « Carnot standards » development and promotion**
  (I.P. Chart, quotations based on full costs , share of good practices…)
- **Pooling actions policy for research means optimization**
- **The construction of coordinated international relationships**
  (Fraunhofer, TNO, VTT, international groups…)

Carnot institutes Alliances

Setting up of Carnot institutes Alliances, in order to :



- **Build and promote our shared vision of a domain**
- **Identify and promote our available competencies**
- **Coordinate Carnot involved teams and competencies, and to develop synergies to better fit the firms' expectations in terms of systemic & transverse offers**
  (common projects on pre-competitive market oriented topics associating as soon as possible industrial partners…)
- **Coordinate and structure our research efforts at the European and worldwide levels**
  (Fraunhofer-Allianz Bau, large international enterprises…)

- **Run collective actions in the frame of national & international programs**

The Carnot Alliances already running

The Carnot Alliances are given fully integrated R&D offers in…

- **Meca-Mat-Pro : Mechanics, Materials and Processes**

  From the development of materials to the mechanical system and its recycling.

- **ICT-MNT : ICT + Micro & Nano Technologies**

  A synergy of both worlds to better fulfill companies needs.

- **Transportation**

  A systemic approach including energies for transport, safety and security problems, infrastructures, ICT for transports, materials 1 structures.

- **Sustainable Buildings**

  A multi-scale and systemic approach, from materials to the city and country scales.

Energy and the Carnot institutes network

Energy R&D and markets addressed

→ **R&D programs led on :**

- **Renewable Energies** (H_2, solar, wind turbine, ground source heat pump…)
- **Energy storage** (H_2, electrical power…)
- **Energy management (Smart grid…)**
- **Fuel cells**
- **CO2 storage management**
- **Energy efficiency for building, vehicles, terrestrial, maritime and flying systems**
- **Bio-fuels**

→ **Large commitment of the Carnot institutes within various economical sectors such as Sustainable building, Land use planning, Transports, Energy production and storage, Environment,…**

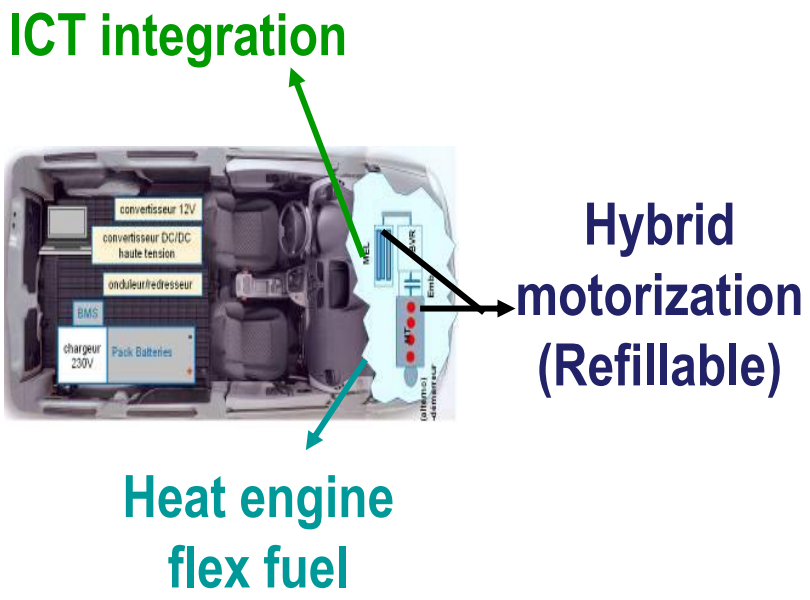
Example of R&D action under process for transports

→ **PIME**

Innovative platform for a better energy efficiency.
Energy and ICT for transports (propulsion).

Domains :

. Embedded ICT
. Hybrid sustainable motorization
. Flex fuel heat engine
. No carbon emission vehicles
. Bio fuels



Energy and the Carnot institutes network

Energy and building

Experimental platform *for performing geothermal heat pumps development and testing*

Context

Grenelle of environment : providing 600 000 houses with geothermal heat pumps before the end of 2020.

