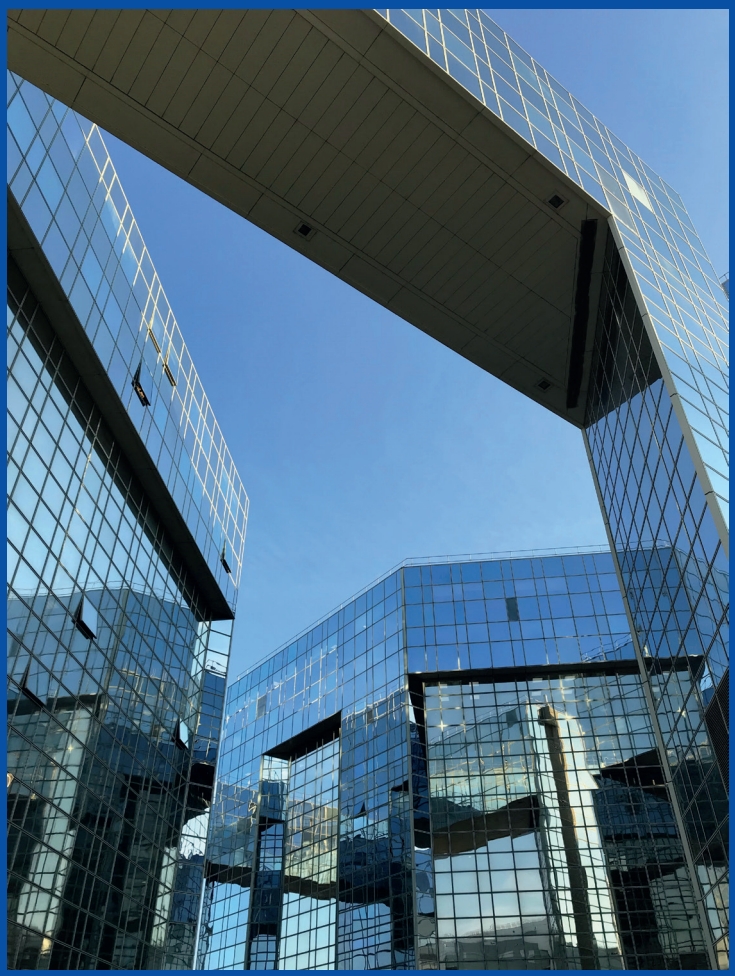
ACADÉMIE
POUR UN PROGRÈS RAISONNÉ CHOISI PARTAGÉ DES TECHNOLOGIES

NATIONAL ACADEMY OF TECHNOLOGIES OF FRANCE
SHARING A REASONED, CHOSEN PROGRESS

ACTIVITY REPORT 2021

DIGEST AND OUTLOOK 2022



CONTENT

Founded in 2000, the National Academy of Technologies of France (NATF) counts today more than 300 members, including 4 Nobel Prize winners. They are all experts in their respective fields and from very diverse backgrounds: academic and industrial researchers, economists, sociologists, architects, doctors, etc. Members are appointed through a strict co-optation process that ensures diversity of expertise, professional backgrounds and gender. The Academy examines opportunities and risks associated with new and emerging technologies and is committed to improving the attractiveness of technological careers, particularly for young people and women. The Academy makes proposals and recommendations to public authorities, socio-economic actors, and citizens for better exploitation of the potential of technologies by and for the society, in accordance with its motto: *Sharing a reasoned, chosen progress*. NATF is pursuing an intense international activity; in Europe as a managing partner of Euro-CASE and with its work in the SAPEA project, and more globally as a member of CAETS which brings together the academies of 30 countries around the world.

2000

The National Academy of Technologies of France (NATF) is created as an association

2007

It becomes a public administrative institution

2013

It is placed under the protection of the President of the Republic.

