

Abengoa and Innovation

The year 2007 proved to be especially significant in the impetus given by public administrations to research, development and innovation (R&D&I).

The European Union (EU) started up the 7th 2007-2013 Framework Program (FP7) in R&D. With a duration of seven years, instead of the four-year length of previous programs, the budget has increased considerably: 53.2 billion euros in total. Spain was allocated a Business R+D Technological Fund of 2 billion euros for this period.

According to a 2007 survey by the National Institute of Statistics (INE), in Spain R&D investment in 2006 rose to 1.2 percent of GDP, with a 16 percent increase over the previous year (2005). The aim continues to be 2 percent of GDP in 2010, a goal that seems plausible. Therefore, it must be pointed out that Business R&D grew by 20 percent, reaching 56 percent of total R&D investment. In the R&D field, 5,000 new researchers joined companies and 2,000 more were incorporated in the Public System in the R&D field.

In November 2007, the 6th National Plan for Scientific Research, Development and Technological Innovation was approved for the 2008-2011 period. It is structured into four areas: generation of knowledge and capabilities, promotion of R&D cooperation, sector technological development and innovation, and strategic actions. The new plan seeks to intensify R&D cooperation between business and the public system, especially in the last two areas. Abengoa has actively participated on the committees set up under the 4th Plan, and considers the focus on Energy and Climate Change to be very positive.

Abengoa invested 69 million euro in R&D&I in 2006. This year 59 million euro has been invested and the figure projected for 2008 is 101 million euro. These figures confirm Abengoa's commitment to innovation as the basis for long-term sustainable growth.

There are currently over 450 people working at Abengoa in research and development. Most R&D&I activities are carried out through demonstration projects. At present there are over a hundred projects in progress, the following being among them:

- Construction in Kansas (United States) of the world's first commercial plant for producing bioethanol from lignocellulosic biomass. This project receives partial financing from the U.S. Department of Energy (DOE), and has received a 76-million-dollar non-recoverable subsidy. For developing this project partnership agreements were made with the University of Auburn in Alabama.
- I+DEA Project for developing production and use technologies for bioethanol as a biofuel. With a budget of 29 million euros, in the execution of this project collaboration agreements were signed with the following universities: Seville, Valencia Polytechnic, Comillas, Madrid Polytechnic and Castilla-La Mancha. The project receives partial financing from the Cenit program of the Ministry of Industry, Commerce and Tourism.

These projects emphasize the close working relationship in R+D with the public sector, universities, international research centers and specialized technological corporations.

Main Projects	2006		2007		2008 (P)	
	M€	% / sales	M€	% / sales	M€	% / sales
1 Solar Energy	17.4		12.9		38.1	
2 Biomass conversion to bioethanol	26.2		13.1		23.1	
3 Enhancement bioethanol efficiency (residual starch)	1.6		3.4		3.3	
4 Hydrogen Technology	2.1		1.8		3.6	
5 Electricity, environmental, oil and gas control centers	7.6		8.4		9.4	
6 Road and rail traffic, and ticketing systems	5.6		3.9		5.6	
7 Public Administration support systems	2.2		4.5		6.3	
8 Geographic Information Systems (GIS)	2.3		3.0		2.9	
9 Industrial Waste Management	0.5		0.5		1.2	
10 Vitrification	0.4		0.1		0.3	
11 Desalination	1.0		0.8		0.4	
12 Environmental Technology Center	0.0		0.1		1.0	
13 Treatment of wastewater	0.4		0.3		0.9	
14 Development of polypropylene	0.1		0.1		0.8	
15 Other projects	1.1		1.7		4.4	
Total Inversión I+D+i	68.5	2.6%	54.6	1.7%	101.3	2.5%

Strategy and financing in innovation

Abengoa's policy is focused on the creation of long-term value. At Abengoa, innovation is geared toward results, with three tangible objectives:

- Diversification: new products and services.
- Differentiation: improving and adapting existing products and services.
- Process improvement

The intangible aims pursue the acquisition of basic competencies and, above all, the creation of forward-looking options. This goal is especially tied to value, through anticipated growth and the development of new businesses.

Internal lines of innovation are largely based on Abengoa's main businesses: bioenergy, solar energy, H2 hydrogen technologies, information technologies and desalination.

In order to finance the company's research and innovation projects, in addition to Abengoa's annual investment, there are other external funding channels: subsidies, partnerships with universities and research centers, and shared R&D.

New horizons

At Abengoa, we firmly believe in the need to deliver innovative solutions that contribute to the development of a sustainable society. To this end, one of our strategic goals is precisely the pursuit of new avenues for development and innovation

Hydrogen technologies: Hynergreen Technologies. Hynergreen is the Abengoa company that seeks to develop projects involving the production of electricity using fuel cells, as well as hydrogen production from renewable energy sources.

Emissions management: ZeroEmissions Technologies. Company set up by Abengoa to encompass activities in the fight against greenhouse gas emissions. Its main action areas are the following:

1. R&D&I to develop solutions for eliminating gases with a high greenhouse effect level.
2. MDL/AC (Mechanisms for Clean Development and Joint Action) Projects. Through these two mechanisms put forth by the Kyoto Protocol, countries committed to emissions reductions can reach compliance through projects to reduce emissions in other countries.
3. Participation in carbon funds, as yet another commitment to sustainable development.

CO₂ storage and capture. Abengoa participates in diverse platforms and groundbreaking national and international projects in this area. Our aim is to develop the technology needed to be able to securely capture and confine CO₂, the primary cause of the greenhouse effect.

Energy efficiency. At Abengoa we are convinced of the need to combine the use of clean sources of energy with the development of alternatives for achieving greater efficiency in the generation, distribution and consumption of energy. We therefore conduct research and development on technologies for the following purposes:

1. To increase efficiency in the conversion from primary energy (fuel-oil, gas, coal, wind, sun, etc.) to usable energy (electricity, heat, etc.).
2. To reduce losses in transmission and distribution systems.
3. To increase efficiency in the conversion of consumed energy to useful work.

