CHEMICAL ENGINEERING,

THE RENAISSANCE OF THE FRENCH PROCESS INDUSTRIES

Summary of the White Paper

Société Française de Génie des Procédés

PREFACE

The French Society of Chemical Engineering (SFGP) provides an environment for dialogue, reflexion and innovation in the domain of industrial processes. In addition to several hundred members and the organisation of the biannual national congress in chemical engineering, the SFGP relies on a network of academic and industrial experts from diverse economic sectors, including the chemical, pharmaceutical, agronomy, food, materials, energy and environmental sectors.

The SGFP is committed to addressing major societal challenges, including access to resources, energy transition, employment and the development of a responsible economy. In 2017, the SFGP took the initiative to organise the Assizes of Chemical Engineering. This event was the occasion to reunite the key players in the French process industries and to inform parliamentary members in charge of research and of the industry, discipline and related issues. The strengths and weaknesses of the scientific community were identified and the major industrial advances were put forth. Furthermore, the national assizes demonstrated the important role chemical engineering has in the transformation of the French process industries to become worldwide leaders.

The White Paper brings together and describes the prospective work, which has been translated into a roadmap for parliamentary members and key players in industry. The SFGP is convinced of the importance of chemical engineering for the future of the French process industries and therefore has decided to enhance resources and collaborations and to promote innovation in order to tackle a dual challenge: increase the competitiveness and develop the French industries such that they are better accepted by society.

François Nicol
President of the SFGP

INTRODUCTION

Chemical Engineering is essential for tackling the industrial and societal challenges of tomorrow.

Most agree that France needs to prompt economical and societal changes and become one of the world leaders in manufacturing and production again. Indeed, France must not only resist de-industrialisation but also rethink the manufacturing industry in order to improve employment and not be so dependent on foreign countries. France has the resources – including excellent education, quality scientific research, and a capacity to innovate – which are needed to succeed. What is missing, however, is modernisation of its R&D methods, and this is essential to increasing the competitiveness of companies. In this context of reindustrialisation, chemical engineering plays a very important role and will be key to taking the French manufacturing industry to a world-leading level.

Chemical engineering offers solutions for the development of new products and technologies, for better management of resources (raw materials, water, energy) and for the reduction of waste in various domains such as the food industry, chemical industry, wastewater and environment, nutrition and healthcare industries, energy, and sustainability of cities. Following the French National Strategy for Research (SNR) and the Future Investments program, the SFGP organised the Assizes of Chemical Engineering in 2016-2017. These assemblies, which were held under the patronage of the Ministry of Higher Education and Research and the Ministry of Industry, aimed at informing industrialists of the importance of chemical engineering to their manufacturing and production activities.

The Assizes of Chemical Engineering were held in Paris in March 2017 with participants from academia, industry, the Ministry of National Education, the Ministry of Higher Education and Research and the Ministry of Economy and Finance, as well as the parliamentary Office for Scientific and Technological Assessment.

The main ideas discussed during the assizes have been presented in a White Paper, which the present booklet summarizes. This booklet aims at illustrating the essential contribution of chemical engineering to the renaissance of French industries in the framework of the New Industrial France.

WHAT IS CHEMICAL ENGINEERING?

Chemical engineering studies the transformation of materials for product manufacturing, whilst optimising the use of raw materials and energy resources.

Chemical engineering deals with real objects, which are complex in terms of their geometry, structure, time evolution (reactions, heat and mass transfer) or behaviour (deformation, transformation of materials...).

Challenges and domains of application

The challenges of chemical engineering are both industrial and societal: **the goal is to move towards a cleaner industry, a zero-waste society and a sustainable economy**. Chemical engineering offers technical solutions, which respond to the following constraints: robustness, flexibility of manufacturing processes, economic viability, control of safety and environmental impact, and reduced energy use.

Specialists in chemical engineering work in both research and development, in engineering consulting offices, in production, in equipment manufacturing, as well as in associated technical and economic activities.

There are **numerous domains of application of chemical engineering** including industries related to environment, food, biotechnology, pharmacy, healthcare, chemistry, materials, energy, nuclear, petrol, textile, automobiles, aeronautics and even space exploration. This large field of investigation and the systemic approaches developed in chemical engineering respond to 8 of 10 challenges stated in the 2017 SNR.

