IFRF

# Annual Report 2013

## to members

INTERNATIONAL FLAME RESEARCH FOUNDATION

IFRF Doc N° K63/y/13
Livorno, June 2014

Annual Report 2013
Summary Financial Statements 2013

Prepared at Livorno,

in June 2014

# CONTENTS



# 2013 HIGHLIGHTS

## Technical

- IFRF investigators in parallel tests on FOSPER and CIUDEN 20MW oxy-coal demonstration facility for RELCOM
- Solid Fuel database enriched with coals and biofuels characterisation data resulting from RELCOM and BRISK activity in IPFR
- Hydrogen Combustion tests in GT burners in TAO for Enel
- ISA modified for atomisation tests in Endesa and MILD projects
- 4 technical reports issued and 2 Industrial Combustion articles published
- Two TOTeMs and numerous National Committee events held

## Member Services

- Guide to IFRF Experimental Facilities published
- Phase one of IFRF Website revamp completed and launched
- New Membership Policy document ratified by Joint Committee
- BRISK/EFRI Facilities database launched
- Collected papers from MC 15, 16 and 17 published
- 26 issues of MNM published
- 64 reports ordered

## Management and organisation

- New Enel and Unipi agreements signed
- Executive Committee approves modifications to IFRF Statute
- Executive Committee confirms appointment of full time IFRF Director at October meeting

## Membership

During 2013 the IFRF Membership group continued the process of stabilisation begun in 2008. From a numbers point of view, despite a temporary hiatus in CI activity and a major loss of 7 Member Organisations from NVV*, total numbers dropped only slightly from 127 to 125 due to new acquisitions in AMG (Wits and Silesian Universities as well as SSV in Venice), in CF (Heurtey), in AFRC (NAO and Sage) and in SFRC (Umea University). There was also some uptake up of the new Independent member option, with four applications accepted in AFRC, four in AMG and one in BFRC. **Tata Steel, TNO, NEW, Philips Lighting, Dacolt, Twente and Eindhoven Universities*

For the second year in a row, actual income equalled expectations. This is the result firstly of consistent and ongoing rationalisation of deadwood in the Member database and secondly of active relationship management.

# RESEARCH

## Message from the outgoing Superintendent of Research

It seems like half a professional lifetime since I became re-involved officially with IFRF, firstly as Interim Director with the task of relocating the IFRF from its former base in the Netherlands while identifying a successor as Director, and then as an Honorary Officer of the Foundation, serving first as Deputy Superintendent of Research, and more recently as Superintendent.

Throughout this 10 year period, it has been a pleasure to work firstly alongside retiring IFRF Director Peter Roberts and then incoming Director Leonardo Tognotti and their teams in IJmuiden and Livorno respectively. I have also been privileged to enjoy the support of the two organisations that hosted the IFRF during this period, Corus IJmuiden (formerly Royal Dutch Steel, and now Tata Steel) and ENEL Ricerca for the last 8 years, as well as fellow Members of the IFRF Joint Committee.

I must also recognise the important part played in recent IFRF history by the University of Pisa who graciously allowed one of their full time Professors, Leonardo Tognotti, to devote a significant portion of his professional time to directing the IFRF and facilitating exchanges of scientific and technical personnel between the two organisations.

Following the move from IJmuiden to Livorno, there was an urgent need to re-establish the research priorities of the IFRF, taking account of the new resources available and the IFRF Members' needs and interests. Through a programme of interaction with National Committees and ordinary IFRF Members participating in National Meetings and TOTeMs, a new agenda for the IFRF Members' Research Programme was developed and described and approved as the **IFRF Members Research Programme – an agenda for 2010-2014.**

The validation of numerical modelling of combustion at an industrial scale emerged as an overwhelming option to address the technology gaps identified, supported by a programme to continue the development of in-flame measurement techniques and to characterise new and alternative fuels.

The actual choice of specific areas for active research would depend on the availability of funding. It is a great pleasure to look back now from the end of 2013 and to see how the team at Livorno has been able to acquire the funding, execute the experiments to create the data needed for model development and validation, and report the outcomes, with the latest instalment featuring in the present document.

IFRF Doc N° K63/y/13
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Annual Report 2013
Summary Financial Statements 2013
RESEARCH

As this is my last official role for the IFRF, I would like to take this opportunity to congratulate outgoing Director Leo Tognotti and his colleagues for a job well done, and to wish his successor as Director and my successor as Superintendent of Research the very best for the future. But this is no time for relaxing. The IFRF's statutory objective is the generation and dissemination of knowledge relating to the clean and efficient combustion of fuels. Although set in 1950, this objective addresses a current and growing need. Preparation of the Research Agenda for 2014/17 awaits…

My best wishes for the future to all those associated with the IFRF.

*Neil Fricker, Visiting Professor of Combustion Technology, University of South Wales*

# RESEARCH

## Technical Publications

Four IFRF reports were published during 2013 and are available for download by IFRF Members at *www.research.ifrf.net/research/new.html*

The content and main outcomes of these reports are described here.

**F 96/y/04 – Biofuels devolatilization and char combustion characterization with the IPFR**
*G. Bonvicini, G. Coraggio, M. Faleni*

**F 96/y/03 – Biomass characterization for co-firing applications: black pellets and torrefied palm kernel shell.**
*E. Biagini, F. Barontini, G. Coraggio, M. Faleni*

**F 96/y/02 – Devolatilization and char combustion characterization with the IPFR of a lignin produced by steam explosion**
*G. Bonvicini, G. Coraggio, M. Faleni*

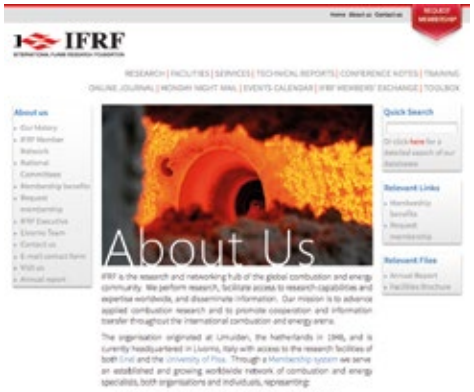
**G 27/y/01 – Development of the experimental procedures for advanced biofuels characterization in the Isothermal Plug Flow Reactor - New methodologies for feedstock characterization**
*E. Biagini, G. Bonvicini, G. Coraggio, M. Faleni*

