

**FUNDACIÓN PARA EL FOMENTO  
DE LA INNOVACIÓN INDUSTRIAL**

# **REPORT 2011**

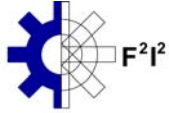
(TRANSLATION OF “MEMORIA 2011”)

Madrid, june 2012



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## 0. PRESENTATION

Our Foundation has turned 20 years in the spring of 2012, which means that this is the twentieth edition of the Memories that we make to give account of our business, not so much on its financial results, which are very worthy, but in all its technologic aspects, which is our reason for being.

At the end of 1991, there was the Ministerial Order of Industry, which allowed the conversion of the old Patronage of Industrial Laboratories of the School of Industrial Engineers in to a private foundation, but with public participation in its patronage, whose foundational endowment was given by the extinguishing patronage. As stated the order itself, the technical awards of the patronage went to the Foundation, as happened with the staff, which was from the beginning the best asset that the foundation had.

In a few months, we moved from possibility to fact, and the Foundation was established under the chairmanship of the Rector D. Rafael Portaencasa, true promoter of the idea, from the conviction that the Universidad Politécnica de Madrid, in addition to teaching and research, should be open to technology transfer and cooperation with public authorities in the specific aspects of their specialties, and in particular industries.

At the same time it counted on the invaluable guidance of the General Secretary of Industrial Promotion and Technology of the Ministry of Industry, Don Eugenio Triana, for the effective implementation of a foundation that had aspirations of converting the previous Patronage into a useful tool for our society and our industry face to the challenges of XXI century.

Twenty years later does not correspond to the Foundation evaluate its results, but these memories that year after year have been edited is the best demonstration of our evolution and our capabilities.

This anniversary coincides with the opening of a new stage in our Foundation, in the Technology Center of Tecnogetafe, always in collaboration with UPM, opening new possibilities of laboratories in our traditional areas of work, being also willing to deal with others in function of the industrial evolution and the innovation it needs.

In this sense, from our traditional position of some privilege in the field of Electrotechnics and Automotive, we can deal with new ideas like the Electric Vehicle, and what it will mean revolutionary economic, energy and environmental impact; all of which will involve new regulations and a requirement of verification and testing in which F2I2 expresses its willingness of firm actuation.

In these twenty years, an important part of the country's industrial assets, such as the automotive industry and its components, has been consolidated and strengthened, while other realities, like the mainland system to power lines stretched and modernized. In parallel, from the LCOE, as a fundamental tool of the Foundation, we have been updating in these areas and other parallels, such as EMC and we are ready to tackle the new appearing challenges.

For this, it will be also crucial the collaboration with research groups of the UPM, many of them through concertation of laboratories, work mainly with the Foundation, in areas as

important for the country as railway technology, electronics power, or sustainable energy development.

With the new capabilities recently created, the next 20 years seem lighter in terms of challenge of what appeared the 20 years that have elapsed, since figures like Rafael Portaencasa and Eugenio Triana put the Foundation on track to meet expectations.

## 1. BACKGROUND

This report is prepared, as in previous years, to comply with current legislation. It gives the description of the work carried out by the Fundación para el Fomento de la Innovación Industrial, hereinafter Foundation, during the year 2011, in its Laboratorio Central Oficial de Electrotecnia, in concerted Laboratories and in Units of General Issues and Consulting and Training.

It is complemented with activities concerning the foundational purpose of the Foundation, and other information relating to the financial management of the year 2011.

## 2. GOVERNING BODIES

### 2.1. PATRONAGE

The constitution of the patronage at January 1, 2011 was as follows:

- |                           |  |
|---------------------------|--|
| President:                | <b>D. Javier Uceda Antolín</b> , Rector of the Universidad Politécnica de Madrid.  |
| Executive Vice President: | <b>D. Jesús Félez Mindán</b> , Director of the Escuela Técnica Superior de Ingenieros Industriales of the Universidad Politécnica de Madrid.   |
| Members:                  | <b>D. Antonio Muñoz Muñoz</b> , General Subdirector for Quality and Industrial Safety of the Ministry of Industry, Tourism and Trade<br><br><b>D. Luís Carlos Mas García</b> , Technical Adviser of the General Directorate of Industrial Development of the Ministry of Industry, Tourism and Trade<br><br><b>D. Adolfo Cazorla Montero</b> , Vice Rector of the Universidad Politécnica de Madrid.<br><br><b>D. José María Martínez-Val Peñalosa</b> , Director of the Fundación and ex –Director of the Escuela Técnica |

Superior de Ingenieros Industriales of the Universidad Politécnica de Madrid.

**D. Fernando Aldana Mayor**, ex –Director of the Escuela Técnica Superior de Ingenieros Industriales of the Universidad Politécnica de Madrid.

**Dña. Celina González Fernández**, Assistant director of Investigation of the Escuela Técnica Superior de Ingenieros Industriales of the Universidad Politécnica de Madrid

**Dña. Linarejos Gámez Mejías**, Associate of the Vice Rector of Economic Planning at Universidad Politécnica de Madrid.

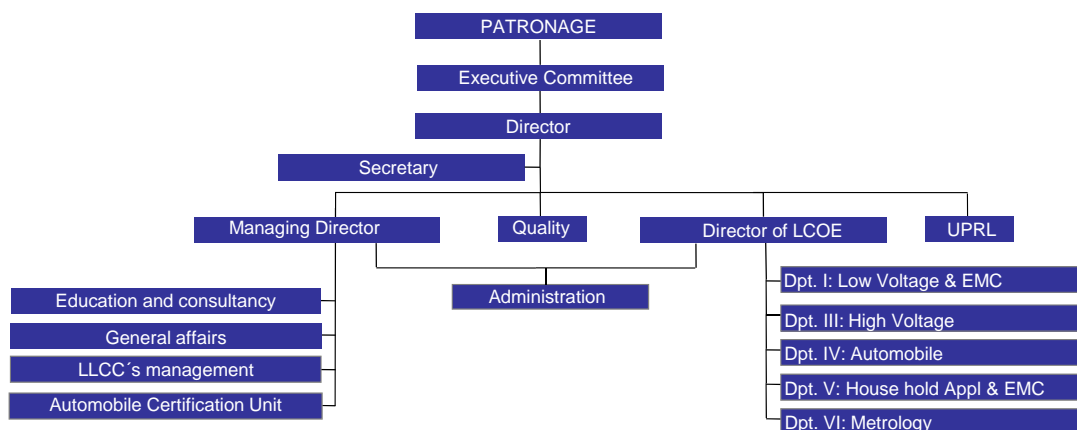
**D. Jesús M<sup>a</sup> Pérez García**, Assistant of the Director of Economic Affairs, Planning and Infrastructure of the Escuela Técnica Superior de Ingenieros Industriales of the Universidad Politécnica de Madrid.

Secretary:

**D. Juan Manuel González García.**

On day 10 February 2011 D. Antonio Muñoz Muñoz terminated as Patron, when ceasing on his position at the Ministry of Industry, Tourism and Trade and it was appointed in his place, his successor, D. Timoteo Garcia de la Fuente.

## 2.3. ORGANIGRAMA



Director:

D. José M<sup>a</sup> Martínez-Val

Secretary:

D. Juan Manuel González

Director LCOE:

D. Ángel M. Alonso



Manager:	D. Manuel Valcárcel	
Director of Administration:	D. José Luís Sánchez	
Director of the Department of Switchgear:		D. Antonio Valladolid
Director of the Department of High Voltage:		D. Fernando Garnacho
Director of the Department of Automobile:		D. Eugenio S. Muñoz
Director of the Department of Electrical Appliances:		D. Rafael Guirado
Director of the Department of Metrology And Getafe Center:		D. Pascual Simón
Director of the Unidad de Certificación del Automóvil:		D. Santiago Salinero

### **3. ACTIVITY REPORT**

#### **3.1. LABORATORIO CENTRAL OFICIAL DE ELECTROTECNIA**

##### **3.1.1. HOMOLOGATION AND TESTING CENTER**

The testing is the most important activity of the LCOE, so it is classified in the areas of low voltage, high voltage, automobiles and components and electromagnetic compatibility.

The most important fact of the year was the movement of most of the LCOE to the new facilities in Tecnogetafe. The three new buildings dedicated to Low Voltage and EMC, High Voltage, and Vehicles, respectively, have a total useful surface of 5,500 m<sup>2</sup>, which together with the general services building represent a quantitative and qualitative jump of great scope and prospective which place it as the reference Technology Center.

##### **TESTING AREA OF LOW VOLTAGE ELECTRICAL EQUIPMENT**

This area of testing completed his movement to Tecnogetafe during 2011. This new facility provides ample space coherently organized, enabling a better provision of services to our customers.

The new facilities and space available has tripled in relation to the previous, and they open the door to future projects that begin in 2011 and will be fully developed in 2012.

The tests of this area are related in part, to electrical safety and protection of user and its environment from risks arising from the use of electrical equipment, and other part, to energy efficiency, aptitude to the function and energy consumption.

The low voltage building is divided into several specialized laboratories in each of the main areas of activity, among which are:

**COLD EQUIPMENT SECURITY TESTING LABORATORY:** In this room there are 3 cameras of temperature and humidity necessary for the performance of the test in environment conditions of cold, hot and humidity, between -30°C and +45°C and until 95% of relative humidity. Each one of the cameras has been equipped for a total of 16 test positions with thermocouple and individuals feedings in each position, allowing exterior data collection systems.

The main tests performed in this room are related to electrical safety and aptitude to the function of refrigeration and air conditioning equipment as well as the energy efficiency thereof.

**LABORATORY OF LUMINAIRES:** In this large room there are carried out tests to all lighting equipment and associated equipment, providing an enclosure protected from air currents of 35 m<sup>2</sup> and a room for testing the endurance up to 40 ° C. It is complemented with another room attached where there is a sphere of Ulbricht and auxiliary equipment for testing.

**LABORATORY OF ENERGY EFFICIENCY:** This new testing area has new laboratories among them highlight the following: **WASHING:** a modern facility made to measure, which allows the storage and control of water to be used in tests of the energy efficiency on washing machines and dishwashers, allowing it to be a reference laboratory at the European level in such tests, **REFRIGERATORS:** it count on 3 cameras of temperature and humidity and a temperature and power measurement system that allow to test the energy parameters required for labeling thereof.

The remaining laboratories moved (Automatic Controls and small appliances, water heaters and baking, heating and boilers, electronic equipment, IP ratings and testing of plastics) have made a clear renewal of the activities that had been carrying out so far, allowing an increase in the productive capacity of the tests, complemented by the renewal of a large part of the measuring equipment, which suppose an important enhancement of this area.

These tests are made for voluntary certification and certification of compliance with the essential requirements of directives and regulations applicable to the products of manufacturers and importers, and also for the various government inspection conducted annually according to the established in the Directives and regulations.

There are listed below the types of devices have been tested:

- **Luminaries**
  - ✓ Luminaries for Fluorescent lamps
  - ✓ Portable and recessed luminaries
  - ✓ Domestic luminaries
  - ✓ Exterior luminaries, lighting public and spotlight
  - ✓ Emergency luminaries
  - ✓ Attractive children luminaries
  - ✓ Rail luminaries
  - ✓ Lighting chains
  - ✓ LED luminaries



- ✓ Energy saving lamps, fluorescent and LED lamps
- **Equipment associated to lights**
  - ✓ Ballast for fluorescent and discharge lamps
  - ✓ Electronic ballast
  - ✓ Electronic ballast for fluorescent lamp
  - ✓ Electronic ballast for discharge lamp
  - ✓ Starter for discharge lamp
  - ✓ Capacitors for lightning
  - ✓ Electronic converter for halogen lamps
  - ✓ Light set for high voltage lamp
  - ✓ Light equipment for double level
  - ✓ Stabilizer and reducers equipments of flow in head-board of lines for exterior light
  - ✓ Control devices for LED modules
- **House hold appliances**
  - ✓ Refrigerator
  - ✓ Freezer
  - ✓ Washing machine, dishwasher and tumble dryer
  - ✓ Heating installation
  - ✓ Electric terms
  - ✓ Cooking and oven installation
  - ✓ Air conditioning
  - ✓ Bath and hydro massage shower
  - ✓ Electric Boiler equipment and gas thermos
  - ✓ Electric equipment for garage door
  - ✓ Tests relative with the aptitude of functioning and energetic consumption in refrigerators, washing machine, electric thermos and ovens
  - ✓ Small house hold appliances
  - ✓ Slot and distribution machine
- **Electric equipment of industrials machines.**
  - ✓ Machines to cut food
  - ✓ Service lifts and wind tower
  - ✓ Train truck
  - ✓ People lifters for various purposes
- **Electronics equipment, informatics and telecommunication**
  - ✓ Television
  - ✓ Videos and high fidelity equipments
  - ✓ Processing equipment (computer, printer...)
  - ✓ Arcade games (type B and type C)
  - ✓ Terminal sale point

- **Automatic controls**

- ✓ Programmer
- ✓ Thermostat
- ✓ Magnet valve
- ✓ Hour switch
- ✓ Gas burner control
- ✓ Gas detector

- **Transformers**

- ✓ Measure
- ✓ Security
- ✓ Insulation
- ✓ Autotransformers
- ✓ Switched power source

- **Railway and airport equipments**

- ✓ Gloss system control for beacon
- ✓ Signalling system for level crossing
- ✓ Flasher
- ✓ Timer
- ✓ Light signals for train circulation

- **Other equipment and materials for installation**

- ✓ Connection terminal
- ✓ Switches
- ✓ Motor capacitors

In addition, trials are conducted as follows:

- **Trials of degrees of protection (IP numbers and figures IK)**

- ✓ Junction boxes and distribution
- ✓ Busbars
- ✓ Wardrobes
- ✓ Luminaries
- ✓ Metal poles for outdoor lighting

- **Luminaries photometric curves and light source**

- ✓ Intensity matrix
- ✓ Polar diagram C-Gamma
- ✓ Isolux curve
- ✓ Glare diagram
- ✓ Operating factor
- ✓ Lightning efficiency

- ✓ Luminous flux, color temperature and color rendering index
- ✓ Analysis of the emission spectrum between 300 nm and 1000 nm

In household appliances safety tests it should be noted the outstanding participation of LCOE in the development of an implementation guide for testing of electronic equipment and analysis of integrated software of household appliances driven by the IECCE, as an international certification body for electrical safety . Experience and participation of LCOE in standards groups related to it (IEC TC 61 and MT 23) and groups of international agreements between laboratories (CTL ETF 1 and OSM / HA) has made LCOE representatives to be invited to develop two of the basic documents of the Guide and to chair the group that elaborates it.

In 2011 it has continued to act under the agreement signed with the Consumer Service of the Autonomous Community of Madrid, in which have been carried out tests and inspections of large consumption electrical products such as down lights, attractive luminaries for children and desktop luminaries, blenders, oil coolers, refrigerators, circular saws and lifting jacks, among others.

Among other activities it stands out the project PROINVER for the study of protections in investors and the project ECOPLIANT (European Commission) of development of tools for control of products in the Ecodesign Directive.

All these new projects combine the study and analysis of possible solutions to the problems, along with the verification test of the relevant technical aspects, which gives the laboratory a singular potential in the performance of these projects.

It has also continued with the activity of collaboration with IDAE for the control of information of energy labeling of appliances, and IDAE databases for the grant "renewal plan" of appliances. It has also continued with the work of conformity assessment of facilities and equipment subject to the requirements of the facilities of cable carriage of passengers Directive (2000/9/EC), particularly cable cars and ski lifts, in collaboration with AENOR.