An integrative science

Chemical engineering is an integrative science that feeds on other scientific disciplines (chemistry, biology, physics, thermodynamics, applied mathematics, solid and fluid mechanics, sociology, economy and management of companies…) to develop unique concepts. **This encompassing vision enables the ensemble of the steps of diverse transformation processes to be better understood** in terms of design, operation and optimisation, leading to the production of high quality functional products.

Chemical engineering feeds on other scientific disciplines to better understand chemical and physical phenomena in a global manner and uses this to develop unique scientific concepts.

Chemical engineering covers a wide domain of physical scales, from the nano- and micro-scales (employing fundamental approaches from physics, quantum chemistry or genomics) to large-scale systems (equipment, processes, factories and national territory).

Chemical engineering reunites two complementary approaches in a single methodology:

- **Detailed analysis of elementary phenomena**: this first step consists in describing and modelling the complex nature of phenomena occurring using fundamental laws in order to achieve a thorough understanding of a process.
- **Integration of elementary phenomena at the scale of a process**: this second step consists in assembling and describing the interactions between different elementary phenomena such that they are considered as a whole process.

The integration of several scientific disciplines into a modelling framework makes this scientific methodology **a powerful tool for applications in numerous domains**.

CHEMICAL ENGINEERING, KEY FOR A NEW INDUSTRIAL FRANCE

Chemical engineering contributes to the industrial solution "New Resources".

Transforming the industrial model

Accomplish reindustrialisation in France: this is the ambition of the New Industrial France and the project "Industry of the Future" . The objective is to incite companies to modernize their industrial tools and transform their business model. This ambition is based on nine industrial solutions, which offer specific answers to important economical and societal challenges encountered by French companies. Chemical engineering directly contributes to these dynamics and particularly to the industrial solution "New Resources" via input on renewable energy, water and air quality, green chemistry, bio-sourced molecules, bio-fuels and, more generally, bio-economy.

Core of the factory of the future

The contribution of chemical engineering to the "Factory of the Future" is based on three key concepts:

- Interconnected operation of equipment and the energy and products circulating in the factory;
- High flexibility and modularity of production processes in order to adapt to variabilities in both raw materials and the market, as well as the manufacturing of off-catalogue products at large production scale;
- The development of decision making tools for the design of new product-process pairs.

A change in mentality and of culture

Several trends contribute to a change in mentality and of culture, including:
• Digitalisation of industry (internet of things, virtual reality, big data),
• Reindustrialisation based on the specificities of the national territories,
• Reconfiguration of production units and the underlying question of large centralised production sites, compared with small delocalised sites that are more easily reconfigured,
• Adaptability of production systems,
• Economy and sharing of resources,
• Necessity of social acceptability.

A change in mentality and of culture, whilst keeping in mind the management of resources and the **global costs for the society**, is necessary.
The underlying themes focus particularly on the analysis of data streams in real time, sensors, advanced process control, data analysis, numerical modelling of complex systems, simulation, advanced robotics, additive manufacturing, connected objects, enhanced reality, man-machine interfaces, new organisations, training, placement within the national territory, environment, health, safety, and employability.

An essential discipline to guide manufacturing

Chemical engineering is an essential discipline to guide manufacturing. It provides a methodology, which will allow the development of more efficient processes by reducing energy usage, the emergence of new materials, the use of renewable resources, the development of biotechnology, the re-use of waste, and in a general manner, a circular economy.

REMARKABLE ACHIEVEMENTS

The contribution of chemical engineering to industrial production in diverse domains of application is undeniable.

Stimulating the industrial renaissance

Stake

Isopropyl acetate is used as a solvent for extraction processes in the pharmaceutical, cosmetics and perfume industries, as well as for the production of inks used food packaging and numerous synthetic resins.

