

E&M

March 2012 · Nº1

Combustion News



Flexitime to cater for childcare



SOCIAL RESPONSIBILITY

Irene Carranza
Purchase Manager



**China, a
country with an
amazing growth
potential**



E&M Combustión:

A new work philosophy

Feature · Incinerators for Cuban hospitals

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Meeting point

It gives me great pleasure to introduce you to the first issue of our journal **E&M Combustion News**. The publication is being launched this year for the purpose of featuring innovations and developments related to the combustion sector, made either by E&M or its collaborators, and projects developed by our company, among other matters, as well as for acquainting you with the people who make up this small family that is E&M Combustión.

Our aim is to turn this journal into a place where potential customers and our staff can meet. Besides covering technical information that we trust will be of interest, our objective is to present what we consider our core value and which makes us immensely proud, namely, our human resources.

This first issue of **E&M Combustion News** is going to be translated into four languages and distributed over the five continents. We would be delighted to receive any suggestions or comments you might have with a view to making this publication as interesting and attractive as possible for our readers. Indeed, our intention is to publish these contributions in future issues, thereby engaging those people all over the world who, from both a technical and a human perspective, would like to share their remarks or ideas for the development of this publication.



Iñigo Béjar

Sales Manager and Founding Partner
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E&M Combustión, a new work philosophy



Firstly, I would like to devote my first words to thanking those companies, people and institutions that have always believed in our project and business development since its outset.

Of course, we also thank our clients who give us their support and trust every day, without whom we could not continue our technological developments, in order to be able to offer front-line technology in the field of energy efficiency and reduction of pollut-

ant emissions, thus contributing to the sustainable development of our planet.

One of the mainstays of our work line and philosophy is investment in innovation (RD&I) which is transmitted through new equipment and

designs adapted to our clients' needs. In relation to this question, 2010 saw the presentation of the J B M - H P models

(monoblock burners up to 25 MW) which have reaped considerable market success. Furthermore, these burners are manufactured in keeping with the ATEX standard and they are being installed and well received, particularly in the petrochemical sector.

TECHNOLOGICAL INNOVATION

Another important milestone achieved in 2011 was the manufacturing of the first burner that we have developed with a triple air register for installation in vertical thermal oil boilers in thermal-solar power plants. Spain is world leader in the development of this type of facility and E&M, as could not be otherwise, is contributing to this

**Our philosophy is to
create equipment and
designs adapted to our
clients' needs**



development with these equipment items, custom designed for this application. These burners produce a special kind of flame which adapts perfectly to this kind of boiler and, above all, they attain very low NO_x emissions. We shall talk more extensively about these new designs in an article focussed exclusively on this type of project.

Likewise during 2011, we concluded the I+DEA 2 project, carried out over 4 years and funded in part by the Centre for Industrial Technological Development in Spain (CDTI, after its initials in Spanish). This project, headed by Abengoa (the world's leading company in the development of biofuels and solar energy), in which burners have been studied for using different biofuels, particularly varied blends of bioethanol and bioethanol-biodiesel, will undoubtedly make us a world benchmark in the combustion of environmentally friendly fuels. One of our company's great-



Design innovation

E&M develops combustion equipment with truly innovative and avant-garde designs, creating a highly attractive product for the end client. This innovation in design combines, moreover, with an improvement in equipment functionality and performance.

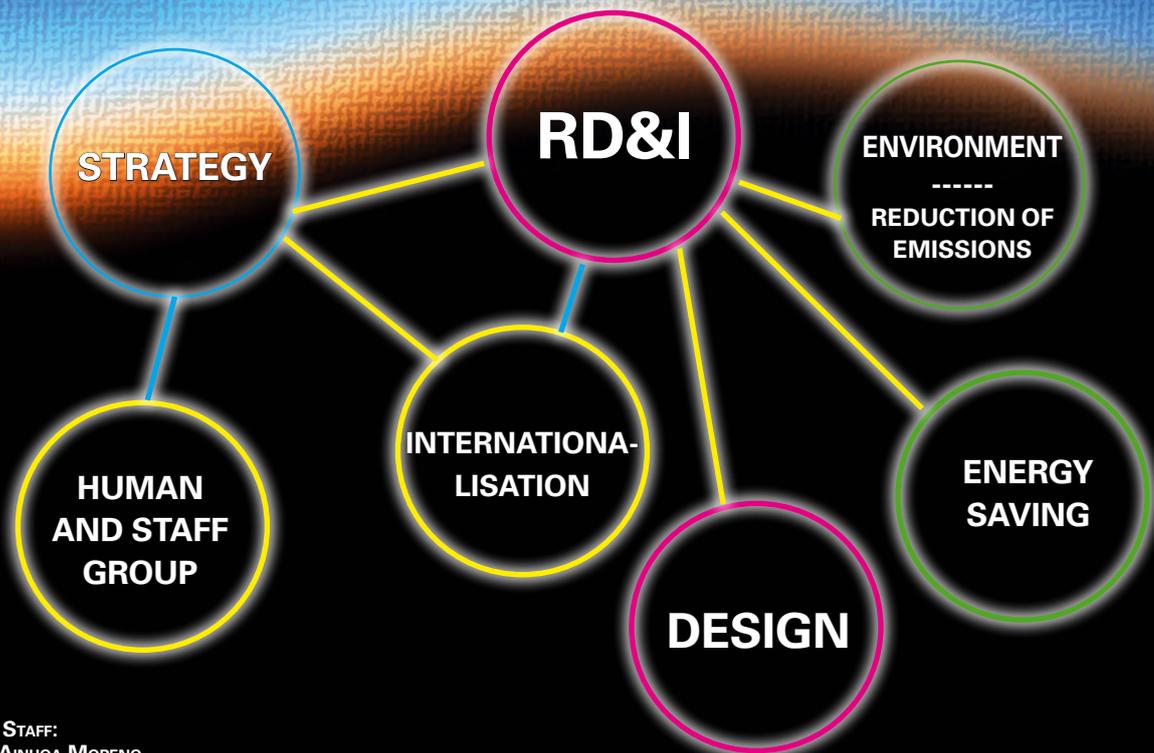
est virtues is its swift capacity to adapt its designs to clients' needs, always seeking the high-

est energy efficiency and the lowest level of pollutant emissions.

We design burners with a-la-carte flame widths and lengths, i.e. according to our clients' indications, and this is awarding us significant added value, unlike other companies that only work to standard designs. As I have briefly mentioned, other products we are manufacturing with great success are burners for areas classified as anti-explosive, both under the European ATEX standard and that of its American counterpart. This is enabling us to address various projects for the petrochemical industry in different countries around the world, with very highly satisfactory results.

INTERNATIONALISATION

Another of the mainstays of our business development is based on company internationalisation. E&M Combustión markets its equipment in over 20 countries, of which we should underline



MANAGERIAL STAFF:

LEFT-RIGHT: AINHOA MORENO,
RAÚL GIL, AITOR JAUSORO, IÑIGO BÉJAR,
IRENE CARRANZA AND AITOR FERNÁNDEZ.



THE COMPANY'S FACILITIES IN ARTEA ARANTZAZU.

our presence in China, with the opening of our first sales office outside Spain. It is, undoubtedly, our greatest international commitment in a country with spectacular growth potential, where important investments will most certainly be required in environmental matters and where we think we can provide our low pollutant emission technology and become benchmark suppliers.

But it is not only in China where E&M is undertaking projects. Throughout last year, we also received visits from clients or collaborators from other countries such as Russia, Iran, Pakistan, Morocco, etc., as well as from a number of European companies.

The I+DEA 2 project has made us a world benchmark in the combustion of environmentally friendly fuels

Companies and people from different cultures from whom we wish to carry on learning and who always find E&M Combustión staff willing to forge successful collaboration projects.