HIGHLIGHTS

JANUARY

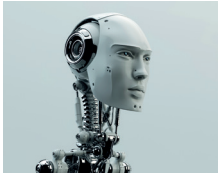
- Computing and Data. New prospects for high-performance digital simulation (report)
- Meeting of the Academy Cenacle
- The 2020 Paul Caseau award, in partnership with EDF
- Progress report on COVID. Session co-organized by Pierre-Etienne Bost, Yves Lévi and René Amalberti
- How will the autonomous vehicles fit into tomorrow's mobility? Session organized by Christophe Midler

FEBRUARY

- OPECST hearings on the report "Megadata storage beyond 2040: the DNA trail"
- New microprocessor paradigms. Session organized by Gérard Roucairol
- Plastic recycling: cutting-edge industrial technologies needed to face major societal challenges. Session organized by Michaël Matlosz

MARCH

- Innovation in the food industry: impacts of the digital revolution (report)
- What to expect by 2050 on French electricity needs (statement)
- Meeting with the High Commissioner for Planning
- AI: scientific challenges, social impacts, entrepreneurial realities.Session organized by Michèle Sebag
- Digital twins.Session organized by Dominique Vignon



APRIL

- Covid-19: Modelling and data for health crisis management (report)
- Meeting with the General Secretary and the General Reporter of the High Commissioner for Planning for a discussion on digital technology
- Modelling in the light of major health, social and environmental events. Session organized by Alain Pavé
- Progression from R&D, through technology and innovation to human progress: where do we stand? Session organized by Marc Giget

MAY

- Testing for infectious diseases and pandemics - lessons from Covid-19 (Inter-academic report)
- Inaugural conference "What kind of vision and strategy for a decarbonized and desirable city?", as part of the conference cycle "City and real estate facing the climate emergency" organized by X-Ponts Pierre and in partnership with the Academy

- Symposium "The future as a legacy", co-organized with ANRT, Cnam, Futuribles International and IFRI
- Mission Perseverance, the Martian robot. Session organized by Claudie Haigneré
- MOOCs and training: a new contract? Session organized by Alain Bravo and Jean-Pierre Chevalier

JUNE

- The 12th national final of the Engineering Sciences Olympiad, in partnership with the Academy, including a new award for the best technological innovation
- Conference "Energy or data: do we have to choose?" co-organized with the General Counsel of Economics
- Hearing by the Economy, Finance, Industry services of the Prime Minister's office on the Covid-19 report: Modelling and data for health crisis management
- Hearing of the Academy by the Senate's information mission about the Uberization of the society: what impact do digital platforms have on professions and employment?
- The challenges of aeronautics. Session organized by Bruno Stoufflet
- Debating the Pierre Veltz's book "Desirable economy: a world without fossil energies". Session organized by Dominique Vernay

JULY

- Creation of the "Women in Tech" portrait gallery

- The Jean Jerphagnon Award, part of the "optics and photonics meetings", jointly organized by the Institut Mines-Télécom and the Academy on the occasion of the 2021 Dijon Optic Congress
- OPECST hearing on the Covid-19 report: Modelling and data for health crisis management
- Building on the Sustainable Development Goals in a responsible and resilient way (Inter-Academic collection of 12 thematic notes)
- Geopolitics of technologies. Session organized by Olivier Appert

SEPTEMBER

- Teaching technology in middle school. The case of cycle 4 – 7th to 9th grade, between 13 and 16 years of age (report)
- 3rd plenary session of the Steering Committee of the French GAIA-X Hub
- Geological storage of CO_2. Session organized by Dominique Vignon

OCTOBER

- 4th Energy for Smart Mobility Forum organized by Capenergies and GreenUnivers and under the patronage of the Academy
- Annual seminar of the Academy "Achieving the 2030 goals in order to successfully transform the society by 2050"
- 1st international continued education seminar "Frontiers of Engineering", in partnership with the National Academy of Sciences and Techniques of Senegal, the National Polytechnic Institute Houphouët-Boigny of Yamoussoukro (Ivory Coast) and the CIO Mag journal

NOVEMBER

- 20th award of the Irène Joliot-Curie prize
- 34th award of the Roberval prize, organized by the Université technologique de Compiègne and in partnership with the Academy
- Elections for the renewal of all academic bodies for the 2022-2023 term
- Elections of new academic members (qualification stage)
- Annual convention of the Academy: "Achieving the 2030-2050 transitions" on the occasion of its 20th anniversary, co-organized with BPIfrance, the Foundation Arts et Métiers and the Foundation of the National Academy of Technologies of France, and awards ceremony (science-fiction short story prize in partnership with Usbek & Rica and Grands prix, startup award in the field of the energy transition, in partnership with the Foundation Arts et Métiers)