## Industrial Combustion

Twelve articles were submitted to the journal during the year of which two had been published by December. These are available at *www.industrial.combustion.ifrf.net/papers.html* . E.G.:

***Z. Wheaton, D. Stroh, G. Krishnamoorthy, M. Sami, S. Orsino, P. Nakod***
A comparative study of gray and non-gray methods of computing gas absorption coefficients and its effect on the numerical predictions of oxy-fuel combustion

***J. Seebold***
Plant-wide NOx reduction projects






RESEARCH

## Experimental Activity

### Background

Despite **resource limitations** imposed by the volume of internal R&D funds from Membership fees and the small size of permanent core team, in 2013 **IFRF** continued to play to its **strengths** which include access to the Enel facilities at Livorno, an established knowledge base and the support of the University of Pisa.

Areas of focus during 2013, identified in IFRF Doc. No. D 0/y/37: IFRF Members Research **Programme, an Agenda for 2010-2014 continued to be:**

- **Solid fuel characterisation/focus on biofuels**
- **Probe development for oxy-combustion/novel combustion technologies**
- **CFD validation : tests and sub-models**

with emphasis on experimental tests at semi industrial and pilot scale.

Financial resources, as always, were augmented by the activities of the RELCOM and BRISK projects.

IFRF's aim is to couple experimental activities to modelling activities at different levels of phenomena and systems. The concept of Design of Experiment (DOE) is applied for the planning and execution of semi-industrial tests with the purpose of validating «reduced» sub-models and coupling methodologies. In 2013 the focus of the experimental work continued to be the development of criteria for validating industrial combustion CFD models and codes. Work also continued to develop and test measurement probes/diagnostics with the focus on ***in-flame and in furnace* measurement techniques for industrial applications**, to quantify uncertainties (UQ) and update/upgrade instrumentation (HW/SW).

### Research Topics and Projects

At the time of writing IFRF is involved in the following research topics:

- Oxy- coal combustion (RELCOM)
- Characterisation of 2nd generation biofuels (BRISK)
- Gasification of 2nd generation biofuels (BRISK)
- Coal-biomass co-firing, biomass combustion (ENEL, National fundings)

The main features of the principal projects of 2013 are briefly reviewed here.

# RESEARCH ACTIVITIES

## RELCOM Project

RelCO2m Reliable Combustion

**RELCOM – "Reliable and Efficient Combustion of Oxygen/Coal/Recycled Flue Gas Mixtures"** is designed to undertake a series of applied research, development and demonstration activities involving both experimental studies and modelling work to enable full-scale early demonstration oxyfuel plant to be designed and specified with greater confidence and to provide improved assessment of the commercial risks and opportunities.

The project is funded by the European Commission Seventh Framework Programme and is being undertaken by a consortium of higher education institutions, research centres and industrial partners.

**IFRF** has both research and dissemination roles and early in 2012, a dedicated website was developed and launched at *www.relcomeu.com*

In terms of research activities assigned, the first of these was to provide a baseline for oxy-coal burner scale-up criteria, collecting all the information about the burners available in the project, starting with the **IFRF AASB** burner.

In 2013 **IFRF** continued the characterization of coals in oxy combustion environment with the **IPFR** (Isothermal Plug Flow Reactor) and was involved in oxy combustion sub-model development and validation, through different scale experimental campaigns. In December a two week test campaign was performed at Livorno **FOSPER** facilities on AASB burner in different operating conditions. During the tests, IFRF hosted visiting scientists and investigators from partners, including IFRF Member organisations, **Technische Universität Munchen, IFK Stuttgart** and **University of South Wales**

## BRISK Project

BRISK

**BRISK (Biomass Research Infrastructure for Sharing Knowledge)** has a four year life span, is an initiative from the European Commission's 7th Framework Programme and is coordinated by KTH Royal Institute of Technology in Sweden. BRISK aims to develop a European research infrastructure for **thermochemical biomass conversion** – a family of processes whereby second generation biomasses (usually ligno-cellulosic raw materials) such as wood, energy crops, agricultural wastes and other biogenic materials can be thermally converted into liquids, gases and solids for production of electricity, heat, transport fuels and a wide variety of chemicals.

The three principle activities incorporated in the initiative are **Transnational Access, Joint Research Activities** and **Networking Activities**.

**Transnational Access** enables European organisations, including those outside the project partnership, to send their researchers to undertake experiments on any of the laboratories offering access. The cost of running the rigs for this activity will be met by the EC's BRISK cofunding.

In 2013 **IFRF** again offered access to its **Isothermal Plug Flow Reactor** (IPFR), and to a **200kW downdraft fixed bed gasifier** which is the property of the CRIBE Research Centre for Bio-Energy at the University of Pisa, and was offered to IFRF for the purpose of the project.

**BRISK** funding allowed IFRF to complete the development of an on-line searchable database of European test rigs initiated as part of the European Flame Research Initiative (EFRI). **The European Facilities database** was launched in mid 2013 (see page 18) with its scope extended to include all aspects of fuels processing, adding processes such as gasification, pyrolisis, cleaning and upgrading.

### Solid fuel characterisation and development of a solid fuel database

One of the main areas of IFRF research is solid fuel characterisation. Over the years, the objectives of the activities have developed as follows:

- to establish **protocols** for solid fuels combustion characterisation
- to characterise solid fuels, and to fill data gaps for numerical model validation & application,
- to include economically and environmentally significant fuels – biomass, wastes, and their blends with coals – and conditions that reflect the current interests of IFRF Members and other sponsors.

