

THE ESSENTIALS
2017 - 2018

INNOVATING
FOR ENERGY

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2017 - 2018

INNOVATING
FOR ENERGY

www.ifpenergiesnouvelles.com

MEETING TOMORROW'S CHALLENGE TODAY

IFP Energies nouvelles

is a major research and training player in the fields of energy, transport and the environment. From research to industry, technological innovation is central to all its activities.



IFP ENERGIES NOUVELLES

INTERVIEW WITH **DIDIER HOUSSIN**

Chairman and CEO of IFPEN

**PREPARING
FOR
THE FUTURE**
**BY BUILDING
ON IFPEN'S
SUCCESSSES**



“ *There is a determination to accelerate and reinforce IFPEN's focus on new energies and to move towards the complete self-funding of activities conducted within the context of the responsible oil and gas strategic priority, in line with our objectives and performance contract.* ”

IFP ENERGIES NOUVELLES (IFPEN) IS A MAJOR RESEARCH AND TRAINING PLAYER IN THE FIELDS OF ENERGY, TRANSPORT AND THE ENVIRONMENT.

From research to industry, technological innovation is central to all its activities, structured around three strategic priorities: sustainable mobility, new energies and responsible oil and gas.

As part of the public-interest mission with which it has been tasked by the public authorities, IFPEN focuses on:

- providing solutions to take up the challenges facing society in terms of energy and the climate, promoting the transition towards sustainable mobility and the emergence of a more diversified energy mix;
- creating wealth and jobs by supporting French and European economic activity, and the competitiveness of related industrial sectors.

Consisting of world-leading industrial players and small to medium-sized companies with strong growth potential, this policy of valorisation is illustrated by the portfolio of subsidiaries and stakeholdings of the IFP Group.

An integral part of IFPEN, its graduate engineering school – IFP School – prepares future generations to take up these challenges.

Created in 1944, IFPEN is a state-owned industrial and commercial establishment.

KEY FIGURES 2017



€278,2M budget
INCLUDING
€232,9M for R&I

R&I activities self-funded
to the tune of more than
50%

50% 
of budget dedicated
to new energy
technologies

2 SITES
at Rueil-Malmaison (near Paris)
and Solaize (near Lyon)

More than
600
scientific
publications
and conference
papers



187
basic patent
applications
of which **79**
in the field of NETs

66
collaborative projects
with public support
involving IFPEN under
way in 2017

Around
500
IFP School
graduates of whom
50% are international
students



1,638 
Total full-time equivalent
workforce for 2017
including **1,115** researchers
(R&I engineers and technicians)

Over
50
job fields

More than
210
research
grant holders,
post-doctoral
researchers and
placement students



More than
30
companies
created by IFPEN
since 1944



450
employees have
been mobile
since 2014



More than
72%
of employees
benefited from at
least one training
initiative in 2017



ISO
9001
certification renewed
for R&I activities



4,89%
Proportion of disabled
workers in 2017



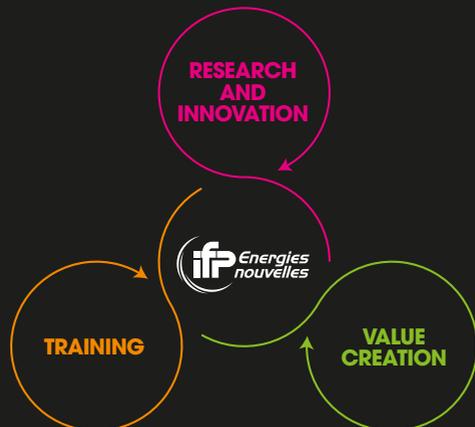
OUR MISSION

A CONTEXT

CLIMATE CHANGE AND THE ENERGY TRANSITION



THREE PRIORITY AREAS



STRATEGIC DIRECTION

DEVELOPING THE INNOVATIONS OF TODAY AND TOMORROW

As a committed player in the energy transition, IFPEN has set itself a dual objective: contributing to the development of the energy mix in the 21st century, by supporting the creation of new industrial sectors in the field of renewable energies, while simultaneously maintaining the technological competitiveness of the oil, gas and transport industries. To achieve this, IFPEN'S R&I work is structured around three strategic priorities supported by fundamental research.