Moreover, throughout 2011, the area of lighting and luminaries has conducted for the IDAE a study on the different halogen lamps of dichroic reflector type and their equivalents in LED technology, which were mostly available in the market to see the real possibilities of replacement of traditional incandescent lamps by the new LED technology and in addition it has continued with the performance of the validation tests for the supply of energy saving lamps to the winner of the public tender of the IDAE. The tests have involved the checking of electrical and photometric characteristics of the lamps provided, with regard to compliance with the technical specifications of the tender.

## **TEST AREA OF HIGH VOLTAGE ELECTRICAL EQUIPMENT**

This area of testing has been partly relocated to the new facilities of Tecnogetafe that will be completed in the first quarter of 2012.

The FFII has made a firm commitment to new high voltage laboratories. The two shielded buildings of high voltage of 40x25x25 mxmxm and 29x13x12 mxmxm respectively, with the new lightning impulse generator of 2.4 MV designed and built by LCOE high voltage

department itself, place the Tecnogetafe center in line with his career and nationally and internationally recognized prestige.

- Dielectric Testing

During 2011 the LCOE has had a significant activity at on-site tests, both on high-voltage insulated cables and their accessories such as in high voltage power transformers. It has also maintained the offer of on-site dielectric tests of nacelles with insulating arms that are used for works in tension power lines, with a facility that allows the testing of insulating arms for electrical networks up to 66 kV, and complements the capacity of LCOE in their own facilities, where it can test insulating arms for higher voltages. Until 2009 these works were exclusively performed at laboratory facilities.

On the other hand, it has maintained the testing activity on the laboratory own premises of equipment such as isolators, cells, switches, distribution transformers, instrument transformers, cable terminations, arresters, etc.. The tests were performed according to standards UNE-EN, IEC, Harmonized Documents (HD), etc.

The LCOE tests facilities have allowed to carry out tests of dielectric withstand voltage of 800 kV at industrial frequency, 2 MV lightning impulse and 1.1 MV operation impulse.

During 2011, thanks to the coordination of activities with the High Voltage Laboratory of EUITI of UPM, the LCOE has disposed a resonant facility of 700 kV for frequencies between 30 Hz and 300 Hz which has allowed to carrying out tests of rating high voltage cables.

- Partial Discharge Tests and radio interference.

The LCOE has coupling capacitors and measuring instruments suitable for detecting partial discharges (PD) and radio interference voltages (RIV) in equipment up to 400 / V 3 kV. The test protocols issued are internationally recognized and used by the electricity sector.

Measuring instruments of partial discharge of the LCOE have been complemented by techniques for measuring high and very high frequency, to analyze the patterns of partial discharges in order to evaluate the type of insulation defect in the object under test (cables, transformer, etc.).

During 2011, the techniques of partial discharge test have been further developed, so that it can detect and locate discharges practically in all the situations that can be found at on-site measures.

LCOE activity in this field has not been limited to national territory, having successfully completed measures abroad, and in extreme measurement conditions (Iceland).

- Testing of fire extinguishers

Fire extinguishers are tested to verify that the leakage current through them, not threatening the person making them act when the projection of gas / dust goes to high voltage parts.

- High Current Test

A test facility capable of generating up to 24 kA rms short circuit and up to 50 kA peak to test the behavior of devices under thermal and dynamic stress of short circuit. Tests requiring higher short circuit currents are tested at the power facilities of the LCOE in Boroa (Bilbao).

- Testing of arresters protection of buildings

Annex C of the standard UNE 21186 contemplates the determination of time of anticipation of active arresters for protection of buildings and facilities. The LCOE has a testing facility pulse of high voltage and high current (10/350 microseconds high-intensity), up to 200 kA, which allows mandatory tests for the AENOR certification of these devices.

- Tests of lightning current impulses

The LCOE has a facility for test of normalized current pulse of 8/20 ms, 4/10 ms and 10/350 ms, suitable for testing materials and equipment. It should be noted the standard tests on arresters and metal oxide and surge arresters for the protection of networks of low, medium and high voltage.

Furthermore, these generators allow testing carbon composite materials used for aircraft structures. In these cases, the representative waveforms are A / D, B and C, which simulate the lightning discharges on its initial component, of high energy range and A / D up to  $3 \cdot 200\text{kA}/100\text{kA}$  106A2s and  $2.5 \cdot 105\text{A}2\text{s}$ , intermediate component B: 2kA, 5ms and final component C: 200A, 1s.

In recent years, the techniques of sparking measurement have improved by high sensitivity digital cameras that have been characterized by special calibration procedures.

- "On-site" Test of High Voltage Cables

The LCOE has a mobile laboratory for "On-site" measurement of PD (partial discharge) of cables and transformers, using specific measurement instruments that allow discriminating electrical noise of the PD from internal defects.

During 2011, thanks to the coordination of activities of R + D + i with the High Voltage laboratory of the EUITI of the UPM, the LCOE has provided extensive service of "On-site" tests for the measurement of PD for the sector of high tension both in out of service and in service, which is expected to increase in the coming years bearing in mind the importance of the asset management for the electricity sector.

The PD measurement system developed makes a powerful filtering through a robust specific mathematical tool for "On-site" measures, capable of discriminating PDs produced by the overlapping interferences that mask it. After filtering each PD pulse is analyzed to determine three characteristic parameters of waveform: the frequency  $f$  and two parameters associated with the asymmetry of the pulse envelope ( $\alpha$ ,  $\beta$ ). A 3D representation of each pulse through its three characteristic parameters ( $f$ ,  $\alpha$ ,  $\beta$ ) allows the formation of clouds associated with different sources of PDs. The pattern of the PD resolved in phase associated with each selected

group of PD (PD cluster) is evaluated automatically by a neural network to identify the root cause of the PDs. This technique has been proved in multiple installations of HV and by different laboratories specialists in PDs with very favorable results. The figure shows the separation of four different sources of PDs. None of them evidence an internal danger in isolation.

Likewise, the PD measurement system developed allows locating the position of the PDs along the cable by analyzing the time delay of arrival of pulses PD to two sensors at the ends of the cable system. When the PD pulse reaches both sensors at the same time (no late arrival) the focus of the PDs is in the geometric center of the cable and when the difference in arrival times is not zero, the position of the generating of PDs is determined taking into account the propagation velocity of the PDs and cable length (Figure).

- Facilities for testing and "On-Site" measuring of Power Transformers, HV/MV cables and GIS

During 2011 there have been carried out "On-Site" tests of transformers with testing facilities for measurement and diagnosis of the insulation of power transformers. The LCOE has two facilities, one for transformers up to 150 MVA and other for large transformers up to 700 kVA. With those facilities it is possible to test the transformers with the cables that are connected to both sides (high and medium voltage) and switchgear connected to them, eg GIS. The first facility is very compact, mounted inside a 6m container length. It consists of a motor generator controlled through an adjustable frequency converter and a set of reactance's of low and high voltage capable of compensating reactive power up to 1 MVAR.

The other test facility, installed in a trailer with 13 m long, is designed for testing commissioning of large power transformer substation, and its technology was designed to vary the frequency of testing by using a converter group of 650 kVA instead of a motor generator.

Both facilities allow the induced voltage test of transformers in order to know their state of isolation and prevent isolation failures that could lead to power arcs.

- Drilling cables facility up to 300 kV

The LCOE has a MV drilling cables test facility whose breakdown voltage reaches up to 300 kV. The facility consists in two terminations of water with resistivity and temperature controlled, and a pool of 2 x 2 x 1.2 m specially designed to maintain the temperature of the cables at 90 ° C. With this facility it can be made cable qualification tests of medium and high voltage.

- Thermal cycle test for high voltage cables up to 220 kV

During 2011 the LCOE has launched a facility for testing thermal cycles up to 220 kV cables that allows to induce through the cable a current of 4000 A, while the cable is subjected to high voltage test through generator of the cascade of transformers of 500/1000 kV or of the resonant generator up to 700 kV.

- Tests of power

The LCOE has ENAC accreditation for tests of power thanks to the agreement established with the HPL (High Power Laboratory) of OCT (Ormazabal Corporate Technology) on "temporary cession of testing facilities" for tests of power up to 2,500 MVA. The accreditation covers tests of power transformers, voltage and current transformers for measuring and / or protection, switchgear, cell and cables / cable accessories.

The LCOE has a permanent headquarters in Bilbao HPL provided with own laboratory means which guarantees the confidentiality of the measures and the results of the tests that are performed exclusively by the staff of LCOE.

- Tests of voltage dips in wind farms

The activity of test of voltage dips in wind farms has decreased substantially during 2011, having been certified the majority of existing parks, hopefully in the next year 2012 this type of tests will be required for photovoltaic parks. In this area the LCOE has the corresponding ENAC accreditation on PO12.3 requirements of REE.

#### *AREA OF TESTS IN AUTOMOBILE AND ITS COMPONENT*

Test realised can be classified in the following groups:

- Sonorous admissible level
- Tone ringer
- Mirros
- Interference suppression / Electromagnetic Compatibility
- Retroreflectors
- Brake light and sidelights
- Indictators
- Number plate light
- Fog lamps
- Reversing lights
- Visual field conductor
- Dashboard identification
- Security glass
- Glass installation

#### *AREA OF ELECTROMAGNETIC COMPATIBILITY TEST*

This area of testing is already fully located in the new facilities of Tecnogetafe. They have also made significant investments equipment, especially in new cameras.

In this area there are included the testing of emissions and immunity, conducted and radiated in all types of appliances covered by the Directives under the Ministry of Industry, Energy and Tourism, and in which the LCOE is the competent body: household appliances, electronics,

lighting, control and regulation equipment, industrial equipment, scientific and medical equipment, etc.

The LCOE has acted within the scope of recognition and accreditation of the FCC (Federal Communications Commission) of the United States of America and CAB (Conformity Assessment Body) for testing certification and conformity declaration in accordance with Parts 15 and 18 of the FCC proceedings.

Through this recognition, the LCOE perform tests of Electromagnetic compatibility (EMC) on those computers and equipment that according to the U.S. law, need a procedure of Declaration of Conformity (DoC) to can export those products to the U.S.

Moreover, in 2011 there have been measurements of the electromagnetic radiation produced by appliances that affect living beings, according to the Low Voltage Directive.

Listed below are the types of emission tests performed:

- Measurement of conducted emissions, current harmonics and voltage fluctuations (flicker) in electrical equipment

- ✓ Refrigerators, washing machines
- ✓ cooking appliances
- ✓ Heating and air conditioning
- ✓ Small Appliances
- ✓ Luminaires and associated equipment
- ✓ Electronic equipment and computer
- ✓ Industrial Machines
- ✓ Lifts
- ✓ Automatic Controls
- ✓ Electrical and electronic control of non-electric appliances (such as boilers and gas heaters)

- Conducted and radiated emissions in brown line electronics, information technology, and other luminaires, such as:

- ✓ Television
- ✓ Audio
- ✓ Laptops
- ✓ Control Equipment of large machines
- ✓ ECG luminaires
- ✓ Emergency lighting

- Tests of immunity to electrostatic discharge, gusts, lightning impulses and radiated disturbances

- ✓ Electronic Circuits of electrical appliances (refrigerators, washing machines, boilers, etc.).
- ✓ ECG luminaires



- ✓ Emergency lighting
  - ✓ Automotive electronic equipment
  - ✓ Railway signaling equipment
  - ✓ Electronic Converters
- radiated emission tests on vehicles
    - ✓ Vehicles
    - ✓ Motorcycles
    - ✓ Trucks
  - Conducted Emission of high voltage equipment
    - ✓ Disconnectors
    - ✓ Insulators
    - ✓ Voltage Converters
    - ✓ Current Transformers

### **3.1.2. CALIBRATION CENTER**

#### ***3.1.2.1. ELECTRICAL CALIBRATION IN THE ELECTRIC AREA (DC and low frequency) IN LOW VOLTAGE AND TIME AND FREQUENCY***

During 2011, the laboratories of the LCOE Department of Electrical Metrology in Low Voltage have developed their activity in the following two areas, accredited by ENAC:

- ✓ Electricity in direct current and low frequency.
- ✓ Time and frequency.

The calibration service provided by the LCOE in low voltage can be divided into the following main areas:

- ✓ Electricity, DC and low frequency.
- ✓ Time and frequency and high frequency electricity (calibration of oscilloscopes, frequency counters, tachometers and differential testers).
- ✓ Magnetism.

The LCOE Metrology Department also provides services of metrological confirmation, complementary to the simple calibration of measuring equipment:

- ✓ Determination of the intrinsic errors associated with the calibration.
- ✓ Comparison of intrinsic errors in the specification or accuracy class, whenever possible.
- ✓ Set of equipment where possible with prior agreement with the client.
- ✓ Labeling calibrated instruments, and sealing integrity if necessary.
- ✓ Calibrations to measure according to individual specifications.
- ✓ Repair service if necessary.



- ✓ Calibration annual contracts for parks of instrumentation.
- ✓ Performing "On-Site" calibrations in specific cases.

Calibrations performed in 2011 can be divided into several types according to the customers target:

- ✓ Calibrations of standards (mainly aimed at accredited calibration laboratories and for calibration laboratories of quality assurance industry).
- ✓ Calibrations of equipment used by testing laboratories.
- ✓ Calibrations for entities of conformity assessment (eg inspection bodies, control organisms, technical inspection bodies of vehicles).
- ✓ Industrial Calibration and quality control (aimed at manufacturers and engineering companies and SMEs in general).
- ✓ Calibration for the field of electrical installation, such as low voltage testers, network analyzers, Resistance Testers, etc.

Here are the main types of instruments calibrated classified by groups:

- Calibration pattern
  - ✓ Passive elements such as pattern resistors, inductors and capacitors.
  - ✓ RLC measuring bridges.
  - ✓ DC Comparators.
  - ✓ Pattern current transformers or current comparators.
  - ✓ Electric Multifunction Calibrators.
  - ✓ Zener and solid state voltage references.
  - ✓ High-resolution digital multimeters (8 ½ digits).
  - ✓ Pattern counters of electrical energy.
  - ✓ Pattern Resistances of high ohmic value.
  
- Industrial and quality control calibration
  - ✓ Oscilloscope up to 1GHz bandwidth
  - ✓ Amperimeter, kiloamperimeter
  - ✓ Power and energy analyser
  - ✓ Network and harmonic analyser
  - ✓ Ballast
  - ✓ Decade cases of resistance, inductance and capacity
  - ✓ Gauges, thermocouple simulator
  - ✓ Gauges, thermoresistance simulator
  - ✓ Capacity meter
  - ✓ Welding tester
  - ✓ Active and reactive energy meter
  - ✓ Chronometer associated with protection checker

- ✓ Strobes
  - ✓ Phase meter
  - ✓ Gaussmeter
  - ✓ Temperature meter for Thermocouple and Thermoresistance
  - ✓ Megger
  - ✓ Digital meter
  - ✓ Analogue and digital Insulation resistance meter
  - ✓ Voltage radio bridge
  - ✓ Bridge from transformer's calibration
  - ✓ Wheatstone bridge and Thomson
  - ✓ Temperature simulator
  - ✓ Direct and alternating shunt
  - ✓ Motion indicator
  - ✓ Earth resistance meter
  - ✓ Lifter, ammeter, phase meter o voltammeter
  - ✓ Voltage and intensity transformer
  - ✓ Voltage relay tester
  - ✓ Voltage tester, voltammeter and jigger
- Calibration for electrical installers
    - ✓ Harmonic and network analyser
    - ✓ Differential tester
    - ✓ Low voltage tester
    - ✓ Looping impedance meter
    - ✓ Spacing and contact measures
    - ✓ Megger
    - ✓ Multimeter
    - ✓ Motion indicator
    - ✓ Earth resistance meter
    - ✓ Ammeter lifter
    - ✓ Leak finder lifter

### **3.1.2.2 OPTICAL CALIBRATION LABORATORY**

This year, the LCOE has performed the most part of his work in this area under the ENAC accreditation for the calibration of light meters (according to the file number 1-LC/475 ENAC).