→ Need for a good management of the geothermal surface and for a validation of these equipments in real environment.

Targets

→ Performance characterization and validation platform for new materials in supervised & controlled environment,

→ Definition of sizing and sustainable exploitation criteria for superficial geothermal under multiple contexts.

BRGM and "Centre Region" partnership.

Markets

Energy and building.

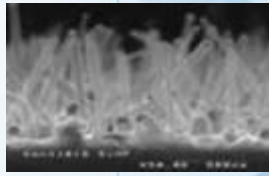
Agenda

Opened in December 2008, this plat-form allowed testing innovating compact equipments in the frame of a project financed by ANR and coordinated by the Solar Energy National Institute (part of the Energies du Futur Carnot institute), with a partnership with BRGM and CSTB Carnot institutes, Polytech' Savoie, CIAT and Eco-Alternative (EDF group).

Carnot institute "Energies of the Future" at a glance

Key figures

- 800 researchers, engineers, PhD and technical staff
- 95 PhD per year
- 90M$ budget
- 500 papers in journal and conferences per year
- 90 new patents per year



New generation of solar cell

Magnetic cooling prototype

Local environment

- Private research centers (Schneider Electric, Alstom, ST)
- Competitiveness cluster

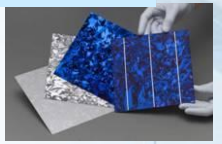
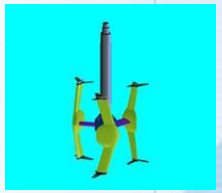
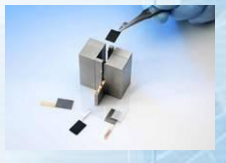
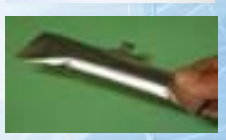
Efficient Kraft process

A national leadership
in the new technologies for energy

Marine energy

6 Strategic axes for "Energie du futur"

Photovoltaic	Efficiency, network insertion
Smart grids	Massive insertion of renewable energy New architectures
Energy storage	Hybrid or electric vehicle, renewable energies
Energy efficiency	Low consumption buildings, transport and convergence transport / building
Hydrogen	Production / management / storage Fuel cell
Micro-sources	Micro-storage and harvesting

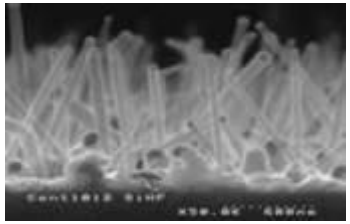







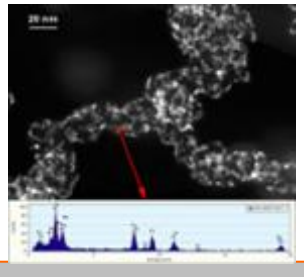
A **multidisciplinary approach** of the complex technologies (microelectronics, nanomaterials, electrochemistry, electrical engineering, fluids mechanics, simulation, …)