New renewable energy sources. Abengoa works in the development of the so-called emerging renewable energies, those with great future potential that are still in the R+D phase.

University Collaboration

Abengoa has a long-standing tradition of collaboration with universities. Usually this partnership is implemented through joint R&D projects, scholarship programs for upperclassmen and doctorates through specific agreements with different research groups.

There are currently signed collaboration agreements for R&D&I projects with 24 Spanish universities and 13 universities abroad. (*)

(*) All information related to agreements with universities can be found in Section V: Abengoa and the Communities in which it operates.

Recognition of R&D&I efforts

Over the past five years, Abengoa has received the following awards in recognition of its research efforts.

"2007 Andalusian Business Success Award", awarded to Abengoa's Solar Platform in Sanlucar la Mayor by Actualidad Económica; category: Best Business Initiative.

"2007 Supplier of the Year Award", awarded to Befesa Gestión PCB by Iberdrola (5th Edition); category: Quality Management System.

"2007 Financial Times and International Finance Corporation Awards". Befesa Mexico was a finalist for its "Project of the Year in Sustainable Development".

"City of Seville Medal", awarded to Abengoa (2007) by the City of Seville.

"2007 Leading Private Construction Business in Turnover" awarded to Teyma Uruguay, for the second year in a row, by the Diario Observadores and MC Consultores.

Felipe Benjumea Llorente, Abengoa chairman, voted "Most noteworthy Spanish businessman of 2007" by the Spanish Chamber of Commerce in Chile.

"2006 National Quality Award", awarded to Teyma Uruguay for the third consecutive year by the government of Uruguay in recognition of its continuous process improvement.

"Global Water Awards", awarded to Befesa CTA by the publication Global Water Intelligence; in three categories: Best International Company in Hydraulic Infrastructure Concessions in 2006, Best Project in 2006 (for the Beni Saf plant in Algeria), and Desalinating Plant of the Year (Cartagena plant, Phases I and II).

"2006 Prince Philip Award for Business Excellence", awarded to Abengoa Bioenergy; category: Renewable Energy Sources and Energy Efficiency.

"Research, Innovation and Enterprise Award", awarded to Abengoa by the Academy of Social Sciences and the Environment of Andalusia, the Andalusian Confederation of Businesspeople and the Andalusian Council of Chambers of Commerce, Industry and Shipping.

"7th Andalusian Award for 2006 Business Excellence", awarded to Inabensa by the Andalusian Government.

"11th Andalusian Environment Award", awarded to Befesa by the Andalusian Government; category: Environmental Management".

"2006 EOI Award", awarded to Abengoa by the Business School and Public Foundation of the Ministry of Industry and other companies, for its efforts in the field of sustainable development.

"4th City of Seville Award for Best Business Initiative in 2006", awarded to Solucar by the Energy Agency of Seville, for the Sanlucar la Mayor Solar Platform.

"3rd Ricardo Carmona 2006 Award", awarded to Solucar R&D by the Chamber of Commerce and Industry of Almeria for its work in the development of thermoelectric solar energy; category: Technological Innovation.

"2005 Alas Award" (5th Edition), awarded to Abeinsa by the Andalusian Government for International Expansion (2006).

"Best of European Business 2005" awarded to Abengoa Bioenergy by Roland Berger and the Financial Times; category: Innovation.

"2005 City of Seville Award". of the Seville City Council. Hynergreen received an honorable mention.

"2005 Mare Nostrum National Information Technology Award", awarded to Telvent by the Ministry of Education and Science.

"2004 Best Energy Website Award", awarded to Abengoa Bioenergy by the Web Marketing Association (U.S.).

"2004 Andalusian Excellence Award", awarded to Telvent by the Andalusian Government.

"2003 Bargoa Award" by the Miguel Calmon Institute to the best company in the State of Rio de Janeiro.

"2003 Excellence and Best Practices Award", awarded to Sainco, Telvent by the AENA; category: Technological Innovation.

"2003 ComputerWorld Technological Innovation in Andalusia Award", awarded to Telvent Outsourcing.

"2003 Nebraska (U.S.) Business Innovation Award", awarded to Abengoa Bioenergy Corporation.

"2003 Best Project of the Year Award", awarded to Hynergreen by the Eight Grove Fuel Cell Symposium.

"2003 Award for Technological Innovation in the Recovery Sector", awarded to Deydesa 2000 by the Spanish Recovery Federation.

Abengoa's R&D&I Projects

Demonstration projects

Abengoa believes that demonstration projects are a key instrument for carrying out a policy of innovation in the development of new products to be introduced into the market. Demonstration projects achieve operational validation of an innovative product, system or process and its market proof. They also facilitate knowledge of its cost in order to fix a real starting price, which can later be lowered through the experience curve. In addition, demonstration projects lead to a real demand for R&D from public administration that gives science the capacity to serve the needs of society.

Abengoa, through its companies, always has dozens of demonstration projects underway, targeted at the market and geared toward creating value, usually in collaboration with numerous scientific institutions and different technological agents. Many of these projects receive public funding.

In this context, noteworthy examples are the activities conducted by Abengoa Bioenergy on the production of bioethanol from lignocellulosic biomass (currently obtained from cereal). The aim of this project is to turn corn husks and stalk litter from other cereals, as well as agricultural waste, into bioethanol, which will bring new benefits to farmers, lower production cost, bringing it closer to that of gasoline, and will reduce the greenhouse effect, as plants - the raw material for bioethanol production - absorb CO₂ through the chlorophyll function. With an investment estimated at 35,478,765 US\$ over five years, this project has received considerable non-recoverable funding from the Department of Energy of the Federal Government of the United States, for a total of 17.5 million dollars, which constitutes 50% of investment.

Below is a list of other projects in Innovation started up and developed over the course of 2007 at Abengoa's companies.

Solar Energy

Abengoa Solar believes that investment in R&D&I is vital in order to be able to offer the best solar energy-based solutions for contributing to the fight against climate change and ensuring sustainable development. This is why they are making heavy investment efforts in order to lead, through their own resources and by means of agreements with leading institutions, a highly ambitious program in research and development.