These instruments are commonly used by the inspection bodies in different regulatory fields (Regulation on Energy Efficiency in outside Lighting installations, the Low Voltage Electrotechnical Regulation, Lifts Regulations, Technical Building Code), to assess whether levels of lighting meet the set limits of brightness and uniformity. They are also used by Health and Safety insurance companies when checking if the lighting is adequate to the type of work being performed.

The laboratory has a photometric bench, so that the light meters are calibrated by the direct method or by substitution. The right combination of different patterns and distances can

achieve very low illuminance values, especially for checking the operation of the light meters when measuring emergency lighting and panic in public places. The accreditation extends from very small levels of lighting to 3000 lux, although it is possible to get higher levels of 5000 lux.

During 2011, it has obtained the ENAC accreditation for the calibration of luminancimeters or cd/m<sup>2</sup> meters to be used under the new Regulation on energy efficiency in outdoor lighting installations (RD 1890/2008). Luminance measurements are required, among other applications, to check the night light pollution and obtrusive or uncomfortable light, whose maximum values are limited in ITC-EA 03. The accreditation extends from 1.8 cd/m<sup>2</sup> to 1000 cd/m<sup>2</sup>.

### ***3.1.2.3. ELECTRICAL CALIBRATION IN THE AREA OF HIGH VOLTAGE***

The LCOE is a laboratory associated with the EMC, and as depositary of the national pattern of high voltage (> 1000 V) recognized by the R. D. 346/2001, plays an important work of custody, maintenance and dissemination of traceability of high voltage magnitude. Their patterns based on high precision dividers, zener systems and pattern transformers has allowed to the International Bureau of Weights and Measures (BIMP) to recognize the CMCs of LCOE for DC high voltage up to 200 kV, AC high voltage up to 240 kV AC and high voltage impulse up to 600 kV.

The LCOE is also a testing at the source laboratory recognized by the Community of Madrid in order to provide service in the legal metrological work lines.

During 2011 activities listed below were performed:

- Calibrations of meters and generators of high voltage

Calibrations performed on the facilities of LCOE have normally corresponded to portable equipment for measuring and generation of high voltages, such as dielectric strength meters, EMC pulse generators, high-voltage sensors, transformers, etc.

- "On-Site" calibration campaign of measurement systems of high voltage

As usual since 1991, also during this year the LCOE has made a calibration campaign for On-Site Measurement Systems of High Voltage Laboratories manufacturers, and other independent laboratories. Note the extension of the service of "On-Site" calibration to other systems and measuring instruments such as transformation ratio in transformers of voltage and current and meters of partial discharges.

- Calibration and verification "On Site" of transformers in High Voltage substations up to 400 kV

The "On-Site" calibration of installation of measurement transformers installed in high voltage substations of tensions up to 400 kV, has been widely used in 2011 by the national electricity sector.

- Measurement of voltage harmonics in networks of up to 400 kV

The LCOE has a mobile installation of measurement of harmonics. The installation consists of an accuracy transformer of 400 /  $\sqrt{3}$  kV whose transfer function has been characterized in the frequency range of measurement. This facility has quality wave analyzers metrologically traced to national patterns. The facility is used for both measures of harmonic content in the networks of transport and distribution networks.

### 3.1.3. INTERCOMPARISONS

#### INTERCOMPARISONS CALIBRATION IN THE AREA OF HIGH VOLTAGE

The LCOE is pilot of two international intercomparisons of reference laboratories, which are developed within the framework of EUROMET (project: EURAMET EM-S33-S34 EURAMET MS). The EM-S33 EUROMET intercomparison on the measurement of peak value of AC high voltage up to 200 kV 50 Hz and the EM-S34 EURAMET on the measurement of capacity and tangent of losses. In both intercomparisons participate a total of eleven different metrological institutes: VNIIMS (Russia), BIM (Bulgaria), LNE (France), INRIM (Italy), HUT (Finland), PTB (Germany), VSL (Netherlands), Czech Metrology Institute, SP (Sweden), UME (Turkey) and LCOE by Spain. These intercomparisons will improve the metrological capabilities of the LCOE for AC high voltage and request recognition of International Bureau of Weights and Measures of international traceability in capacity and tangent of losses for voltages up to 200 kV.

#### INTERCOMPARISONS IN THE AREA OF METROLOGY AND CALIBRATION (IN LOW VOLTAGE)

In 2011 several intercomparisons have been developed in order to ensure the quality of the calibrations that are performed in the LCOE, among the following stand out:

- ✓ Intercomparison for measuring of DC current low value, the LCOE acting as pilot.
- ✓ Intercomparison for measuring AC resistance.
- ✓ Intercomparison for measuring AC resistance with laboratories from nine laboratories.
- ✓ Intercomparison for measuring high value resistor.
- ✓ Intercomparison for the measurement of electric power at industrial frequency, the LCOE acting as pilot.
- ✓ Intercomparison organized by STC1 of ENAC for the calibration of electric power meters at industrial frequency acting as reference the Spanish Centre of Metrology ..
- ✓ Intercomparison organized by STC1 of ENAC for the measurement of high value resistors acting as a reference laboratory the CEM.

### 3.1.4. Projects R + D + i

The following sets, in addition to the general objectives, a summary of the actions taken by the LCOE in 2011, ranked by the following type: R & D, and Services and Technology Assessment.

✓ R & D line

The projects listed below correspond to the line of work that LCOE has been following during recent years in the field of High Voltage.

- Evaluation of lightning impulses

The LCOE pilots the "task force" for UHV within WG D1.36 of CIGRE for the extension of the evaluation method of lightning impulses (K-factor voltage test method) with superposed oscillations on ultra high voltage networks. The results obtained allow us to evaluate different behavior of the air against overlapped overvoltage on the crest of lightning impulses for the air dielectric in non-uniform field with voltages up to 1500 kV.

- Project "On Site Energy Measurement in medium and high voltage grids."

The project aims to provide a pattern facility for calibration of energy measurement at high voltage frontier points where different agents have to transfer energy (generation / transport / distribution / consumption). The objective is to evaluate the error in energy measurement in HV considering the complete measurement chain: processing and transmission, and measuring instrument, both voltage as current. The project is part of EMRP Joint Research Project Protocol within the ENG4 Smart Grids package. Metrology for Smart Electrical Grids.

- Project of PD sensors integrated in MV cells to predict the state of isolation in isolated networks

We have continued with the "SMART CITY" project to integrate into MT cells measurement capacitive sensors compatible with PD diagnostic systems by partial discharge isolation.

For its part the LCOE has worked with the LAT of the EUITI to improve the design of HFCT high frequency sensors for integration in MT cells (non-intrusive PD sensor) in order to make assessments of the state of isolation in a not intrusive way in the existing cells in the network.

- Project of Impulse Generator of 2.4 MW

The LCOE in 2011 launched an internal project for the design and construction of a lightning impulse generator up to 2.4 MV of 120 kJ of twelve stages. The project is constructed in two phases; the first completed in 2011 had the objective that the generator was operating for

1.4 MV. In 2012 the second phase will be developed to reach its full rated voltage of 2.4 MV. The generator has a powered grounding.

- Project of "Determination of overvoltage in shields of power lines and choice of surge arresters"

The LCOE has developed a numerical calculation tool for determining the overvoltages in high voltage cables shields that are connected in different configurations (cross-bonding, single-point) in order to properly select surge arresters that protect the insulation shields against overvoltages resulting from short circuits in the transmission and distribution of electricity. The software tool allows setting any architecture connection between power lines shields even when bounded to airlines in order to evaluate the most unfavorable conditions against different types of failure (substation failure, distant failure intern siphoning). The tool has been used in an increasingly larger part of the designers of new isolated lines and existing lines.

- Project of overvoltages limitations at railway substations

During the past year 2011 the LCOE has continued with the study of limiting the risk of insulation failure due to direct impacts, indirect from lightning and transmitted from railway facilities. In 2011 it was initiated the study and modeling of the ATP of the transforming and rectification substations. For this purpose, it have been planned a series of characterization tests on the high frequency spectrum of power transformers, auxiliary transformers and signal transformers. Once known their response it will develop a model that responds to the results obtained and, as of the model, it makes the study of transitory of the complete substation against overvoltages coming from traction or supply grid.

- ✓ Line of Services and Technology Assessment

In this type of activity the Foundation have as global objectives the commitment of providing the utmost attention to achieve meeting the needs raised by companies and institutions that demand their services with the full compliance with current regulations and through continuous improvement of the quality of its work.

### **3.1.5. OTHER ACTIVITIES**

#### **ACTIVITIES OF THE LCOE AS VERIFICATION BODY OF ELECTRICAL MEASUREMENTS**

The LCOE has performed during 2011 the verification of voltage and current measuring transformers, regulated activity according to the resolution of 15 September 2008 from the Dirección General de Industria, Energía y Minas of the Comunidad de Madrid, of the

Consejería de Economía y Hacienda, that designates the Foundation through the LCOE as verifying body of electrical measurements.

#### REBT - ITC-BT-52 ELECTRIC VEHICLE

The LCOE has participated during 2011 in works related to the project of Royal Decree by which it establishes the requirements and the basic technical conditions of the infrastructure needed to enable effective and safe recharging of electric vehicles and to this end it is developing the ITC -BT 52 "special purpose facilities. Infrastructure for recharging electric vehicles "and it will modify other technical instructions of the Low Voltage Electrotechnical Regulation.

#### REBT - ITC-BT-40 PHOTOVOLTAIC ENERGY

During 2011 it has been working on the development of a new RBT Guide for Low Voltage power equipment covered by the ITC-BT-40. The guideline development group has cited the participation of the most relevant affected sectors, such as electric companies, inverter manufacturers, association of photovoltaic installers, installation companies, Red Eléctrica, as well as representatives of Ministry of Industry, energy and Tourism and the LCOE.

Result of work done and in anticipation of the definitive guide, the group has developed an interpretation sheet about grounding in photovoltaic facilities and equivalencies for the required galvanic isolation in RD 1699/2011, which is available on the web page of the Ministry of Industry, Energy and Tourism in where it details the RBT Guides.

In the coming months it is expected the completion of work for the first definitive edition of the Guide to ITC-BT-40.

#### REGULATION OF POWER PLANTS, SUBSTATIONS AND TRANSFORMATION CENTERS

The LCOE has participated during 2011 in works related to the new Regulation of Power Plants, Substations and Transformation Centers, which is finished and awaiting for publication during 2012.

#### PARTICIPATION IN MEETINGS, CONFERENCES AND NATIONAL AND INTERNATIONAL SEMINARS

During 2011 LCOE staff participated, among others, in meetings, conferences and national and international seminars as follows:

##### LOW VOLTAGE AND EMC

- ✓ LVD ADCO WG1 Hot non functional surfaces. Frankfurt (Germany).
- ✓ ECODESIGN ADCO. Berlin (Germany).
- ✓ CIG-OSM/EE. CIG Operational Staff Meeting for Electronic Equipment. Brussels (Belgium).
- ✓ LVD ADCO. Amsterdam (Holland).



- ✓ IEC-TC 61. International Electrotechnical Commission, Technical Committee N° 61: safety of household and similar electrical appliances. Jakarta (Indonesia).
- ✓ CENELEC OSM/LUM y ETF5 del CTL. CIG Operational Staff Meeting for Luminaires. Arnhem (Holland).
- ✓ CENELEC OSM/HA. CIG Operational Staff Meeting for Household Appliances. London (United Kingdom).
- ✓ IECEE-CTL Workshop on PTP. Geneva (Switzerland).
- ✓ IECEE-CTL. Meeting of the IECEE Committee of Testing Laboratories. Geneva (Switzerland).
- ✓ IEC-TC 61. International Electrotechnical Commission, Technical Committee N° 61: safety of household and similar electrical appliances. Rimini (Italy).
- ✓ LVD ADCO WG1. Hot non functional surfaces, Munich (Germany).
- ✓ EEPKA. Technical Assessor Training Meeting, Kista (Sweden).
- ✓ LVD ADCO, Brussels (belgium).
- ✓ LVD WORKING PARTY, Brussels (belgium).
- ✓ CENELEC-TC 61. Technical Committee N° 61: safety of Household and similar electrical appliances, Valletta (Malta).

#### HIGH VOLTAJE

- ✓ G.T.G.T. “Grupo de Trabajo de Gestión Técnica”, Madrid.
- ✓ CIGRE WG D1.36 UHV “Ultra High Voltage Equipment” Meeting, Dresden (Germany).
- ✓ CTN 207/SC42 “Técnicas de ensayo de Alta Tensión”.
- ✓ CTN 207 “Transporte y distribución de energía eléctrica”.
- ✓ PD sesión “Partial Discharges”, Brugg (Switzerland).
- ✓ CIGRE “Conceil International des Grands Réseaux Électriques” – Comité Directivo, Madrid.
- ✓ “Análisis del Reglamento de Seguridad Industrial”, Madrid.
- ✓ EMRP JRP “SmartGrids” – Metrology for Smart Electrical Grids, annual meeting, National Physical Laboratory, Hampton Road, Teddington (United Kingdom).
- ✓ “Nuevo Reglamento de Centrales ITC-03 del RAT”, Madrid.
- ✓ G.T.G.T, “Grupo de Trabajo de Gestión Técnica 36ª reunión, Valencia.
- ✓ CTN 207 “Transporte y distribución de energía eléctrica”, Madrid.
- ✓ CIGRE WGD1-02 Advisory “High Voltage and Current Testing and Diagnosis”. Stralsund (Germany).
- ✓ CIGRE WGD1-036 “Special Requirements for Dielectric Testing of Ultra High Voltage Equipoment”. Stralsund (Germany).
- ✓ CIGRE WGD1-035 “Testing and Measuring of High Voltages”. Stralsund (Germany), August 27th to 30th 2011.
- ✓ CIGRE WGD1-035 “National Institutes of Metrology in High Voltage” EURAMET. Stralsund (Germany).
- ✓ CIGRE WGD1-037 “Maintenance and Evolution of Measuring Procedures for Conventional and Unconventional P.D. Testing”. Stralsund (Germany).
- ✓ “Nuevo Reglamento de Alta Tensión”, Madrid.
- ✓ SC 42 “Técnicas de ensayo de Alta Tensión”, Madrid.
- ✓ Reuniones de la Comisión de Laboratorios Asociados del Centro Español de Metrología (CEM).