An integrated strategy of research

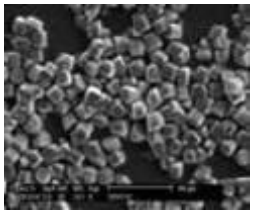
Nano wires for solar cells



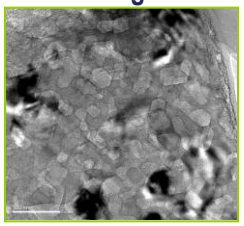
Nanocatalyst for fuel cells



Nanoparticules for Li-ion batteries



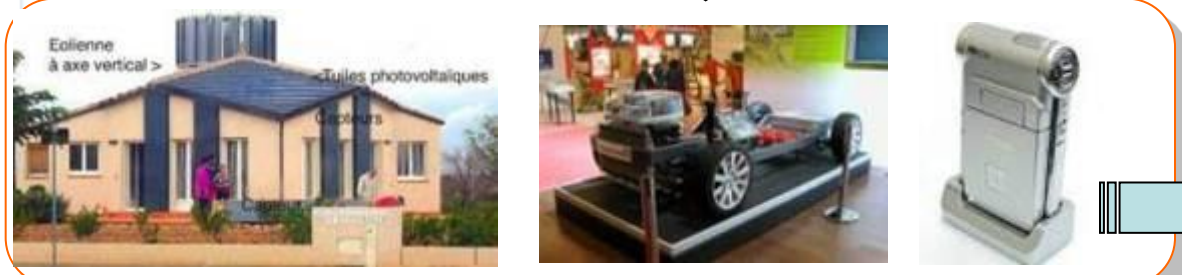
Hydrides for hydrogen storage



From materials breakthroughs …

… through innovative devices design

including demonstrators and platforms



… to system approach and simulation

Some current research activities

- **PV cells**
  - 1st generation : Reduce the cost/ increase the efficiency
  - 3rd generation cells (multi junction nanostructures, dye-sensitized solar cell, up /down conversion)

Hydrogen storage metal hydrides tank

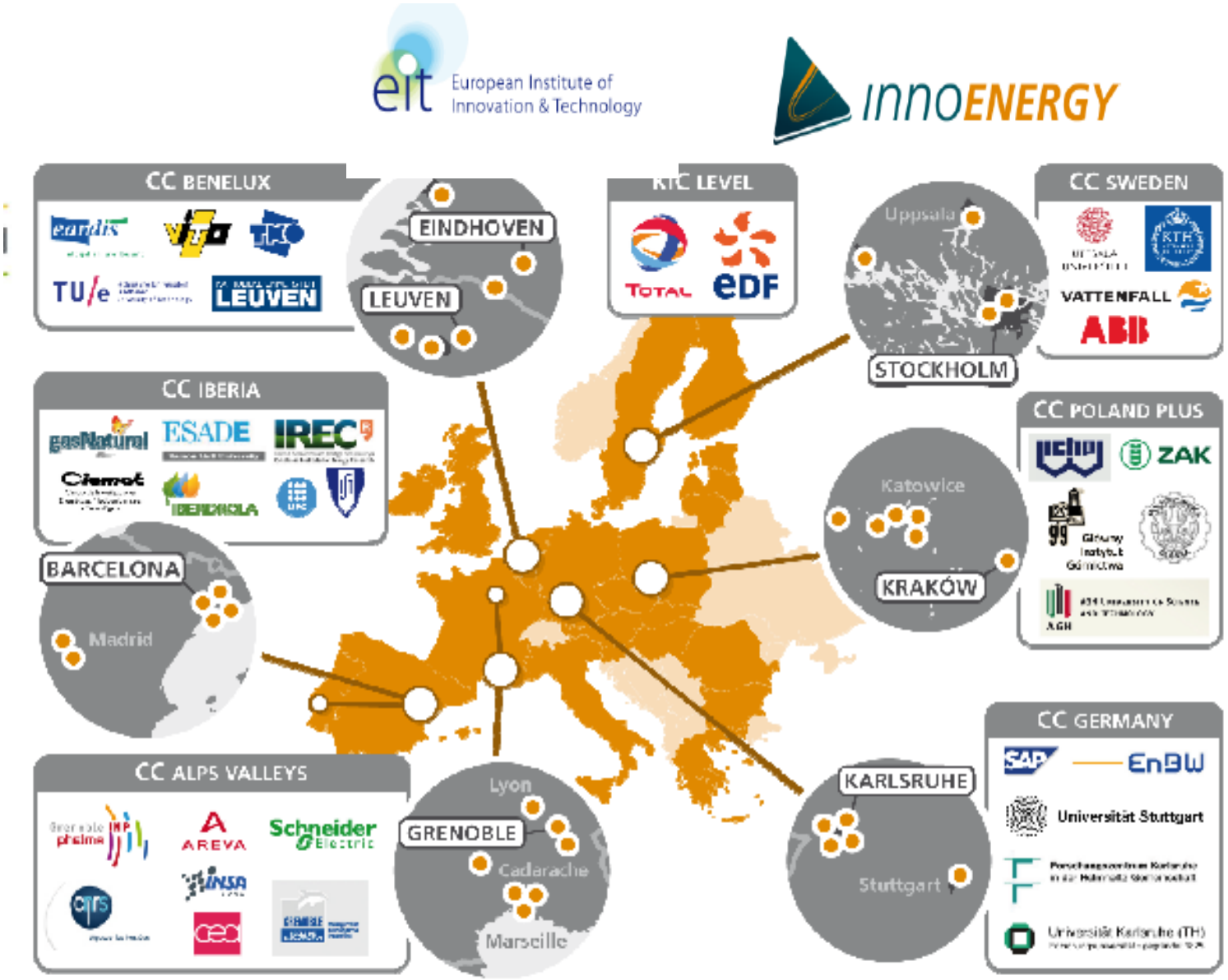
- **Hydrogen and fuel cells**
  - PEMFC/SOFC : Large test facility, improving the reliability
  - Reversible storage of hydrogen on metal hydrides