SUSTAINABLE MOBILITY

Reducing CO₂ and pollutant emissions, diversifying energy sources and incorporating the evolution in transport modes: these are the challenges associated with sustainable mobility. IFPEN channels its expertise into addressing this triple challenge via the IFPEN Transports Energie Carnot Institute. The latter explores three complementary technological avenues, namely, vehicle electrification, from the hybrid to the electric vehicle; the development of services and applications for the connected vehicle; and the improvement of IC engines in terms of energy efficiency, the reduction in pollutant emissions and pollution control, and the optimization of fuel use, particularly low-carbon fuels.



NEW ENERGIES

The energy transition and tackling climate change depend on the development of new resources. For example, IFPEN develops sustainable fuel production processes based on biomass that can be used in conventional engines, as well as production processes targeting bio-based chemical intermediates. Its activities are also aimed at proposing technological solutions for the development of ocean energies. In parallel, IFPEN focuses on energy storage technologies and conducts research to improve CO₂ capture processes.



RESPONSIBLE OIL AND GAS

Today, the oil and related industries have to meet the still sustained demand for oil and gas, while significantly reducing their environmental footprint and consuming less energy. IFPEN develops eco-efficient processes for the production of fuel, hydrogen and chemical intermediates meeting the strictest standards. In addition, IFPEN develops cutting-edge technologies in target fields, such as exploration or enhanced oil and gas recovery, in order to improve the production of existing reserves.

FUNDAMENTAL RESEARCH SERVING INNOVATION

In order to facilitate the emergence of its innovations and ensure the scientific excellence of its research activities, IFPEN draws on a solid fundamental research program. Organized around nine scientific challenges, the program represents a cross-functional bedrock for addressing scientific questions associated with the development of new products and processes. To this end, IFPEN maintains a dynamic ecosystem of academic partnerships and invests in numerous French and European collaborative research initiatives.



CREATING WEALTH AND JOBS

IFPEN's economic model is based on the transfer to industry of the technologies developed by its researchers. This technology transfer generates jobs and business, fostering the economic development of fields and approaches related to the mobility, energy and eco-industry sectors.

A CULTURE OF INNOVATION

The success of IFPEN's value creation model depends on its capacity to deliver innovations, via the development of a forward-looking vision of its activities and the production of research in line with the needs of its customers and partners. IFPEN has also equipped itself with the organizational structure, methods and tools it needs to detect new opportunities and to take into account the potential for the market development of the targeted products and services right from the outset of projects.

A STRONG PARTNERSHIP STRATEGY

Because pooling knowledge, know-how and costs creates synergies and accelerates the innovation process, because developing new industrial processes depends on the involvement of all the players, IFPEN favors collaborative research via strategic partnerships with academia and industry, throughout the innovation chain.

FROM RESEARCH TO INDUSTRY

IFPEN's innovations are brought to market through close partnerships with industrial players and IFP Group subsidiaries, that include benchmark global players and young innovative companies. In addition, IFPEN creates firms or acquires shareholdings in innovative companies, and supports the development of start-ups, SMEs and intermediate-sized companies.



TRAINING THE KEY PLAYERS IN THE ENERGY TRANSITION

Against the backdrop of the energy transition, IFP School and IFP Training provide industry with the highly qualified personnel it requires. IFP School provides young graduates and professionals with advanced graduate degree programs in the fields of energy and sustainable mobility. Over 500 students from throughout the world graduate from the school each year. IFP Training, an IFPEN subsidiary, offers training programs to almost 15,000 employees from industry every year, reinforcing their competitiveness.