Our business philosophy is based on honesty and sincerity

and always highlighting collaborations as the way forward to success. We do not want to sell equipment just for the sake of selling, at any price or in just any way, simply to meet sales targets, as some of our competitors do; but rather we are seeking collaborators where human values are a point of reference and where close bonds are established be-

yond mere business or sales relations. We understand that this is the basis of success and it is what makes us grow every year and makes us different from the rest. From here, we invite you to come and get to know us, because we will most certainly not let you down.



OUR STAFF RECEIVE CONTINUOUS PROFESSIONAL TRAINING TO KEEP THEIR SKILLS AND QUALIFICATIONS PERMANENTLY UP TO DATE.



THE ADMINISTRATION BUILDING OF THE SALVADOR ALLENDE HOSPITAL, POPULARLY KNOWN AS "LA COVADONGA".



Aitor Fernández

Project Engineer
Head of the Automation Department
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Incinerators for Cuban hospitals

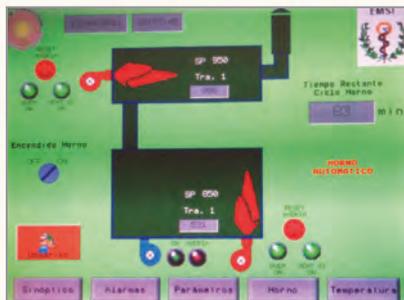
High-technology solutions to join social responsibility and the environment

Two years have gone by since E&M Combustión, S.L. (E&M) addressed the possibility of collaborating with the Cuban Ministry of Health (MINSAP). The scope of said collaboration was to supply materials for the construction of incinerators for hospital waste and their automation. The design, development and construction of the incinerator would take

place in Cuba, performed by the team led by the engineer Osvaldo Morua, while E&M would focus on supplying low power burners, instrumentation and control of the equipment based on a touch screen PLC.

Given the special characteristics of the environment and their situation, the Cuban people are en-

dowed with great creativity. This creativity, together with the technology we have at our fingertips in Europe, has led to the provision of high-tech solutions in areas in which E&M was not present. At present, the Cuban society is addressing topics which have been the subject of debate in Europe for some time, one of which is respect for the environment. In



TOP, SYSTEM CONTROL SCREEN.
 BOTTOM, DETAIL OF THE INCINERATION BURNER AND TEMPERATURE PROBE.
 RIGHT, BUILDING HOUSING THE INCINERATOR.
 BOTTOM RIGHT, INSIDE THE COMBUSTION CHAMBER WITH THE BURNER IN OPERATION.



FEATURES OF THE FACILITY

- Entry into service: April 2011
- Maximum temperature: 1150° C.
- Total power of the burners: 1.200.000 Kcal/h
- Combustion chamber volume: 10 m³ (aprox.)

this case, we are talking about a reduction in emissions of pollutants into the atmosphere and waste processing.

For materials employed in hospitals and biological waste, the alternative to processing is incineration and this means doing so under parameters that imply not issuing pollutant particles. This process is performed as follows: The waste is introduced into a combustion chamber, it is incin-

erated by a burner which reduces it to inert ash and the smoke produced as a result of the combustion passes through an oxidation chamber where it is subjected

to high temperatures in order to reduce its impact on the atmosphere.

The process is controlled by a

PLC that receives readings from several probes and acts on the burners to maintain the temperature at the level set. The machine can control the process automatically based on an order given by an operator or it can be activated manually from the touch screen.

The system likewise provides us with information on the state of the elements, alarms that have occurred and graphs of the temperature readings. Research into other solutions is ongoing and these will be addressed as new projects in the future, both in the environment protection field (washing smoke prior to it being emitted into the atmosphere) or to do with energy saving (exploitation of the temperature of smoke from other processes).

E&M took on this project as one of collaboration with the Cuban institutions involved, offering high level solutions at the most competitive price. This relationship has always been addressed taking a strategic approach. The response received has been highly positive, not only in profes-



Salvador Allende Hospital, Habana*

In 1895, the famous Asturian, Manuel Valle, bought the 24-ha. property where the Casa de Salud Covadonga (Covadonga Health Centre) would be built, which was immediately transferred to the Asturias Centre in Habana to be used for charitable purposes.

On 19 April 1896, the first stone was laid in what would be the health centre for Asturian citizens residing in Cuba.

The official inauguration of

the Casa de Salud Covadonga which then comprised the first three wards situated among gardens and large groves of trees, ready to receive their first patients, took place on Sunday 15 March 1897,.

The remaining wards were built afterwards to reach the 40 that make up what is today the Dr. Salvador Allende Clinical/Surgery and Teaching Hospital. It took this name on 15 September 1973, in posthumous tribute to the memory of the constitutional president of Chile.

It currently employs over seventeen hundred staff, of which 245 are doctors representing all specialties (except neurosurgery and burns injuries), almost all of which are in the teaching category, and around 400 nurses, most of whom hold nursing degrees.

*Source: Cubahora



OSVALDO MORUA (ENGINEER) FLANKED BY TWO MEMBERS OF HIS TEAM (RICARDO AND ANTONIO), TO THE LEFT THE WRITER OF THESE LINES.

sional terms, but it has contributed to forging personal bonds and creating a comfortable work environment, despite the distance and the added difficulties

to a new project for both parties. From E&M, we offered our know-how to the undertaking of this project which has matured over time and from which new pro-

totypes will be developed which will be implemented in the short term and these will translate into a continuous supply of equipment and technology.

Irene Carranza

Purchase Manager at E&M Combustión

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“E&M Combustión is committed to flexitime to cater for childcare and to improve performance at work”

+ [PROFILE]

Irene Carranza

is a graduate in Business Management, and specialised in Marketing.

She is married with three children, who are 8, 4 and one and half. She speaks Spanish, English and French and has worked in the marketing departments of a variety of industrial companies. In 2000, she made the leap to the Purchasing Department, first, in an automotion business and, since April 2008, she has been working as Purchase Manager at E&M Combustión.

What is your function in the company?

I manage purchases: bid requests, negotiation of prices and deadlines, drawing up estimates and controlling merchandise.

What is a normal working day like in E&M Combustión?

You cannot talk about a normal day in this sector as you are constantly required to adapt to clients' needs and so, every day is different. The usual activity consists in looking through and replying to emails, updating the latest developments in the administration department and following up the different projects, either by telephone with the suppliers or checking the relevant information on the internet.

How do you manage to reconcile your intense professional activity with family life?

I have two formulas: a wonderful

husband, with a contemporary outlook, who works fifty-fifty with me at home, and an exceptional timetable at E&M Combustión, concentrating the entire workday into the hours from 8 am to 4 pm; this allows me to see to my children in the afternoon, while I have somebody in to look



Reconciling is easier when you have a good timetable and a husband who collaborates”



I do not feel ignored because I am a woman. My professional opinions are taken into account”



after them in the morning. I admit that this timetable is not the norm in most companies.

What are the main difficulties you have to face on a daily basis?

It is hard to disconnect when I leave work for home and have to concentrate on a mother's chores, to fight the physical and mental fatigue, as well as the difficulty in matching working hours with school hours and the summer, Christmas and Easter school holidays.

What is your relationship with your colleagues? Do they treat you differently because you are a woman?

I have a very good relationship with my colleagues and boss. We are on friendly terms and in no way am I treated differently for being a woman. There is no male chauvinism in the company. They take my professional opinions into account and I am not ignored because I am a woman.

How has your professional situation changed with respect to former generations?

My grandmother was widowed with four children after the Spanish civil war and she had to work as a seamstress. My mother worked from a very early age in a hairdressing salon and she had five children. But she was supported by my father, and my grandmother and aunt who lived with us. I can see the generational change in the fact that, before, families were larger and women had permanent support at home. Now, however, women workers do not have the support of other female family members to help them raise their children. My mother was modern and made sure we had a contemporary education and that we went to university.

Do we need men to take on responsibilities in



Extending paternity leave has meant progress for everyone

A female executive is not always able to live out her pregnancy in a natural way and enjoy her maternity leave by delegating to her team. The 16 weeks of maternity leave existing in Spain are often insufficient. "Maternity leave is considerable for the company but insufficient for the mother". In fact, maternity leave is the only leave programmed, the only one that the company can foresee, as the usual accidents are not foreseeable. You know when it starts and when it ends and you can therefore manage it. "In my case, my position was covered by dividing out the tasks among other staff members", Irene concludes.