The **IFRF Solid Fuel Database** has been available to IFRF Members as an online resource since 2010 for use in the design and operation of industrial solid fuel fired combustors and gasifiers. Originally populated with devolatilisation, char combustion and nitrogen release data from the IPFR (Isothermal Plug Flow Reactor), the key facility for solid fuel characterisation, the database is being steadily extended with information generated at the same source.

# RESEARCH ACTIVITIES

In 2013, experimental tests were performed on different coals and biomasses in the context of RELCOM and BRISK and updates made to the SFDB. In June 2013 at the time of writing, the database contains a complete dataset on the characterization of three coals in an oxy-fuel environment. Users may compare conventional and oxy-fuel devolatilization and char combustion and also quantify the role of char gasification with carbon dioxide and water in an oxy-fuel atmosphere. Finally, devolatilization and char combustion of various biomasses including straw, black pellet, wood pellet, palm kernel shell and lignin can be compared and analyzed to determine reliable kinetic parameters.

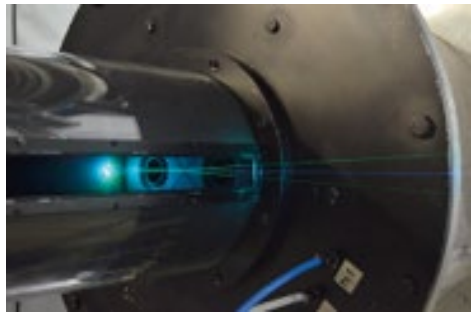
## Other projects

### Hydrogen combustion tests in GT burners

In 2012 and 2013, IFRF was involved in the project **"Development of an ultra low NOx hydrogen fuelled burner"**. The objective of the project which was funded by Regione Veneto and Enel Ingegneria & Innovazione, was to develop an innovative hydrogen burner limiting $NO_x$ emission below 100 mg/Nm$^3$ with reduced inert injection in flame. **The Optical Test Rig for Gas Turbines** (TAO) was used for the necessary tests.

"In flame" temperature measurements tests were executed on the burners designed by co-partner Nuovo Pignone of the GE group, and involved the use of a micropyrometer expressly designed and manufactured for the purpose.

In further tests, **IFRF** performed velocity field characterization of the prototype burners in the Enel aerodynamic laboratory. The wind tunnel was modified in preparation and experiments were performed with the use of laser doppler velocimetry.





IFRF Doc N° K63/y/13
Livorno, June 2014

Annual Report 2013
Summary Financial Statements 2013

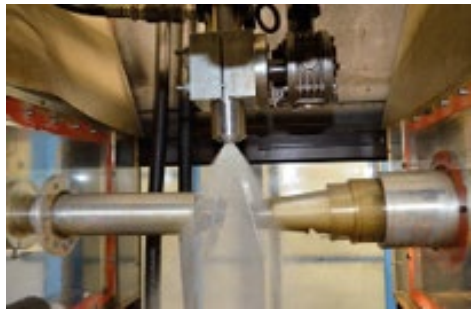
RESEARCH ACTIVITIES

### Biopower in Tuscany

For **Biopower in Tuscany**, IFRF's task was to perform temperature and chemical species measurements inside the combustion chamber of biomass systems. In late 2013, the first of four campaigns were carried out at the Enel "Energy Farm" rig, a biomass fired boiler with an external gas microturbine cycle, and the measurements were repeated for different biofuels. The results provided to project partners a dataset useful for assessing the system performances and for the validation of boiler and system models.

## MILD Project (atomisation tests)

Refurbishment is complete on the Enel **Experimental Atomiser Rig** (ISA) which characterizes full scale oil burner atomizers for energy plants or industrial furnaces. The task was completed over the summer by the IFRF investigative team in collaboration with Enel Ricerca Livorno, and 2 oil atomisers were characterized for the project Industria 2015, funded by the Italian Government. The **ISA** Rig one of a suite of experimental facilities available to **IFRF** and also to its member organizations. It uses simulation oil up to a maximum flowrate of 10000 kg/hr and atomization air up to 1500 kg/hr. **ISA** is equipped with a Malvern Laser particle sizer which can measure the particle size distribution in any point of the spray. This information is very useful for researchers doing mathematical models of the spray in isothermal conditions and using these to create prototypes.



### ENDESA injectors performance assessment

During 2013 the IFRF research team performed some measurements for an internal Enel contract to assess the performances of some injectors of an ENDESA gas turbine burner. The main task was to assess the influence of water flow on the final particle size distribution of the fuel.

# RESEARCH ACTIVITIES

## Papers published based on IFRF activities and collaborations

Numerical investigation of oxy-natural-gas combustion in a semi-industrial furnace: Validation of CFD sub-models
*C. Galletti, G. Coraggio, L. Tognotti*
Fuel 109, 445-460, 2, 2013

Analysis of coal combustion in oxy-fuel conditions through pulsed feeding experiments in an entrained flow reactor
*C. Galletti, E. Giacomazzi, S. Giammartini, G. Coraggio, L. Tognotti*
Energy & Fuels 27, 2732-2740, 2013

Analysis of oxy-coal combustion through measurements in a pilot-scale entrained flow reactor
*C. Galletti, L. Giovannini, G. Coraggio, L.Tognotti*
Chemical Engineering Transactions 32, 709-714, 2013

Assessment of syngas composition variability in a pilot-scale downdraft biomass gasifier by an extended equilibrium model
*M. Simone, F. Barontini, C. Nicolella, L. Tognotti*
Bioresource technology 140, 43-52 1, 2013

A Novel Methodology for Chemical Time Scale Evaluation with Detailed Chemical Reaction Kinetics
*B.J. Isaac, A. Parente, C. Galletti, J.N Thornock, P.J Smith, L. Tognotti*
Energy & Fuels, 27, 2255-2265, 2013

Comparing reaction orders of anthracite chars with bituminous coal chars at high temperature oxidation conditions
*O. Karlström, A. Brink, E. Biagini, M. Hupa, L. Tognotti*
Proceedings of the Combustion Institute 34 , 2427-2434, 2013

Flame characteristics of pulverized torrefied-biomass combusted with high-temperature air
*J. Li, E. Biagini, W. Yang, L. Tognotti, W. Blasiak*
Combustion and Flame 160 , 2585-2594, 2013

High-temperature rapid devolatilization of biomasses with varying degree of torrefaction
*J. Li, G. Bonvicini, L. Tognotti, W. Yang, W. Blasiak*
Fuel 122, 261-269, 2014





# INTERNATIONAL TECHNICAL EVENTS

## Technical Events

### TOTeM 38 "Tar and sulphur sampling and analysis"

TOTeM 38 was a BRISK event and was arranged as a special session within the 21st European Biomass Conference and Exhibition in Copenhagen on 6 June.