IFP SCHOOL



IFP School's ambition is two-fold: to provide industry with the skills it needs today and to train the future energy transition players. For this, it is supported by a strategic ecosystem of academic and industrial partners, offering its students a resolutely innovative teaching model. IFP School graduates are immediately operational and already prepared for the jobs of the future in the field of new energy technologies.

IFP TRAINING

IFP Training trains the operators, technicians, managers, engineers and leaders of the oil and gas, chemicals and powertrains sectors. A shareholder in Corys, the global dynamic process simulation leader, IFP Training provides a unique global solution combining high fidelity, generic or specific simulators, and programs leading to a qualification, aimed at improving the performances and safety of teams in the field.



SUMMARY

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HIGHLIGHTS

IFPEN 2017-2018 NEWS IN BRIEF

IFPEN-LYON: 50 YEARS OF INNOVATION

In 1967, IFPEN opened its design and industrial development center in Solaize, near Lyon, to expand its testing facilities. The site houses pilot units and large scale equipment used to extrapolate laboratory research to an industrial scale. Over the decades, IFPEN has thus contributed to the development of new products, processes and industrial sectors, in the fields of energy, transport and eco-industries. Half a century of innovation.



IFPEN AMONG THE WORLD'S TOP INNOVATORS

- In 2017, with 175 patent applications filed, IFPEN remained 13th in the INPI (French National Industrial Property) rankings of patent filers and was also among the top three research bodies in France with the CEA (French Alternative Energies and Atomic Energy Commission) and CNRS (French National Center for Scientific Research);
- IFPEN also filed 187 first patents, including 79 relating to new energy technologies (NETs), and is one of the top patent filers outside France, with 1,140 rights created in 2017;
- IFPEN was also singled out for the 2nd year in succession, winning a silver medal in the category "Intellectual property division: patents" at the 2017 "Trophées du Droit" (Law Awards) ceremony.

IN LIFE-CYCLE ANALYSIS

Life-Cycle Analysis (LCA) is a key tool for quantifying a sector's environmental externalities, from the resource to be mobilized through to product launch. IFPEN's expertise in this field now incorporates the geographical dimension, an essential approach when it comes to addressing territoriality issues inherent to the decentralization of production resources related to new energies. The potential of spatialization in LCA was illustrated at the EcoSD* network's theme day, held at IFPEN in March 2017. Co-organized with IRSTEA (French National Research Institute of Science and Technology for the Environment and Agriculture), INRA (French National Institute for Agricultural Research) and the school of Environmental Management and Engineering, the event brought together around one hundred academic, industrial and institutional representatives.

* Eco-design of systems for sustainable development

AN IN-HOUSE INNOVATION CHALLENGE

In 2017, IFPEN launched a major in-house innovation challenge. The goal: to help reinforce IFPEN's activities in the field of new energy technologies (NETs), providing research programs with new projects. In total, 167 proposals were evaluated with a view to selecting 6 winning projects in 2018.



A ROADMAP TO SUPPORT THE DIGITAL



IFPEN conducted a major reflection process concerning the digital transformation, a veritable strategic priority for the years to come. The resulting roadmap will guide the evolution of the company's operating tools and methods with a view to achieving greater efficiency, as well as - and above all - the evolution of its R&I services to address new market needs.

PANORAMA 2018 CONFERENCE

The 2018 conference was dedicated to the "Energy transition: the role of territories and technological challenges". The event brought together more than 140 energy, transport and environment professionals, as well as 200 online participants, to discuss fundamental issues concerning levers for accelerating the energy transition in the territories, the challenges and obstacles to be addressed for the large-scale roll-out of renewable energies and the funding of territorial climate initiatives.

www.panorama-ifpen.fr



SUSTAINABLE MOBILITY



25%
of global energy
demand is related
to the transport
sector

THE IFPEN CARNOT INSTITUTE MEETS MOBILITY SECTOR PLAYERS

The IFPEN Transports Energie Carnot Institute forges relations with micro-companies, SMEs and intermediate-sized companies operating in the car and mobility sectors at various events it either organizes or takes part in. The objective: to help these companies gain access to R&I support specific to their innovation need. For example, it:

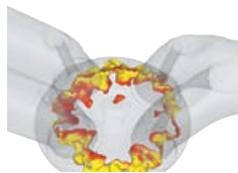
- organized the first "17-20 Carnauto" event, held in May 2017, at IFPEN-Lyon, on the theme of vehicle electrification;
- took part in the 10th edition of the Carnot Events, held in Paris in October and met numerous project leaders;
- presented its innovations at the Global Industrie Conference in March 2018, particularly an electric motor co-developed with Mavel and a light vehicle ORC* prototype co-developed with Enogia.

* Organic Rankine Cycle, a thermal energy recovery system

TESTS IN REAL OPERATING CONDITIONS OF VEHICLES EQUIPPED WITH THE CIGAL CONCEPT

The CASUAL project, funded by ADEME Auvergne-Rhône-Alpes, entered the experimental phase in 2017. This project brings together IFPEN and Warning, a goods delivery company operating in the urban environment. Lasting a year, including six months spent with a small vehicle fleet out on the road, CASUAL demonstrates the benefits of the CIGAL concept developed by IFPEN in real operating conditions. In a context in which access to town and city centers is becoming increasingly restricted, this concept, based on the simultaneous injection of gas and gasoline in an IC engine, represents an important step in the energy transition prior to the all-electric era. This series of tests also makes it possible to collect information on the respective consumption of the two fuels, with a view to optimizing the tanks used.

MODELING AND SIMULATION: CONTINUED TRUST OF IFPEN'S PARTNERS



Within the context of its R&I activities, IFPEN develops software tools for the design of powertrains, marketed by various partners. Two major partnership contracts were renewed in 2017:

- the first, with Convergent Science Inc., relates to the Converge 3D modeling software for fluid flows and engine combustion,
- the second, with Siemens PLM Software, concerns the Simcenter Amesim™ simulation platform, which, in 2017, incorporated the

HOT (Hybrid Optimization Tool). Stemming from IFPEN's R&I, this tool is designed to facilitate the design and optimization of hybrid powertrains.

E-TURBO: A TURBOCHARGER THAT PRODUCES ELECTRICITY



Most current piston engines use a turbocharger to improve the vehicle's performance and fuel consumption, recovering some of the energy lost via exhaust gases. IFPEN has gone further thanks to the development of an original turbocharger electrification solution making it possible to recover even more exhaust gas energy. A demonstrator, designed and tested in 2017, was used to validate the concept of the innovative electric motor adapted to this application, which is extremely demanding in mechanical and electrical terms due to the very high engine speed.

TOWARDS HIGHLY EFFICIENT GASOLINE ENGINES

Significantly improving the thermodynamic efficiency of gasoline powertrains is one of IFPEN's research avenues. Optimized combustion systems based on an original internal aerodynamic approach were thus developed in 2017. Presented at the Aachen conference in October, a demonstration on a 1 liter - three cylinders - 2 valves per cylinder engine delivered a maximum effective efficiency of 42.5% and efficiencies in excess of 40% over a broad operating range.

66 g/km
Average CO₂ emissions
objective set by the European
Union for new cars by 2030

REDUCTION IN AIR POLLUTION: GECO AIR GOES A STEP FURTHER

Developed by IFPEN, the Geco air app provides a real-time analysis of pollutant and CO₂ emissions associated with a journey. Launched in early 2017, Geco air has already caught the attention of numerous private users, local authorities and air quality players. Since May 2018, the app's algorithm has taken into account all sources of particle emissions, including those from worn tires and brake pads, for the calculation of the environmental footprint associated with a specific journey. Moreover, now incorporating a particle emission model specific to direct-injection petrol vehicles, Geco air enables drivers to reduce their particle emissions by a factor of between 1 and 4. Geco air is available free on Google play and iTunes.

