



# Increasing the energy efficiency thanks to CAE simulation



## What was the main reason for introducing these technologies?

Since its inception the mission of Immergas is to win a leading position in the design and manufacturing of first-class products in terms of perceived quality, energy efficiency, safety and value for money in the extremely competitive market of the home HVAC.

I recall that in the late '90s we were well aware that globalization would bring unheard of opportunities and challenges such as larger untapped emerging markets, a more demanding and sophisticated customer base, increasing regulation and a shorter product life cycle. It was then easy to forecast increasing pressures on our R&D to deliver a wider range of appliances, with better performances, lower costs and reduced time to market.

Therefore I would say that the main reason for introducing the CAE was the necessity to invest in the engineering of new products in order to remain among the leaders and expand our customer base.

## What kind of products are you using simulation for?

We use CAE methods to design and optimize a wide array of systems and components such as fuel mixers and controls, combustors, heat exchangers, exhaust piping, pressure vessels, filters and valves.

An emerging trend has been recently the downsizing of the boilers powered with fossil fuels and their integration into more complex systems that include renewable energy generators like PV panels, solar heaters or heat pumps.

Also in this case I believe that simulation can be of great help to understand the interaction among many devices and to ensure that each appliance performs in its optimal operating range and therefore to achieve the best balance in terms of performance and efficiency of the whole system.

## Why did you decide to introduce mathematical modeling in the design process?

As I have previously mentioned, our industrial sector undergoes increasingly competitive pressure.

Besides the usual requirements such as reliability, low cost and flexibility of the installation, the market demanded additional features such as energy efficiency, emissions, acoustic and connectivity to name a few.

Mathematical modeling can provide a large amount of data that can be used to understand the details of the physics associated to

Immergas has been the leading Italian company for condensing boilers since 2002 and before that traditional gas boilers. About 200,000 of the 350,000 boilers produced in 2015 are manufactured in Italy at the Brescello (Reggio Emilia) headquarters and most of the components are designed and made at our Italian plants, where over 600 employees design and manufacture 200 different models over 10 production lines.

Immergas also owns a second plant in Poprad, Slovakia, where it manufactures entry level appliances conceived specifically for emerging markets.

Similarly, the aim of the new start up being launched in Iran is that of producing boiler models suited to the Middle East markets.

Fifty years after its birth – on February 5, 1964 – the company started by Romano Amadei, Giuseppe Carra and Gianni Biacchi is consistently ranked among the leading European companies in the home HVAC industry and owns 100% of nine sales subsidiaries in Europe and one in China.

## How long have you been using CAE simulation technologies and mathematical modeling in your company?

We have been using CAE technologies since late 1997. We first acquired the ANSYS software for FEA and the Fluent package for CFD simulation.

In 2004 we added the ANSYS CFX suite in order to increase the integration and the potential of the CAE package.

The first project developed with ANSYS Mechanical was an optimization of a pressure vessel made of stainless steel.

functional systems and components of the appliances for the HVAC. Furthermore, by doing virtual simulations it is possible to explore a larger design space in a quicker way compared to the physical prototyping approach.

#### How does this affect your design process?

The design of an innovative appliance may require the use of many CAE tools such as advanced fluid dynamics, thermal, thermal-structural, mechanical, combustion, acoustics, DOE algorithms, etc.

Our internal advanced engineering team can source from a wide array of experimental data in order to validate the most effective simulation path.

Virtual modeling allows faster design iterations and only a few optimized solutions are tested in our laboratory.

Following the introduction of the CAE into R&D we have changed the design process remarkably from a trial and error method and physical prototyping loops to advanced collaborative engineering where the virtual simulation leads the process.

#### Are you also thinking about applying mathematical modeling for new products and what expectations do you have?

Today Immergas concentrates on intelligent installations that choose the more cost-effective energy source among condensing boilers, heat pumps, solar panels and photovoltaic energy in order to deliver heat or cool air with the least energy consumption.

New European and National legislative obligations and the need felt strongly by everybody to reduce pollution and the associated costs push towards more advanced technological solutions. Thermal solar and PV panels, heat pumps, hybrid systems and other sources of renewable energy are already well-established and in great demand. We expect that these trends will grow stronger in the near future. I'm sure that Immergas, as we have been doing for almost 20 years, will keep investing in advanced engineering and will take advantage of the most updated CAE technologies such as Multi-physics integration, acoustics, advanced combustion and HPC.

#### What's the value that EnginSoft can give you?

In our view EnginSoft's unique strength is the multidisciplinary approach that includes many areas of Computer Aided Engineering. Its expertise covers all types of analyses for both product and process, including all the key physics for our R&D such as advanced fluid dynamics, thermal, thermal-structural, mechanical, combustion, acoustics, FSI and multi-objective optimizations.

EnginSoft's collaboration with some of the most prestigious academic groups, leading industries and cutting edge CAE vendors insures it can transfer the best practices used in the most challenging engineering.

Besides the routine support provided on the simulations handled internally by Immergas, an other recognizable value of our collaboration with EnginSoft is the large amount of resources that can be quickly leveraged in order to speed the convergence of the



## Interview with Eng. Luca Cavalli, Immergas, Advanced engineering team

projects toward their targets.

Lastly, the valuable partnership with EnginSoft is the continuous push towards the education of human resources through a wide range of instruments such as training courses, training on the job, webinars and of course the annual CAE conference.

#### In your perspective do you believe there will be a need for computation codes to handle future challenges?

Looking ahead, we reckon that the home and commercial HVAC systems will be cleaner, more efficient and more connected.

Furthermore, the emergence of cutting-edge technologies such as IoT could enhance the demand of increasingly complex systems.

It is clear to us that the design challenges of the future, and the multiphysics phenomena involved, cannot be economically handled without an increasingly large portfolio of virtual prototyping tools.

#### Could you estimate the return on the investment related to these R&D activities?

Immergas develops a wide range of appliances in house or in collaboration with hundreds of suppliers and therefore it is hard to assess the CAE activities with a ROI figure without going through the challenges of each project.

I would rather talk about some of the costs of not doing simulations. For instance, due to various constraints of our laboratory some high powered systems cannot be developed through physical prototypes. Moreover, the performance demanded of our new products may easily go beyond the reach and the budget of a trial and error approach. Last but not least the CAE adoption in Immergas has proven to enhance the skills and the commitment of our technical staff towards amazing innovations.