In addition to invited reviews on the state of the art in measurement techniques for tar and organic sulphur compounds in raw gas outlets from gasifiers, the TOTeM was used to launch a programme of round robin testing of existing techniques. Participation in the programme was to be either through offering a test facility for measurements, or by collecting samples from other test rigs with their own instrumentation.

The event was also used to promote the Transnational Access element of BRISK where visiting researchers may apply for EC funding to undertake their own tests at the rigs offered by project partners.

Chaired by York Neubauer (TU Berlin), Serge Biollaz (PSI) and Markus Kleinhappl (bioenergy 2020+), and with speakers from TU Delft, ECN, Karlsruhe Institute of Technology and VTT Finland, TOTeM 38 attracted some 50 delegates.

The proceedings are downloadable from *http://www.trends.ifrf.net/trends/project.html?pid=45*

### TOTeM 39 "Oxy-coal Combustion"

TOTeM 39 was organized for the RELCOM Project on June 18th and 19th in Pisa. The meeting was hosted by ENEL Research and Engineering.

Topics included flame ignition and stabilization, heterogeneous phenomena in oxy/coal combustion, radiation and heat transfer modeling, explosion issues in oxy-coal systems, and high temperature corrosion.

Keynote speakers included Lars Strömberg of Chalmers University, Sweden who also chaired the proceedings, and Stanley Santos, IEA GHG. Invited presentations from specialists within the RELCOM team were complemented by input from four external speakers, Phil Smith of the University of Utah, Osvalda Senneca of CNR Naples, Klas Andersson of Chalmers University, and Flemming Frandsen of DTU. IFRF Superintendent of Research Neil Fricker was the meeting Rapporteur.

The meeting was attended by some 50 delegates.

The proceedings, including the presentations and programme, a delegate list and the introductory and concluding comments are available at *http://www.trends.ifrf.net/trends/project.html?pid=46*

# INTERNATIONAL TECHNICAL EVENTS

## Technical Events

### National Committees

The following events were organised by the IFRF National Committees during the year:

### FFRC Flame days and Gasification Workshop

The meeting was held on 17 and 18 April 2013 in Jyväskylä, Finland, and featured technical visits to both the 490 $MW_{th}$ CFB CHP power plant at **Jyväskylän Energia** and the VTT combustion pilot facilities. The main topics were combustion and gasification of coal and biomass, with some presentations covering flameless technology, optical and spectrometer instrumentation, CFD modeling and related technologies.

Keynotes were offered by Hartmut Spliethoff, Dr. Christian Fredriksson of member organization **LKAB**, Mikko Hupa from **Åbo Akademi**, and Tero Saarno from Jyväskylän Energia on Experiences on co-firing peat with wood in BFB and CFB plants of Jyväskylän. The program and all the presentations are available to IFRF members on the FFRC website.
*http://www.ffrc.fi/FlameDays_2013.html*

### British Flame Spring Meeting
### *"Combustion Diagnostics, Control, Computational Methods & Process Optimisation"*

The meeting was organized in collaboration with the Coal Research Forum and the University of Kent, on Thursday 2nd May 2013. IFRF Director Leonardo Tognotti delivered a keynote address entitled address entitled "Combustion diagnostics and computational methods for process optimization" and eleven presentations followed, divided over three sessions: Laboratory-scale Experience, CFD and Computational Analysis, and Industrial-scale Experience.

Speakers included representatives from **Air Liquide**, the **Universities of Kent**, **Rouen, Sheffield, Glamorgan** and **Leeds, Doosan Power** and **RJM International**. presented the results from a study on low $NO_x$ combustion at SSE Ferrybridge, **Zeeco** introduced the low $NO_x$ burner retrofits with BMS for process heater optimization, and the **University of Glamorgan** dealt with the monitoring and control of burners co-firing coal and biomass using joint time- frequency methods. The **University of Kent** completed the session with the in-line measurement of particle size distribution at a biomass-fired power plant. Pictured above, **Roger Dudill** (BFRC) with **Leo Tognotti**.




IFRF Doc N° K63/y/13
Livorno, June 2014

Annual Report 2013
Summary Financial Statements 2013

INTERNATIONAL TECHNICAL EVENTS

Technical Events

### 26th German Flame Day

Organised by the VDI Vissensforum in cooperation with DVV, the German section of the Combustion Institute and the VDI Society Energy and Environment (GEU), the event was held on 11 and 12 September at University of Duisberg-Essen, Duisberg. Prof. Dr.-Ing. Klaus Görner chaired the proceedings.

### AFRC Symposium "Safe and responsible development in the 21st Century"

Held from 22-25 September 2013 at Sheraton Kauai, Hawaii, the Symposium featured special sessions on biofuels, flame sensing and control, and flameless combustion. Sponsorship support was received from **John Zink – Hamworthy**, **Great Southern Group**, **Sage Environmental Consulting**, **University of Utah Institute for Clean and Secure Energy**, **Callidus**, **OnQuest**, **Zeeco** and the **Energy Research and Development Center** at **Missouri S&T**.