NEWS ENERGIES

15%

share of renewable
energies in overall fuel
consumption by 2030*

* Objective specified by the French
energy transition and green growth law

A NEW BIOGAS PURIFICATION TECHNOLOGY

IFPEN joined forces with SME Arol Energy for the Biomet project, supported by ADEME. The project, which ended in May 2018, targeted the energy recovery of biogas produced by methanization. For nearly a year, biogas was purified continuously using gas sweetening technology developed by IFPEN, and then injected into the GRDF gas network. Objective: a reduction in the carbon footprint and an increase in the economic profitability of the process.

FINAL STEPS PRIOR TO THE MARKETING OF THE FUTUROL PROCESS

IFPEN is contributing to the Futurol collaborative project, aimed at developing a complete chain for the production of 2nd-generation bioethanol, which is economically competitive. In 2017, a series of tests conducted on the industrial biomass pretreatment prototype commissioned in 2016 delivered the technical parameters required to validate the industrial scale-up of this technology. Further tests are being conducted in 2018 to qualify a broad range of biomass. Axens is responsible for marketing the process.

VALIDATION OF A PILOT UNIT FOR THE PRODUCTION OF BIO-AROMATICS



IFPEN, Axens and American company Anellotech joined forces in 2015 to develop Bio-TCat, a process for the thermocatalytic conversion of lignocellulosic biomass with a view to the production of bio-aramatics. In 2017, an important milestone was reached with the commissioning of the pilot unit installed at the Silsbee site in Texas, aimed at testing the viability of the process on an industrial scale. In 2018, the first tests validated the technologies and the pilot unit's process control, and demonstrated the unit's continuous operation in a test conducted over 14 days. A major testing program is scheduled for 2018 and 2019 in order to acquire the operational data required for the industrial scale-up of the process. Once the development phase has been completed, the industrialization and marketing of the process will be handled by Axens.

CHEMICAL LOOPING COMBUSTION: THE FOCUS OF A NEW PROJECT

Alongside Sintef and Total, IFPEN is among the nine industrial, university and institutional partners of the Cheers project, launched in October 2017 for a period of five years. Funded by the European Horizon 2020 program and China, this project is aimed at further advancing CO₂ capture technology via the chemical looping combustion process developed by IFPEN and Total. The industrial pilot built in China will be used to evaluate the efficiency of the process through the production of a "pure" CO₂ flow that may be stored underground, used for enhanced oil recovery or recycled by the chemicals industry.

145 gw

estimation of the world's stationary
energy storage capacity

NEW LIDAR MEASUREMENTS FOR THE SMARTEOLE PROJECT

Within the context of the ANR SmartEole project aimed at improving the productivity and life span of wind turbines, IFPEN is working with Avent Lidar Technology (Leosphere group) to develop an innovative software and hardware solution known as Wise-Control. Based on lidar wind measurements, it makes it possible to estimate the wind field in real time with a view to optimizing the orientation of the nacelle and blades. In 2017, a series of tests conducted on a land wind turbine demonstrated the relevance of this solution: considerable potential production gains and reduced mechanical stresses were identified.



FLOW BATTERIES: A PROMISING TECHNOLOGY

In the field of stationary energy storage, IFPEN is targeting the development of alternative technologies to Li-ion batteries - the current market standard -, focusing more specifically on redox flow batteries. There are two advantages with these batteries: they can be scaled to the desired power and energy, and tolerate an extremely high number of recharging cycles. The major challenge concerns the development of new, cheaper, more energy-efficient electrolytes, and this is an area IFPEN is working on.