Challenge

Reduce energy consumption by designing new methods and technologies, which enable suppression of the limiting steps in the production processes (process intensification)

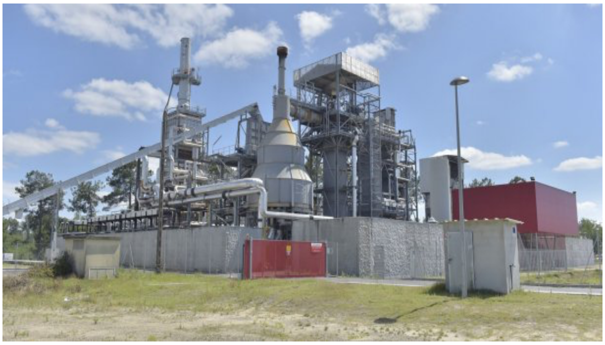
Isopropyl acetate industrial production unit

Result

In partnership with IFP Energies Nouvelles, Novapex has developed a new isopropyl acetate production process and opened a production unit with an annual capacity of more than 5000 tons. In 2016, this innovation was awarded the Pierre Potier Prize, which honors sustainable development initiatives in the chemical industry.

A novel concept combining process intensification, as well as energy and environmental efficiency.

Renewing the energy package



Reactors at the industrial site of Morcenx, France. CHO_Power industrial process

Stake

Generate electricity from biomass.

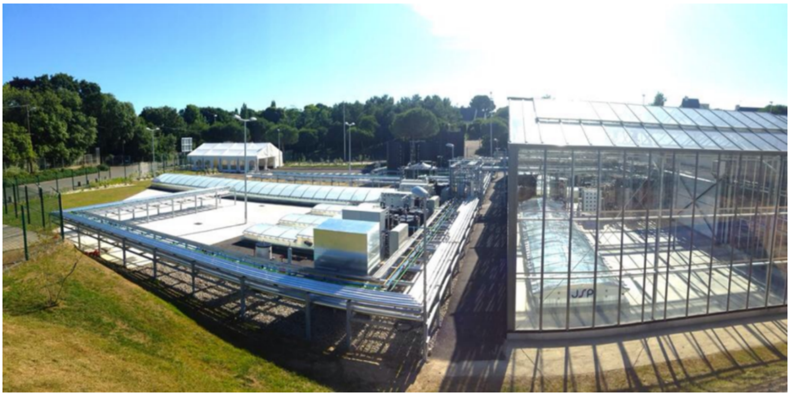
Challenge

Design a high temperature reactor for cracking tar, which comes from gasification processes.

Result

In partnership with LaTEP (*Laboratoire de Thermique, Energétique et Procédés*) at the University of Pau, France, the SME Europlasma has designed and developed an industrial reactor (60 m^3), as well as a pilot-scale reactor for R&D purposes.

Exploiting the potential of microalgae



R&D AlgoSolis platform (GEPEA Saint Nazaire, France)

Stake

Produce 3rd generation bio-fuels and non-petroleum based binders.

Challenges

- Optimise and control the photosynthetic bioreaction
- Develop, optimise and control microalgae production processes and biorefinery
- Integrate unit operations such that the industrial production is optimised

Result

With the support of GEPEA (*Laboratoire Génie des Procédés, Environnement et Agroalimentaire, CNRS/Université de Nantes/IMTA/ONIRIS*), a start-up AlgoSource was created and a service platform (AlgoSolis), which is open to both industry and academia, was set-up.

Recycling aeronautical wastes

Stake

Recycle composite materials (polymer materials reinforced with carbon fibres), which are widelv

Challenges

Develop an evaluation system that enables the environmental, economic and societal performances to be assessed in the sector of the recycling of composite materials.

Result

The LGC (*Laboratoire de Génie Chimique, Université de Toulouse/CNRS*) participated in the definition of criteria and evaluation methods for different sectors of recycling in order to enable those concerned (aeronautical industry, composites and recycling sectors, government, regulation authorities) to integrate aspects of sustainable development in their technical and organisational choices.

The increased use of composite materials and their potential end of life waste raises environmental concerns for which chemical engineering can provide solutions.

Exploring new horizons

Chemical engineering is the only possible approach that allows the knowledge on bioprocesses to be integrated into a global model.

Stake

Enable man to carry out missions in outer space without provisions by reusing wastes to produce oxygen, water and food.

Challenges

• Understand and control decomposition and production processes
• Develop models that can be adapted to non-conventional operating conditions (e.g. reduced gravity)
• Integrate the knowledge of each process into a global model, which provides solutions for the life support of man in space.