"For the mother, 16 weeks of maternity leave are insufficient but, given the situation, you cannot ask for more. The coming into force of the Equality Act in 2007 and the increase in paternity leave from two to fifteen days has meant progress for everybody. It is a great advance to help raise fathers' awareness and make them a part of this moment".

order to reconcile private life and work?

Reconciliation and the collaboration between men and women are vital. One of the two parties in the couple cannot be expected to take charge of everything. It is a lot of work for only one of

them when they are both working out of the home.

Do you believe that professional activity delays pregnancy?

It is obvious that women put off having children. Before, at the age of 25, families already had one or two children. I had my first daughter at the age of 30 and the last child at 38. In our community, this is what generally happens although, in other regions, or in the case of less qualified people, it may be different. In addition, we are less self-sacrificing than our parents and more demanding. We want everything organised before we marry. The created needs are tremendous



Women are making great strides. More is demanded of them and they are better qualified"

Do women put family welfare before success at work?

Women make greater sacrifices in caring for their family. Nowadays, it is women, to a considerably higher percentage, who cut down on their working hours or give up work to look after their children.

So it is more difficult for women to rise in their career?

In general, women are more willing to sacrifice their career. But women are making great strides. More is demanded of them and they are better qualified to overcome difficulties. In the case of learning a second or third language, they are the ones who make the greatest effort. For example, when I was studying French, 90% of the students were women.

What are your interests and leisure activities?

These days I devote my leisure time to my children and do the things they enjoy doing.



Proceeding in China as you would do in your own country is the biggest mistake”



Efficient, quality and long-lasting products have business opportunity”



JUERGEN PRAEST WITH ÍÑIGO BÉJAR AT THE INAUGURATION OF THE BRANCH IN NANCHANG IN 2009

Juergen Praest

Manager of E&M Combustión China

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E&M Combustión in the Chinese market

In addition to the language, what other difficulties does a foreign company usually come up against when it arrives in China?

The Chinese market is huge and many companies are unsuccessful because they retain an excessively outside viewpoint. They typically proceed in China as they do in their own country and that is the biggest mistake one can make. It is necessary to follow the rules of this country and act at all times like a Chinese company would, not like a foreign company. Setting up a company here

requires an awful lot of paperwork and many civil servants make up their own rules, and we have to comply with them all. Even if some civil servants do not know what the others are doing, a foreign company has to deal with all of them and try to carry out all the formalities.

Is it necessary to know how to speak Chinese to be successful in this country? How long does it take to gain a command of the language?

It is possible to learn standard Manda-

rin Chinese in approximately two years, studying full-time two days a week. It is not essential to know the language, but it helps when one understands a little.

It is necessary to trust your translator or things end up “lost in translation”. If you find a good translator (something not too easy) it is necessary to trust them and not let them get away. Furthermore, there are so many dialects in China, that people from one town may even not be able to understand the dialect of another.

Are you detecting business opportunities at this time? In which sectors?

The biggest opportunity lies in the environment sector, where E&M Combustión is already operating. However, if pollution continues to rise like at present, perhaps it will be the production of anti-pollution masks and air filtering and cleaning products, (ha, ha!). In truth, the biggest business opportunities in China are efficient, quality and long-lasting products, when you manage to sell and explain to customers why they have to assign more money to this type of product.

Which are currently most active cities or provinces for your activity sector?

Beijing, Shandong, Tianjin, Hebei, Liaoning, Jilin, Heilongjiang and Inner Mongolia are now our top priority provinces, but we are exploring in all directions.

What is the best and the worst thing you have encountered as an expat?

The best has been my wife and the hardest is perhaps the hospitals and the car drivers

Since when has E&M been present in China?

E&M has been in China since 2009, although we began working in this market in the year 2007

Do you find the professionals in your sector of activity in China are suitably qualified?

Not really. The biggest problem is the lack of professionals in some activities.

What is ordinary life like for expats in China? From the professional and personal viewpoint.

On the professional side, it is necessary to completely change your way of thinking about the things you have heard about. The best way of getting to know clients is through working dinners, when you usually drink Chinese white wine, toasting with the client. Getting to know the culture and traditions of the Chinese people is the best way to learn their needs and to adapt



E&M COMBUSTIÓN HEADQUARTERS IN CHINA.

to the customs of the country. Personal relationships are so important that they, in themselves, account for 60% of the possi-



Institutional support

¿Do you think that foreign trade institutions like Spain's ICEX or others are helping companies operating in China? What would you ask them to do for companies?

The institutions initially lend their support by providing basic information about what to do and how to do it and they arrange meetings with potential clients. Then, they continue providing assistance, but we miss a little more personal support when the time comes to create a company in this country.

bilities of managing to do business. In the personal aspect there are only two options when living in China: Either you love it or you hate it. I love it and I have integrated in China. Otherwise I would not still be here after over eight years, but I have seen people leave their job after a fortnight because it was too much for them.

Do you enjoy Chinese gastronomy and the leisure activities in this country? What do you recommend to those who have just got here?

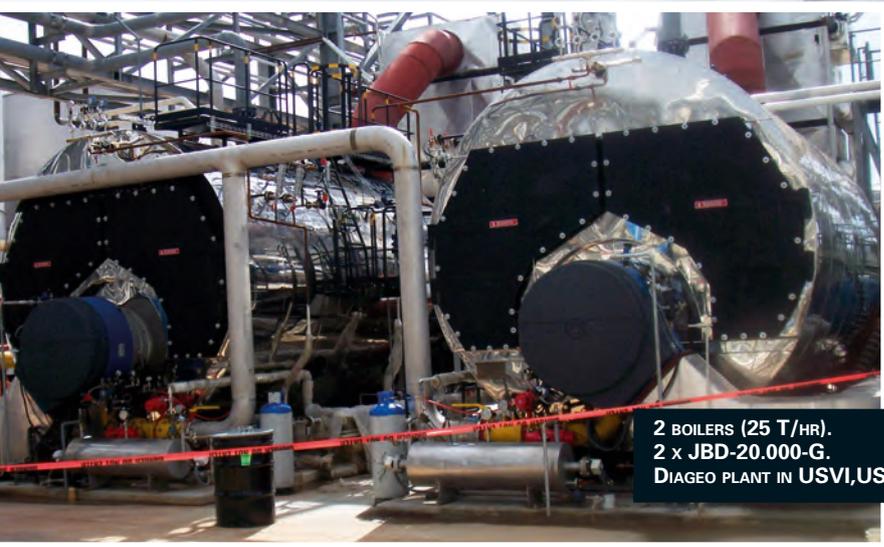
Personally, I enjoy Chinese gastronomy, although it is necessary to get used to spicy food. I have many Chinese and foreign friends who I go out with regularly and we have fun in bars, pubs or dining out. If you are accepted, you receive many dinner invitations which bring you closer to the customs of China and its culture. As a recommendation for people coming here for the first time, I would tell them to try to find pleasant places to stroll, to discover the best dishes in their cuisine and to gradually embrace Chinese culture.



STEAM WATER-TUBE BOILER (60 T/HR).
JBD-50.000-G BURNER.
ABENGOA SOLAR PS-20 THERMAL SOLAR POWER PLANT.
SEVILLE, SPAIN.



20 MW HEATER
1 x JBD-20.000-G.
FOMESA FACTORY.
VALENCIA, SPAIN.



2 BOILERS (25 T/HR).
2 x JBD-20.000-G.
DIAGEO PLANT IN USVI, USA.



THREE 4.5 MW HOT WATER BOILERS.
3 JBM-6.000-G MONOBLOCK BURNERS.
NOVGOROV, RUSSIA.

TWO 7 MW HOT WATER BOILERS.
2 JBM-8.500-G MONOBLOCK BURNERS.
BONNYSA FACTORY, RUSSIA.