RESPONSIBLE OIL AND GAS

+3%

Average annual growth
in the demand for chemical
intermediates over the period
2018-2035

NEW PRIME-G+ PROCESS: LESS SULFUR, MORE OCTANE

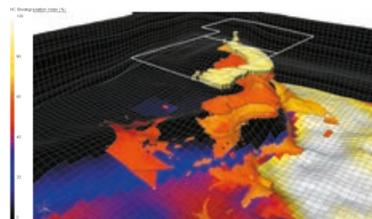
A new version of the Prime-G+ gasoline hydrodesulphurization process was finalized by IFPEN, in partnership with Axens, in 2017. It is aimed at two main markets. Firstly, the USA, where the tightening up of specifications governing sulfur (US Tier 3 standard reduced from 30 to 10 ppm) means that there is a need to upgrade industrial sites with a view to increasing the quality of petrol produced and their volume. The process scheme developed by IFPEN makes it possible to minimize the investments required for this adaptation. Secondly, Asia, and more specifically China, where compliance with the new standard (10 ppm) sits alongside a significant octane constraint requiring compounds containing octane to be preserved during operations to remove sulfur. The process developed by IFPEN addresses this specific need, because it offers enhanced octane retention. To date, more than 290 Prime-G+ units have been licensed by Axens, making it a reference process in the field of clean gasoline production.

A NEW, HIGH-EFFICIENCY SIEVE FOR THE ELUXYL PROCESS



In 2017, IFPEN and Arkema finalized a new molecular sieve to be employed in the Eluxyl separation process for paraxylene, a major product in the formulation of a polymer used to make plastic bottles and synthetic textile fibers. It delivers a 140% increase in productivity compared to the previous generation, while enabling the production of ultra-pure paraxylene, highly sought-after by the chemicals industry. This innovation addresses a strong market demand and consolidates Axens' leading position in the segment as the company that markets the Eluxyl process: it has more than 30 references around the world. As a result of these successes, Arkema set up a new production unit at its Honfleur plant, where the molecular sieves for the Eluxyl process are manufactured. Inaugurated in April 2017, this unit has doubled the plant's production capacity and created local jobs.

OPTIMIZING THE PREDICTION OF EXCESS PRESSURES AND STRESS FIELDS IN OIL BASINS



The modeling of pressure regimes in oil basins is crucial for drilling dimensioning and well safety. As oil exploration begins to move into increasingly complex geological environments, more accurate predictive models are required. To address this problem, in 2015, IFPEN and Total launched the Nomba project, within which IFPEN is responsible for developing a calculator combining the ArcTem basin simulator (integrated into the TemisFlow oil system-modeling suite) with free geomechanical simulation software. In 2017, the world's first combined 3D hydromechanical modeling conducted on a basin operated by Total demonstrated the control exerted by tectonic constraints on the amplitude of excess pressures. The aim of future developments will be to apply this methodology to increasingly complex 2D and 3D faulted tectonic contexts in order to estimate the evolution of excess pressures and stress fields over the history of sedimentary basins.

2035

The date by which the global demand
for fuel should have stabilized

GEOANALOG: A NEW WEB SERVICE FOR THE OIL INDUSTRY

In December 2017, IFPEN launched its GeoAnalog web service. This information and decision-making tool, which has already caught the eye of several major oil industry players, contributes to a better understanding of the deformation of complex geological structures, which in turn, will help guide exploration strategies. With a simple internet connection, the tool provides access to a database of structural analogical models, the fruit of 30 years of expertise and some 1,500 analogical experiments conducted by IFPEN. The complete catalog of analogical models can be consulted free of charge and, for GeoAnalog customers, models are analyzed and visualized via interactive and intuitive technologies.

<https://geoanalog.ifpen.fr>



FUNDAMENTAL RESEARCH

SERVING INNOVATION

LAUNCH OF THE DATAIA CONVERGENCE INSTITUTE

IFPEN is a founding member of DATAIA, a Convergence institute dedicated to data sciences. Supported by the ANR* and led by Paris-Saclay University, this interdisciplinary institute brings together 12 partners (universities, research organizations and graduate schools) to focus on the scientific and technical challenges related to data sciences and associated socio-economic issues. In line with the digital transformation under way at IFPEN, this participation falls within the framework of one of its scientific challenge for the “optimum processing of large volumes of experimentation and simulation data”.