This program has two goals:

1. To lead in the development of the generation and storage technologies we consider most advantageous for the future.
2. To understand all solar technologies to a considerable degree.

In 2007, Abengoa Solar made progress in the following projects:

- **Repow PS10.** Design and construction of a parabolic trough collector facility employing ET technology and thermal oil working fuel with an opening of 3,600 square meters for generating 45-bar, 257-degree-centigrade saturated steam. The steam will be stored in pressurized water tanks and processed at PS10, the world's first commercial tower in use. The PS10 solar plant is equipped for 30 minutes of storage and, under conditions of low radiation, can burn between 12 and 15% in natural gas. The plant will generate 24.3 GWh of clean energy and prevent the emission of 6,700 mT of CO₂ each year. The project has received subsidies from the Andalusian Energy Agency.
- **GDV. GDV concept validation.** Direct steam generation in parabolic trough collector fields and tower technology. The project has received aid from the Andalusian Technology Corporation and IDEA.
- **AZ TH Dishes.** Eighty-kilowatt gross power output capacity Stirling technology demonstration plant, made up of eight parabolic dishes, each producing 10 kilowatts. It has received aid from the Andalusian Energy Agency.
- **Superheated steam receiver.** In 2007 the Solar business unit has advanced in the construction of a demonstration high-temperature tower with approximately two megawatts of power output capacity. This plant, being built based on the experience with PS10 and PS20, will allow the production of superheated steam, leading to significant improvements in turbine efficiency. It receives aid from the Center for Industrial Technological Development (CDTI).
- **Saturated steam receiver,** based on tower technology, for implementing improvements making operation of this kind of receiver more secure and profitable by reducing self-consumption and dependence on the flow map. It receives aid from the Center for Industrial Technological Development (CDTI).
- **Photovoltaic laboratory.** Creation of a photovoltaic laboratory for analyzing the energy production costs of different technologies and configurations; improving production cost through optimization of photovoltaic devices and systems, and preventing and resolving problems during the life of the devices (modules, inverters, etc.) and photovoltaic systems.

Bioenergy

The strategic mission of Abengoa Bioenergy New Technologies consists of developing and demonstrating technological solutions through science and innovation, with the aim of meeting Abengoa Bioenergy's strategy plan targets, which include the following:

- Develop and market biomass technologies at competitive prices.
- Increase the added value of existing byproducts and develop new byproducts.
- Improve current dry milling technology.
- Promote the development of energy crops.
- Develop end-use programs for biofuels.

In 2007, Abengoa Bioenergy conducted work on the following projects:

- **Development and construction of the world's first commercial plant for producing bioethanol from lignocellulosic biomass** in Kansas, United States. In order to carry out this project partnership agreements were reached with the University of Auburn in Alabama. This project receives partial financing from the U.S. Department of Energy of the United States (DOE), with a non-recoverable subsidy of 76 million dollars.

- **I+DEA project for developing technology for production and use of bioethanol** as a biofuel, with a budget of 29 million euros. In order to carry out this project, Abengoa Bioenergy finalized collaboration agreements with the universities of Seville, Valencia Polytechnic, Comillas, Madrid Polytechnic and Castilla-La Mancha. It is partially financed by the "Cenit" program of the Ministry of Industry, Commerce and Tourism.
- **Advanced Biorefining of Distillers Grain and Corn Stover Blends.** The Department of Energy of the United States (DOE) and Abengoa Bioenergy R+D signed a five-year contract in 2004 for the development of biorefinery technology. Abengoa Bioenergy R&D leads the team that is developing this innovative technology for processing biomass derivatives, which utilizes the advanced biorefinery of blends of the DGS of the grain (a byproduct of bioethanol production with a high protein content) and the biomass from corn crops in order to obtain increased production of bioethanol and, at the same time, maintain the protein nutritional value. This technology will lead to a more sustainable and economic industry, reduce petroleum consumption per liter of produced bioethanol and will increase the availability of bioethanol. The project receives aid from the U.S. Department of Energy.
- **BC and L demonstration plant.** Abengoa Bioenergy built this plant, the world's first commercial-scale biomass plant, in order to test the technology of turning biomass into bioethanol. The plant will process 70 tons per day of agricultural waste, such as wheat chaff, to produce 5 million liters of bioethanol each year. Its ultimate aim is to develop gasoline-competitive production technologies. It receives subsidies from the European Union 5th Framework Program.
- **Research on E-diesel use.** E-diesel is a fuel that is obtained by adding bioethanol to conventional gasoline, with a percentage that can vary between 5 and 15%, along with an additive to ensure the stability of the blend. It can be used in any diesel engine. It is being conducted in collaboration with the Cideaut Foundation and the E-diesel Consortium of the United States. The project has received subsidies from the Ministry of Education and Science.
- **Agrobihol.** Energy crops our rapid-growth crops used for producing energy (electricity or liquid fuels) using a part of or the entire plant. Abengoa Bioenergy's objective in this project is to produce ethanol from Spanish crops from cereals with high starch content; from lignocellulosic material, such as straw, or other grass and stalk crops. In addition, the viability of producing bioethanol from sorghum or potato is also under study, and the use of bioethanol as an alternative fuel in ethanol-gasoline and ethanol-gas oil blends in conventional vehicles, as well as hydrogen production for fuel cells. The project receives subsidies from the Ministry of Education and Science.
- **Bioethanol Transformation.** Abengoa Bioenergy is making a considerable effort in perfecting hydrogen generation systems from bioethanol. To this end, work is being conducted on transforming ethanol, a chemical process by which hydrogen is generated thanks to the steam and catalyst reaction. The research projects have led to obtaining an ethanol-transforming catalyst and the construction of two pilot plants for accumulating thousands of operation hours. The demonstration facility for this technology has been completed, which has facilitated acquisition of exhaustive knowledge of the design, operation and costs associated with this technology, and in determining aspects to be reviewed for its optimization. The project has received subsidies from the Spanish Navy.