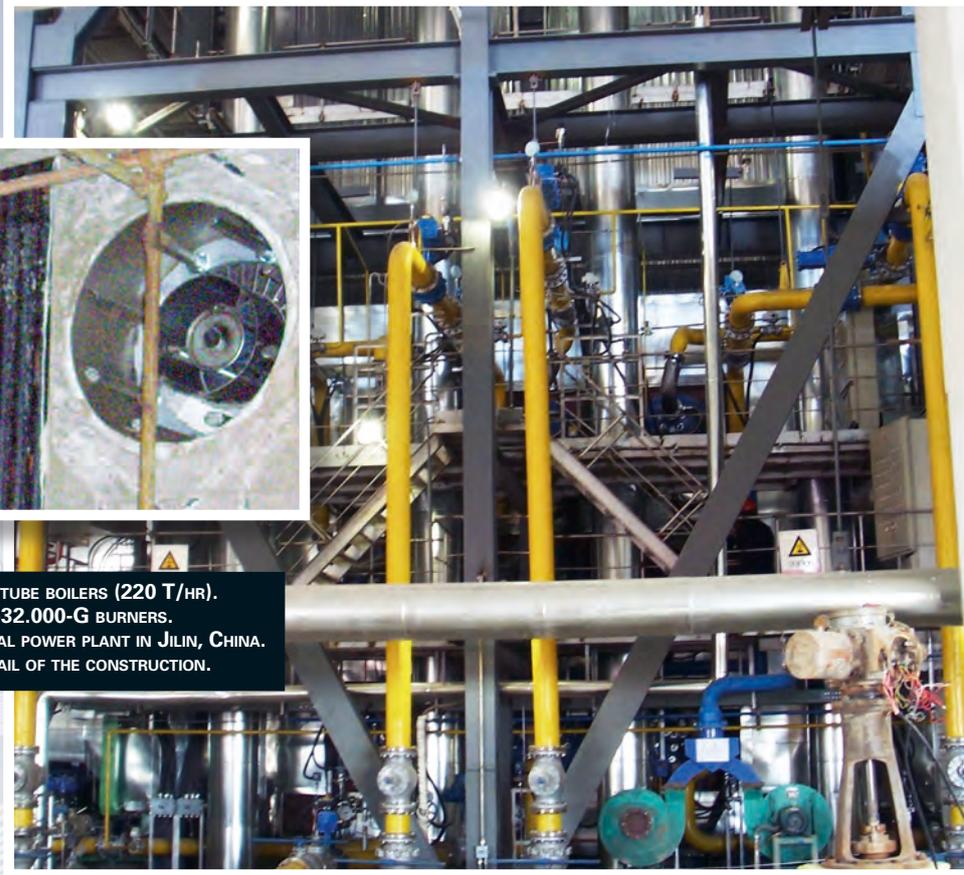
1 WATER-TUBE BOILER (12 T/HR).
1 x JBD-8.500-G.
FORMICA FACTORY.
GALDAKANO, SPAIN.



AIR VEIN BURNER
(3,000,000 KCAL/HR).
RENFE PAINTING FACILITY.
MADRID, SPAIN



**2 WATER-TUBE BOILERS (220 T/HR).
18 JBD-32.000-G BURNERS.
ELECTRICAL POWER PLANT IN JILIN, CHINA.
TOP, DETAIL OF THE CONSTRUCTION.**



ERS.



**WATER BOILERS.
G MONOBLOCK BURNERS.
RY, SPAIN.**



**4 MW HOT WATER BOILER.
JBD-4.500-G MONOBLOC BURNER.
BOSCH & SIEMENS FACTORY.
ESTELLA, SPAIN.**



**MULTITUBULAR STEAM BOILER (25 T/HR).
2 x JBM-11.500-G.
SIDENOR FACTORY. BASAURI, SPAIN.**

IES.

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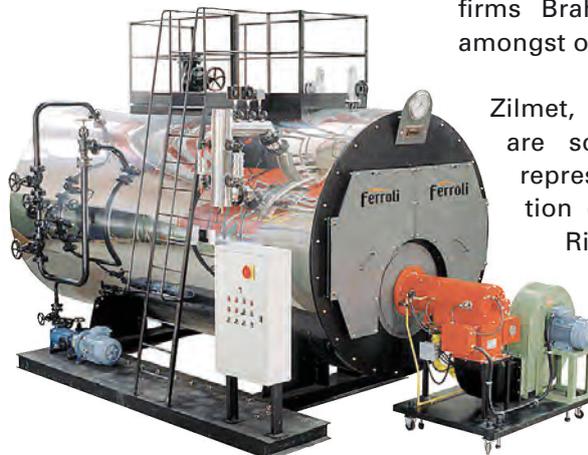
26,000 product references of parts for oil and gas burners and boilers



PHOTOGRAPH OF THE WAREHOUSE (ABOVE) AND
DETAIL OF THE BOILER AND BURNER (RIGHT).

Distribuciones Suner S.L. was founded in 1990, thanks to the experience of our manager, Emilio López-Davalillo, who has over 30 years' knowledge of the sector. This experience has helped us to know the problems professionals come across, particularly in the maintenance area, and to offer solutions in terms of product, price and service.

Our company has managed to attain over 26,000 part product references, both for oil and gas



burners, and for boilers, becoming consolidated as the leading company in the marketing of these products and at highly competi-

tive prices at international level.

The availability of this wide range of products is guaranteed through our installations which occupy 4,000 sq.m. spread between Pamplona, Madrid and Bilbao, which enable us to hold a permanent stock and guarantee our products are delivered within 24 hours.

We are the official distributors for Spain for Suntec pumps (France), HP Technik (Germany), Steinen pulverising nozzles (USA-Germany), Danfoss (Denmark) and Delavan (USA). We distribute directly for the Italian firms Brahma, Cofi and Fida, amongst others.

Zilmet, Wilo and Grundfos are some of our brands represented in circulation circuits, although OR Rigamonti, Caleffi and Kramer are also examples of parts for these installations.

Our best guarantee are the international brands we represent; large multinational firms whose quality is demonstrated and fully acknowledged at international level.

LOW NO_x technology for thermal solar power plants



Aitor Jausoro

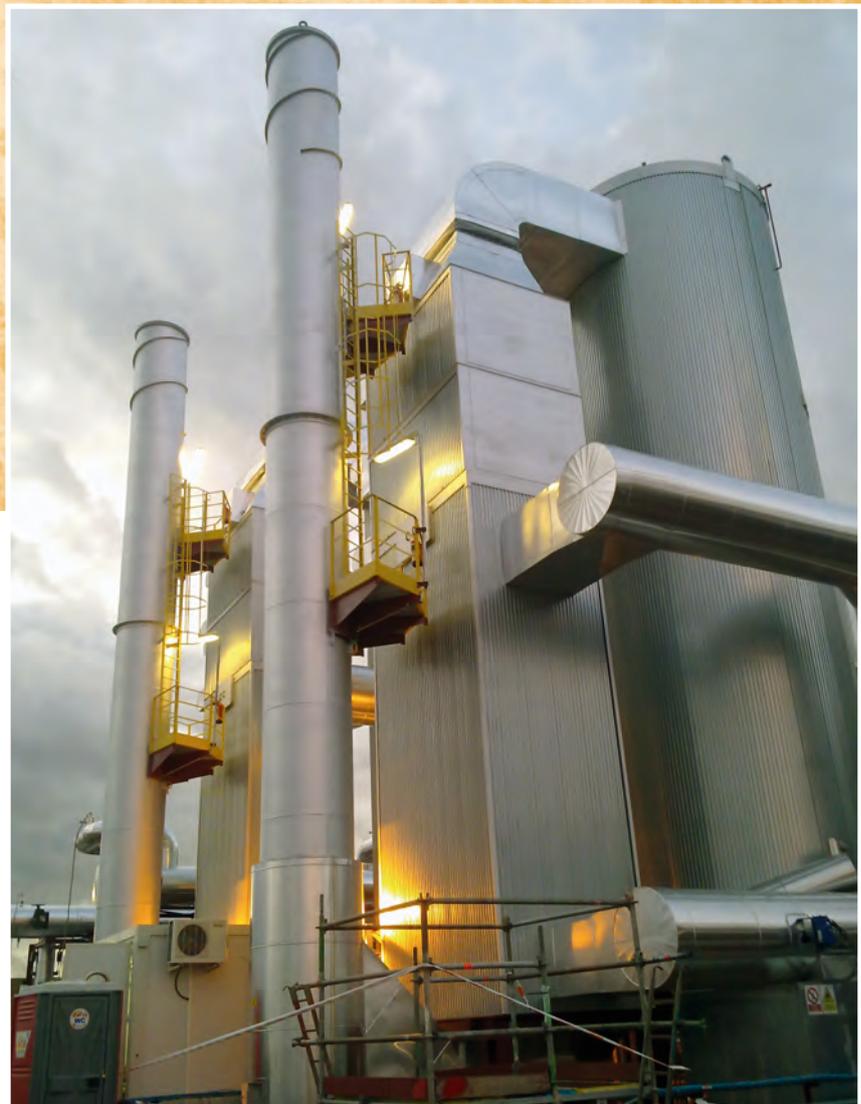
Technical Manager,
founding partner of E&M Combustión
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Since its early days, E&M Combustión has been committed to the development of burners with the lowest possible pollutant emissions, while at the same time also committing itself to partici-