The final agenda is available at *http://www.calendar.ifrf.net/event.html?id=417*

### NVV Combura Symposium

The 12th annual Combura Symposium was held on 9 and 10 October at Vaeshartelt Castle near Maastricht. The **2013 NVV Combustion Award** was presented to Mara Wustmans for her work on Thermophosphors as a probe for surface temperature measurements. Pictured below from left to right, **Giel Rameakers**, **Joris Koomen**, **Pepijn Pronk**, NVV.

# STRATEGY AND MEMBER SERVICES DEVELOPMENT

## STRATEGY AND MEMBER SERVICES DEVELOPMENT

### Communications

The suite of IFRF marketing collateral was augmented early in the year with the production of a printed guide to the Enel and University of Pisa Experimental Facilities. Additional material followed, including technical flyers describing IFRF's instrument manufacturing capability, and the 2012 Annual Report. These resources, along with the key Benefits and Services brochures created in 2011, were integrated into the IFRF website as downloadable documents and the website itself was given a cosmetic facelift in line with the new brand image. Website content was completely rewritten and reorganised to showcase the IFRF more clearly and effectively.


### European Test Facilities Database launched

The database was prepared in the first half of the year and launched to users in MNM 14 of July 15 with a focus on the BRISK component – that is rigs associated with the thermochemical conversion of raw biomass to useable biofuels. Later, in MNM 19 of September 16, the database was marketed as a public resource and invitations extended to organisations outside of the original EFRI group* wishing to be included. One new addition resulted from Laborelec. A planned relaunch of the EFRI group with a view to extending the database is pending.

*Cardiff University, CNRS, DTU, ETC, GDF Suez, GWI

### Conference Proceedings

In the second half of the year a student investigator was tasked with collecting the proceedings of MC 17 into a single publication with an ISBN numbers.

Similar collections of the papers from MC 16 and 15 were then assembled and their availability announced in MNM 19 of September 16. It is envisaged that with time the IFRF archive of electronic documents will be further enhanced with the addition of the collected papers from the first 14 Member Conferences.

The required material is currently ready in scanned format.



IFRF Doc N° K63/y/13
Livorno, June 2014
Annual Report 2013
Summary Financial Statements 2013
STRATEGY AND MEMBER SERVICES DEVELOPMENT
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### Membership

During 2013 membership continued the process of stabilisation begun in 2008.

Regarding the number of members, despite complete stagnation in CI and a major loss of 7 Member Organisations from NVV (Tata Steel, TNO, NEW, Philips Lighting, Dacolt, Twente and Eindhoven Universities), total numbers dropped only slightly from 127 to 125 due to new acquisitions in AMG (Wits and Silesian Universities as well as SSV in Venice), in CF (Heurtey), in AFRC (NAO and Sage) and in SFRC (Umea University).

There was also some uptake up of the new Independent member option, with four applications accepted in AFRC, four in AMG and one in BFRC.

For the second year in a row, actual income equalled expectations. This is the result firstly of consistent and ongoing rationalisation of deadwood in the Member database and secondly of active relationship management. As at mid May, expected fee income for 2014 is down only very slightly to €156,285 despite a €12,000 loss due firstly to the departure of DONG Energy and secondly to a €5000 cut in the payment from DVV.

The number of members has increased to 126 with some requests still pending.

Movements end 2013/beginning 2014:

- AFRC loses Shell, TAQA; Hamworthy and John Zink merge; gains Clearsign Combustion Corp.
- NVV loses Laborelec to AMG and MONS to CF but gains De Jongh for IFRF.
- CF loses AGMS and Imerys during 2013, gains Fives in April 2014.
- AMG loses Dong but gains B.IEI. Italia, Denmark and Tsinghua Universities as well as Universidad di Sevilla and LEAP.
- SFRC loses Umea University

# MANAGEMENT AND ORGANISATION

## Progress Report

### IFRF Statute

The IFRF Statute was revised during the period. In accordance with certain management requirements at Enel, modifications to the original document included the redefinition of the General Secretary's role to preclude signing power for contracts, human resources etc. from his supervisory activity regarding IFRF administration. The Director's duties were also integrated where previously they had been documented separately. The new Statute was verified by the Executive at their October 2013 meeting and will be ratified at JC 161.

### Executive and Joint Committee appointments

At JC 160, Hartmut Spliethoff was confirmed as IFRF President and Gerard Flament as Vice President for the January 2014 to December 2016 cycle. The role of Superintendent of Research was bestowed on outgoing Director Leonardo Tognotti at the October meeting of the Executive – this in addition to his ongoing responsibility as representative of University of Pisa for the UniPi-IFRF collaboration agreement.

A three year fixed period appointment was agreed for Joint Committee B Members. Confirmed at JC 160 were Chuck Benson (New Fuels), Mikko Hupa (Emissions) and Jacques Dugué (Diagnostics). It was also agreed that Klaus Hein would retain the Education portfolio until June 2014, alongside the associated role as a member of the UniPi liaison committee.

### Appointment of IFRF Director

At the October meeting of the IFRF Executive in Pisa, Tomasz Klajny was confirmed as the replacement for Leonardo Tognotti, assuming all executive responsibilities involved with the Director position by Jan, 1st 2014.






MANAGEMENT AND ORGANISATION

## Staffing

During 2013, the staff complement of the IFRF was again sustained by contracted Investigators and a technician. In addition a full time IFRF Director (Candidate) recruited at Livorno

Individuals contracted to IFRF during the year:

- **Leo Tognotti** Director
- **Tracey Biller** Communications and Marketing – permanent staff
- **Giovanni Coraggio** Investigator, Measurement Techniques – permanent staff
- **Cristiana Gheorghe** Admin Accounts – permanent staff
- **Marco Faleni** IPFR Technician – contractor
- **Tomasz Klajny** Operations Manager/Candidate Director
- **Giorgio Bonvicini**, **Sergio Macchiavelli**, **Pierfrancesco Guagnano**, **Cosimo Sbano** Trainees
- **Neil Fricker** Consultant, also retained to assist with the BRISK project