- **ACES.** A research project conducted in conjunction with the High Council of Scientific Research (CSIC). The aim of the project is to develop a catalyst capable of producing ethanol from Syngas (basically hydrogen and carbon monoxide). It represents a key step in the thermo-chemical channel for obtaining ethanol from biomass. It is financed entirely by Abengoa Bioenergy.
- **DOE ethanol catalyst development project.** The U.S. Department of Energy (DOE) selected Abengoa Bioenergy R&D (ABRD) to develop an ethanol catalyst. In this program, besides ABRD, project leader, two laboratories are participating (Argonne National Laboratory and the Pacific Northwest National Laboratory), two universities (Washington University and Lehigh University) and the research organizations of GTI and Avantium. The total budget exceeds 3,570,000 dollars. Twenty percent is provided primarily by ABRD, and the remaining 80 percent comes from the DOE. It represents a basic research program for developing a synthesizing ethanol catalyst and characterization, as well as fast sifters and testing in the reaction systems, elucidation of reaction mechanisms and kinetics, durability tests, and simulation and development processes. The aim is thus to obtain a catalyst that can execute Syngas bioethanol synthesis at a reasonable cost.
- **RENEW.** The RENEW project aims to develop, compare, demonstrate (partially) and test a range of fuel production chains for motor vehicle fuels. In this project, coordinated by Volkswagen AG (Germany), Abengoa Bioenergy participates as a key partner for optimizing bioethanol production from biomass by means of enzymatic hydrolysis and gasification and thermo-chemical catalysis, as well as to produce byproducts. For these tasks, Abengoa Bioenergy has collaboration from the chemical engineering department of the Andalusian Industrial Research and Cooperation Association (AICIA) and the University of Seville. The project is financed by the 6th Framework Program of the European Union.

Environmental Services. Befesa

The R&D&I strategy of Abengoa's Environmental Services is focused on creating value and developing new technologies for conducting our activities in a sustainable way. Befesa's R&D&I strategic plan has the following objectives:

- To become technologically competitive leaders in the industry of aluminum waste recycling and galvanized steel.
- To develop new technologies for industrial waste management.
- To be technological leaders in desalination technology and technologically competitive in treatment of wastewater and its reutilization.

This strategy, which represents a permanent commitment for Befesa, is used as a vehicle for continuous improvement and consolidation of our technological leadership in waste treatment and water generation and management.

In 2007 Befesa developed the following projects:

- **Mecoal.** Improving aluminum casting, particularly the elimination of external thinning in bars.
- **Realox.** To perfect fusion by means of improving basic knowledge of aluminum oxidation in its fusion and in the presence of melting materials. The program was developed in conjunction with Inasmet.
- **New treatment of filter dust residue for its inerting.** Phase III. A program developed in collaboration with Inasmet, it has received subsidies from the Center for Industrial Technological Development (CDTi).
- **Paval improvement through the study of slag reactivity in order to ascertain via computer the advancement in the saline slag reaction.** The first phase of the project ended in March with success, applying the Valladolid and Wales reactor model.
- **SPL treatment in collaboration with Alcoa.** The project involves finding an application of the carbonous part of the electrolysis cells used (SPL) in the production of primary aluminum. It represents an environmental service for these plants, which need to recycle this material. The project has received subsidies from the Technological Research Promotion Program (Profit).
- **Ecoretech.** Development of new Paval/BFA applications for architecture projects. Paval is a saline slag generated in the production of secondary aluminum; it is an insoluble solid and a hazardous waste, composed of aluminum oxide and a lower portion of silicon oxide and magnesium oxide.
- **PP+FV.** Industrial installation for the production of materials composed of pure polypropylene or recycled and reinforced with fiberglass residues from the production waste that is currently dumped. The project has received a loan from the Center for Industrial Technological Development (CDTI).
- **Pilot plant for energy-chemical capturing of residual gases in the process of recycling steel mill dust.** It is being carried out in conjunction with the Euskoiker Foundation and the Advanced Industrial Engineering School of Bilbao.
- **Obtaining new products from Purified Waelz Oxide (D-L.W.O.[®]).** Being conducted in collaboration with the Euskoiker Foundation and the Advanced Industrial Engineering School of Bilbao.
- **Study for reducing sulfur and fluoride concentration in the dump at the Befesa Zinc Aser, S.A. plant.** In collaboration with the Euskoiker Foundation and the Advanced Industrial Engineering School of Bilbao.
- **Construction of a facility for pelletization of zinc oxide to lower diffuse emissions of solid particles generated in the manufacture of zinc oxide by 80 percent.**
- **Production of fiberglass-reinforced thermoplastic compounds.**

- **Production of new materials and alternative fuels.** The project aims to validate methods of evaluation of inorganic industrial waste as substitutes for raw materials in industrial processes, such as the manufacturing of cement and other construction materials. Additionally, the project seeks valorization of organic waste as an alternative fuel to fossil fuels in the industrial sector. The project is being developed in collaboration with the University of Seville. It receives subsidies from the Research Results Transfer Impulse (Petri) and the Ministry of Education and Commerce.
- **Restoring contaminated soil using non-hazardous waste and other byproducts.** With subsidies from the Technical Research Promotion Program (Petri) of the Ministry of Education and Science, and from the Ministry of the Environment program.
- **Development of Oxygenated Additives from Glycerines.** The project has received subsidies from the Technical Research Promotion Program (Profit) of the Ministry of Education and Science.
- **Pretreatment of fuel for vitrification.** The project is focused on the design of the process of pretreatment of waste upon entering the vitrification process, so that a feed fuel can be obtained for the process, ensuring proper functioning and allowing valorization of the synthesis gas obtained.
- **High-Efficiency Desalination Pilot Plant.** The plant's objective is to reduce energy consumption in the processes of desalination by reverse osmosis, below 2.5 kilowatts hour/square meter. This implies obtaining potable water from sea water at a reasonable price, which is essential for sustainable development. To this end, analysis is being conducted on the high-pressure pumping systems, reverse osmosis membranes and energy recovery systems. The project has been granted a subsidy from the Council for Innovation, Science and Commerce from the Andalusian Government.
- **Development of advanced pre-treatment systems for desalination.** Design of an optimum system for pre-treatment for desalination plants that minimizes investment and operation costs, ensuring water quality, as well as plant reliability and availability. To this end, development is underway on physicochemical process technologies, their combination and subsequent application to desalination. The project has received a subsidy from the Council for Innovation, Science and Commerce from the Andalusian Government.
- **Study of the brine dilution phenomenon.** The aim of this project is to acquire in-depth understanding of the physics of the brine dilution phenomenon in marine beds; develop tools for simulating said phenomenon validated through real results; create optimal diffusion systems and a system for continuous measurement to monitor brine or rejection dilution in desalinating plants. Through subsidies from the Idea program of the Andalusian Government.
- **DeReDes: Development of Desalination with Renewable Energies.** The project aims to drive business activity in the field of desalination, through design, installation and maintenance of systems using renewable energy sources. In order to achieve this, a technical-economic evaluation is being carried out comparing different technologies, and the three pre-commercial plants determined as optimal will be designed for three different scenarios. Through subsidies from the Ministry of Industry, Commerce and Industry and the Technical Research Promotion Program (Profit) of the Ministry of Education and Science.