**Spain is one of the
pioneer countries in
thermal solar power
plant technology**

pation in R&D projects, above all in the field of renewable energy sources as an alternative means of producing electricity.

Within this field of renewable en-

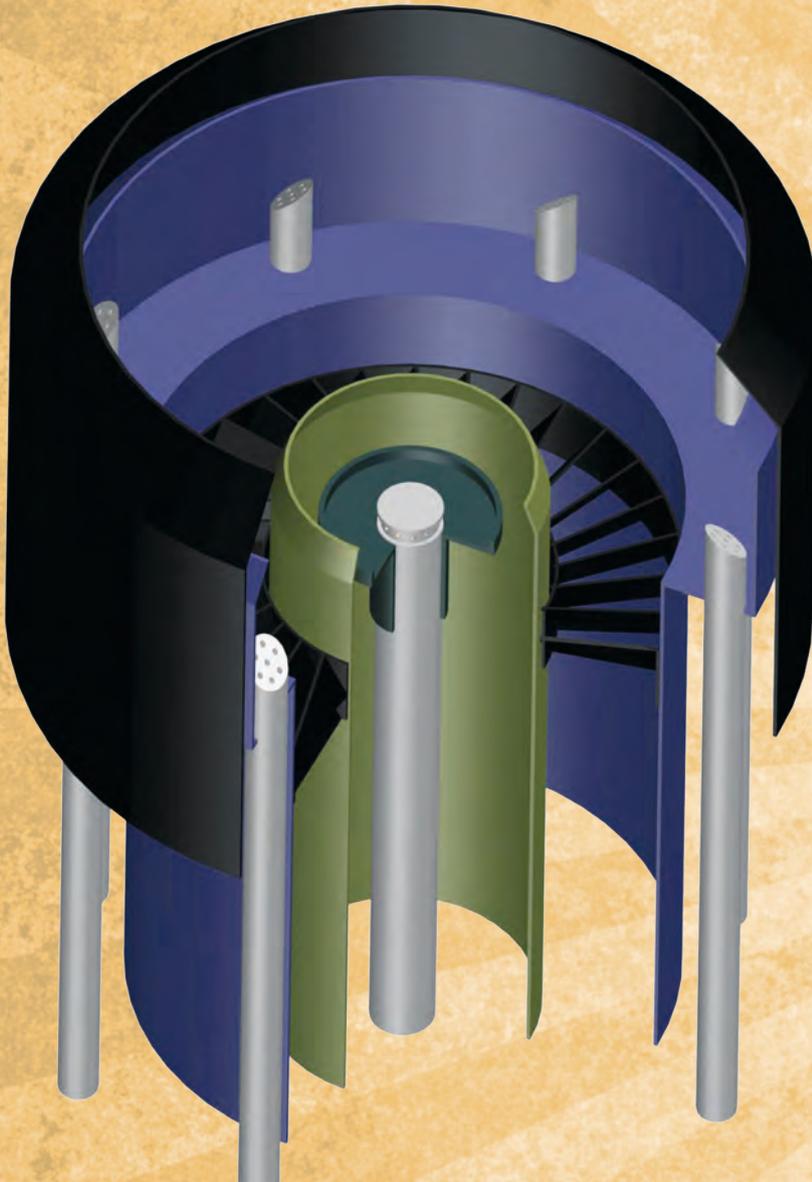


25-MW THERMAL OIL BOILERS AT THE SOLACOR I PLANT, CÓRDOBA (SPAIN).

ergy, E&M Combustión has a significant presence in the thermal solar power plant sector, where Spain is one of the pioneer countries in this technology.

Hence, E&M Combustión has been involved both in the de-

velopment of plants combining tower and heliostat field technology, such as the PS20 solar plant in Sanlúcar la Mayor (the second power plant in the world with this kind of technology) and in the development of plants with HTF technology.



Our new JBD-40.000 G burner design is in the equipment for the Solacor I and II, Helios I and II and Solaben III and IV plants

modulation range of no less than 1:10.

E&M Combustión intended from the very beginning to simplify the installation works of said burner, as well as the safety of the people who worked in the boiler area. When working in combustion air at approx. 200° C and it being a burner located in an easily accessible area, it was thought that it was a hot spot that could cause burns to the staff in the area. To avoid this, there was one of two possible solutions: One, the traditional approach of insulating the burner by lagging it externally, once fitted in the boiler, or a more novel approach, which is to design the burner with 50mm internal insulation comprising calcium silicate fibre-glass, all covered inside by a 1mm-thick stainless steel sheet. It was eventually decided to go for the second option because it offered several advantages in the financial aspect, facilities for accessing the inside of the burner for maintenance work, greater simplicity in assembly, faster installation, fewer staff having to handle the burner, amongst other qualities.

E&M Combustión's participation in the PS20 solar plant project has led it to develop a 50 MW burner to work with LNG and with NOx emissions of less than 100 mg/Nm³ and a wide modulation range of 1:25, which provides it with great accuracy in controlling the steam pressure in the facility.

At E&M, we are involved in power plants with tower and heliostat field technology and plants with HTF technology

facing E&M Combustión in developing thermal solar plants with HTF technology, consisted of designing LNG burners for 25 MW Sugimat vertical thermal oil boilers at a working temperature of 390°C. Said burner had to work with combustion air at a temperature nearing 200°C and have NOx emissions of less than 150 mg/Nm³ at 3% O₂ and a

On the other hand, the challenge

Another of the challenges which they faced was that of lowering the NOx emissions from 150



mg/Nm³ at 3% O₂ working with combustion air at approximately 200°C. To achieve this, the simplest but the most expensive solution was to resort to external recirculation of part of the combustion gases which implied installing additional pipelines for conducting said recirculation gases and regulation and control systems. E&M preferred to work on the variant of modifying the design of the combustion header in order to try achieve this because this made the installation a simpler process. Lastly, and after several tests, it was opted for introducing tertiary air into the combustion to thus perform combustion in three stages, reducing the NO_x emissions to below 150 mg/Nm³. This tertiary air enabled the flame, moreover, to have a very long and compact shape, which is necessary in this type of vertical boiler in order to achieve uniform heat distribution throughout the chamber. The burners designed also achieve a great combustion performance when working at maximum points of 1-1.5% excess O₂ with



CO levels below 100 mg/Nm³.

This new design of JBD-40.000 G burners has been used for the equipment in the Solacor I and II, Helios I and II and Solaben III and IV solar power plants.