* Agence nationale de la recherche (French National Research Agency)

SIGNATURE OF THE AGREEMENT FOR THE ROAD4CAT CHAIR WITH THE UNIVERSITY OF LYON AND IDEX LYON*

Awarded to Pascal Raybaud (IFPEN), the ROAD4CAT (RatiOnAI Design for CATalysis) chair brings together IFPEN and Lyon’s ENS chemistry laboratory. Its purpose is to develop fundamental research projects aimed, on the one hand, at identifying new concepts governing the transformation of fossil carbon into clean fuels and, on the other hand, exploring new approaches in the fields of biomass conversion and photocatalysis for energy.

* Winning project in the call for IDEX projects (national excellence initiatives) launched by the ANR (National Research Agency) and the *Secrétariat général pour l’investissement* (French Investment Secretariat) within the framework of the “Investments for the Future” program

135
theses under way each year on average

THE 2017 IFPEN THESIS PRIZE IS AWARDED TO...

The 2017 Yves Chauvin thesis prize was awarded to Zlatko Solomenko for his thesis entitled “Study of dual-phase flows and wetting in structured packings”. Conducted and supervised at IFPEN, this thesis was directed by the École Centrale de Lyon. The research validated a digital simulation methodology for wetting phenomena that could be used for the development of optimal geometries for gas/liquid contactors, with potential applications in the fields of gas treatment and CO₂ capture.



COLLABORATIVE RESEARCH INITIATIVES IN FRANCE AND EUROPE

IFPEN and ANDRA* have signed a new partnership framework agreement, for scientific collaboration in four areas: geological modeling; monitoring, instrumentation and analysis; digital simulation; and steel corrosion.

Three new partnerships have been ratified with foreign research actors:

- University College London: relating to chemical engineering themes for catalysis,
- Politecnico Milano: in areas associated with chemical kinetics and catalytic reactor modeling,
- Utrecht University: in the field of geosciences and renewable energies.

* Agence nationale pour la gestion des déchets radioactifs (French National Radioactive Waste Management Agency)

IFPEN SCIENTIFIC EVENTS



Every year, under the aegis of the French Academy of Sciences, IFPEN organizes its *Rencontres scientifiques* events, bringing together international experts from academia and industry. In January 2018, the Scienc’Innov Workshops were incorporated, hinged around the scientific challenges underpinning IFPEN’s fundamental research program. The first workshop examined the contributions and challenges of Data Science for applications in the energy field.

BASIC RESEARCH CONDUCTED BY THE ANCRE* ALLIANCE

ANCRE is currently conducting a process of reflection concerning fundamental research, thus preparing the emergence of an interdisciplinary research community that will deal with basic sciences for energy. IFPEN is an active member of the working group, which aim is to build a national research program hinged around shared objectives, with a view to driving innovations for the energy transition. Working seminars organized at the end of 2017 brought together some twenty academic and industrial experts to identify priority research avenues.

* French National Alliance for Energy Research Coordination

30%
share of fundamental research in IFPEN’s R&I activities

CREATING WEALTH AND JOBS

4,470
employees at
IFP Group,
in 25 countries

A CUSTOM INNOVATION STRATEGY FOR STARTUPS AND SMEs

IFPEN has been actively supporting SMEs and intermediate-sized companies for nearly 30 years. This support now extends to start-ups and is focused on new energy technologies, sustainable mobility and sustainable development. The objective: to accelerate the innovation projects of these companies and create value through partnerships adapted to their needs, ranging from R&D co-development to potential capital investment. The creation of an Incubation and SME Department at IFPEN in 2017 reflects this objective.