Result

In the framework of the MELiSSA project (European Space Agency), the Institut Pascal (Université Clermont/CNRS/SIGMA Clermont) has contributed to the demonstration of a complete closed loop concept, which has been operated for 100-day measurement campaigns.

KEY PLAYERS IN CHEMICAL ENGINEERING RESEARCH

A diverse community

Chemical engineering is present in **universities and engineering schools**, as well as in public **scientific & technical centres (EPST) and industrial & commercial centres (EPIC)**. The themes addressed in the different chemical engineering departments contribute to 8 out of 10 challenges of the SNR and 19 out of 41 priority research trends. The exact number of chemical engineering researchers is relatively difficult to assess due to the large number of research centres and the overlap with various scientific disciplines. A reasonable count is **1800 researchers** (excluding PhD candidates and post-doc fellows). This estimation does not take into account the researchers from industrial R&D centres and technical centres. The majority of researchers, engineers and technicians in chemical engineering are from the institutions listed below. These institutions unite their strengths in joint laboratories (Mixed Research Units, UMR).

Chemical engineering in universities and engineering schools

In France, academics in chemical engineering work in universities (typically in technical institutes (IUT) specialising in chemistry, biology, chemical engineering, thermal engineering and energy) and in chemical and process engineering schools. There are approximately 1000 chemical engineering teaching staff in higher education across France. The universities and engineering schools principally operate under the Ministry of Higher Education, Research and Innovation; however, some operate under other ministries, such as ministries of agriculture and food, or economy and finance.

In France, academics in chemical engineering work in universities and in engineering schools.

Chemical engineering in public research organisations

CNRS – national centre for scientific research

Chemical engineering is essentially developed in the Institute of Sciences of Engineering and Systems (INSIS). A few teams from the Institute of Chemistry (INC) and the Institute of Ecology and Environment (INEE) also work in domains relative to chemical engineering.

Number of researchers: 120*

CEA – atomic and alternative energy authority

At the CEA, the researchers in chemical engineering are involved in the field of nuclear energy, with particular focus on the fuel cycle and renewable energies (biomass, solar, batteries, hydrogen).

Number of researchers: 300*

IFP Energies Nouvelles (IFPEN) – IFP new energies

The researchers in chemical engineering are mostly located in the Lyon research centre in two research divisions: "Process Design & Modelling", and "Process Experiments". Another department "Applied Physical Chemistry and Mechanics" in Rueil-Malmaison includes studies on thermodynamics, chemistry and physical chemistry of complex fluids and materials, and electrochemistry.

Number of researchers: 170*

INRA – national institute for research in agronomy

Chemical engineering is for the most part developed in the department "Science for Food & Bioproduct Engineering", as well as in the departments "Environment and Agronomy" and "Microbiology and the Food Chain".

Number of researchers: 70*

* approximate data

INRS – national institute for research and safety

An entire department at INRS is dedicated to the development and dissemination of technical solutions that allow risks related to exposure to toxic compounds (aerosols, gases, liquids, solids) to be prevented. The approach employed focuses on taking the risks into account when the equipment and technical installations are being designed. INRS works on the modification or substitution of processes, or of their operating conditions, in order to decrease the exposure of workers to chemical risks.

Number of researchers: 45*

CIRAD – centre for international cooperation in agronomy research

Research in chemical engineering is developed in the department "Performance of production systems".

Number of researchers: 30*

*approximate data

INERIS – national institute for industrial environments and risks

The researchers in chemical engineering at INERIS work in the "Accidental Risks" division. They focus on the control of risks, which are associated with both conventional and novel processes.

Number of researchers: 30*

IRSTEA – national research institute of science & technology for the environment and agriculture

The researchers in chemical engineering are grouped in the department of "Environmental Technologies", which focuses on food safety and the re-use of wastes and effluents.

Number of researchers: 25*

IFSTTAR – institute for science & technology for transport, planning & networks

The researchers in chemical engineering at IFSTTAR belong to the departments "Geotechnical engineering, Environment, Natural Hazards, Earth Sciences" and "Materials & Structures".