- 6 notes issued by the Academy following its annual seminar:
  - Transition to zero emissions in 2050: challenges and strategy
  - Two essential conditions to meet the challenges of the renewed industrialization of France
  - Taking more risks in technological research and innovation, a must-do for France and Europe
  - New measurement tools for new growth
  - For a Europe that fosters the emergence of champions
  - No transition without a culture of attention to technical objects
- Handling controversies, in theory, and in practice. Session organized by Bernard Chevassus-Au-Louis and Thierry Weil

DECEMBER

- Election of new academic members (continuation of qualifications). Postponed to February 9, 2022 due to technical reasons
- Meeting with the General Secretary of the High Commission for Planning to discuss energy field
- Technological advances in sail traction over the past 20 years and those possible in the coming years. Session organized by Bernard Saunier
- When will 5G be genuinely deployed? Session organized by Thierry Bonhomme

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AIMING AT 2050

After 2 years of a health crisis, technologies are taking an essential place in our lives. The issues that our societies must face are more than ever at the heart of social debates; they fuel the news, challenge the political sphere, and drive our daily lives. The year 2021, like 2020, has only accentuated and accelerated these observations. France and Europe, demonstrating their resilience, have decided to build strong economic foundations reinforcing industrial and digital sovereignty, developing jobs for the future and promoting innovation, with the environmental challenge in the background. The necessary trajectory towards carbon neutrality in 2050 has been initiated.

The Academy sees technologies as an asset to achieve these goals, with the particularity that they are often seen as answers to complex issues. We can mention the improvement of the health system, a better connection between people by reducing the digital divide, the moderate development of work automation, or the decarbonization of our practices and our industries. More than ever, we need to innovate. The role of technology is to make life easier for citizens, especially in these uncertain times. The coronavirus crisis has taught us a lot: finding a new professional balance between on-site and remote working, with the emergence of digital work tools that we have been able to seize; dematerializing what could be, digitizing documents, developing medical teleconsultations, organizing virtual events… In most cases, it has been made possible by a range of technologies, and we can go even further.

This is an opportunity that our Academy will seize as the best "trustworthy scout" and a recognized voice of "independent expertise" on technologies. The role of the National Academy of Technologies of France is to bring its thoughts, proposals and recommendations to the attention of the government officials and the general public. Thanks to its indispensable scientific rigour, the Academy contributes to ensuring that technologies and their impacts, often systemic, are the subject of debates that are as enlightened and objective as possible, taking into account the concerns of citizens and ethical questions. This issue appears all the more important with the increasing level of public questioning of technologies.

It is also up to us to think about the future uses of technologies and their consequences, their acceptance by society, always in an ethical and environment-friendly way. Our Academy, whose expertise covers extremely broad fields, especially with its transversal programs, produces initiatives with strong societal impacts. The year 2021 was thus rich in actions, productions and collaborations materialized by means of 17 bimonthly

thematic sessions, 8 debate meetings, 3 conferences & symposia, 5 reports, 1 statement, 1 thematic collection, 6 notes, our annual internal seminar and our annual convention celebrating the 20th anniversary of the Academy. Some of our work continued to be connected to the current health crisis, such as the report on the progress of France's capacity to test infectious diseases published jointly with our sister academies, the report on modelling and data for health crisis management, the Inter-academic collection of 12 thematic notes on the Sustainable Development Goals (SDGs) and the impacts of agriculture and food systems, sustainable production, housing, and mobility... We have also developed our actions on prominent topics such as the digital revolution with artificial intelligence and machine learning; energy and prospects for electricity consumption, independence from fossil fuels and CO_2 storage; the evolution of mobility and habitats through new technologies for autonomous vehicles and low-carbon housing; technological innovation for recycling plastics; the implementation of new education technologies; ethics at the handling of controversies.