LEFT. SECTION IN 3D. TRIPLE REGISTER BURNER HEAD OF LOW NO_x AIR FOR VERTICAL BOILERS.
TOP. OUTSIDE OF THE INSTALLATION.
RIGHT. DETAILS OF THE INSIDE OF THE INSTALLATION.
BOTTOM. JBD 40.000 G DETAILS OF THE BURNER.



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Advanced industrial combustion monitoring techniques



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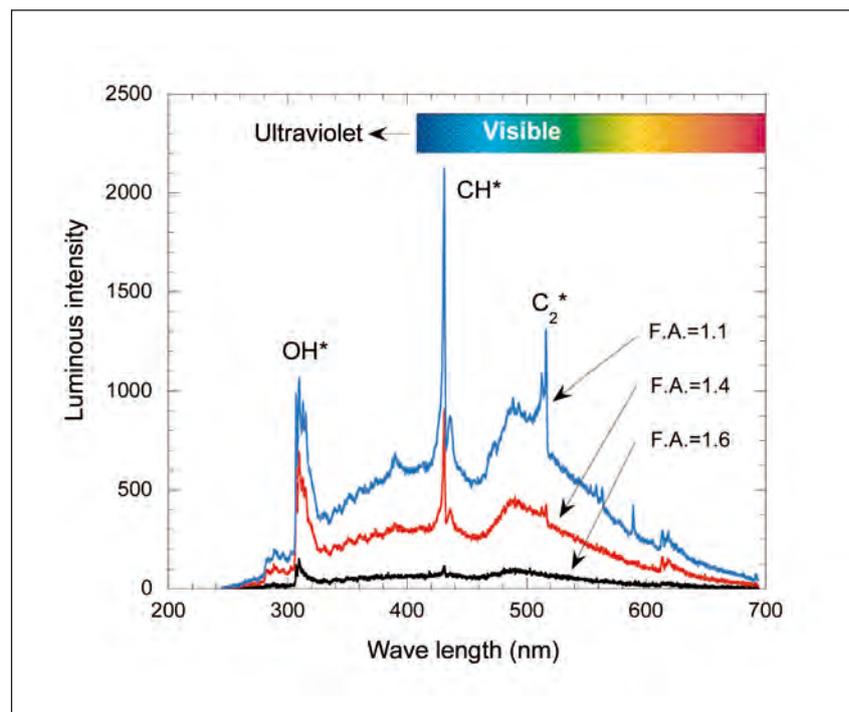


FIGURE 1 – GAS FLAME EMISSION SPECTRUM WITH DIFFERENT AIR FACTORS.

1. INTRODUCTION

The development of advanced control systems capable of optimising burner performance on an ongoing basis could be highly beneficial in terms of efficiency, pollution reduction and flexibility of operation. However the actual possibilities of monitoring and optimisation systems for industrial combustion equipment remain highly limited. Burner supervision and control is generally based on a compulsory flame detector plus an analysis of flue gases. The data provided are usually insufficient for real, ongoing burner monitoring (e.g. to minimise NO_x, adapt

equipment to variations in fuel or correct drifts in operation), and adjustment and optimisation operations have to be carried out by specialist technicians in the course of one-off or scheduled checks.

This lack of capacity for supervision and control of industrial burners has given rise to a number of papers in recent years. The main obstacle is the lack of information on the actual status of the flame, which prevents efficient, reliable, safe adjustment of the burner with no risk of stability problems or loss of flame. The main challenge is therefore to

develop new forms of monitoring that can provide information on the actual status of the flame at any given time.

This paper briefly reviews various techniques that have been proposed in recent years for the supervision of industrial flames. They can be described as emerging technologies, and with a few exceptions they are still under development or at most at the pre-marketing stage. Some methods are illustrated by means of studies conducted by LIFTEC, which has been investigating such techniques over the past ten years, sometimes

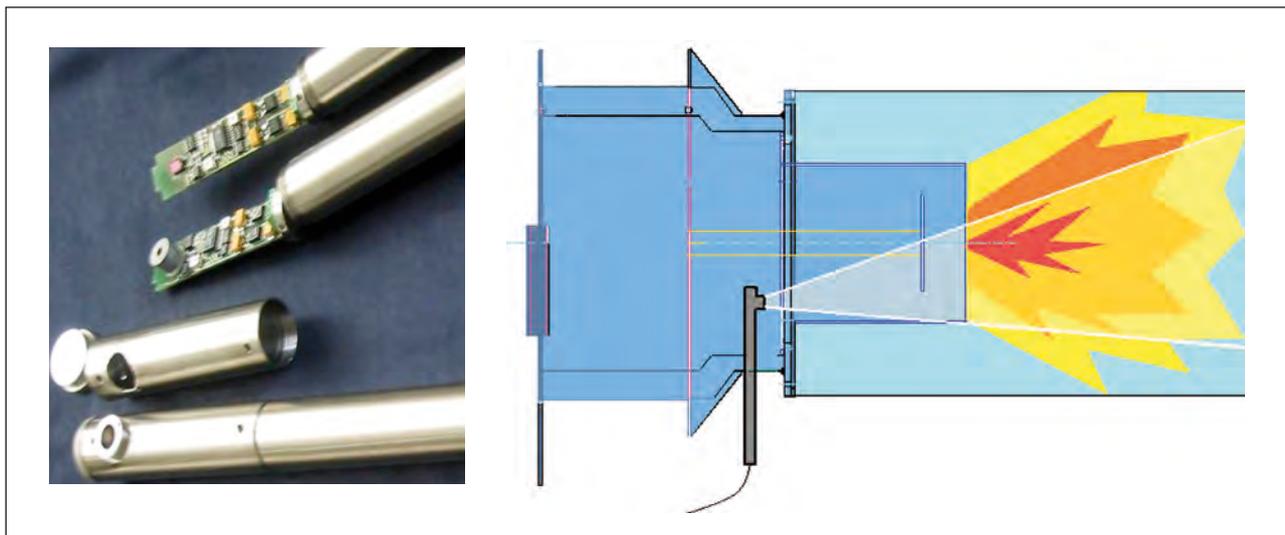


FIGURE 2 – OPTICAL HEADS AND THEIR LOCATION ON THE BURNER.

in co-operation with E&M Combustion. The paper “Diagnostic techniques for the monitoring and control of practical flames” published in *Progress in Energy and Combustion Science* (vol. 36, 2010) presents a more extensive review of the matter.

2. RADIATION SENSORS

It is well known that flames spontaneously emit light radiation, the characteristics of which vary in line with the properties of the

flame. This provides the operating principle for some of the methods developed in recent years for monitoring industrial burners.

The radiation emitted by flames is caused by two effects. Incandescent particles generate continuous emissions, described by Planck’s law, which give flames their orange or reddish colour with suspended solids (soot, ash). This effect is not present in

blue, gas flames, the light from which stems from chemiluminescence: certain radicals generated during chemical reactions emit light in narrow bands of the spectrum. The main radiation peaks are those shown in Figure 1: the radical OH^* limits in the ultraviolet, CH^* in the blue (giving gas flames their blue colour) and C_2^* is responsible for the greenish colour of flames with little excess air. As can be seen in Figure 1, the emission spectrum