- **Elimination of EDAR sludge through supercritical oxidation.** Through subsidies from the Idea Program of the Andalusian Government and the Andalusian Technological Corporation (CTA).
- **TRASOS.** Development of optimal technologies for regenerating wastewater.
- **Development of a control system for large desalinating plants.** The goal is to develop an integrated central system for optimizing desalination plant operation, maximizing its availability. Through subsidies from the Idea Program of the Andalusian Government, the Andalusian Technological Corporation (CTA) and the Technical Research Promotion Program (Profit) of the Ministry of Education and Science.

Information Technologies. Telvent

The Information Technologies, business group, with Telvent as the lead company, has a team of over 350 people dedicated to research, development and innovation (R&D&I), distributed among the group's nine product and competency centers all over the world.

The product centers deliver infrastructure technologies that are the basis for the different solutions Telvent offers. These technologies, occasionally commercialized in isolation, are used by the competency centers in order to develop high-value-added systems architectures and advanced applications, specifically developed for each sector. Combined with our experience in business processes and our services, products and solutions, Telvent delivers capabilities for real-time decision-making to our customers.

Telvent works each and every day to be a global company that, through the use of the most advanced information technologies available, contributes to making the tremendous challenge of creating a sustainable world for future generations possible.

The most relevant R&D&I projects in 2007 were the following:

- **Idaho National Laboratory (INL) Phase I.** 2007 marked the beginning of the multi-annual research project in research on critical infrastructure security. The project has begun to reap benefits with the first report from the Idaho National Laboratory (INL) on the evaluation of the security of Telvent's SCADA OASyS DNA 7.5 system.
- **Smart Client.** This program is aimed at modernizing the OASyS user interface. This year work has been conducted on the new ezXOS versions, the new interface, compatible with clients' old versions of OASyS which are still installed at their facilities.
- **CD-Platform.** Development of a hardware and software platform for real-time acquisition systems that agglutinate current and future tendencies, applying them to all Telvent lines. The initiative is partially subsidized by the Ministry of Industry, Tourism and Commerce, through the PTC project.
- **Saitel Family.** In 2007 work was continued on the evolution and maintenance of the Saitel family of telecontrol equipment options. The year has seen the advent of a new compact device with high communications capacity and integrated E/S (Saicom_IO), specially intended for oil and gas, environment or the electric sector. In the same way, a new module was developed, ST_SOL, for controlling heliostats in solar plants.

- **ArcFM Server.** This is the first version of a Telvent GIS solution based on a web server. It is intended especially for organizations that need centralized architectures with web services that are browser-, desktop- or mobile client-accessible. It represents a solid base for creating a service-oriented architecture (SOA).
- **Inspector Extension.** Inspector is a new software function developed for ArcFM Viewer (ArcGIS Engine). It allows collection of information related to geo-referenced assets and permits a wide variety of mobility applications for utilities, including damage assessment, equipment inspection and inventory of third-party infrastructure usage.
- **Conduit Manager.** Subterranean facility diagrams.
- **ArcFM Solution.** Its evolution led to the release of the new version 9.2 and two service packs this year.
- **Replication of the geospace database.** The mobility components of the ArcFM solution gained in functionality with the 9.2 version. The new replication now allows incremental upgrades of mobile field devices from a central company server. This permits work crews out in the field to access updated versions from the company database in a very efficient way.
- **Designer** Optimal Designs. These tools allow electric companies to make lower-cost designs for the development of underground residential networks.
- **Responder.** Responder is Telvent's OMS (Outage Management System) product for managing incidents and service interruptions for electric companies.
- **Free Flow Toll Solution.** Throughout 2007 we continued to perfect detection and classification equipment, and work was conducted on new systems by means of optical stands and piezoelectrics for detection of axles and double wheels, and on a new state-of-the-art telepay tag in conjunction with Delta and Fela. The solution is complemented by the development of the Back Office, a project that has received a subsidy from the Basque Government.
- **MobiFast.** This project is focused on the design of a new compact coin device for vending machines of a smaller size and in the development of a new hybrid vending module of C-tickets (contact-free tickets) and magnetic tickets, within the objective of creating new equipment and devices for completing the range of ticketing products.
- **Valtick.** A program for developing a new solution for bus ticketing management integrating the expertise and products of Telvent and Maexbic.
- **SmartTouch.** An international consortium of European companies and universities that aims to integrate the functions provided by contact-free intelligent card-reading, which is in wide use in ticketing systems for cellular phones. It is financed by the Ministry of Industry.
- **Reconoce.** This project, approached as an evolution of the Genius and Access4All projects for giving self-sale machines an oral interface in natural language, is based on the mechanisms for noise filtering and treatment. It has received subsidies from the Basque Government.
- **SAREF.** This project, begun two years ago, seeks to develop a railway regulation system in collaboration with the Center for Railway Technologies Research (CITEF). In 2007 a large portion of

the modules and tools was completed. The system will substantially improve punctuality and service quality, as well as achieve cost reductions and the integration of the different regulation systems into just one.