## VEHICLES AND COMPONENTS

- ✓ Rechargeable Energy Storage Systems (RESS), Paris (France) .
- ✓ TAAM Type Homologation Authorities Meeting, Borlange (Sweden).
- ✓ Working Party on Lighting and Light-Signalling (GRE), Geneva (Switzerland).
- ✓ Working Party on General Safety Provisions (GRSG), Geneva (Geneva).
- ✓ Rechargeable Energy Storage Systems (RESS), Boras (Sweden).
- ✓ Working Photometry Group (WPG), Bled (Slovenia).
- ✓ TAAM Type Homologation Authorities Meeting, Riga (Latvia).
- ✓ Working Party on Lighting (GTB), Budapest (Hungary).
- ✓ Rechargeable Energy Storage Systems (RESS), Mainz Kastle (Germany).
- ✓ Working Party on Noise (GRB), Geneva (Switzerland).
- ✓ Working Party on Lighting and Light-Signalling (GRE), Geneva (Geneva).
- ✓ Working Party on General Safety Provisions (GRSG), Geneva (Geneva).
- ✓ Rechargeable Energy Storage Systems (RESS), Madrid.
- ✓ TAAM Type Homologation Authorities Meeting, Geneva (Geneva).

## ECODESIGN

- ✓ Regulatory Committee Meeting for the definition and final vote on Ecodesign requirements for air conditioners and fans, Brussels (Belgium).
- ✓ Meeting of the consultation forum for domestic lighting II, Brussels (Belgium).
- ✓ Meeting of the Regulatory Committee on the ecodesign of energy-related products, directive 2009/125/EC, Brussels (Belgium).

### **3.1.6. FOREIGN PRESENCE**

#### ***3.1.6.1. TESTS AT THE INTERNATIONAL LEVEL***

The LCOE does not limit its activity to the national territory, as many manufacturers require certification from different countries to export their products.

On the other hand, various circumstances such as size of the equipment or ease of assembly can make very convenient LCOE staff moves to the laboratories of the manufacturers for testing.

Therefore, the Laboratory has obtained recognition from various agencies in order to that the reports and certifications that are issued have the greatest validity.

#### ***3.1.6.2. STANDARDIZATION***

The Foundation is active in various standardization bodies, which are listed below:

#### AENOR (ASOCIACIÓN ESPAÑOLA DE NORMALIZACIÓN Y ACREDITACIÓN)

- ✓ CTN 207/GT 42 Technologies of High Voltage's test (presidency).
- ✓ CTN 207/GT 14 Power transformers.
- ✓ CTN 207/GT 17 Low Voltage.
- ✓ SC 05 Generation and Transport.
- ✓ CTN 213 Security in electro domestic appliances and analogous.
- ✓ CTN 205 Lamps, lights and its equipments components (presidency).
- ✓ CTN 207 Transports and Distribution of the energy.
- ✓ CTN 66 Quality management.
- ✓ CISPR 08 Electromagnetic Compatibility.
- ✓ CTN 67 Sanitary appliances.
- ✓ CTN 215 electromagnetic Fields in the human environment.

#### IEC/CENELEC

- ✓ TC 61 of IEC and TC 61 of CENELEC (domestic and analogous appliances).
- ✓ Technical Expert nominated by CENELEC TC 61 for the elaboration of provisional documents of standarization (TS) in electro domestic appliances and analogous.
- ✓ GT OSM of CENELEC (organ of the CENELEC composed by representatives of the European laboratories of the agreement of mutual recognition CCA), in the following areas: domestic appliances, electronic equipments and lights. Nowadays the LCOE shows the Presidency of the group OSM/HA (House Hold appliances).
- ✓ CTL ETF-1 (appliances), ETF-5 (lighting) and ETF-10 (EMC) IECCE bodies composed of representatives of worldwide laboratories mutual recognition of the agreement CB Scheme.
- ✓ Task Force for Guide for analysis of software for IECCE for the CB Scheme (Chair and 2 members)
- ✓ TC 42 WG 19 High Voltage Testing Techniques - UHV Testing

#### CIGRE (CONSEJO INTERNACIONAL DE GRANDES REDES ELÉCTRICAS)

- ✓ Directive committee of CIGRE-Spain.
- ✓ Advisory Group WG D1.02 "High Voltage Testing and Measuring Techniques".
- ✓ Workgroup CIGRE D1.35 "High Voltage Measuring Techniques"
- ✓ Workgroup CIGRE D1.36 "UHV Testing techniques"
- ✓ Workgroup CIGRE D1.37 "Partial Discharges"
- ✓ Workgroup "EURAMET Experts"

### **3.1.6.3. CERTIFICATION**

The LCOE is part of the following Technical Committees of Certification of AENOR:

- ✓ CTC-002 electro domestic and analogous appliances of white line.
- ✓ CTC-007 Lights and associated equipments.
- ✓ CTC-014 Sanitary Appliances.

- ✓ CTC-023 Electronic Equipments of domestic use.
- ✓ CTC-058 Protection devices against the beam.
- ✓ CTC-075 Electric cables for the high voltage distribution networks.

#### **3.1.6.4. OTHER ORGANIZATIONS**

##### ENAC

- ✓ Permanent Secretary.
- ✓ Board of directors (member).
- ✓ Sectorial Electrical Commission (presidency and secretary).
- ✓ Sectorial Electronic Commission (member).
- ✓ Sectorial Mechanical Commission (member).
- ✓ Sectorial Chemical Commission (member).
- ✓ Technical Committee of Environmental Check (member).
- ✓ Technical Subcommittee of Calibration nº 1, area of direct current and low frequency.

##### AEDIVE

- ✓ Board of Directors

##### FOREVE

- ✓ Member

##### OTHER ORGANIZATIONS

- ✓ Spanish Representative of the GTB (Workgroup "Brussels 1952") of United Nations.
- ✓ Spanish Representative of the GRE (Workgroup of Lighting and of luminous signposting) of United Nations.
- ✓ Spanish Representative of the GRB (Workgroup of noise) of United Nations.
- ✓ Spanish Member of the GRSG (Workgroup of the general regulations of safety) of United Nations.

##### OTHER ORGANIZATIONS

- ✓ Spanish Representative of the GTB (Workgroup "Brussels 1952") of United Nations.
- ✓ Spanish Representative of the GRE (Workgroup of Lighting and of luminous signposting) of United Nations.
- ✓ Spanish Representative of the GRB (Workgroup of noise) of United Nations.
- ✓ Spanish Member of the GRSG (Workgroup of the general regulations of safety) of United Nations.

### 3.1.6.5. ACCREDITATION AND RECOGNITION

During 2011, the LCOE has maintained the accreditation given by ENAC and by the MITYC, at a national level, and by CENELEC at international level.

- NATIONAL LEVEL

#### MINISTRY OF INDUSTRY ENERGY AND TOURISM

The accreditation of the Industrial Security from the Industry, Tourism and Commerce Ministry can be gathered in the following areas or sector:

- ✓ Optical Devices of signposting.
- ✓ Devices of lighting.
- ✓ Safety glasses.
- ✓ Acoustics and noises.
- ✓ Radio interferences.
- ✓ Equipments of electro medicine.
- ✓ Lights.
- ✓ Equipments associated with the lamps.
- ✓ Electronic, computer Equipments and of telecommunications.
- ✓ Electrical Equipments of industrial machines.
- ✓ High voltage
- ✓ Tests on insulating materials.
- ✓ Electromagnetic Compatibility (Emission, Immunity and High voltage).

#### ENAC

From ENAC, we dispose of the accreditation according to the ISO Standard 17025, for the performance of tests in the following areas (certificate numbers 3/LE130, 3/LE190, 3/LE192, 3/LE261):

- ✓ High voltage.
- ✓ Distribution transformers.
- ✓ Voltage hollows.
- ✓ House hold appliances (cold, heating, wash and small household appliances)
- ✓ Lights.
- ✓ Equipments associated with the lamps.
- ✓ Electronic, computer Equipments and of telecommunication.
- ✓ Electrical Equipments of industrial machines.
- ✓ Tests on insulating materials.
- ✓ Electromagnetic Compatibility (Emission, Immunity in Low and High Voltage).

The LCOE also has ENAC accreditation for calibrations in the following magnitudes, certificate numbers 1/LC038-1, 1/LC038-2, 1/LC039 and 1/LC475:

- ✓ AC voltages (high and low voltage).
- ✓ DC voltages (high and low voltage).
- ✓ HV pulses.
- ✓ Transformation ratio (voltage and current).
- ✓ DC and AC current.
- ✓ Power and energy.
- ✓ Resistance, capacitance, inductance, frequency, phase angle and magnetic flux.
- ✓ Frequency, period and time interval.
- ✓ flicker. Meters
- ✓ Temperature simulators and Meters.
- ✓ Optic: photometric magnitudes, luminance and illuminance

During 2011 the LCOE has proceeded to the reassessment of its accreditations LC038-1, LC038-2 and LC039 in the areas of electrical current and time and frequency, which has allowed it to add new capacities of measurement, for example calibrating high frequency resistance meters used for the measurement of lands in airlines or for improving the calibration and measurement capacity in many magnitudes (eg shooting time of differentials, testers of closing and opening time of switches, power, phase angle).

The LCOE is the only accredited laboratory in Spain for testing in the new Directives of Ecodesign.

This recognition is a forward step in the line of service provision to the industry that the LCOE has been developing for over 60 years.

These Ecodesign directives are especially relevant because they are mandatory for CE marking of industrial products sold in EU countries

Although the Ecodesign Directive and the Rules that develop it are of recent appearance, the LCOE has for more than 20 years ENAC accreditation in various standards of measuring energy consumption of some household appliances such as refrigerators, washing machines, dishwashers, dryers, water heaters and others, that has been increasing during these years with new rules on other devices such as energy saving lamps, ovens.

Moreover, the LCOE is accredited by ENAC as a Control Body for Electromagnetic Compatibility Directive 2004/108/EC (Certificate No. OC-L/157).

It also is recognized as a laboratory for Certification in several Technical Committees of Certification of AENOR.

## NATIONAL HIGH VOLTAGE REFERENCE

The laboratory is recognized by the R. D. 346/2001 as a Depositary Laboratory of National Standards of High Voltage associated to CEM and has been accredited by the BIPM-MRA.

- **INTERNATIONAL LEVEL**

The LCOE operates under the IECEE-CB international agreement "IEC system for Conformity to standards for safety testing of electrical equipment". Through this recognition, the tests performed by the LCOE on certain appliances (appliances, electronics, lighting, transformers, automatic controls, etc.) are recognized by other countries signing the agreement. Likewise at the European level, LCOE acts within the CCA agreement.

The LCOE is "Competent Body" according to Annex II to the Directive 89/336/EEC of the European Union, called "Electromagnetic Compatibility".

It is also licensed as laboratory of the FCC.

It has been designated by the Ministry of Industry, Tourism and Trade as "notified body" in the field of European Low Voltage Directive (73/23/EC), for analysis in case of dispute under Articles 8 and 9.

### **3.1.6.6. PUBLICATIONS**

With the promotion of Gas Natural Fenosa, it was published the book "Calculation and design of high voltage power lines" whose authors are Pascal Simon (LCOE), Fernando Garnacho (LCOE), Jorge Moreno (UPM) and Alberto Gonzalez (Natural Gas Fenosa). This text develops through solved examples the most common technical problems resulting from the application of the Regulations of power lines and it is used as teaching material of the industrial safety course that the Fundación para el Fomento de la Innovación Industrial imparts on this subject (ISBN: 978-84-9281-286-8).

### **3.1.7. VOLUME OF ACTIVITY**

The following table shows the number of test reports and calibration certificates of the total of the LCOE in 2011 and its evolution in recent years.

<i>Number of tests and calibrations</i>						
	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
LCOE	4.386	4.160	4.604	4.327	4.507	5.095

### **3.2. GENERAL BUSINESS ACTIVITIES**

The main tasks carried out in this section correspond to support the concerted laboratories of the ETSII-UPM and the management of Study of Level of Compliance with Legislation on industrial products traded. Control of Industrial Products (CPI) for the Ministry of Industry, Energy and Tourism (MINETUR).

This study aims to analyze the degree of compliance with the directives and regulations in vigor by industrial products put on the market, for which, there have been numerous inspections and tests of products purchased in a large number of areas, in all the Autonomous Communities.

For its management it has internally developed a web application that allows consulting and introduction of information remotely.

In 2011 there have been 1,746 inspections, which result led to 443 test reports on as many products, and analyzed further 55 technical dossiers (technical dossiers).

Sponsored by MINETUR (through the Directorate General of Quality and Safety) it has remained the point of information on industrial safety regulations, which is visited on the Internet, both from the website of MINETUR ([www.minetur.gob](http://www.minetur.gob)), and from the Foundation website ([www.f2i2.net](http://www.f2i2.net)).

This web site contains the information corresponding to the Regulation of Industrial Security that is elaborated in the above mentioned Department. It is updated periodically and contains complete information both national corresponding legislation (Regulations, etc.) as the Directives and Notified Bodies. Should be noticed presence of the energy efficiency Regulation and the RLAT, as well as its interpretative guides.

On the other hand, as continuation of the agreement signed the last year, it was renewed the agreement of collaboration with the Certification Technical Committee of AENOR of house hold appliances CTC-002 (whose secretary hold ANFEL), and with FAPE's support for carry out a market study on electrical safety, under the protection and control of the Industrial Security from the Ministry Industry, Tourism and Commerce. This agreement comes to promote, to improve and make more effective the inspection of the fulfillment of the community in force legislation in the area of the house hold appliances.

In the same line, it was signed an agreement for the collaboration with the Asociación Nacional de Fabricantes de Luminarias (ANFALUM) for the control of compliance with the directives of security from the associated illumination equipment; also under supervision of the Ministry of Industry, Tourism and Commerce which has allowed to focus on such an important sector in Spain, as it is the lightning.

In the area of the R. D. 208/2005 on electrical and electronic devices and the management of its residues there have been signed agreements of collaboration with ECOLUM Fundación para



el Medio Ambiente, and AMBILAMP Asociación para el Reciclaje de Lámparas in fields of activities of common interest related to the application of the mentioned Royal Decree.

Regarding the presence on Internet, throughout the year there have edited and sent two editions of the virtual bulletin "F2I2 informa", periodic publication on the Internet that is madden to reach to more than 7.000 addressees and the Web of the Foundation has been updated.

It is also necessary to indicate that there has been kept a System of Management of the Quality of these activities, of agreement to the procedure of the ISO series 9001:2008, certified by AENOR with n<sup>o</sup> ER-0717/2000.

This certification recognizes formally the quality level reached in our services, and supposes a milestone in our workline and service towards the full satisfaction of the clients and the excellence in our activities.

### **3.3. CONSULTING AND TRAINING**

During 2011 there were carried out design, implementation and monitoring of the quality system of different laboratories and inspection bodies and certification bodies.

This work has included the design phases, design and development of quality system support, its implementation, and evaluation and monitoring.

As in previous years, Foundation staff has conducted several audits to testing and calibration laboratories for ENAC, and also a number of audits for the notified body 318 of the Directive 93/42/EEC on medical devices.

On the other hand, it has also carried out audits of suppliers for various companies, according to specific standards developed to measure.

With regard to studies and technical assistance, should be noted the one carried out for the IDAE, which consisted of a computer application to support the technical verification of household appliances with high energy efficiency. The database includes about 7,000 equipments from 45 producers and has allowed storing about 9,000 computer files corresponding to the technical documentation (test reports, energy efficiency labels, etc.). The application also includes tools for recording contacts and actions related to the producers (about 8,000), and various reports and alerts designed to manage and ensure the validity and completeness of the documentation received.

With regard to the training area (which has ISO 9001:2008 Certification awarded by AENOR) during 2011 have organized a total of 28 courses. Of these, should be noted that 12 have had subvention from the Ministry of Industry, Energy and Tourism (area of Industrial Security).