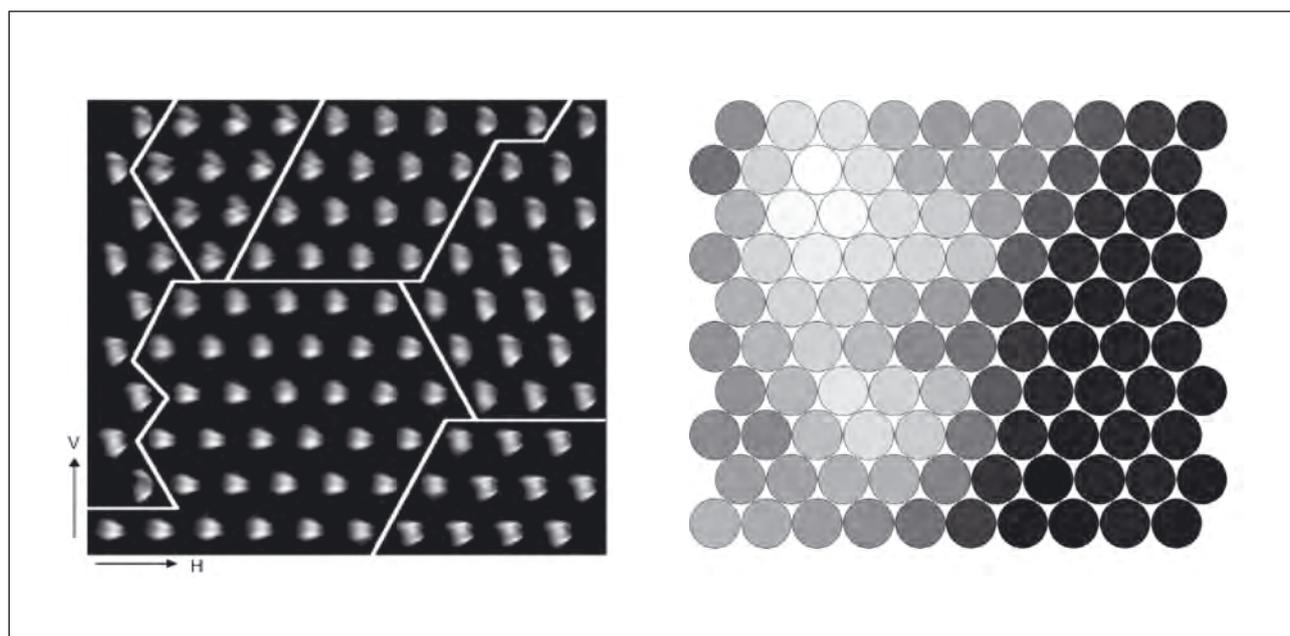


FIGURE 3 – KOHONEN MAP OF DIFFERENT FLAME IMAGES (LEFT) AND NO_x EMISSIONS ASSOCIATED WITH EACH ONE (RIGHT, ON A GREY SCALE: WHITE = 44 PPM, BLACK = 14 PPM).

of a flame, which defines its colour, depends on operating conditions. This effect may be used in the opposite way: a method can be developed for diagnosing combustion status and based on measurements of the light emitted by the flame.

E&M Combustion and LIFTEC have worked together to develop this type of flame monitoring technique. Figure 2 shows the optical heads developed and how they are installed on an actual burner. In this case 4 photo-sensors were used which were designed to record the radiation emitted in 4 bands: ultraviolet, blue, green and infrared. The heads comprise the photo-sensor and the signal conditioning electronics. Their robust design means that they are suitable for installation on industrial equipment.

3. FLAME IMAGES

The appearance of the flame can often reveal a great deal about combustion conditions, so visual inspection is usually an important element in burner adjustment. This idea provides the basis for various flame monitoring methods based on the capture and processing of images.

Flame image analysis has aroused considerable interest in recent years for various reasons. There are numerous video cameras on the market that are suitable for use in industrial environments and their cost is steadily dropping. Similarly, continual improvements in calculation resources make image analysis perfectly feasible with low-cost equipment. These technological



> LIFTEC:
500 KW THERMAL
MULTI-FUEL TEST BED.

Fluid Dynamics & Combustion Technology Research Laboratory (LIFTEC)

LIFTEC is a research centre run by the CSIC (Higher Council for Scientific Research) and the University of Zaragoza. Since its founding in 1991 it has focused its work on the fields of energy, combustion, the environment and applied fluid dynamics. The Centre combines more basic lines of work with applied research

advantages make it viable to develop a wide range of relatively sophisticated procedures for linking the visual appearance of flames to their characteristics. In some cases characteristic parameters of the flame image geometry (length, width, angle, etc), colour or intensity are measured and then correlated with such important variables as the air/

projects conducted
incorporation with
numerous other research
centres and businesses in
Spain and elsewhere in
Europe.

In the field of industrial combustion, LIFTEC has several experimental and pilot facilities where it conducts a wide variety of studies. Chief among these facilities are a 500 kW multi-fuel plant (gas, liquid and pulverised solid fuel), a 100 kW laboratory combustor, a 60 kW pre-mix combustor, a laminar flow reactor for studying the combustion of particles and a flat-flame burner combustor for studying the combustion of drops.

fuel ratio, the proportion of unburnt products or the amount of pollutants emitted. In other cases the image as a whole is analysed to identify the combustion status moment by moment and thus determine the parameters of interest.

Figure 3 shows some results obtained at LIFTEC which illustrate

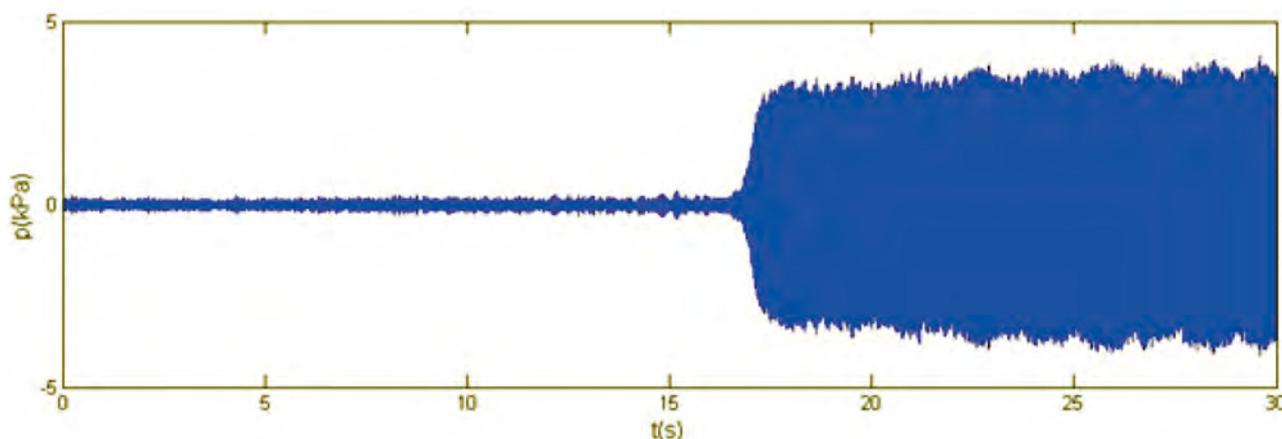


FIGURE 4 – PRESSURE (SOUND) RECORDING ON A LIFTEC PILOT BURNER, SHOWING THE SHARP INCREASE IN INSTABILITY IN COMBUSTION.

this second option. The figure on the left is a Kohonen map (and artificial intelligence technique widely used in pattern recognition) in which images of various flames are grouped according to their degree of similarity. The image on the right shows the NO_x emissions associated with each one. The fact that adjacent flames (which therefore have similar appearances) have very similar NO_x emissions is evidence that the geometry of a flame is closely linked to its properties. The diagnostic procedure entails capturing an image of the flame at a given time and classifying it according to the Kohonen map, thus estimating all its parameters (air factor, emissions, etc.). Trials conducted in pilot facilities have provided very good results for a wide variety of situations (gas and liquid flames, diffusion and pre-mix type burners, stable and unstable flames).

4. PRESSURE FLUCTUATIONS

The ability of flames to produce sound due to the sudden expansion of gas as combustion takes place at different points in the flame is also well-known. All the small, local sound sources within a flame combine with the acoustic properties of the combustion chamber to produce a noise whose loudness and pitch

change according to operating conditions. The link between the sound produced and the status of the flame provides the basis for some monitoring techniques, which use sound recording to obtain a “footprint” characteristic of a particular combustion status. The status of the flame moment by moment can be diagnosed by comparing the sounds recorded with a pre-stored database.

Analysing pressure fluctuations is a particularly interesting way of assessing the degree of stability of a flame and detecting the appearance of instability. In

some circumstances there may be positive feedback between the acoustics of the system and the combustion, giving rise to a sharp increase in pressure fluctuations such as that which can be seen in Figure 4. This can have negative consequences for stability and even for the soundness of the facility itself. In certain applications (e.g. gas turbines) the dynamic pressure level needs to be monitored continuously so that corrective action can be taken if a certain threshold is exceeded.