Number of researchers: 10*

International cooperation

Collaborations between French education/research departments and departments of Chemical Engineering across the world have increased greatly over the last 20 years:

- In terms of education, most higher education institutions in France have agreements with universities worldwide and student work experience in a foreign country is compulsory for most engineering schools. The ERASMUS program in Europe facilitates students being hosted in other countries.
- In terms of research, international collaborations are supported by different means: International Research Groups, CNRS International Associated Laboratories, European programs, Hubert Curien programs etc.

International relations between the key players of chemical engineering have increased significantly over the last 20 years.

Challenges for chemical engineering researchers

Factory and processes of the future

Regardless of the scale, the factory and processes of the future must be novel, competitive, high performance, safe and attractive. The factory of the future will need to create value and employment in synergy with collaborators, production machines, service providers and the national territory. The factory of the future will be designed to provide answers to economical, technological, organisational, environmental and societal challenges.

RECOMMMENDATIONS

• Understand and model multi-scale mechanisms occurring in processes, as well as their interaction with equipment design, such that more flexible and robust processes can be developed.
• Enhance collaboration with industry, including SMEs. Set-up advisory boards under the aegis of the ministry of industry.
• Rethink man-machine interactions with respect to the development of autonomous processes.

Energy

The development of new energy vectors – in particular concentrated solar energy, bioenergy (thermochemical and biological processes), fuel cells and processes related to the production and use of hydrogen – is an important theme in chemical engineering. Energy is a 'mass' product for which scale-up, as well as optimisation of processing steps (from energy resources to energy vectors) are essential. These aspects are the foundations of chemical engineering. The use of renewable energy resources, however, raises new issues such as the problem of energy storage, which may be addressed with compressed air, phase change materials and electrochemistry. Hybrid energy supplies must be optimised with respect to the energy resources used (e.g. electrical networks with different forms of energy production and heat networks) and in function of the end use (e.g. transport, buildings, factories, cities, territories). On the other hand, the optimisation process must be carried out by adapting the energy needs to what is available.

RECOMMMENDATIONS

• Develop chemical engineering for energy transition in interaction with other scientific domains: biology, chemistry, materials, mechanical and thermal engineering.

Re-use of wastes and circular economy

In the context of environmental protection, maintenance, repair, recycling and reutilisation should be compulsory for all. Viable and profitable shortcuts in production, will allow companies to manufacture as needed with greater reactivity and customisation.

RECOMMMENDATIONS

• Develop chemical engineering for a sustainable economy (recycling, reduced needs of raw materials, energy, water), and take interest in the materials used (recycled, biodegradable) from the start of manufacturing processes and in the end of life of products.

• Develop a global engineering approach, integrating products and side-products, which may also be a resource for raw or new materials.
• Collaborate with Social and Human Sciences in order to address the issue of acceptability of factories by the population in a more rational manner.

Renewable resources and new resources

Chemical engineering must provide answers to the issues raised concerning a sustainable economy. The process industries are going to progressively substitute raw materials based on fossil fuels with new sustainable materials. In the chemistry, energy and materials sectors, this means tackling the rarefaction of non-renewable resources and reducing the environmental impact and carbon footprint by employing biomass and recycled materials, instead of petroleum-based raw materials. This transition towards a bio-economy will have significant consequences on production processes and the organisation of the different branches of industrial manufacturing. Numerous aspects, such as securing supplies, formulation and transformation of inputs, end of life product management and recycling, must be reconsidered in a more global manner such that new production chains, which are economically viable and sustainable, are developed. The modification of existing processes or the development of new processes to respond to these needs will require significant effort in R&D.

RECOMMMENDATIONS

• Transfer chemical engineering knowledge and methods to agricultural processes. Chemical engineering must also consider agronomical techniques (e.g. off-ground cultivation).
• Research may be directed to either the adaptation of processes with respect to the resource, or the adaptation of the biomass (selection of variety, cultural itineraries…) to the process. Considering the spatial and temporal variability of resources, the processes that need to be developed should be versatile with multiple possibilities of control.
• Model production systems (from the resource to the product) by integrating life-cycle analyses and factory of the future concepts. Bio-refineries, circular economy and bio-economy are part of this approach. A 'fair' division between the different uses of resources must be included in the modelling approach, as well as a multi-scale (from territories to the planet) vision.