These courses have been held in various autonomous communities with a total of 516 students and 6,753 hours-students.

Below there are related the different courses, grouped by areas.

#### Industrial safety

The courses within this area were:

- Safety Requirements in Machinery Installed (put into service before the entry into force of Directive 89/392/EEC).
- Subterranean and Air Lines for Transportation and Distribution High Voltage Electric Power.
- Machine safety requirements. Directive 98/37/EEC and 2006/42/EC New Version.
- Conditions of Security and Energy Efficiency in Lighting Installations. New Regulation for Energy Efficiency (RD 1890/2008).
- Requirements of the New Directive 2004/108/EC of Electromagnetic Compatibility (EMC).
- High Voltage Insulated Underground Cables.
- Practical Application of the Regulations of Power Lines.
- Guides of the REBT of Photovoltaic Generating Facilities.

#### Quality

The courses within this area were:

- Quality management in laboratories (ISO 17025:2005).
- Calculation of uncertainties in testing, measurements and calibrations.
- Quality in inspection entities (UNE-EN ISO 17020:2004).
- Training of auditors for inspection entities (UNE-EN ISO 17020:2004).
- Internal audits in laboratory quality.
- Measurement management systems. Calibration plan, track and manage equipment
- Interpretation of calibration certificates, acceptance and rejection criteria.

#### Other courses

- Day on Specialization at ATP Rules, RD 237/2000 and Order ITC 2590/2010 concerning Transport of Perishable Goods

#### Customized courses

- Day on Interpretation of calibration certificates, acceptance and rejection criteria
- Practical application of the Regulations of Power Lines
- Internal calibration of electrical equipment, acceptance criteria of calibrated equipment and estimation of uncertainty of use.

	<b>TRAINING</b>	
	<b>Courses</b>	<b>Alumns</b>
Industrial service (MINETUR)	12	270
Quality	12	154
Customized courses	3	40
Others	1	52
<b>TOTAL</b>	<b>28</b>	<b>516</b>

### 3.4. CERTIFICATION OF AUTOMOBILE UNIT (UCA)

The activity of the Automobile Certification Unit, UCA, is developed as technical service designated by the Ministry of Industry, Tourism and Trade to carry out initial checks, continued verification of conformity of production (by Resolution dated April 11 2007, October 22, 2007, 6 October 2009 and July 5, 2010) within the following rules:

- ✓ Directive 2007/46/EC, amended most recently by Regulation (EC) 661/2009, including all its annexes regulatory acts.
- ✓ Directive 2002/24/EC, amended most recently by Regulation (EC) 1137/2008, including all its annexes regulatory acts.
- ✓ Directive 2003/37/EC, amended most recently by Directive 2006/96/EC, including all its annexes regulatory acts.
- ✓ All regulations of functions and parts not included in the annexes of the directives identified and included in Annex I of Royal Decree 2028/14986 of June 6, on the rules for the implementation of certain EC directives concerning type homologation of motor vehicles, trailers, motorcycles, mopeds and agricultural vehicles and parts and components of such vehicles.
- ✓ All regulations not included in the annexes of the previous direct and relating to:
  - CEPE/ONU 2R Regulation: Incandescent lamps for projectors.
  - CEPE/ONU 9R Regulation: Vehicle Noise level L2, L4, and L5.
  - CEPE/ONU 35R Regulation: Layout control pedals.
  - CEPE/ONU 40R Regulation: Emissions from vehicles of category L.
  - CEPE/ONU 41R Regulation: Sound level of vehicles of category L.
  - CEPE/ONU 42R Regulation: front and rear protections.
  - NU 47R Regulation: Contamination of mopeds.
  - CEPE/ONU 84R Regulation: Measuring of fuel consumption.
  - CEPE/ONU 92R Regulation: Silencer replacement of vehicles of category L.
  - CEPE/ONU 2R Regulation: Ministerial Order of June 6, 2001, and ITC 2264/2004: Art Sun.

- CEPE/ONU 2R Regulation: Ministerial Order of 20 September 1985 and ITC / 3698/2008: License Plates.
- ✓ Royal Decree 750/2010 of 4 June, regulating the procedures for homologation of motor vehicles and their trailers, self-propelled or towed machinery, agricultural vehicles and systems, parts, and parts of such vehicles.
- ✓ Directive 2005/64/EC concerning recycling, reuse and valuation of motor vehicles.

The works are summarized in checking that the performance of the products conform to regulatory requirements. They cover the following areas:

- ✓ Vehicles
  - Auto-mobile vehicle (M, N)
  - Motorcycles, Quadricycles (L)
  - Trailers and semitrailers (O1, O2, O3 y O4)
  - Agricultural Machinery
- ✓ Lamps, lights and reflectors destined to be used in motored vehicles and their trailers.
  - Halogen headlights
  - Front fog headlights
  - Rear fog headlights
  - Back-gear headlights
  - Position and stop headlights
  - Galibo headlights
  - Headlights
  - Direction indicators
  - Special advise lights
  - Reflectors, etc
- ✓ Other vehicle components
  - Rear-view mirror
  - Pre-signalling triangles
  - Scape device
  - Security glasses
  - Solar laminate
  - License plate
  - Acoustic advertisers
  - Protective bumpers

During 2011, 1.153 audits have been carried out to companies in the automotive sector, both in the field of vehicles as in the field of components, for audit both the conformity of

production as its capacity to carry out effective controls to ensure compliance with the approved type.

### **3.5. MANAGED AND COORDINATED ACTIVITIES IN COLLABORATION WITH THE LABORATORIES CONCERTED**

#### **3.5.1. TEST CENTER AND HOMOLOGATIONS**

Listed below are the works carried out by the concerted laboratories through the Foundation.

##### **3.5.1.1. RESEARCH AND DEVELOPMENT**

A total of 36 contracts were signed in collaboration with the industry, by several of the ETSII-UPM laboratories.

Also, in 2011 65 contracts signed in the last few years were maintained in force.

Next there are indicated some of the developments and projects carried out by diverse laboratories coordinated through the Foundation:

##### **INDUSTRIAL TECHNOLOGY CENTER OF THE ENVIRONMENT**

- ✓ Energy balance of the city of Madrid for the years 2008, 2009 and 2010.
- ✓ Study for the quantification of measures on the concentration of nitrogen dioxide.
- ✓ Preparation of notification of extension of the deadline to comply with the limit values for NO<sub>2</sub> concentration.
- ✓ Definition of means of improvement the air quality.

##### **DEPARTMENT OF NUCLEAR ENGINEERING**

- ✓ Counseling Services and Development in the area of nuclear fuel of nuclear power plants.
- ✓ Counseling Service in the technical bases for operating nuclear power plant.

##### **DEPARTMENT OF INDUSTRIAL CHEMICAL ENGINEERING AND ENVIRONMENT**

- ✓ "Research and Development in the field of Damage and Claims Research and Environmental and Industrial Analysis and Risk Assessment".

##### **INSIA**

- ✓ Structural analysis of coaches.
- ✓ Inclined elevator model and tests for verification of the braking system according to ISO MS PR 81-22.

- ✓ Analysis of pollutant emissions in a light commercial vehicle.

#### ACOUSTIC TEST LABORATORY (LABENAC)

- ✓ Study of noise immission of electrical transformation centers, both in pre-operational and operational phase.
- ✓ Study and characterization of noise sources of electrical transformation centers.
- ✓ Study of vibrations transmitted to adjacent School of Dance.
- ✓ Inspection of the immission noise to the outside and noise transmission to adjoining dwelling of 5 mobile phone base stations according to local noise regulations.
- ✓ Study of noise immission to the outside environment of mobile stations.
- ✓ Inspection of the outside noise immission and noise transmission to adjoining dwelling of electrical transformer stations according to local noise regulations.
- ✓ Measurement of machine noise immission of smoke extractors on houses before delivering them.
- ✓ Study of noise immission to the outside environment and internal noise caused by congress hall on nearby houses.
- ✓ Study of airborne noise insulation and impact of building in rehabilitation with wood wrought. Influence in isolation at different stages of rehabilitation.
- ✓ Study of on-site acoustic power wood chipper machine.
- ✓ Study of sound absorption of material in a reverberation chamber of ceiling insulation system.
- ✓ Study of noise immission to the outside environment of industrial activity.
- ✓ Documental analysis and assessment of acoustic survey reports associated with litigation.
- ✓ Study of noise immission to the outside environment and adjacent dwellings of air extraction machines located on the deck of commercial premises.

#### COMPUTER LABORATORY

Improvement and development of new probabilistic version of CROM Code (Código de cRiba para la evaluación de iMpacto). Optimization and maintenance of the deterministic version.

The activities carried out consisted mainly in the design and development of the statistical version of the application CROM (Código de cRiba para la evaluación de iMpacto), focusing this development in aquatic modules. The most important activities carried out include the design of a new improved interface, changing the data structure to support probabilistic calculations in the modified modules, a deep renewal of the graphics module, and optimization of calculations. To all this we must add a large set of minor activities. On the other hand, there were various maintenance tasks in previous versions of the application consisted of, among others, the optimization calculations, repairing errors and a set of minor improvements.

#### LABORATORY OF MACHINES AND MECHANISMS

- ✓ Study of Derailleur Shim behavior in the conventional network.
- ✓ Modelling of the mechanical behavior of actuators AMVI.
- ✓ Development of modular resistive elements in composite materials and combinations of these with metals, applicable in machines and structures.

#### METROLOGY LABORATORY AND METROTECNIA

- ✓ Cooperation agreement with ENAC on transfer of patterns for the accreditation audits.

#### CHEMICAL LABORATORY TESTING AND QUALITY CONTROL

- ✓ Smart materials in road safety.
- ✓ Materials, products and smart systems in engineering.
- ✓ Nanopolymers.
- ✓ Formulation of paints of defined requirements.

Within the Program SEGVAUTO (S22009/DPI 1509):

- ✓ Formulation, characterization and manufacture of road marking paints with good non-skid, anti-glare and high contrast.
- ✓ Development of optical systems to improve the visibility of signs and panels and remote detection of hazardous conditions.

#### CHEMISTRY LABORATORY II

- ✓ Analysis of fatty acids in anaerobic digestion of sludge from municipal solid waste.
- ✓ Analysis of metals in sludge anaerobic digestion.

#### CHEMICAL TECHNOLOGY LABORATORY

- ✓ Technical opinion on the location of the measurement stations of air quality.
- ✓ Development of a methodology for estimating emissions of greenhouse gases avoided through the application of specific measures.

### ***3.5.1.2. TESTING, LISTINGS, STUDIES AND TECHNICAL REPORTS***

It is described below the work and studies and technical reports issued:

#### INSIA

- ✓ Testing of vibrations transmitted to the bus driver.
- ✓ Evaluation of interior lighting glare on the windshield of a vehicle.
- ✓ Study of aero transportability of an adder / mixer car of 1000 l.
- ✓ Lateral stability study of an adder / mixer car of 1000 l.
- ✓ Analysis of lateral stability of two armored vehicles.
- ✓ Characterization and performance study of a VIGIA equipment as calibrator in charge maintaining the pressure of the tires of a vehicle, protecting them from its operation under low pressure.
- ✓ Uniform provisions concerning the homologation of vehicles for the transport of persons regarding the mechanical strength of its superstructure. CEPE/ONU 66 R00 Regulation.

- ✓ Homologation of large capacity vehicles for transporting persons with respect to the mechanical strength of its superstructure. CEPE/ONU 66 R01 Regulation.
- ✓ Masses and dimensions of vehicles other than M1. Directive CE 97/27-2003/19.
- ✓ Vehicles used for carrying passengers with eight seats in addition to the driver's seat. Directive CE 2001/85.
- ✓ ECE 107 R01 Regulation on general construction of passenger vehicles on two floors.
- ✓ Directive 2007/46/CE by which it establishes framework for the homologation of motor vehicles and trailers, systems, components and separate technical units intended for such vehicles.
- ✓ Fire behavior of materials used in vehicle interiors. Directive CEE 95/28.
- ✓ Rear protection of liquid fuel tanks. Directive EC 70/221.
- ✓ School. R.D. 443/2001
- ✓ Reforms. R.D. 886/2010
- ✓ Bicycles. R.D. 2406/85.
- ✓ Screens. R. D. 2822/1998
- ✓ Tires. Regulation CEPE/ONU 30 R02.
- ✓ Tires for commercial vehicles. Regulation CEPE/ONU 54 R00.
- ✓ Homologation of retreaded tires for commercial vehicles. Regulation ECE 109 R00.
- ✓ Homologation of retread tires for passenger cars. Regulation ECE R00 108.
- ✓ Uniform Provisions concerning the approval of tank vehicles N and O with regard to lateral stability against overturning. Regulation CEPE/ONU R00 111.
- ✓ Rear underrun devices. Regulation CEPE/ONU 58 R01.
- ✓ Positioning and mounting of rear registration plates. Directive CE 70/222.
- ✓ Plates and inscriptions. Directive CE 76/114.
- ✓ Lighting and signaling. Directive CE 76/756
- ✓ Identification of tales and indicators. Directive CE 78/316
- ✓ Couplings. Directive 94/20.
- ✓ Seats and their anchorages. Directive 74/408.
- ✓ IPM (partial regulations).
- ✓ Individual Homologation.
- ✓ Reports lateral stability.
- ✓ Trials wiper motors.
- ✓ Reforms of importance.
- ✓ Completion of two audits for ENAC.
- ✓ Calibration of calibration equipment of tachographs and speed limiter check.
- ✓ Control of Industrial Products (12 tests) for the Ministry of Industry, Tourism and Trade.

The reports issued have been a total of 1,825.

#### LABORATORY OF AUTOMATICS

The Laboratory of testing of gaming machines in the Department of Automatic, Electronic Engineering and Industrial Computing, is recognized by all the Autonomous Communities and central administration for testing and analysis and the corresponding issuance of technical reports relating to equipment and technical systems of game. For that, the laboratory uses specific developments for testing equipment that manufacturers present to testing as well as approaching custom development for the analysis of non-conventional systems.



During the year 2011, there have been issued reports of gaming machines and technical systems, and there have been giving advice and technology support to government.

The reports and essays issued have been a total of 137.

#### LABORATORY OF INDUSTRIAL CONSTRUCTIONS

It has issued a test report.

#### ELECTRONICS LABORATORY

It has issued a test report.

#### ELECTROTECHNICS LABORATORY

Two reports have been issued.

#### ACOUSTIC TEST LABORATORY (LABENAC)

#### ENVIRONMENTAL NOISE:

- ✓ Spatial and temporal sampling in accordance with Annex IV of Royal Decree 1367/2007 of 19 October.
- ✓ Measurement of environmental noise levels in accordance with Annex IV of Royal Decree 1367/2007 of 19 October.
- ✓ Inspection of noise regulations applying local and national legislation.

#### BUILDINGS AND CONSTRUCTIVE ELEMENTS:

- ✓ Sampling in buildings and construction elements according to RD 1371/2007 of 19 October by which it is approved the Basic document "DB-HR protection against noise."
- ✓ Measurement of airborne noise insulation between rooms according to UNE EN ISO 140-4:1999.
- ✓ Measurement of airborne noise insulation of facades (speaker global method) according to UNE EN ISO 140-5:1999.
- ✓ Measurement of insulation of noise from impacts of wrought according to EN ISO 140-7:1999.