- **InTraSy.** The aim of the project is to develop the new generation of solutions for urban traffic control, both with respect to field equipment, zone regulators and exchanges, as well as the Center's system.
- **Itaca.** In 2007 work was conducted on the development of a variation of our real-time traffic control system, Itaca, which reduces installation costs by using only data from the detectors in the stop line.
- **Shadow Toll.** Through this project planned over two years, 2007-2008, Telvent is developing a Shadow Toll Smart System. Different types of sensors for detecting and classifying vehicles were analyzed and selected, and system specification was completed. Integration of one of these sensors in the remote for data collection was conducted, and the basic software infrastructure that will complete the solution was developed as well.
- **m:VIA.** This project involves the development of a cellular platform permitting vehicle-infrastructure interaction and allowing drivers to receive available information during their trip. The objective of the project, which is backed by the Ministry of Industry, Tourism and Commerce, is research and development of basic systems for content management, both for docked elements as well as infrastructure, for traffic and transportation sector applications.
- **Gas Suite.** Improvement of the Gas Suite infrastructure to allow better control of access to measurement data having financial materiality. GMAS, in particular, is used as an auditing tool to ensure compliance with regulations on corporate governance, such as the Sarbanes-Oxley Act.
- **Gas Suite Interface.** A new research project in interface technology and the most efficient way to present information with the aim of reducing fatigue and the consequent errors.
- **SimSuite Integration.** SimSuite Pipeline is a key component of the LMS (Liquids Solutions Suite) solution. The objective of this project is to offer an integrated solution which at the same time lowers costs in the long run.
- **Next Generation Liquids Suite (NGLS).** A new stage in the project launched in 2006 with the aim of creating a superproduct based on the solid nature of existing products.
- **Pipeline Power Optimization.** This application is based on the Liquids Suite SimSuite module and determines energy consumption and operating cost of a pipeline at a given moment. This information is used to determine optimal pump configuration in order to minimize costs.
- **Smart Grid Solutions Suite Smart Grid Solutions Suite (SGS).** This solution encompasses the SCADA OASyS, ArcFM Enterprise GIS, Responder Outage Management, DMS Distribution Management, Titanium Smart Meter Solution for automating substations. SGS will provide, among other advantages, network energy efficiency, improvements in consumer service, reduction in the frequency and duration of service interruptions and possibilities for intelligent management of demand which were unheard-of until now.
- **Denise.** This represents a 4-year (2007-2011) research project developed by a consortium comprised of representative companies from the electricity sector and Spanish research centers. The aim is to apply the latest generation of technologies to create a new generation of networks for electrical

distribution with the capacity to improve the quality of the energy supply, optimize supply and demand management, increase energy efficiency and supply security and support a new generation of energy services. The project is financed by the Cenit program of the 2010 Ingenuity Plan.

- **Cariel.** Within the Smart Grid concept, the Cariel project involves research on the control use in high-speed communications network substations and large-capacity information treatment equipment. The new IEC 61850 standard offers interesting novelties in this sense, representing a new concept in information organization at substation level. It will allow handling the information necessary for power network operation in real time more efficiently.
- **Cirrus 100 Ceilometer.** This cloud height sensor (ceilometer) will form part of the Telvent product catalogue for aviation meteorology. It will be a key component in airport security, increasing confidence in security during takeoff and landing maneuvers.
- **Telmet 320.** Telmet 320 is a new generation of /PRD data acquisition units. Its main characteristic is its flexibility and scalability, which make it suitable for all applications for meteorological observation systems, such as Atmospheric Weather Stations (AWS), Aviation Weather Observation Systems (AWOS), Road Weather Information Systems (RWIS) and Marine Meteorological Sensors.
- **Befitel** (optimized control system for desalination plants). The aim of the project is to design and develop an advanced control system that will permit optimization in the operation of a desalination plant. This project began in 2006 and is being developed in conjunction with Befesa CTA. It is subsidized by the Andalusian Technological Corporation, the Ministry of Industry, Tourism and Commerce and the Andalusian Government.
- **Telvent Hydrometeorology Decision Tool (THMDT).** The project aims to design and develop a monitoring and control platform for watersheds, permitting integration of new field technologies for measuring precipitation and hydrological modeling. In the development of the project there is collaboration from the Hydrometeorological Research Group at the University of Catalonia and financial support from the Ministry of Industry, Tourism and Commerce and the Council for Innovation, Science and Industry of the Andalusian Government.
- **Terwis 2.** The aim of the project is to advance in the development associated with the Road Weather Information Systems. This project is aided by the Ministry of Industry, Tourism and Commerce.
- **Tesemat.** This project entails the design and development of a solar energy management tool for optimizing solar energy generation by means of exploiting an accurate weather forecast adapted to the needs of the operator. Tesemat will allow efficient and sustainable handling of solar plants. The project is developed in conjunction with Solucar R&D. Subsidies were granted for 2007 and 2008 by the Ministry of Industry, Tourism and Commerce.
- **PMAI** (Image-Assisted Medical Processes). Through this project, the aim is to increase efficiency of current surgical procedures in order to achieve more precise and minimally invasive surgery at a lower cost. It has received a subsidy from the Andalusian Technological Corporation (CTA).