### ENEL and UNIPI support for Research

- **ENEL Experimental Area: Davide Cecchini and a team of 10 engineers and technicians**
- **University of Pisa: Researcher Chiara Galletti and Enrico Biagini**

### External suppliers

- **Studio Bonaccorsi** for bookkeeping and accounts
- **Studio Guerrini Vitti** for auditing
- **Nextworks**, **InterVisors**, **Tesene and Antonio Raimondo** for IT
- **Net Group Communication** for visual design
- **Patrick Lavery** for Combustion Industry News

In-kind support was also made available by IFRF Member Canmet to edit the IFRF Journal

- **Peter Gogolek** (**Canmet**), Editor-in-Chief
- **Cecilia Lam** (**Canmet**), Editorial Secretary

# IFRF EXECUTIVE COMMITTEE

## IFRF Executive Committee

Until December 31st 2013, the members of the IFRF Executive were:

### President:

**Jacques Dugué**
Total, France
*(January 2011 to December 2013)*

### Vice President:

**Hartmut Spliethoff**
Munich University, Germany
*(January 2011 to December 2013)*

### Vice President:

**Gérard Flament**
Retired, Lhoist, Belgium
*(June 2012 to December 2016)*

### General Secretary:

**Sauro Pasini**
Enel Engineering & Research SpA, Italy
*(June 2009 – No fixed term)*

### Superintendent of Research:

**Neil Fricker**
Visiting Professor of Combustion Technology, University of Glamorgan, UK
*(January 2011 to December 2013)*





# FINANCIAL SUMMARY

## Financial Summary

During the financial year 2013, having achieved the status of an ONLUS (Organizzazione Non Lucrativa di Utilita` Sociale) in 2008, the IFRF continued to operate as a "not-for-profit" Foundation in Italy.

The Financial Statements are presented in the form of a **Balance Sheet** and **Income Statement** showing the financial information for ONLUS. The consolidated Profit and Loss figure is compared with the approved budget (JC158).

The figures used in this annual report are taken from the full audited Financial Statements for ONLUS produced according to Italian bookkeeping and accounting principles. Copies of the full Financial Statements were made available to Members of the IFRF's governing body, the Joint Committee following the acceptance of a draft version by the IFRF Executive Committee.

The Financial Statements were accepted by the IFRF Executive Committee as being a true representation of the financial affairs of the International Flame Research Foundation in 2013.

# BALANCE SHEET AT 31st DECEMBER 2013 – ONLUS

| ASSETS | | At 31-12-2013 | | At 31-12-2012 |
|---|---|---|---|---|
| | | Partial | Total | |
| B | FIXED ASSETS | | | |
| *B.I.* | *INTANGIBLE ASSETS* | | 4.000 | |
| B.I.2 | Research, development and advertising costs | | 21.149 | 28.198 |
| B.I.4 | Concessions, licenses, trademarks and similar | | | 694 |
| ***Total INTANGIBLE ASSETS*** | | | **25.149** | **28.892** |
| *B.II* | *TANGIBLE ASSETS* | | | |
| B.II.2 | Equipment and machinery | | 79.917 | 105.288 |
| B.II.3 | Industrial and commercial equipment | | 859 | 960 |
| B.II.4 | Other tangible assets | | 12.697 | 8.245 |
| ***Total TANGIBLE ASSETS*** | | | **93.473** | **114.493** |
| ***TOTAL FIXED ASSETS*** | | | **118.622** | **143.385** |
| C | CURRENT ASSETS | | | |
| *C.I* | *INVENTORY* | | | |
| C.I.3 | Contracted work in progress | | 817.600 | 541.445 |
| ***Total INVENTORY*** | | | **817.600** | **541.445** |
| *C.II* | *RECEIVABLES* | | | |
| C.II.1 | Trade receivables | | 185.030 | 221.607 |
| | within 12 months | 185.030 | | |
| C.II.4-bis | Tax credit/receivables | | 11.891 | 21.932 8 |
| | within 12 months | 11.891 | | 21.932 |
| C.II.5 | Other receivables from third parties | | 53.976 | 50.072 |
| | within 12 months | 53.976 | | |
| ***Total RECEIVABLES*** | | | **250.897** | **293.611** |
| *C.IV* | *CASH AND BANKS* | | | |
| C.IV.1 | Bank and postal deposits | | 224.578 | 201.623 |
| C.IV.3 | Cash | | 191 | 31 |
| ***Total CASH AND BANKS*** | | | **224.769** | **201.654** |
| ***TOTAL CURRENT ASSETS*** | | | **1.293.266** | **1.036.710** |
| D | ACCRUED INCOME AND PREPAID EXPENSES | | | |
| | Prepayments and deferred expenditures | | 4.231 | 5.384 |
| ***Total ACCRUED INCOME AND PREPAID EXPENSED*** | | | **4.231** | **5.384** |
| | | | | |
| ***TOTAL ASSETS*** | | | **1.416.119** | **1.185.479** |