#### LABORATORY TESTS:

- ✓ Sound power tests of machines in an anechoic chamber according to ISO 3744:2011 EN ISO 3745:2010 and EN.
- ✓ Sound power tests of machines in a reverberation chamber according to UNE EN ISO 3743:2011.
- ✓ Insulation tests to airborne sound in transmission camera according to UNE EN ISO 10140 of 2011.

## LABORATORY OF TESTS OF COMPONENTS OF LIFTS

During the year 2011 there have been issued a total of 10 reports corresponding to the tests defined in Annex F of the UNE EN 81-1/2 and which correspond to the scope of reference 36/LE121 ENAC accreditation held by the laboratory.

- ✓ Locking of landing door:
  - Inspection of operation.
  - Fatigue Test.
  - Static test.
  - Dynamic test.
  - Fatigue test of contacts.
  - breaking capacity test.
  - Test of resistance to leakage currents.
  - Review of the vanishing lines and distances in air.
  - Review of specific requirements to the contacts and its accessibility.
  - Specific tests to certain types of locking devices.
  
- ✓ Speed limiter:
  - Control of the characteristics of the limiter.
  - Dynamometer test.
  - Cinematic Test
  
- ✓ Parachute cab and counterweight:
  - Parachute of instant action.
  - Parachute of progressive action.

In addition, there have been 6 tests within the control study of industrial products for the analysis of the degree of compliance with Directive 95/16/CE on safety in elevators, for the Ministry of Industry, Tourism and Trade.

There have been issued a total of 16 reports.

## MATERIALS TESTING LABORATORY

There have been issued a total of 19 reports.

## NUCLEAR PHYSICS LABORATORY

There have been issued a total of 3 reports.

## THERMAL ENGINEERING LABORATORY "FRANCISCO VIGHI"

Testing on vehicles for the transport of perishable goods in cold tunnel. These tests are performed under the Agreement on International Carriage of Perishable and Special Equipment used in such transport (ATP) and R.D. 237/2000 of Ministry of Industry.

There have been performed a total of 261 jobs.

#### ELECTRICAL MACHINES LABORATORY

There have been issued a total of 4 reports.

#### LABORATORY OF MACHINES AND MECHANISMS

- ✓ Test of Safety for construction protection devices(group A), in accordance with EN 13374:2004.
- ✓ Testing of shopping trolleys according to standards UNE EN 1929-1:1998 and prEN 1929-2:1998 for marking "N".
- ✓ Testing corresponding to placement of the mark "N" in garbage containers, according to the UNE EN 840-1:1997, EN 840-5:2004, EN 840-6:1997 and UNE EN 840-6 / A1: 2001.
- ✓ Tests for Control of Industrial Products as the Machinery Directive 2006/42/EC.
- ✓ Testing requested by companies for the placing on market of different machines according to the Machinery Directive 2006/42/CE.
- ✓ Testing of people mobile lifting platforms according to the standard.
- ✓ Technical reports on rugged machines with crisis file opened.
- ✓ Technical reports on rugged machines with file open crisis.
- ✓ Evaluation of thermal conductivity in concrete samples from.
- ✓ Control of Industrial Products for the analysis of the degree of compliance with the Machinery Directive on machines sold in Spain, for which, there have been inspections and testing of industrial machinery, acquired in a large number of CCAA (160 inspections, 33 tests ) for the Ministry of Industry, Trade and Tourism.
- ✓ Control of Industrial Products for the analysis of CE marking on machines sold in the Autonomous Community of Madrid, for the Directorate General of Food and Consumer Affairs.
- ✓ Administrative cooperation for monitoring the implementation of the Machinery Directive in the CEE.

There have been issued a total of 61 reports.

#### FLUID MECHANICS LABORATORY

- ✓ Test for verification of Bourdon type pressure gauges (MITYC).
- ✓ Hydrostatic testing of pressure vessels (MITYC).
- ✓ Rupture tests by hydrostatic pressure (MITYC).
- ✓ Tests for verifying setting of safety valves (MITYC).
- ✓ Leak tests of aerosols and cartridges GLP at 50 ° C (MITYC).
- ✓ Control of Industrial Products (Area of pressure vessels) for the Ministry of Industry, Tourism and Trade.

There have been issued a total of 13 reports.

#### METALLURGY LABORATORY

There have been issued a total of 7 reports.

#### METROLOGY AND METROTECNIA LABORATORY

- ✓ Analysis of the degree of compliance with screwed accessories, fast joints and galvanized steel pipe (64 inspections) for the Ministry of Industry, Tourism and Trade.

#### THERMAL ENGINE LABORATORY

There have been issued a total of 3 reports.

#### CHEMISTRY LABORATORY II

- ✓ Control of Industrial Products: It is tested the accomplishment of the R. D. 363/1995 on hazardous substances in bleach, cleaning products (8 tests) for the Ministry of Industry, Tourism and Trade.
- ✓ Analysis of washing waters.
- ✓ Analysis of water and sodium chloride.
- ✓ Leakage test of resistance of packaging and 1.5 liters.

There have been issued a total of 13 reports.

#### CHEMICAL LABORATORY OF TESTING AND QUALITY CONTROL

- ✓ Covering power of dry film and contrast ratio: Paints and varnishes: Determination of non-volatile matter in paints, varnishes, binders and vehicles. Fixed material in volume of paints and varnishes. Performance Evaluation of specific surface on paints and varnishes. Determination of in-depth dry state and in-depth drying time: Paints and varnishes. Obtaining of the infrared spectrogram of the fixed vehicle extracted from paints and varnishes. Analysis for N mark of matt emulsion paint for interiors: application of particular Rules of AENOR Mark N for matt acrylic paint in aqueous dispersion for interiors: Resistance to alkalis. Determination of film thickness. Storage and stability in the package. Determining the contrast ratio. Overcoatability after drying. Wet scrub resistance.
- ✓ Determination of color differences according to CIELAB. Determination of specular gloss and surface analysis. Aging tests in climatic chamber and solar radiation chamber. Color Strength of textiles. Determination of the content of toxic metals. Determination of the content of toxic solvents and determination of flash points in paints. Determination of thermal properties of materials. Characterization of biomaterials. Thermal relaxation tests on standardized aluminum blocks. Several aging tests panels of traffic.
- ✓ Control of Industrial Products. Chemicals: Paints, enamels and lacquers. Batteries and accumulators. Restoration, maintenance and surface treatment. Household pesticides for the Ministry of Industry, Trade and Tourism (6 reports).

There have been issued a total of 14 reports.



#### METALLURGY LABORATORY

There have been issued a total of 21 reports.

#### CHEMICAL TECHNOLOGY LABORATORY

There have been issued a total of 3 reports.

#### THERMOTECHNICS LABORATORY

The thermotechnics laboratory, located at the Headquarters of Getafe, is enabled for the implementation of procedures for conformity assessment of module B (type examination) and module F (declaration of conformity to type based on the verification of product) temperature recorders and thermometers, as reflected in the Order ITC 3701/2006 and also as Metrological Verification Body of Temperature Recorders and Thermometers, as reflected in the Order ITC 3701/2006.

During the year 2011 there have carried out the work summarized below:

Tests on temperature characterization of (mapping) in drugs warehouses of thermolabile

- ✓ Verification of the data acquisition system of store drugs at controlled temperatures.
- ✓ Review of models of temperature recorders and thermometers according to the Order ITC-3701/2006.
- ✓ Review in accordance with the model of temperature recorders and thermometers according to the Order ITC-3701/2006.
- ✓ Verification of temperature recorders in accordance with the Order ITC-3701/2006.
- ✓ Tests of verification of heat meters.
- ✓ Control of industrial products It is tested the accomplishment of the regulations on Temperature recorders for transport and storage of frozen and ultrafrozen.

The work has been 269.

#### MATHEMATICS

There have been performed a total of 269 jobs.

#### CALIBRATION LABORATORY OF ACOUSTIC INSTRUMENTS (LACAINAC)

During 2011 1,500 jobs were performed in the Calibration Laboratory of Acoustic Instruments.

#### METROTECNIA AND METROLOGY LABORATORY

During the year 2011 there have been issued 110 Certificates of Calibration, for a total of 629 patterns and dimensional metrology instruments.

### **3.5.1.3. TRAINING**

During the year 2011 there have been organized and lectured courses for the following laboratories and centers:

- ✓ Electrotechnics: Course on Introduction to the links of direct current in high voltage (HVDC) (2 editions).
- ✓ INSIA: Digital Tachograph Courses (16 editions).
- ✓ Electrical Machines: Course of protection of generators.
- ✓ Machines and Mechanisms:
  - Aligning Machinery.
  - Design of electronic vibration equipment.
- ✓ Heat Engines:
  - Course of internal combustion engines.
  - Advanced course on combustion turbines for power generation (two editions).

### **3.5.2. ACCREDITATION**

The following are the accreditations to perform tests or calibrations of the laboratories.

INSIA

Accreditations by the MITYC for the following regulations:

DIRECTIVES:

- ✓ Directive CE 76/115; 81/575; 82/318; 90/629; 96/038 and 2005/41 Seat belt anchorages.
- ✓ Directive CE 77/389 and 96/064 Towing hooks of motor vehicles.
- ✓ Directive CE 77/541; 81/576; 82/319; 90/628; 96/036; 2000/3 and 2005/40 Seat belts and restraint systems.
- ✓ Directive CE 78/548; 2001/56, 2004/78 and 2006/119 Heating systems for the passenger compartment of motor vehicles.
- ✓ Directive CE 78/549 and 94/78 Wheels guards.
- ✓ Directive CE 78/932 Head restraints.
- ✓ Directive CE 71/320; 74/132; 75/524; 79/489; 85/647; 88/194; 91/422; 98/12 and 2002/78 Braking.
- ✓ Directive CE 74/60; 78/632 and 2000/4 on interior fitting of motor vehicles.
- ✓ Directive CE 74/483, 79/488 and 2007/15 on exterior projections.
- ✓ Directive CE 78/316; 93/91 and 94/53, on identification of controls, witnesses and indicators.
- ✓ Directive CE 76/114 and 78/507 on plates and regulation inscriptions.
- ✓ Directive CE 70/222 on rear registration plate space.

- ✓ Directive CE 76/756, 97/028 and 2007/35 on installation of lightning and light signalling devices.
- ✓ Directive CE 70/156, 92/53, 93/81, 98/14, 2001/116 and 2007/37 on type approval of motor vehicles and their trailer.
- ✓ Directive CE 70/221; 79/490; 81/333; 97/019; 2000/8 and 2006/20 on fuel tank and rear protection devices.
- ✓ Directive CE 74/408; 96/037 and 2005/39 on seat strength and its anchorages.
- ✓ Directive CE 75/443 and 97/039 on speedometer and reverse gear.
- ✓ Directive CE 70/311; 92/062 and 1999/7 on steering effort.
- ✓ Directive CE 91/226 on spray-suppression systems.
- ✓ Directive CE 89/297 on lateral protection of certain vehicles (BOE 13/04/89).
- ✓ Directive CE 92/021y 95/048 on masses and dimensions of the vehicles M1.
- ✓ Directive CE 92/23; 2001/43 and 2005/11 on tyres, installation in the vehicle (2).
- ✓ Directive CE 92/114 on external projections in industrial vehicles (BOE 17/12/92).
- ✓ Directives CE 92/23; 2001/43 and 2005/11 on tyres' installation of temporary use in vehicles (3).
- ✓ Directive CE 94/020 and DC 2006/444 on couplings' devices of the vehicles and its tows.
- ✓ Directive CE 97/24 and 2006/27 relative to certain components of characteristics of 2 ó 3 wheel motor vehicles.Cap.1 Tyres.
- ✓ Directive CE 95/28 on Burning behaviour of materials used in interior construction of certain categories of motor vehicles.
- ✓ Directive CE 97/27; 2001/85 and 2003/19 on Masses and dimensions different vehicles of M1.
- ✓ Directive CE 2000/40 on front underrun protection.
- ✓ Directive CE 2001/85 relative to vehicles used for the carriage of passengers comprising more than eight seats in addition to the driver's seat.
- ✓ Directive CE 97/24 relative to certain elements and characteristics of the vehicles to engine of 2 ó 3 wheels. Cap.10 Tows' devices and anchorages.
- ✓ Directive CE 89/173; 2000/1 and 2006/26 on components and characteristics of the agricultural tractors. The attached IV mechanical Hooking between tractors and tows.
- ✓ Directive CE 92/23; 2001/43 and 2005/11 on pneumatic Homologation. (1).

#### REGULATIONS OF GENEVA:

- ✓ Regulation CEPE/ONU 14 R06 of Seat belt anchorages (BOE 20/04/83) (BOE 27/02/92) O. M. of 30/07/74 (BOE 09/08/74).
- ✓ Regulation CEPE/ONU 21 R01 on interior conditioning of vehicles (BOE 10/10/83) (BOE 06/06/84) (BOE 11/10/93) O. M. of 31/07/79 (BOE 08/08/79) (BOE 16/10/80).
- ✓ Regulation CEPE/ONU 25 R04, on head restraints of 11/10/93 (BOE 13/07/84) (BOE 22/04/89).
- ✓ Regulation CEPE/ONU 26 R03, on exterior projections vehicles of 11/10/93 (BOE 14/01/84).
- ✓ Regulation CEPE/ONU 30 R02 on tyres of 20/03/58 (BOE 7/10/83) Obl. (09/07/85).
- ✓ Regulation ECE 36 R03 of vehicles of collective transport of more than 16 seats (BOE 6/04/83). (BOE 12/10/93) (BOE 19/10/93).
- ✓ Royal decree 2574/83 of July 13 (BOE 3/10/83) (BOE 04/11/83).

- ✓ Regulation CEPE/ONU 13R10, relative to braking. Start on 06/02/89 (BOE 11/10/89) Obl. (16/12/89).
- ✓ Regulation CEPE/ONU 66 R01, on homologation relative to vehicles used for the carriage of passengers regarding the mechanical resistance of its superstructure. (BOE 29/10/92) Obl. (05/18/92).
- ✓ Regulation ECE 52 R01, on vehicles of collective transport of more than 8 seats (BOE 30/03/94).
- ✓ Regulation CEPE/ONU 64 R00, on vehicles of temporary-use spare wheels or tyres (BOE 06/06/92) Obl. (05/08/92).
- ✓ Regulation CEPE/ONU 80 R01, on seat strength in vehicles used for the carriage of passengers of great capacity (BOE 19/05/94).
- ✓ Regulation CEPE/ONU 54 R00, on tyres for industrial vehicles (BOE 28/07/87) Obl. (22/04/89) (BOE 27/02/93).
- ✓ Regulation CEPE/ONU 34 R02, prescriptions of homologation of vehicles on prevention of risks of fires.
- ✓ Regulation ECE 108 R00, on homologation of remoulded tyres for vehicles of tourism.
- ✓ Regulation ECE 109 R00, on homologation of remoulded tyres for industrial vehicles.
- ✓ Regulation CEPE/ONU 58 R01, on underrun back devices.
- ✓ Regulation CEPE/ONU 73 R00 on lateral protection vehicles tow and semi trailer.
- ✓ Regulation CEPE/ONU 93 R01, on front underrun protection.
- ✓ Regulation CEPE/ONU 55 R01, on homologation of pieces of hooking of the sets of vehicles.
- ✓ Regulation CEPE/ONU 75 R00, homologation of motorcycles' tyres.
- ✓ Regulation ECE 107 R01, on general characteristics of construction of the passengers' vehicles of two floors.
- ✓ Regulation CEPE/ONU 61 R00 on exterior projections for industrial vehicles.
- ✓ Regulation CEPE/ONU 67 R01 on equipments for vehicles that G.L.P uses.
- ✓ Regulation CEPE/ONU 110 R00, equipments for vehicles that G.N.C uses.
- ✓ Regulation CEPE/ONU, 111 R00 on uniform provisions relating to the homologation of vehicles cisterns of category N and O regarding its stability to overturn wings.
- ✓ Regulation CEPE/ONU 106 R00 on agricultural tyres.
- ✓ Regulation CEPE/ONU 118 R00 on burning behaviour of materials used in interior construction of certain categories of motor vehicles.