And the Academy continues to open up to the outside world. We are developing our strategic plan and our contributions to public innovation policies, notably through the Academy's Cenacle of business leaders and through our continued interactions with government officials such as with the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST). At the European level, via the Euro-CASE association, we partner with the academies of 23 other countries, and this especially in the SAPEA project. Furthermore, we are involved in the construction of the French hub of the Gaia-X European initiative. At the international level, we are collaborating with the Ivory Coast in the "Frontiers of Engineering" project and we are organizing the 2022 CAETS congress, which will take place in Versailles next September and will be centred on technologies for health (CAETS is the worldwide network of Academies of Engineering). In this particular global context, the Academy wished to reflect on the direction taken by technologies and their societal impact during the next few crucial decades. The 20th anniversary of the Academy was an opportunity to collectively focus on the global topic, which is the transition to 2050, whether it concerns the short- and medium-term prospects or the lessons to be learned from the health crisis. These intense studies were presented at our annual seminar and published together with recommendations on these future societal challenges.

Ultimately, 2021 was marked by continuity and acceleration in the work of our Academy. The "on-site" participation in our new premises could be resumed thanks to the hybrid mode of working. The Academy has availed itself of the appropriate technological equipment, enabling exchanges in the respect of social distancing and even allowing some conviviality events. The 2020 elections, which had been postponed due to the coronavirus crisis, were held in 2021 and led to the recruitment of 23 new members and the renewal of all the Academic bodies. The impact of the crisis on our activities is far from being negligible and it is indeed due to the commitment of the volunteer members and the permanent team that our Academy continues to be successful. The key points of this year were without any doubt the well-done and well-known work based on the resilience, commitment, action and initiative of all.

In this final year of my tenure, I am indeed proud of our achievements. The Academy has a strong motto: *Sharing a reasoned, chosen progress,* which illustrates the need for technologies resolutely turned towards the public good. I am confident that I can hand over this mission to my successor, Denis Ranque, who, I am sure, will continue to move forward with this vision to further increase the impact of our Academy.

Pascal Viginier

Computing and data. New prospects for high-performance digital simulation

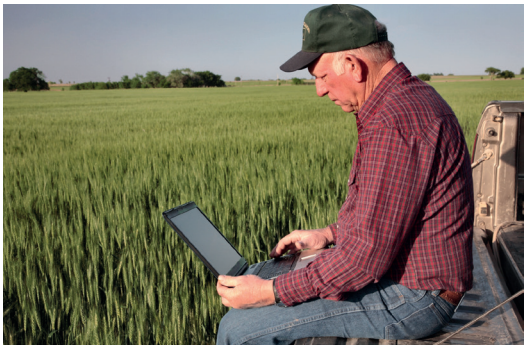
Report (January 13th)

Profound changes and ruptures have appeared, such as the transition to exascale (supercomputing) and the hyper-parallelism that goes with it, or the rapid emergence of new issues linked to massive data and machine learning. In this context, digital simulation in many fields of the industrial sector and beyond (materials, biosciences, manufacturing processes, multi-scale modelling, design optimization) can benefit from hybrid approaches. These methods combine information extracted from data by deep learning with knowledge and physico-mathematical modelling. In order to be competitive with the United States and China, the Academy recommends that France and Europe develop these methods, which will require infrastructures that allow the convergence of these technologies for computing and data, as well as broader skills, to implement them. The need for better validation, qualification and explanation of simulation results remains crucial. Finally, software must also evolve rapidly to converge with hardware.

Innovation in the food industry: impacts of the digital revolution

Report (March 10th)

The French food industry faces several challenges: restoring its economic competitiveness and responding to diversified and evolving consumer demand while being compatible with environmental requirements. The Academy analyses how digital technologies can foster innovative design, food product manufacturing and tracing. One of the recommendations is to bring together the existing "digital resource" centres so that they could share the development of databases and processing capabilities as well as their interoperability.



What to expect by 2050 on French electricity needs

Statement (March 10th)

French needs for electricity will grow significantly to replace oil and gas consumption. Various recent forecasts underestimate this growth, which could jeopardize the security of our energy supply and the daily life of the French people. The impacts on the cost of electricity and broadly of all energies, and on the competitiveness of our economy would be far-reaching. The Academy makes a reasonable assessment of the electricity needs in 2050 and proposes some principles for choosing economic data to be used in the optimizations related to the European electricity system, as it will be more fragile in the future. Based on these

elements, key points for managing the upcoming changes in the electrical system are highlighted.