- **eQECM** (eQuirófano: Entorno Colaborativo Multimedia – eSurgicalSuite: Collaborative Multimedia Environment). eQECM is a project that began in 2006 in planning the development of functionalities related with the e-surgicalsuite, or intelligent operating room, which is understood as the strategic control center in clinical activities associated with invasive processes. With this project, we are improving the capabilities of the TiCares global management suite in the aspects of mobility and availability of the information needed by medical professionals. It has received a subsidy from the Andalusian Technological Corporation (CTA).
- **PPC-RFID** (Pacientes Procesos Críticos – Radio Frecuencia Identificación – Critical Process Patients – Radio Frequency Identification). The PPC-RFID project involves the development of a computer application built in an open environment for the automated and continuous identification of agents in care processes, patients and the professionals who care for them, as well as all of the material components involved in these processes, using to do so the capabilities of RFID technology. It has received a subsidy from the Andalusian Technological Corporation (CTA).
- **SIMFO**. (Forensic Multimedia Information System) is a research project in a universal set of solutions is being considered for optimizing all of the stages and scenarios of the forensic medical examiner's activity with the presence of the human body (field work, lab work, maintenance of a central information service and public display of the forensic medical examiner's findings). It has received a subsidy from the Andalusian Technological Corporation (CTA).
- **Amlvital**. The objective of this project is to develop a new generation of CIT technologies and tools for modeling, designing, implementing and operating Environment Intelligence (Aml) systems, the aim of which is to provide personal services and support for independent living, health and well-being. It has received a subsidy from the Center for Industrial Technological Development (CDTI).
- **Identica**. The Identica project arose in 2007 with the objective of constructing an advanced identity verification system through biometrics and personal documentation in secure environments to respond to the current need for unequivocal evidence of a person's identify, while verifying physical presence at the same time. It is subsidized by the Ministry of Education and Science (MEC).
- **Sigmus**. This initiative, developed in collaboration with the AIE of Municipal Companies of Seville, seeks to improve the processes involved in manual and/or automated tasks in the context of municipal management. This allows internal and/or external administrative tasks to be carried out in a fluid manner, accessing information or procedures of municipal companies by means of master tools and other information systems (property registry, urban planning information, for example) by means of capacities in interoperability. The project has a subsidy from the Andalusian Technological Corporation (CTA).

- **Opera 2 Open Powerline European Research Alliance** – Phase 2. Opera is a European alliance for developing a new generation of integrated communications networks through the power line (PLC). This technology permits the use of existing power networks for the transmission of information and provides the user with Internet, telephone and television services, thus eliminating the creation of new costly and contaminating infrastructures. The project is funded by the European Commission.
- **Cosi**. This project within the Eureka-ITEA program framework is focused on the open source from the standpoint of the interests of an industrial organization. The project is financed by the Ministry of Industry.
- **Osiris**. A project within the Eureka-ITEA program framework that was started up in 2005, geared toward the development of Open Source service platforms in distributed environments, covering the identification of aspects related to component life cycle, definition of a communications bus between services, security aspects in distributed environments, development of tools for the management and configuration of services and demonstrators of the implemented technologies. The project is financed by the Ministry of Industry.
- **Nuadu**. A European collaborative project within the Eureka-ITEA program framework that approaches the technical risks in delivering a residential surroundings intelligent environment and mobility for services for health and well-being, with the aim of improving the quality of life of its users through effective and efficient solutions for service suppliers. The project is financed by the Ministry of Industry.
- **Atenea**. Atenea is a project within the Prometeo technological platform that groups a relevant subset of participants with great synergy into real-time systems. The main objective is to approach strategic areas identified in Prometeo's strategic agenda; reference architectures, middleware, methods and tools. The project is subsidized by the Ministry of Industry.
- **MoSIS**. Initiated in 2006 as a continuation of lines of research on the development of families of systems such as CAFÉ or FAMILIES, in order to analyze obtaining high-quality, more flexible and adaptable products, while optimizing their production costs at the same time, in a world in which industry demands increasingly more complex products and services. The project has received financing from the Ministry of Industry.

Abeinsa (Engineering and Industrial Construction)

A prerequisite for sustainable development is that it must be sustainable for all, for every inhabitant of our planet. And to assure that this is so, Abeinsa is convinced that the right path to follow is that of research, development and technological innovation, geared toward improving the use of natural resources, helping them to reach all places and ensuring respect for the environment.

Therefore, through its different subsidiaries, Abeinsa is currently developing strategic lines in areas such as energy efficiency, CO₂ capture and storage, development of communications infrastructures, and establishing new energy vectors, such as hydrogen and its use in fuel cells.

Below are some examples of the projects and initiatives following the above lines of action which Abeinsa has carried out over the course of 2007:

- **Battery Charger Rectifier Unit (BCRU).** Project for developing a voltage regulated AC/DC converter for the aviation sector, in consortium with Airbus Spain. This project is being conducted in collaboration with the Association of Research and Industrial Cooperation of Andalusia (AICIA) and the Elasticity and Materials Resistance group of the ESI at the University of Seville. The project has received financing from the Andalusian Technological Corporation (CTA) and the Andalusian Government.
- **National Strategic Consortium of Technical Research in CO₂ (CenitCO₂).** The main objective of the project is research, development and validation of new knowledge and integrated solutions to reduce CO₂ emissions into the atmosphere, emissions generated by combustion of fossil fuels in the electrical generation processes. The project has received financing from the Center for Industrial Technological Development (CDTI).
- **Singular and Strategic Nature Scientific-Technological Project (Project PSECO₂).** A project directed by Ciemat and the Geological and Mining Institute of Spain to approach matters pertaining to the capture and geological storage of this greenhouse gas. Abeinsa collaborates in the technological area and in the identification of the potential in Andalusia and the Guadalquivir basin for storing significant amounts of this gas.
- **Nanomembranes against Global Warming (NanoGLOWA).** Program for developing new materials based on nanotechnology for application in separation and purification environments based on membranes. It aims to demonstrate the viability of gaseous effluents from thermal power plants, as an alternative for reducing CO₂ emissions. Involving a consortium of 26 partners, it has received financing from the 6th Research Framework Program of the European Union.
- **DeCO₂.** Project for determining the industrial viability in carbon dioxide decomposition reactions through plasma techniques. Abeinsa receives collaboration in the most basic research from the Institute of Material Sciences of Seville, of the Higher Council of Scientific Research (CSSIC). The project
- **Wi-Pac.** System for helping patients with Alzheimer's disease, the aim being to improve quality of life for these people in hospital, geriatric or other settings, through the development of a wireless management system for tracking and monitoring. This project is developed through a consortium coordinated by Inabensa in which Instalaciones Inabensa, S.A., APIF Moviquity, S.A., the University of Castilla-La Mancha and Intercentros Ballesol, S.A. are participating. It has received financing from the Ministry of Industry, Tourism and Commerce and the European Regional Development Fund (Feder).
- **m:Ciudad Project.** Singular strategic scientific-technological project for promoting Spanish Technological Platforms. Developed by a consortium of 16 institutions, it has received financing from the Program for Technological Research Promotion (Profit), the European Regional Development Fund (Feder) and the Ministry of Industry.
- **RES2H2.** (Cluster Pilot Project for the integration of Renewable Energy Sources into European Energy Sectors using Hydrogen). This program seeks the integration of wind power with hydrogen storage, fuel cell and reverse osmosis technologies, within the 5th Research Framework Program of the European Union. Inabensa has led the engineering and integration of this consortium.
- **Radia.** Design and development of new systems for detecting modulated intensity radiation. This project seeks to drive forward the application of the basic research conducted by the Physics Department of the University of Seville for medicine and radiation treatment and is partnered by Inabensa. It has received financing from the Ministry of Industry.