# BALANCE SHEET AT 31st DECEMBER 2013 – ONLUS

| LIABILITIES | | At 31-12-2013 | | At 31-12-2012 |
|---|---|---|---|---|
| | | Partial | Total | |
| A | EQUITY | | | |
| *A.I* | *CAPITAL* | | 171.785 | 171.785 |
| *A.VII* | *OTHER RESERVES* | | 235.629 | 188.177 |
| Reserve for difference from rounding-off to Euro unit | | 1 | | (2) |
| Miscellaneous reserves | | 235.638 | | 188.179 |
| *A.IX* | *PROFIT (LOSS) FOR THE PERIOD* | | 2.620 | 47.458 |
| ***Total EQUITY*** | | | **410.044** | **407.420** |
| B | PROVISION FOR LIABILITIES AND CHARGES | | | |
| B 2 | *DEFERRED TAXES* | | — | — |
| ***Total PROVISION FOR LIABILITIES AND CHARGES*** | | | — | — |
| C | EMPLOYEE RETIREMENT INDEMNITY | | 45.634 | 36.582 |
| D | PAYABLES | | | |
| D.4 | Bank overdrafts, advances and loans | | | |
| | Bank overdrafts, advances and loans within 12 months | 408 | | |
| D.5 | Other financing Payables | | 6.023 | |
| | Other financing Payables beyond 12 months | 6.023 | | |
| D.6 | Advance payments | | 654.136 | 433.724 |
| | beyond 12 months | 433.724 | | |
| D.7 | Accounts payable to suppliers | | 220.656 | 258.831 |
| | within 12 months | 220.656 | | |
| D.12 | Taxes payable | | 9.058 | 10.030 |
| | within 12 months | 9.058 | | 10.030 |
| D.13 | Social security payables | | 12.431 | 13.249 |
| | within 12 months | 12.431 | | |
| D.14 | Other payables | | 24.373 | 25.643 |
| | within 12 months | 24.373 | | 25.643 |
| ***Total PAYABLES*** | | | **927.085** | **741.477** |
| E | ACCRUED EXPENSES AND DEFERRED INCOME | | | |
| | Accruals and deferred income | | 33.356 | |
| ***Total ACCRUED EXPENSES AND DEFERRED INCOME*** | | | **33.356** | |
| | | | | |
| | | | | |
| | | | | |
| ***TOTAL LIABILITIES*** | | | **1.416.119** | **1.185.479** |

# INCOME STATEMENT

| INCOME STATEMENT | | At 31-12-2013 | | At 31-12-2012 |
|---|---|---|---|---|
| | | Partial | Total | |
| A | VALUE OF PRODUCTION | | | |
| A.1 | Net sales from production and services | | 16.436 | 31.780 |
| A.3 | Changes to contracted work in progress | | 276.155 | 364.305 |
| A.3 | Additions to assets by internal production | | | 35.248 |
| A.5 | Other revenues and income | | 309.379 | 344.488 |
| A.5.a | Other contributions | 259.541 | | 182.740 |
| A.5.b | Other operating revenues | 49.838 | | 161.748 |
| *Total* VALUE OF PRODUCTION | | | 601.970 | 775.821 |
| B | COST OF PRODUCTION | | | |
| B.6 | Raw, ancillary, consumable materials/goods | | 11.212 | 12.795 |
| B.7 | For services | | 369.200 | 486.019 |
| B.8 | For leasing and rentals | | 3.349 | 6.453 |
| B.9 | For personnel | | 168.553 | 174.536 |
| B.9.a | Salaries and wages | 121.992 | | 126.618 |
| B.9.b | Social security contributions | 37.432 | | 37.074 |
| B.9.c | Employee retirement indemnity | 9.129 | | 9.124 |
| B.9.e | Other costs | | | 1.720 |
| B.10 | Depreciation and write-downs | | 36.248 | 34.460 |
| B.10.a | Depreciation of intangible fixed assets | 8.744 | | 7.744 |
| B.10.b | Depreciation of tangible fixed assets | 27.504 | | 26.716 |
| B.14 | Other operating expenses | | 18.280 | 14.962 |
| *Total* COST OF PRODUCTION | | | 606.842 | 729.225 |
| | *Net income from operating activities* | | (4.872) | 46.596 |
| C | FINANCIAL INCOME AND EXPENSES | | | |
| C.16 | Other financial income | | 27 | 71 |
| C.16.d | Other financial income | 27 | | 71 |
| C.16.d.4 | Income from other companies | 27 | | 71 |
| C.17 | Interest and other financial expenses | | (133) | (66) |
| | Expenses to other companies | (133) | | (66) |
| C.17-bis | Profit and loss on exchange | | | (1) |
| *Total* FINANCIAL INCOME (EXPENSES) | | | (106) | 4 |





# INCOME STATEMENT

| INCOME STATEMENT | | At 31-12-2013 | | At 31-12-2012 |
|---|---|---|---|---|
| | | Partial | Total | |
| E | EXTRAORDINARY INCOME AND EXPENSES | | | |
| E.20 | Extraordinary income | | 7.958 | 858 |
| E.20.a | Differences from rounding-off to Euro unit | | | 3 |
| E.20.b | Other extraordinary income | 7.958 | | 855 |
| E.21 | Extraordinary expenses | | — | — |
| E.21.b | Other extraordinary expenses | | — | — |
| *Net EXTRAORDINARY INCOME (LOSS)* | | | 7.598 | 858 |
| | *Results before taxes (A-B+C+E)* | | 2.620 | 47.458 |
| 23 | Net income for the year | | 2.620 | 47.458 |

## Notes to the balance sheet and income statement

### General Accounting Principles

The accounts have been prepared on the basis of historical cost (except when stated otherwise). If not stated otherwise, assets and liabilities are shown at face value.

### Principles for valuation of assets and liabilities

*Tangible assets*

Tangible assets are valued at cost less accumulated depreciation. The depreciation is calculated on a straight-line basis and based on an expected economic life of 3 – 5 years.

*Work in progress*

The work in progress comprises material costs and labour costs plus overhead pro rata. Provision is made for projects that cannot be covered by their revenues in the future.

*Debtors-trade*

Current assets include debtors, which fall due within one year. Provision is made for amounts that probably will not be received.

### Principles for determination of results

*Revenues and costs*

Revenues and costs are allocated to the financial year to which they relate. Losses and risks are also recognised in the period to which they relate.

*Total revenue*

Total revenue comprises the invoiced fees from the Member Organisations and the invoiced amounts for other services rendered, and the change of work in progress. Revenues on work-in-progress are recognized at the time the projects are completed.