Food of the future

Food of the future is a real scientific and environmental challenge, as well as a humanitarian objective. It requires the growing needs of the human population to be satisfied by developing new habits in terms of food consumption and alternative foods (vegetable-, animal- or mineral-based). Food transformation processes also require improvement in order to use or re-use all parts of products, whilst minimising the impact of technological treatments on the bioavailability of biomolecules in the final products.

RECOMMMENDATIONS

• Develop chemical engineering such that it can provide multiple technical solutions, taking into account the temporal and spatial variability of the resource.
• Develop links between academia, technical centres, equipment manufacturers, SMEs and multinational groups.

CHEMICAL ENGINEERING EDUCATION

There are numerous possibilities in chemical engineering education in France despite the fact that it is not a well-known discipline.

Chemical engineering can be studied from high school (professional Baccalaureat) to PhD level, as well as in technical university, engineering and Masters programs.

High school level

Two streams for the professional Baccalaureat and one professional certification exist:

- Professional Baccalaureat in "Transformation Processes in the Bio-industries" (61 institutions)
- Professional Baccalaureat in "Chemical, Water and Paper Processes" (48 institutions)
- Professional certificate in "Food Industries" (12 institutions)

Advanced technical certificates (BTS)

BTS certification (tertiary education) in chemical engineering can be obtained through four streams:

- Process Control (22 institutions)
- Industrial Control and Automatic Regulation (48 institutions)
- Professions in Chemistry (32 institutions)
- Professions in the Water Industry (24 institutions)

University

Different levels of chemical engineering degrees are offered in French higher education institutions: 2-year technical diplomas, 3-year professional bachelor degrees and 5-year combined engineering and masters degrees. Traditional chemical engineering bachelor degrees at universities no longer exist (since 2014), which unfortunately leaves a gap in chemical engineering education system.

Technical university diplomas (DUT)

Technical university diplomas in chemical and process engineering currently represent 2.5% of graduates in the manufacturing sector (i.e. 400 graduates per year from 12 institutions). This number is increased when considering other graduate programs, which include some chemical engineering in the syllabus:

- Thermal engineering and energy: 822 graduates per year, i.e. 4.4% of graduates in the manufacturing sector.
- Chemistry: 1394 graduates per year, i.e. 7.5% of graduates in the manufacturing sector (17 institutions include chemical engineering courses).
- Biology: 2815 graduates per year, i.e. 15.1% of graduates in the manufacturing sector (23 institutions include chemical engineering courses).

Professional bachelor degrees

Amongst the 173 programs for professional bachelor degrees offered in French universities, there are four programs related to chemical and process engineering: "Process engineering for the environment", "Process engineering and industrial bioprocesses", "Process design and control", and "Industrial chemistry".

The education programs in "Pharmaceutical, cosmetics and health industries: management, production and valorization" and "Bio-industries and biotechnologies" also offer professional bachelor degrees in relation to chemical and process engineering.

There is a total of 33 education programs in chemical and process engineering involving approximately 500 students. Some of these are only available through work-study training educational programs.

Masters

The Masters education program "Process engineering and bioprocess engineering", which exists since 2014, is the result of a strong mobilization of the scientific community in support of the discipline. In addition to this program, chemical engineering subjects are also found in other programs such as "Biotechnology", "Chemistry", "Physical and analytical chemistry", "Energetics and thermal engineering" and "Materials science and engineering". There are 11 institutions in France that offer a Masters degree in process engineering.

The strong mobilization of the chemical engineering community has resulted in the creation of a Masters program dedicated to the discipline.

Engineering degrees

The 5-year chemical engineering education program was developed across the French territory between 1991 and 2016. There are 11 engineering schools that offer a specific education program in chemical engineering, resulting in 600 graduates per year, which is two times more than in 1991. In parallel, over the last 25 years, the chemical engineering discipline has spread to other educational programs, such as chemistry (within the Guy-Lussac Federation), general engineering (*écoles Centrales, Polytech, école des Mines…*) and industrial engineering. A quantified summary on the number of students is difficult to provide since the education programs are very diversified (numerous options are available allowing the students to specialise in certain areas). However, 45 engineering schools offer an education program that includes certain aspects of chemical engineering.