AN EVOLVING PORTFOLIO OF SUBSIDIARIES AND STAKEHOLDINGS

2017 saw the finalization of Axens' takeover of Heurtey Petrochem. The merger led to the creation of a benchmark global group for clean fuels and eco-efficient processes, the principal vector for the industrial development of IFPEN's innovations. Other highlights in 2017 and 2018 included:

- the creation of the DriveQuant start-up in the connected mobility sector,
- the joint creation with Mavel and Weisa Automobile Technology Limited of Mavel edt, positioned in the production of electric powertrains for the vehicle market,
- and lastly the acquisition of a 20% stake in La compagnie des mobilités, a young start-up behind the development of the Geovelo bicycle navigation aid solution.

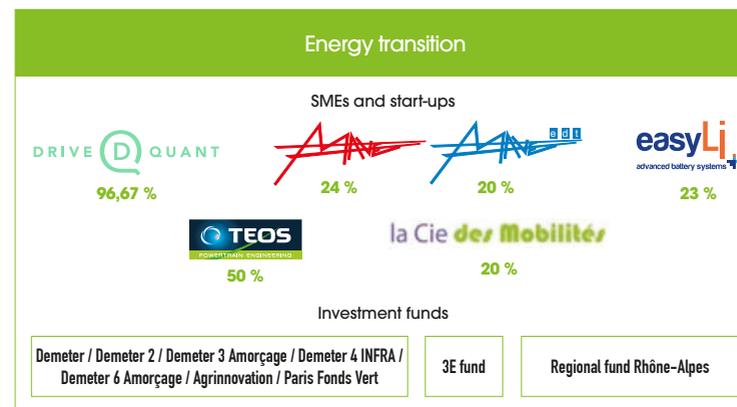
CONVERSION OF WATER-TREATMENT PLANT SLUDGE WITH CLEEF SYSTEM



Cleef System offers sites - urban or industrial - with a water-treatment plant, an innovative process for converting sludge into an eco-fuel with a high calorific value. In October 2017, the SME inaugurated its first industrial demonstrator at the Roussillon chemicals platform (Isère). With a capacity of 200 kg/h, the facility is the fruit of four years of development activities conducted with technological support provided by IFPEN. Present alongside the company from the outset, IFPEN helped it acquire a better understanding of the phenomena governing the process and supported it through the industrial scale-up phase.

PORTFOLIO OF INDUSTRIAL STAKEHOLDINGS

As of 2 July 2018



Geosciences consulting and software



Refining processes, petrochemicals, biofuels, gas treatment and catalysts



Training





TRAINING THE KEY PLAYERS IN THE ENERGY TRANSITION

FIRST PETROLEUM DATA MANAGEMENT PROGRAM GRADUATES

Sixteen students from the first Specialized Master's® Petroleum Data Management program graduated in October 2017. The objective of this program is to address the challenges associated with the energy sector and big data, by training the specialists capable of managing all the data acquired in the field of the exploration and production of natural resources, in particular oil, natural gas and water.

350
lecturers from industry
and around a hundred
from IFPEN



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LEARNING BY DOING: IN STEP WITH THE PROFESSIONS OF TOMORROW

In 2015, IFP School won first prize in the Digital Learning Excellence Awards, given by CEGOS and AEF Groups, for its training module entitled "Industrial Unit Inspection". The module, taken by students on the Energy and Processes graduate program, includes exercises for the drawing up of anomaly detection procedures, via a virtual reality tour with headsets, paving the way for a real field visit. This fun approach enables students to immerse themselves in an industrial environment, true to the School's spirit of learning by doing.

NEW "INNOVATION AND ENTREPRENEURSHIP" MODULE

The first session of the "Innovation and Entrepreneurship" module, organized on the theme of mobility, brought together more than thirty students from various programs in January 2017. With this cross-functional program, IFP School encourages students to discover every aspect of setting up a company: the proposal of innovative ideas using creativity techniques (design thinking), drawing up of a business model, definition of a marketing plan, prototyping in a fablab and a pitch to win over potential investors. Buoyed by the success of this first session, which addresses the needs for agility inherent in energy innovation and student aspirations, a second session was organized in January 2018, proving equally successful.