# PROFIT AND LOSS COMPARISON WITH BUDGET FIGURES

| | 2013 Consolidated | 2013 Budget | Variation 2013 vs 2013 JC | |
|---|---|---|---|---|
| **REVENUES** | **601.970** | **690.000** | **-88.030** | **-12,8 %** |
| | | | | |
| Member Organisation Fees | 159.511 | 180.000 | **-20.489** | **-11,4 %** |
| Funded Members Research Programme | 376.185 | 250.000 | **126.185** | **50,5 %** |
| Access, Education and Training | 0 | 20.000 | **-20.000** | **-100,0 %** |
| Technical Meetings | 2.630 | 30.000 | **-27.370** | **-91,2 %** |
| Special Projects | 47.195 | 180.000 | **-132.805** | **-73,8 %** |
| Reports-Consulting-Hardware | 16.449 | 30.000 | **-13.551** | **-45,2%** |
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| | | | | |
| **COSTS** | **599.244** | **650.000** | **-50.756** | **-7,8 %** |
| | | | | |
| Internal + External Staff Costs | 386.200 | 400.000 | **-13.800** | **-3,5 %** |
| Research services/consumables | 85.500 | 75.000 | **10.500** | **14,0 %** |
| Access, Education and Training | 0 | 20.000 | **-20.000** | **-100,0 %** |
| Technical Meetings | 0 | 15.000 | **-15.000** | **-100,0 %** |
| IFRF NET/ Members Services | 47.000 | 40.000 | **7.000** | **17,5 %** |
| Reports-Consulting-Hardware | 10.574 | 30.000 | **-19.426** | **-64,8 %** |
| Depreciation | 36.248 | 30.000 | **6.248** | **20,8 %** |
| General Operating Costs | 33.722 | 40.000 | **-6.278** | **-15,7 %** |
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| | | | | |
| **Operating Result** | **2.726** | **40.000** | **-37.274** | **-93,2 %** |





# DIRECTOR'S COMMENTS ON THE IFRF'S FINANCIAL POSITION

## Director's comments on the IFRF's financial position

The financial position of ONLUS is determined as at December 31st 2013.

A Profit and Loss surplus of € 2.726 was achieved in 2013. This was below the budgeted figure (JC 158) of € 40,000.00.

There were some differences compared to the budgeted figures, in particular:

- The budgeted Research and Development Income (Funded MRP and Special Projects) of € 430.000 was actually € 423.000 (%). This was because the EU FP7 RELCOM and BRISK, and some activities related to public co-funding were acquired and executed in 2013, whilst an expected activity for testing coal burners was not performed.
- There was a shortfall on the budgeted figure for Members' fees of about € 20.000 due to the rearrangements happened in some National Committees.
- The expenses (-7,8%) were mainly related to the EU co-funded projects, in terms of contracted personnel and experimental activities.

The **cash available** at the IFRF bank accounts on December 31st 2013 was € 224.769 compared with € 201.654 at December 31st 2012.

During the year, the IFRF took on certain research projects within the scope of its non-profit nature. In addition the members' contributions enhanced the organisation financial position.

In 2013 the Foundation continued to work to strengthen its global profile through the establishment of relationships with scientific and industrial organisations, mainly through EU funded projects.

Whilst such projects contributed to supplying financial resources to the Foundation, they also enabled it to further increase the accumulated scientific and technological know-how which is at its heart.

# NOTICE OF JOINT COMMITTEE MEETING 161

## NOTICE OF JOINT COMMITTEE MEETING 161

The 2014 IFRF Joint Committee Meeting (JC161) will be held on Friday 27 June 2014 from 09.00 to 17.00. The venue is Conference Centre "Dudokhuis", Tata Steel, Wenckebachstraat 1, 1951 JZ Velsen-Noord, The Netherlands

### Resolutions

**Ordinary Resolutions needing a simple majority of Joint Committee Members present or represented by Proxy, at least two A Members being present, and at least half the Joint Committee Votes being executable**

**Resolution 1**: *That the Minutes of Joint Committee Meeting 159 (A04y166) be approved.*

**Resolution 2**: *That Frederick Normann to be admitted to the IFRF Joint Committee as Chairman of SFRC.*

**Resolution 3**: *That Wiebren de Jong to be elected as DS Research for the period 1st July 2014 to 30th June 2017.*

**Resolution 4**: *That Klaus Hein's term as B Member for Education to be extended for period from 1st July 2014 to 30th June 2017.*

**Resolution 6**: *That the IFRF Annual Report and Summary Financial Statements for 2013 (B 02/y/128).*

**Resolution 7**: *That the IFRF Budget 2015 and the IFRF Financial Plan 2016 to be approved.*

**Special Resolutions needing the unanimous support of all A Members represented, at least half the A Members being present**

**Resolution 5**: *That the revised IFRF Statutes be ratified.*





# NOTES TO THE RESOLUTIONS

## NOTES TO THE RESOLUTIONS

**Resolution 1: That the Minutes of Joint Committee Meeting 160 (A 04/y/167) to be approved.** These were approved by the Executive Committee and issued to Joint Committee Members by email on 31st July 2013. The President will sign the final version of this document (A 04/y/167) in order that it may be used as a permanent record of the decisions of JC159.

**Resolutions 2-4**: About A and B members of the Joint Committee: extention of mandate and newcomers.

**Resolutions 5** (Revised IFRF Statute): In line with Resolution 4 of JC 159 to resolve legal and other anomalies in IFRF documents specifying general rules and procedures, new documentation has been created.

**Resolution 6: (IFRF 2013 Annual Report and Summary Financial Statements as of 31 December 2013 (B 02/y/128) and the IFRF Complete Financial Statements (B 02/y/127E).** It is a requirement of the IFRF Statutes that an Annual report and Financial Statement be submitted to the Joint Committee for approval each year within six months of the year-end. Document B 02/y/128 comprises an annual report on the activities from January to December 2013, together with summary financial statements. If approved, the views of the Joint Committee will be sought on a more extensive distribution of this document to Members, as well as the provision of additional copies to National Committees for use in supporting enquiries for Membership.

**Resolution 7: IFRF Budget 2015 and Financial Plan 2016** The Executive Committee has discussed this budget with the IFRF Director and commends it to the Joint Committee.

IFRF

FONDAZIONE INTERNAZIONALE PER LA RICERCA SULLA COMBUSTIONE

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