5. GAS COMPOSITION

Flue gas composition is essential information for the adjustment of combustion equipment, since it provides evidence of such essential points as excess oxygen and emissions of unburnt products and pollutants (CO, NO_x, SO₂, etc.). There are many solutions already on the market, but new ones are also being developed that may make it possible to set up smart burner control systems. Stand-out examples include new solid-state sensors and TDLAS (tunable diode laser absorption spectroscopy). These two techniques are very different but both provide measurements of gases inside the combustion chamber, which are of great interest in designing advanced combustion control strategies.

+ [PROFILE]

Javier Ballester holds the Chair of Fluid Mechanics at the School of Engineering and Architecture in Zaragoza, and is a researcher attached to the combustion technology research laboratory (LIFTEC, joint CSIC & University of Zaragoza research centre), where he coordinates the industrial combustion laboratory. He has led numerous R&D projects run with public funding (at European, national and regional levels) and under contract with business corporations in the fields of combustion, energy and industrial fluid dynamics.

[INTERNATIONAL]

E&M Combustión undertakes the start-up of the combined cycle gas power plants for Iberdrola in Algeria and Lithuania



The plant in Lithuania comprises two 30 t/hr boilers with two JBD-11.500 G gas burners each, manufactured by Lointek. The plant in Algeria is made up of two 18 t/hr boilers, also manufactured by Lointek, with one mixed gas-diesel JBD-14.500-GLO burner each.



LEFT. THE OUTSIDE OF THE PLANT IN ALGERIA AND DETAIL OF THE BOILER ASSEMBLY.

TOP. DETAIL OF THE INSTALLATION BEING UNDERTAKEN IN LITHUANIA.

E&M Combustión awarded the contract to install a 57 Mw burner in the Azmeco methanol production plant (Azerbaijan)



This project, undertaken in collaboration with the company Farayand Bokhar, represents the second equipment manufactured by E&M of these characteristics installed in this plant. The burner will be fitted in a 62.5 t/hr water-tube boiler producing steam.

> DETAIL OF THE CONSTRUCTION OF THE PLANT IN AZERBAIJAN.

E&M Combustión awarded the contract for installing a 35 MW biomass plant for the company Saipol, in Bassens (France)

The burner model JBD-40.000-G will be fitted in a 45 T/hr torsional household water-tube boiler for burning sunflower seed husks, manufactured by Berkes, which also uses a gas burner.

[TRADE FAIRS]



27- 30 March. E&M Combustión will be attending the MCE -

Expocomfort 2012 trade fair, which will be held in **Milan**.



31 October and 2 November

We will also be at the

Heatec 2012 trade fair, which will be held in **Shanghai**.

E&M Combustión will have its own stand where it will be able to attend those companies interested in forging trade contacts with our company. Our stand will also showcase our innovative burner models.

LAMTEC Meß- und Regeltechnik für Feuerungen GmbH & Co. KG



Company name / address	LAMTEC Meß- und Regeltechnik für Feuerungen GmbH & Co. KG Wiesenstrasse 6 69190 Walldorf (Germany) www.lamtec.de	New developments	Combination probe KS1D for simultaneous measurement of oxygen (O ₂) and detection of oxidisable components (COH ₂) in exhaust gases. VISIOCONTROL for visualisation and centralised management of combustion plants all over the world. CarboSen1.000 for adaptive control of small furnaces. Lambda Transmitter LT3 a micro-processor-based measuring transducer with diagnostic functions in combination with Combination Probe KS1D. Burner-Management-System BT300 a compact burner control system for average-sized combustion plants. F300K compact flame monitoring system for comfortable and safe operation in various field of applications.
Management	Hans-Jürgen Altendorf; Bernd Jülg; Harald Weber; Olaf Winne	Production	All of the above mentioned products are produced in our LAMTEC factory in Germany.
History	<ul style="list-style-type: none"> • Formation: 1st of July 1995 as a management buy out of ABB. • Experience in the optimisation of combustion plants since 1982. • All in one hand – sensor technology and electronics. 	Competitive advantage	Comprehensive know-how in optimisation of combustion plants, broad installation base, because most of the well-known European combustion manufacturers use LAMTEC devices for control, monitoring, and regulation of modern and low-emission burners, in partnership cooperation with our customers and research facilities to tap the full potential in the field of combustion technology. Therefore, we are able to enhance the efficiency, save resources and reduce pollution. High flexibility, innovation power and the ability to resolve problems are the typical attributes of LAMTEC as a medium-sized enterprise.
Investments	<ul style="list-style-type: none"> • LAMTEC Leipzig GmbH & Co. KG; 100% subsidiary company, MBO of ABB, founding in September 1998 • Escube GmbH & Co. KG (sensor manufacturer 51%) • LAMTEC East Asia Ltd. Buchon South Korea 80%; formation in 2006 	Service	With a large number of service support points and sales outlets worldwide, we are a reliable partner tailored to the needs of our customers, we support commissioning, training remote control, on-site service etc.
Cooperation	University of Stuttgart	Certification	<ul style="list-style-type: none"> • ISO 9001 incl. Pressure Equipment Directive • TÜV-Type approval • TÜV-Suitability test for operation for emission measurements • Foreign authorization: APAVE, GOST, AGA
Number of employees	Walldorf: 70 Leipzig: 30 total: 100		
Export quota	Direct and indirect export is more than 60%.		
Product range	<p>TÜV tested and TÜV approved electronic Burner-Management-System for industrial burners including:</p> <ul style="list-style-type: none"> • Burner Sequence Control • Flame detection • Leakage test • Fuel/air ratio control • Combustion optimisation • CO/O₂ control to save energy and reduce pollution • Volume flow measurements • Fault indicator systems • TÜV approval in accordance with the 13th and 17th BImSchV 		
Contact	<p>Harald Weber Phone: + 49 (0) 62 27 / 60 52 - 41 E-mail: weber@lamtec.de</p>	<p>Ralf Lakatos Phone: + 49 (0) 62 27 / 60 52 - 40 E-mail: lakatos@lamtec.de</p>	

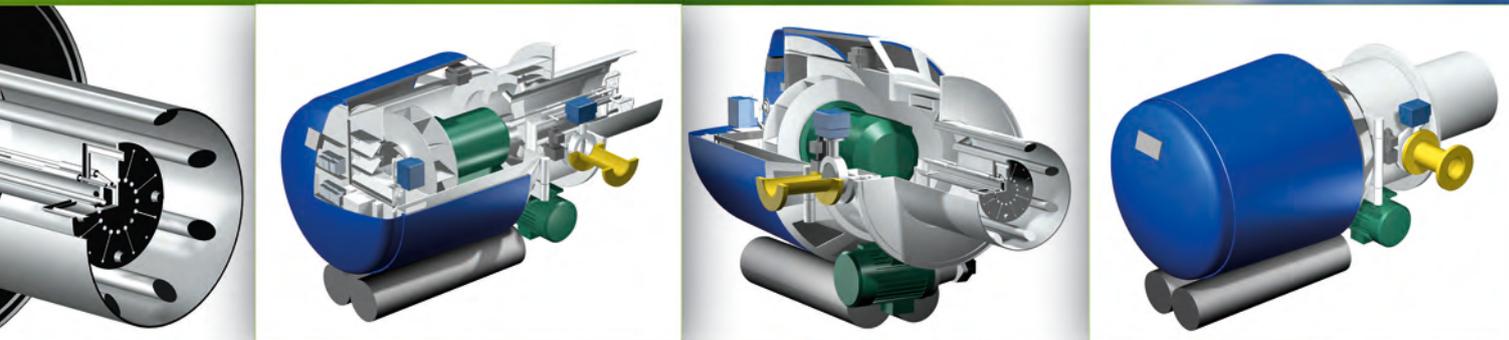


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