The 5-year chemical engineering program has been developed principally in engineering schools.

Doctorate studies

Doctorate studies in chemical engineering are offered by a large number of institutions and doctorate schools. These high-level programs enable graduates to access employment in industry (e.g. as project managers and experts with an awareness in innovation) and in academia. Detailed research work on a specific subject enables the candidates to develop critical thinking skills and a capacity to communicate in international scientific communities.

Positive results …

An assessment of the French chemical engineering education program over the period 1991-2017 shows:

- An increase in the number of graduates.
- An increase in the number of programs that include chemical engineering.
- A diversification of the domains of application, integrating sustainable development, safety and quality.
- Development of industrial engineering.

Over the period, the French chemical engineering education programs have modified their syllabus, as well as the teaching and training methods used, in order to adapt to the needs of industry, the evolution of society and the diversity of students. All of the engineering schools have been certified in terms of syllabus, international relations, partnerships etc. by the national institution for engineers.

Effort is required to provide a better understanding of chemical engineering to the population, as well as to promote it and make it more attractive as a discipline.

…challenges yet to be addressed

There are several current projects that focus on preparing undergraduates for the industry of the future, the management of interdisciplinary and complex problems, as well as the need for new and quickly evolving skills. These projects focus on:

- The development of novel and interactive education programs,
- Increasing the attractiveness of the discipline to future students,
- Anticipating the evolution of the profession,
- Preparing undergraduates for:
  - the industry of the future,
  - the management of interdisciplinary and complex problems,
  - the evolution of expectations of industry and the required skills,
  - the analysis of big data and artificial intelligence.
- Making the discipline better known and more attractive to students,
- Interacting with the national bureau for information on education programs and professions (ONISEP),
- Training secondary school teachers in engineering sciences and in particular, in chemical engineering,
- Introducing base concepts of chemical engineering in secondary school programmes,
- Offering a secondary school teaching degree in chemical engineering.

THE FRENCH SOCIETY OF CHEMICAL ENGINEERING

The SFGP unites the key players of chemical engineering in France.

The SFGP is an association that unites engineers, technicians, academics and research scientists in order to promote chemical engineering in the process industries (chemical, petroleum, pharmaceutical, biotechnology, food, paper and cement). The objective of the association is to contribute to the construction of tomorrow's process industries in France.
The principal tasks of the SFGP are to:

• Contribute to the national thought-process on major industrial challenges: the new industrial France, energetic and ecological transitions, bioeconomy, factory of the future…
• Provide solutions to technical problems encountered in industry and share them with networks of experts.
• Provide an environment for scientific dialogue and brainstorming open to all professionals in the chemical engineering discipline.

An active network

The SFGP is managed by an administration council, composed of 30 members from industry, university, engineering schools, scientific and technical institutions, industrial and commercial institutions, as well as professional associations.
18 working parties contribute to the scientific and technical progress in the field of chemical engineering by organising technical and prospective seminars and by participating in the biannual SFGP national congress.
The SFGP is active in European organisations such as the European Federation of Chemical Engineering (EFCE) and the European Society of Biochemical Engineering Sciences (ESBES).
The SFGP is also interacts with other scholarly societies in France (e.g. the Association of Chemists and Leaders of Agricultural and Food Industries, French Association of Mechanical Engineering, French Group of Polymers, French Society of Chemistry, French Society of Materials, French Society of Thermal Engineering) whose activities overlap with chemical engineering.

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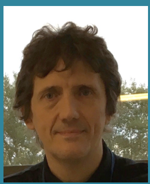

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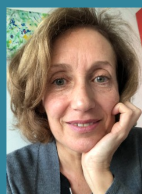

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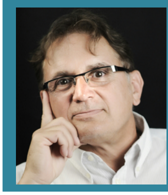

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The national Assizes of Chemical Engineering were held

under the patronage of the Ministry of Higher Education and Research and the Ministry of Economy and Finances

With the sponsorship of

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28 rue Saint Dominique
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December 2017

ISBN 978-2-910239-83-1