**MINISTERIAL ORDERS:**

- ✓ O. M. of 20/09/85 (BOE 27/09/85) on caravans and light trailers. O. M. 01/07/98 (BOE 13/07/98).

**ROYAL DECREES:**

- ✓ R.D. 2140/85 of October 9 Modified and updated by R.D. 1528/88, O.M. 06/02/89, O.M.15/03/93, O.M. 19/01/95, O.M. 31/03/98 by that procedure are dictated on homologation of types of motor vehicles, tows and semi trailers.
- ✓ R.D. 2406/85 of November 20, 1985 on bicycles (BOE 30/12/85).
- ✓ R.D. 736/88 of July 8 (BOE 16/07/88) by that there is regulated the issue of technical reports for reforms of importance of vehicles road. O.M. 22/05/89. BOE 02/06/89 and Order CTE/3191/2002 (BOE 17/12/2002).



- ✓ R.D. 2822/1998 of December 23. General regulation of Vehicles. The attached VII" Devices of retention and insurance of the load in vehicles that could transport simultaneously persons and load in the same cockpit".

ENAC's accreditations for the types of following tests:

- ✓ Tires tests (accreditation n<sup>o</sup> 64/LE178).
- ✓ Tests in electrical Windscreen-Wiper engines (accreditation n<sup>o</sup> 64/LE841).
- ✓ Acceleration, velocity and displacement (accreditation n<sup>o</sup> 113/LC494).

#### AUTOMATICS LABORATORY

The Department of Automatics, Electronic Engineering and Industrial Computer is officially recognized for testing prior to the homologation of gambling machines , performing tests in accordance with all national regulations, except the "País Vasco" (BOE N<sup>o</sup> 1153 of 28 June 1993).

ENAC accreditation for testing of Gambling machines with prizes (accreditation N<sup>o</sup> 441/LE987).

#### LABORATORY OF CALIBRATION OF ACOUSTIC INSTRUMENTS, LACAINAC

Voluntary Metrology:

Acoustic Area – ENAC accreditation N<sup>o</sup> 118/LC262:

- ✓ Sound Level Meters.
- ✓ Acoustic Calibrators.
- ✓ Personal sound exposure meters (Noise Dosimeters).
- ✓ Band filters of octave and fractional octave (analyzers).
- ✓ Verification of instruments.

Area of Electricity in DC and Low Frequency - Accreditation No 118/LC421

- ✓ Data Acquisition Cards.

Legal Metrology (Agency for Metrological Verification and Control)

Legal Metrological Control of instruments for the measurement of audible sound and acoustic calibrators under RD 889/2006 - Order ITC 2845/2007.

Stage of marketing and commissioning - ENAC No OC-I/171

- ✓ Product Verification (Module F).

Phase of instruments in service - ENAC No OC-I/168

- ✓ Periodic verification.
- ✓ Verification after repair or modification and periodic verification.

#### ACOUSTIC TEST LABORATORY, LABENAC

ENAC accreditation for testing in building acoustics and environmental acoustics (accreditation No. 64/LE821).

LABENAC is a recognized laboratory as Lead Acoustic Assessment by the Junta de Castilla y León for the testing of environmental noise and architectural acoustics.

LABENAC is a laboratory Approved by the Xunta de Galicia for measurements in noise and vibration.

#### LABORATORY TESTING OF COMPONENTS OF LIFTS

Accreditations by the MITYC and ENAC (accreditation No. 36/LE121):

- ✓ Homologation of interlock devices elevator landing doors.
- ✓ Homologation of parachute lifts.
- ✓ Homologation of elevator speed limiters.

#### THERMAL ENGINEERING LABORATORY "FRANCISCO VIGHI"

This laboratory is accredited since 1985 by the Ministry of Industry and Energy for the testing on vehicles for the transport of perishable goods in cold tunnel (Carretera de Andalucía km. 17.700 - Getafe).

Laboratory recognized by the Working Group (WP11) of the UN (United Nations, Geneva) and the subgroup CERTE International Institute of Refrigeration in Paris.

First EU Accredited Laboratory in accordance with the UNE-EN ISO / IEC 17025: 2005, ENAC for Vehicles used to transport perishable goods (ATP) N° accreditation 521/LE1147.

The Accreditation includes tests for homologation of vehicles of transporting perishable foods,

- ✓ Isothermal vehicles.
- ✓ Refrigerant vehicles.
- ✓ Refrigerated vehicles.

#### METROLOGY AND METROTECNIA LABORATORY

ENAC accreditation for calibration in the following magnitudes (accreditation N° 3/LC037):

Longitude  
Angle  
Righteousness  
Flatness  
Parallelism  
Perpendicularity

Roundness

Microgeometry

Certification RLA (Laboratory and Infrastructure Network of the Community of Madrid), as a participant in the network with the number 91 and level 5 (External Recognition).

CHEMICAL LABORATORY FOR TESTING AND QUALITY CONTROL

ENAC accreditation for testing of paints and varnishes. Nonmetallic coatings (accreditation N° 28/LE177).

THERMOTECHNICS LABORATORY - TEMPERATURE RECORDERS

ENAC accreditation for the following types of tests:

- ✓ Metrological control of the state: Stage of marketing and commissioning (OC-I/201).
- ✓ State Metrological Control: Phase of instruments in service (OC-I/170).

### **3.6. ACTIVITIES OF OWN CENTERS**

#### **3.6.1. CENTER OF ANALYSIS OF SUSTAINABLE ENERGY DEVELOPMENT (CADES)**

The Centre for Analysis of Sustainable Energy Development has continued its collaboration with the Thermo-energetic Research Group of the UPM, mainly in the field of solar energy for electricity generation.

The CADES has been responsible for the execution of analysis and calculations of configurations of Fresnel type reflection, with multitubular receiver on height. This arrangement allows according to the analysis carried out, achieving a power linear density substantially greater than the cylinder-parabolic collectors, which provides an important advantage of departure.

The lowest concentration of radiation that is produced in these cases, is compensated by the optimum exergetic use of the flow within the various tubes, dedicating the peripherals to the preheating of the calorific fluid, and the centrals to the final heating stage, or even boiling, if it is use for direct generation of steam.

Because of these advantages, the Fresnel devices to achieve a certain electric power, may require the use of a mass of material (mirrors, structural steel, infrastructure and foundation) between 30 and 50% lower than cylinder-parabolic power plants, which would be a significant cost reduction, particularly the solar field.

These advantages must be shown in the near future when the process of design of a Fresnel optimized system be completed which benefits the optical and thermal characteristics of these devices.

### 3.6.2. RAILWAY TECHNOLOGY RESEARCH CENTRE (CITEF)

During 2011 there have been the activities listed below:

#### SIMULATION GROUP ACTIVITIES

- ✓ CAF AND METRO DE MADRID, S. A.

Development of a Driving and Breakdowns Simulator of METRO DE MADRID, SA, for the Expansion Plan 2003 - 2007, 8400 series.

- ✓ ANSALDO BREDA (Italy) and Metro de Madrid, S. A.

Development of a Driving and Breakdowns Simulator of METRO DE MADRID, SA, Expansion Plan 2003 - 2007, series 9000.

- ✓ SANTIAGO DE CHILE METRO

Development of a Driving and Breakdowns Simulator of Line 1 of Metro of Santiago, with trains NS-07 and NS-93.

Development of a Driving and Breakdowns Simulator of Line 1 of Metro de Santiago, with trains AS02.

- ✓ INVENSYS RAIL DIMETRONIC

SESIM, CTBC Simulator for Testing of Data and Equipment, Phase 5: Test Environment ATP -ATO-DMI.

SESIM, CTBC Simulator for Testing of Data and Equipment, Stage 6: Automation.

ERTMS Operational Objectives Simulation. Fernbane, Denmark.

FESIM: ERTMS simulator for Testing of Data and Equipment: Adaptation to UNISIG 2.3.0, Test Environment Level 2, Soak Testing.

CBTC and ERTMS Marmaray Line Simulation, Turkey.

Red Line, CTC Simulator. Enlargement of Lisbon Metro

Vendas Novas CTC Simulator, REFER.

- ✓ MINTRA and METRO DE MADRID, SA

Development of a Driving and Breakdowns Simulator of METRO MADRID SA, Expansion Plan 2003 - 2007, Light Rail.

METRO DE MADRID, SA

Simulation of Line 6 and CBTC system for incorporation in training Simulators for METRO DE MADRID, SA

Update of the Simulator Series 8000 to convert it to the operation of the Simulator Series 8400.

✓ RENFE Integria

Support for validation and commissioning of ERTMS onboard equipment.

INVENSYS RAIL NORTHERN EUROPE (United Kingdom)

SESIM: CTBC Simulator for Testing Data and Equipment, integration of equipment for automatic line DTL Singapore.

ATO project in ERTMS for Thameslink - Network Rail, UK.

✓ MAINS OF SPAIN

Development of a 3D Simulator for Training in Operation and Maintenance of High Voltage Power Substation.

✓ CONSORTIUM LINE II, METRO OF TEQUES, VENEZUELA

Simulation of the Plan of Operation and Electrical Sizing of Line 2.

✓ ALSTOM

Software Development of the Dynamic Operation System ERTMS Level 1, COSMOS.

✓ THALES SIGNALLING

ERTMS Simulation Marmaray, Turkey.

✓ CEDEX, Ministry of Development

Upgrade Interoperability Lab to ERTMS Level 2.

✓ HITACHI, Japan.

RAPS: Radio Propagation Simulator for CBTC.

- ✓ NUEVO SARMIENTO CONSORTIUM, Argentina.

Review and Contribution to the Engineering Integrated System, Line Sarmiento, Argentina.

- ✓ SMART2

Validation of basic engineering playgrounds and workshops by simulation.

- ✓ UIC, France

World Congress on Rail Training, training first world congress on the railway, Madrid, April 2011.

#### ACTIVITIES OF THE GROUP OF PROJECTS FOR FACILITIES

- ✓ THALES

- Study of behavior of needle driving elements at high speed.
- Collaboration on tests of components for protection of trains.
- Development of components and subsystems for train detection by audio frequency track circuit.

- ✓ INSERAIL

- Calculation tool for electrical and dynamic behavior in contact line components.
- Electrical dimensioning of railways and urban railways.

- ✓ ADIF

- Analysis, simulation and testing of railway electrification systems.
- Work related to train control facilities related to power equipment specifications and design of protective filters.
- Analysis disorders from the high-speed network on the conventional network.

- ✓ INECO

- Jobs for the analysis of power protection systems for reversible. substation prototype
- Analysis disorders of the power grid caused by high-speed route Valladolid-Palencia-Leon.

- ✓ METRO DE MADRID

A tool for analyzing data for maintenance.

Design of equipment for maintenance activities of rigid catenary components.

✓ BALFOUR BAETTY

Dynamic simulation of overhead contact line by rigid catenary system.

✓ TELVENT

Development of algorithms for automatization of planning for the Assistance System of Railway Regulation and Exploitation) Saref.

✓ THYSSEN-KRUPP

Jobs for components of mobility by escalators and moving walkways.

✓ TYPASA

Electric dimensioning of the line from Sao Paulo to Rio de Janeiro in Brazil.

### 3.6.3. MECHANICAL ENGINEERING MODELING CENTER (CEMIM)

During 2011 have been performed the following activities

- ✓ Structural analysis, dynamic and aerodynamic studies, acoustic and vibration projects
  - Preparation Project soundproofing and vibration study on a stretch of high-speed line.
  - Study of vibrational levels generated by different vibration sources in a laboratory room of micro-and nanomechanical characterization.
  - Tunnel: Aerodynamic test results; Characterization of emergency exit.
  - Seismic characterization of wind turbines
  - Comparative study of the mechanical properties of wafers from different suppliers.
  - Measurement of vibration levels within a company (vibrations generated by the passage of the tunneling machine).
  - Study of the dynamic behavior the structure of a Leisure Centre. Consulting and Sensitivity Studies. Dynamic tests for analysis of dynamic behavior of the structure of the dish and theaters area.
- ✓ Studies and projects of safety facilities in tunnels
  - Consulting and Technical assistance in tunnel facilities.
  - Aerodynamic studies on gates of emergency exits on AV tunnels.
  - Characterization test of pressure difference phase of construction on tunnels.
  - Evaluation of tunnel visibility conditions.
  - Automatization of criteria and integration support for the tunnel.
  - Automation of criteria and integration support for various tunnels.
  - Test verification and / or implementation for a tunnel.
  - Characterization of ventilation emergency exit tunnels.

- Model test and on-site verification of ventilation control system for tunnels.
- ✓ Working Groups
  - DyFloFoSA - Experimental and numerical techniques for assessing the vibration behavior of floors and footbridges. Ministry Science and Innovation. 2012-2014.
  - ETEAMO-UPM - Estimation of stresses in structures using modal operational analysis. Ministry of Science and Innovation. 2012-2014.
  - AEROSIM: Seismic characterization of wind turbines: Application in the Community of Madrid. UPM. 2011.
  - VIBRACTHUM - structural vibration induced by human activity. Ministry Science and Innovation. 2009-2011.
  - CRYSTHIN - Industrial technologies for high efficiency photovoltaic modules and low cost based on thin crystalline silicon cells. Ministry of Science and Innovation. 2012-2014.
  - AAMCREECB - Numerical modeling and readjustment of structural elements with viscoelastic behavior. Ministry Science and Innovation. 2012-2014.
  - THINCELL - Low cost and high efficiency in bifacial silicon ultra-fine cells. Ministry Science and Innovation. 2009-2011.
  - Participation in the research group "Ingeniería sísmica y dinámica de suelos y estructuras " of the Universidad Politécnica of Madrid.

### 3.7. EVENTS

- ✓ In 2011 were held the following events:

Business French-Spanish Day on Electric Vehicle. Embassy of France - I.D.A.E. - FFII

On 1 April the Business Spanish-French Day on Electric Vehicle, organized by the Foundation, together with the French Embassy (through UBIFRANCE) and the IDAE, with the support of the MITYC.

Attended by 121 representatives of French and Spanish companies from the scope of VE from electric utilities to manufacturers of poles, to fleet managers and managers of service companies.

The day was focused on electric vehicles and infrastructure, such as industrial and socio-economic paradigm, analyzing the various fields of activity and technology domains that constitute it, and seeking to establish relationships and potential synergies between Spanish and French entities in this area, by B2B meetings.

- ✓ Technical Seminar on "Technology and regulation for the electric vehicle and infrastructure"

On June 10 we celebrated the Day of Technology and Regulations for Electric Vehicle, organized by the FFII, together with FOREVE, with support from the MITYC.



Attended by over 250 representatives of Spanish companies in the field of VE from Electric Companies to manufacturers of poles, to fleet managers and managers of service companies.

The success of the day (and the previous one) means that they are preparing specialized seminars about the VE.

### 3.8. PARTICIPATION IN SOCIETIES

The Foundation participates as partner as co-founder of the Testing Center, Innovation and Services, CEIS.