- **Motronic.** It is studying the new Engine Control Centers within the framework of the **Program for Technological Research Promotion (Profit)**. **Inabensa leads the project.**
- **Ada Project.** The project involves a platform based on the combination of wireless technologies that contribute to quality of life for the elderly and care-dependent. The objective is to extend the period of independent living for people in their homes or residential centers. This project is being carried out by a consortium coordinated by Inabensa and composed of the following participants: Instalaciones Inabensa, S.A. (project developer), APIF Moviquity, S.A. (technological Pyme), the University of Castilla-La Mancha (public research institution) and Intercentros Ballesol, (S.A.) (user company). The Ada project is financed by the Ministry of Industry, Tourism and Commerce and the European Regional Development Fund (Feder).
- **Inredis.** Interfaces for the relationship between the environment and people with disabilities. A Cenit project financed by the Center for Industrial Technological Development (CDTI). Inabensa is part of the consortium of companies, public research institutions, universities and foundations. The main objective of the project is to develop base technologies to create channels of communication and interaction between people with special needs and their environment.
- **IDsensor.** Project involving the development of a platform of heterogeneous technologies for the configuration of integrated networks of sensors and identification devices via radio frequency for the fishing sector. The consortium is coordinated by Inabensa and also receives participation from the University of Vigo. It has received financing from the Ministry of Industry, Tourism and Commerce and the European Regional Development Fund (Feder).
- **Elisa.** Environment for Intelligent Tracking of Assisted Services. The project aims to define, design, implement and deploy new services within the framework of technological and research platforms focused on two areas: tracking and accessibility/adaptability. These services are based on cellular technologies and on tracking in both open and closed environments. They will be highly valuable to the disabled as well as other users. Inabensa is among the companies in the consortium. The project has received financing from the Technological Research Promotion Program (Profit).
- **Diablo.** Distribution of audiovisual contents in in-building environments (homes and offices). The project is being conducted through a consortium in which Inabensa participates. It has received financing from the Ministry of Industry.
- **Emissions reduction project in Sanlucar la Mayor.** Led by ZeroEmissions, in collaboration with the Institute for Regional Development, it aims to devise a plan of action with institution and technological solutions for reducing emissions in the municipality of Sanlucar la Mayor in each of its contaminating sectors (energy, transportation, industry, waste, etc.). The first phase of the project will involve carrying out a diagnostic evaluation of the municipality in order to ascertain the initial balance of greenhouse gas emissions, and thereby be able to later evaluate the measures adopted. The ultimate aim is to extend these more effective measures to other municipalities.
- **Aquila Project. Development of electrical power generators for the aviation sector.** The objective is to analyze different options for distributed electric energy generation aboard aircraft utilizing different technology fuel cells, and to also study both the possibility of carrying stored hydrogen and that of producing it on board while the aircraft consumes it. Transformation processes have been used in the project. This project receives funding from the Technology Corporation of Andalusia (CTA), the Agency for Innovation and Development of Andalusia (IDEA) and collaboration from the Higher Council of Scientific Research (CSIC) and the Engineering School of the University of

Seville.

- **EpiCo.** The main objective of the project is to coordinate the efforts of researchers from the main Spanish companies involved in developing different types of polymer membrane (PEM) fuel cells. A total of five partners are participating in EpiCo: three companies (Ajusa, Cegasa and Hynergreen), a research center (INTA) and a technological center (Cidetec). Hynergreen is the global project coordinator of this project which has received financing from the Ministry of Education and Science, which considers it a scientific-technological Project of Singular and Strategic Nature.
- **PlasmaGen Project.** To develop a process for producing clean hydrogen by means of plasma reactors, work has been conducted on perfecting the reform process using plasma as a means for producing hydrogen from different substances. It receives financing from the Andalusian Agency of Innovation and Development (IDEA), and collaboration in its development from the Institute of Material Sciences of Seville (ICMSE-CSIC).
- **Project Hercules.** The objective is to demonstrate that the production of renewable hydrogen from solar energy is viable, and its application in a sector as important as land transportation would contribute to reducing emissions and improving local economy. Through this project, Abeinsa seeks to install a prototype for a production plant and a renewable hydrogen service station in Sanlúcar la Mayor (Seville), with the capability of fueling an electric vehicle designed and built to run on hydrogen, utilizing fuel cells. The project has received financing from the Agency for Innovation and Development of Andalusia (IDEA), and the Ministry of Education and Science, which has catalogued it as a singular scientific-technological project that is strategic in nature. The Hercules project is an Andalusian initiative globally coordinated by Hynergreen and promoted by a total of 8 partners. Hynergreen, Solucar R&D, Santana Motor, Carburos Metálicos, GreenPower, the Energy Agency of Andalusia, the National Aerospace Technological Institute (INTA) and the Association of Research and Industrial Cooperation of Andalusia (AICIA).