High performance Magnetic cooling

- **Innovating technologies and devices**
  - New architectures for electric smart grids
  - Magnetic cooling without greenhouse gas
  - Thermoelectric materials for harvesting energy
  - « stop and go » starter / alternator to hybrid drive
  - Biogas generation from paper manufacturing process

Paper manufacturing

European Institute of Innovation and technology : KIC Inno Energy 2010



GreEn : A major research and training center in energy

GreEn-ER (Education Research) building project :

-Training : Grenoble INP- Ense3 , UJF

- Research centers : LEPMI, G2Elab, SIMAP

- Platforms PREDIS, CMTC, Mat & Proc., Nano safety

39 000 sq mt / 1450 students, 750 staff / 116M$ devoted

Main points of interest of the Carnot institutes Offer

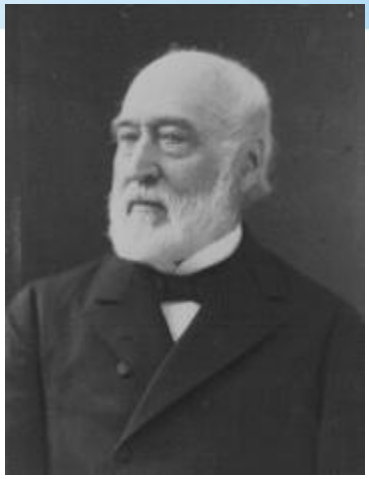
- A strong market-oriented research to fit societal challenges
- Scientific and technological high quality level (international standards)
- Easy access to the network competencies (whatever the entry point is)
- Availability, good listening and partner's satisfaction integration
- Professionalized partnership research, work quality & results (intellectual property and contracts management, projects process…)
- Ability to anticipate market needs and to offer solutions with a global vision integrating enterprises specific constraints
- The strength of a large structured research network

Carnot : an efficient system :

. 12 % of the French public research staff

. Over 45 % of the partnership research financed by enterprises to the French public laboratories.

Why Carnot ? Ending with history …



Lazare Nicolas Marguerite	Carnot	1753 - 1823	Mathematician - physician - poet - revolutionary - Ministry of defense	father
Nicolas Léonard Sadi	**Carnot**	**1796 - 1832**	**Physician- soldier**	**elder son**
Lazare Hippolyte	Carnot	1801 - 1888	Ministry in charge of Education	younger son, father of the next one
Marie François Sadi	Carnot	1837 - 1894	President of France	son of the previous one

Carnot : a good example of applied research that have yielded scientific results at the highest level : Working on the improvement of steam engines - Reflections on the Motive Power of Heat and on Machines fitted to develop this Power.*(1824)*

Thank you for your attention

Any questions ?

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