### 3.9. PERSONAL

The dynamic characteristic of the Foundation leads to the expansion and improvement of the Human Resources, so that in 2011 there have been several changes in different areas of the same.

The following is the composition of staff at 31 December 2011.

<b>Total staff</b>	<b>2011</b>
<b>Management and Administration</b>	<b>57</b>
<b>Production</b>	<b>153</b>
<b>Quality</b>	<b>3</b>
<b>Total</b>	<b>213</b>
<b>Entitled</b>	<b>60%</b>
<b>Titulaciones</b>	
<b>Doctors</b>	<b>7</b>
<b>High Engineers</b>	<b>65</b>
<b>Graduated</b>	<b>12</b>
<b>Technic Engineers</b>	<b>44</b>

### 3.10. SUMMARY

The following are the subtotals for all chapters, added those of the LCOE, the Consultancy and Training of the Foundation and Concerted Laboratories by type of work, for the years 2005, 2006, 2007, 2008, 2009, 2010 and 2011 respectively:

	2005	2006	2007	2008	2009	2010	2011
<b>Contracts</b>	30	44	40	37	62	45	36
<b>Tests, homologations and technic reports</b>	4.970	5.147	5.109	4.884	4.859	5.000	5.850
<b>Calibrations</b>	3.261	3.927	3.791	2.732	2.727	3.021	3.410
<b>Courses</b>	43	57	38	43	56	71	50

## **4. FOUNDATIONAL OBJECT**

### **4.1. FOUNDATION AWARDS**

Prizes Awarded by the Foundation, in its fifteenth summons, are related next.

1. Award Jose Morillo y Farfán, in recognition of the bibliographical labour as Industrial Engineering granted to Mr. Francisco Blázquez García, Mr. Jaime Rodríguez Arribas, Mr. Ángel M. Alonso Rodríguez and Mr. Carlos Veganzones Nicolás
2. Award Manuel Seijas and Lozano, in recognition of the public labour in favour of the Industrial Engineering granted to TÉCNICAS REUNIDAS
3. Medal "Puig Adam", in recognition of the scientific and technical labour of Spanish Engineers who have been meant eximia by the rigor of its work, the technological advances derived from him and the influence in the improvement of the Industrial Spanish Engineering, granted to Mr. Eduardo Montes Pérez.
4. Award F2I2 for outstanding graduates, to Projects presented during the course 2010-2011, with relevant contributions in the fields of quality and safety on products or services, as well as in industrial innovation, granted to the following pupils:
  - Mrs. Gema Cueto-Felgueroso González-Pardo
  - Mrs. Aitana Díez Alcolado
  - Mr. Antonio José Jiménez González
  - Mrs. Irene Martín Martín
  - Mr. Franco Peschiera
  - Mr. Ricardo Picatoste Ruilope
  - Mr. Juan Valverde Alcalá
  - Mr. Leyi Xu

### **4.2. SCHOLARS**

During 2011, 36 students have enjoyed a scholarship from the Foundation.

## 5. ECONOMICAL INFORMATION

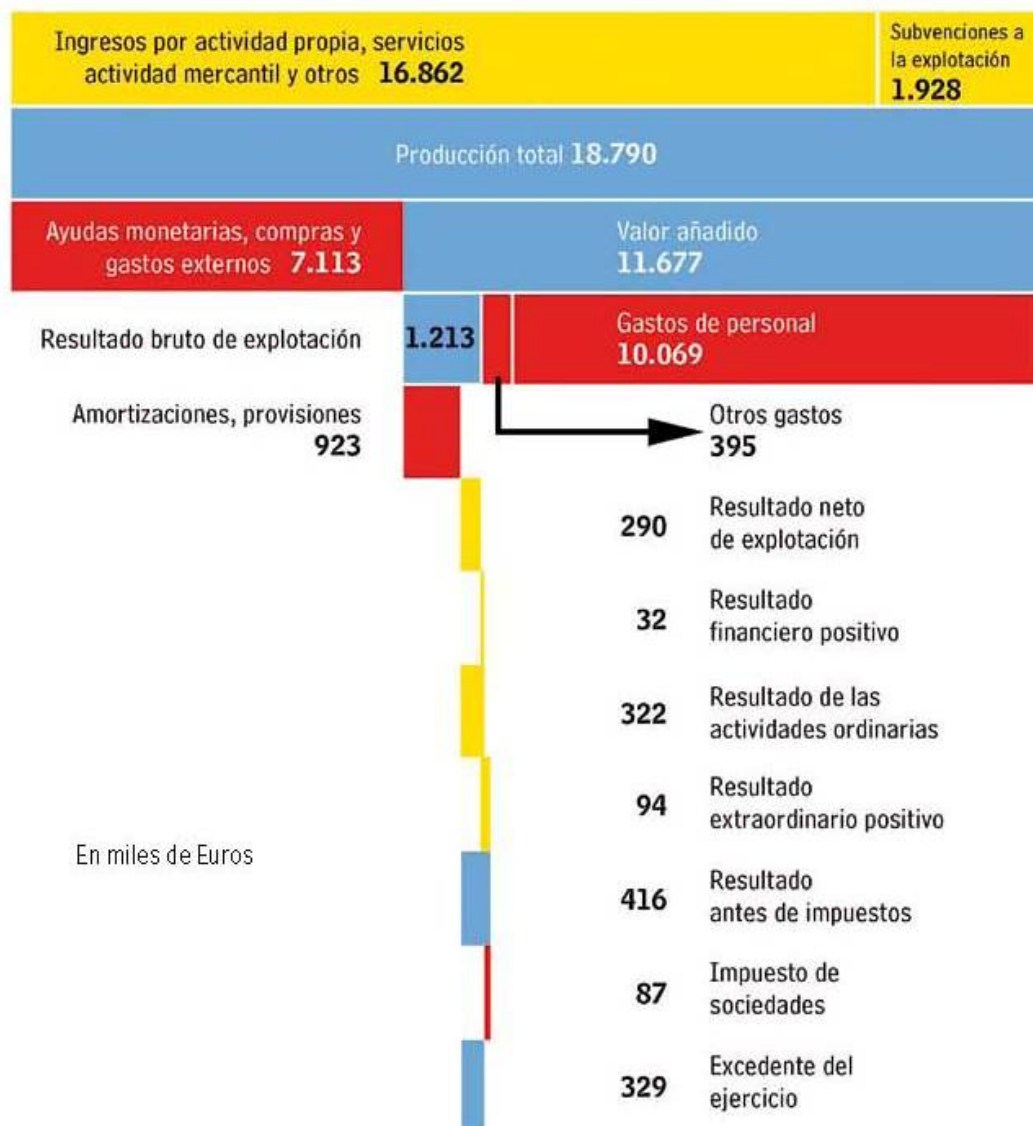
### 5.1. BALANCE SITUATION AT DECEMBER 31<sup>st</sup> 2011

ACTIVO	2010	2011
<b>A) No corriente</b>	<b>2.330.624,88</b>	<b>2.763.869,42</b>
Inmovilizado intangible	58.567,78	75.659,25
Inmovilizado material	2.115.048,46	1.929.047,02
Inversiones financieras a largo plazo	152.083,54	753.712,16
Activos por impuesto diferido	4.925,10	5.450,99
<b>B) Corriente</b>	<b>12.618.646,48</b>	<b>11.750.195,71</b>
Deudores comerciales	6.912.728,01	6.972.470,18
Inversiones financieras a corto plazo	2.196.734,52	2.332.045,33
Periodificaciones a corto plazo	50.824,71	70.043,23
Efectivo y otros activos líquidos equivalentes	3.458.359,24	2.375.636,97
<b>Total Activo</b>	<b>14.949.271,36</b>	<b>14.514.065,13</b>
<b>PATRIMONIO NETO Y PASIVO</b>	<b>2010</b>	<b>2011</b>
<b>A) Patrimonio Neto</b>	<b>7.794.419,85</b>	<b>8.103.114,49</b>
A-1) Fondos Propios	7.716.200,13	8.044.778,78
Dotación Fundacional	422.292,79	422.292,79
Reservas	1.109.839,68	1.313.933,69
Excedentes de ejercicios anteriores	5.458.374,12	5.979.973,65
Excedente del ejercicio	725.693,54	328.578,65
A-2) Subvenciones oficiales en capital	78.219,72	58.335,71
<b>B) Pasivo no corriente</b>	<b>342.459,10</b>	<b>282.249,76</b>
Deudas a largo plazo	333.768,00	275.768,00
Pasivos por impuesto diferido	8.691,10	6.481,76
<b>C) Pasivo corriente</b>	<b>6.812.392,41</b>	<b>6.128.700,88</b>
Provisiones a corto plazo	3.554.307,73	3.599.399,70
Deudas a corto plazo	42.639,42	45.670,91
Beneficiarios acreedores	8.118,58	21.133,28
Acreedores comerciales	2.609.704,93	2.244.887,63
Periodificaciones a corto plazo	597.621,75	217.609,36
<b>Total Patrimonio Neto y Pasivo</b>	<b>14.949.271,36</b>	<b>14.514.065,13</b>

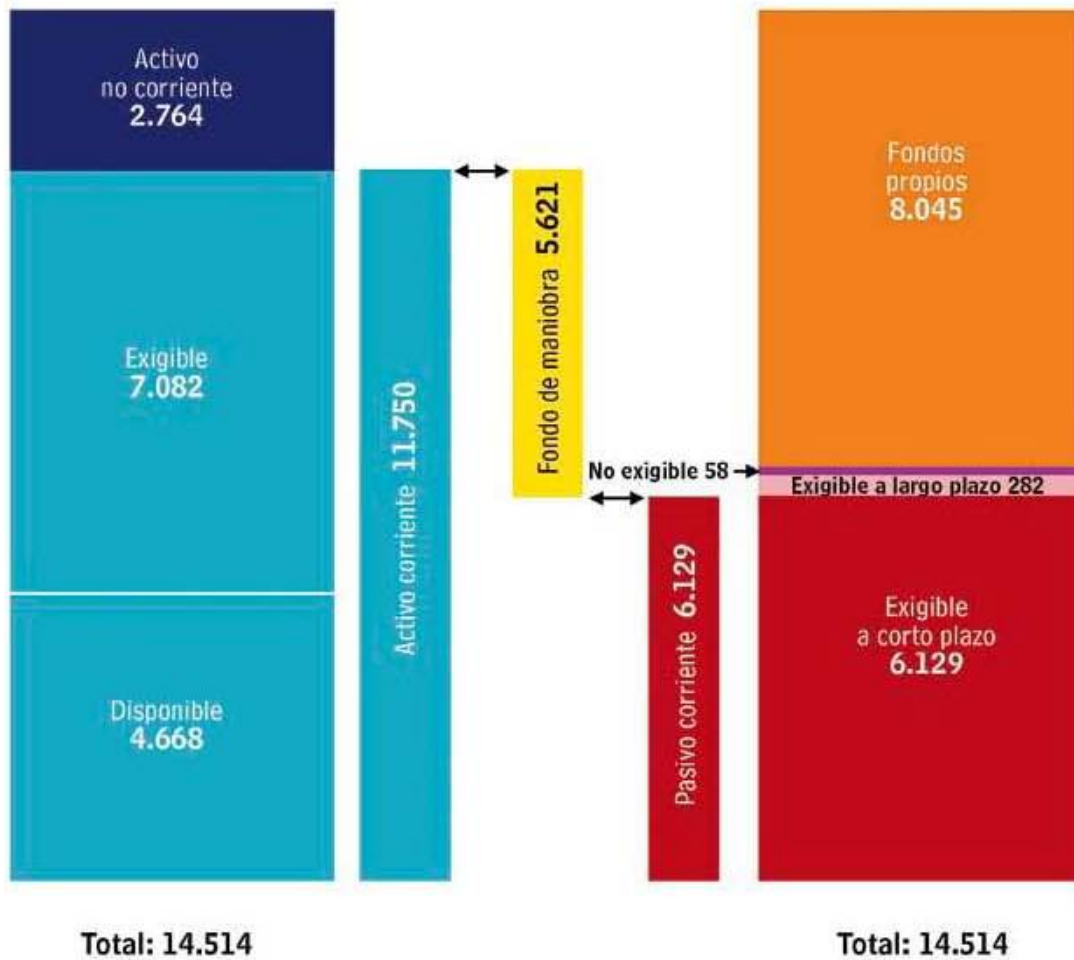
## 5.2. ANALYTIC RESULT ACCOUNT

	2010	2011
Valor de la producción	18.618	18.790
Valor añadido	11.551	11.667
Resultado bruto de explotación	1.588	1.213
Resultado neto de explotación	792	290
Resultado de las actividades ordinarias	788	322
Resultado antes de impuestos	830	416
Excedente después de impuestos	726	329

## 5.3. GRAPHIC OF ACCOUNT ANALYTIC RESULT ACCOUNT



### 5.4. FINANCIAL STATE STRUCTURE



En miles de Euros

!



## 5.5. AUDIT REPORT



### INFORME DE AUDITORÍA DE CUENTAS ANUALES

Al Patronato de La FUNDACIÓN PARA EL FOMENTO DE LA INNOVACION INDUSTRIAL

1. Hemos auditado las cuentas anuales de FUNDACIÓN PARA EL FOMENTO DE LA INNOVACION INDUSTRIAL, que comprenden el balance de situación al 31 de diciembre de 2011, la cuenta de pérdidas y ganancias, el estado de cambios en el patrimonio neto, el estado de flujos de efectivo y la memoria correspondientes al ejercicio anual terminado en dicha fecha, cuya formulación es responsabilidad del Patronato de la Fundación, de acuerdo con el marco normativo de información financiera aplicable a la Fundación (que se identifica en la Nota 2.a de la memoria adjunta) y, en particular, con los principios y criterios contables contenidos en el mismo. Nuestra responsabilidad es expresar una opinión sobre las citadas cuentas anuales en su conjunto, basada en el trabajo realizado de acuerdo con la normativa reguladora de la actividad de auditoría de cuentas vigente en España, que requiere el examen, mediante la realización de pruebas selectivas, de la evidencia justificativa de las cuentas anuales y la evaluación de su presentación, los principios y criterios contables utilizados y las estimaciones realizadas, están de acuerdo con el marco normativo de información financiera que resulta de aplicación.
2. En nuestra opinión, las cuentas anuales del ejercicio 2011 adjuntas expresan, en todos los aspectos significativos, la imagen fiel del patrimonio y de la situación financiera de FUNDACIÓN PARA EL FOMENTO DE LA INNOVACION INDUSTRIAL, al 31 de diciembre de 2011, así como de los resultados de sus operaciones, de los cambios en el patrimonio neto y de los flujos de efectivo durante el ejercicio anual terminado en dicha fecha, de conformidad con el marco normativo de información financiera que resulta de aplicación y, en particular, con los principios y criterios contables contenidos en el mismo.

ABANTOS AUDITORES Y ASESORES, S.L.

José María Carrió Montiel  
Socio Auditor

Madrid, 22 de junio de 2012

INSTITUTO DE  
CENSORES JURADOS  
DE CUENTAS DE ESPAÑA

Miembro ejerciente:  
ABANTOS, AUDITORES Y  
ASESORES, S.L.

Año 2012 N° 0112/13446  
COPIA GRATUITA

Este informe está sujeto a la tasa  
aplicable establecida en la  
Ley 44/2002 de 22 de noviembre.

*Abantos Auditores y Asesores, S.L.*

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