Covid-19: Modelling and data for health crisis management

Report (April 14th)

The coronavirus crisis has shown that epidemiological modelling is important to help political and economic decision-makers. However, other criteria must be taken into account, such as the behaviour of populations as well as economic, social and cultural criteria. The Academy reviews the knowledge required for modelling in the fields of mathematics, computer sciences and decision theory. Having a software platform at the national or European level allowing the rapid integration of models of different origins and natures and associated data at reduced cost is a key tool in crisis management.

Testing for infectious diseases and pandemics - lessons from Covid-19

A joint report by the French Academy of Agriculture, National Academy of Medicine, National Academy of Pharmacy, Academy of Sciences, National Academy of Technologies of France and French Veterinary Academy (May 12th)

This report analyses the different types of SARS-COV-2 virus-related bioassays and their implementation during the Covid-19 pandemic. It highlights their crucial role in the strategy to fight this virus and possible future pandemics. Being better prepared implies the development of a French industry at the world class level, as well as the reactivation of a clearly identified "pandemic" plan with the establishment of a government structure in charge of its implementation at the highest level.

Moving forward with the objectives of sustainable development in a responsible and resilient way

Collection of 12 thematic notes, jointly by the National Academy of Technologies of France and the French Academy of Agriculture (July 19th)

Following the previous work on methods for assessing contributions to the Sustainable Development Goals and on decision-making in the face of uncertainty, the Inter-Academic group specifically addresses topics of the French Recovery Plan related to sustainable consumption and production, air quality, land management (spatial planning), the food system and biodiversity.

Teaching technology in middle school. The case of cycle 4 – 7th to 9th grade, between 13 and 16 years of age

Report (September 8th)

This report intends to give an overview of the technology teaching in middle school, which is mostly perceived negatively by middle school pupils, their parents, and many teachers. Based on the current program, it proposes ways to improve this educational field that is too often neglected and to restore the appeal of technology and its training programs to youngsters, especially young girls.

No transition without a culture of attention to technical objects

Note (November 15th)

The Academy intends to promote a technical culture and education focused on technical objects in order to make manufacturers, consumers and users aware of the material, environmental, human and social costs of manufacturing and disposing of these objects. To do this, it is suggested to open these "black boxes" to unfold the socio-technical system that underlies their manufacture and use, to give them historical and cultural depth by placing them in the evolution of techniques and societies.

Transition to zero emissions in 2050: challenges and strategy

Note (November 22nd)

Decarbonizing the French economy to achieve "net zero emissions" with no greenhouse gas (GHG) released by 2050, and negative emissions beyond that, is a revolution for industry and citizens. However, scaling back our consumption, including energy use, will not be enough, especially since the target is to decrease GHG emissions, which is not synonymous with reducing energy demand. It will be necessary to satisfy a strongly growing electricity demand, by exploiting all decarbonized energy sources, including nuclear, and storage technologies. It will also be necessary to increase natural and technological carbon sinks (CCS) while preserving competitiveness through a carbon adjustment mechanism at Europe's borders.

Two essential conditions to meet the challenges of the renewed industrialization of France

Note (November 22nd)

Deindustrialization of France, and its deleterious consequences in terms of socioeconomics and sovereignty, led to various national plans (French Recovery Plan, 4th Plan of Investments for the Future, France 2030 Plan) aiming at a renewed industrialization of the country. To meet these challenges, 2 essential conditions are required: on the one hand, skills and, on the other hand, political support and governance that encourage innovation and responsiveness.

Taking more risks in technological research and innovation, a must-do for France and Europe

Note (November 22nd)

The United States and China are making technological superiority a major goal to ensure their global military and economic leadership, while France's position has weakened in some technological and industrial sectors. Initiatives to support technological research and innovation at the French and European levels are positive signs for the future. But they do not guarantee that France and Europe will regain a leading technological and industrial position. To achieve this, several options are proposed, including the implementation of processes that encourage risk-taking projects with high socio-economic potential. Opportunities to cooperate between Europeans should also be seized.

New measurement tools for new growth

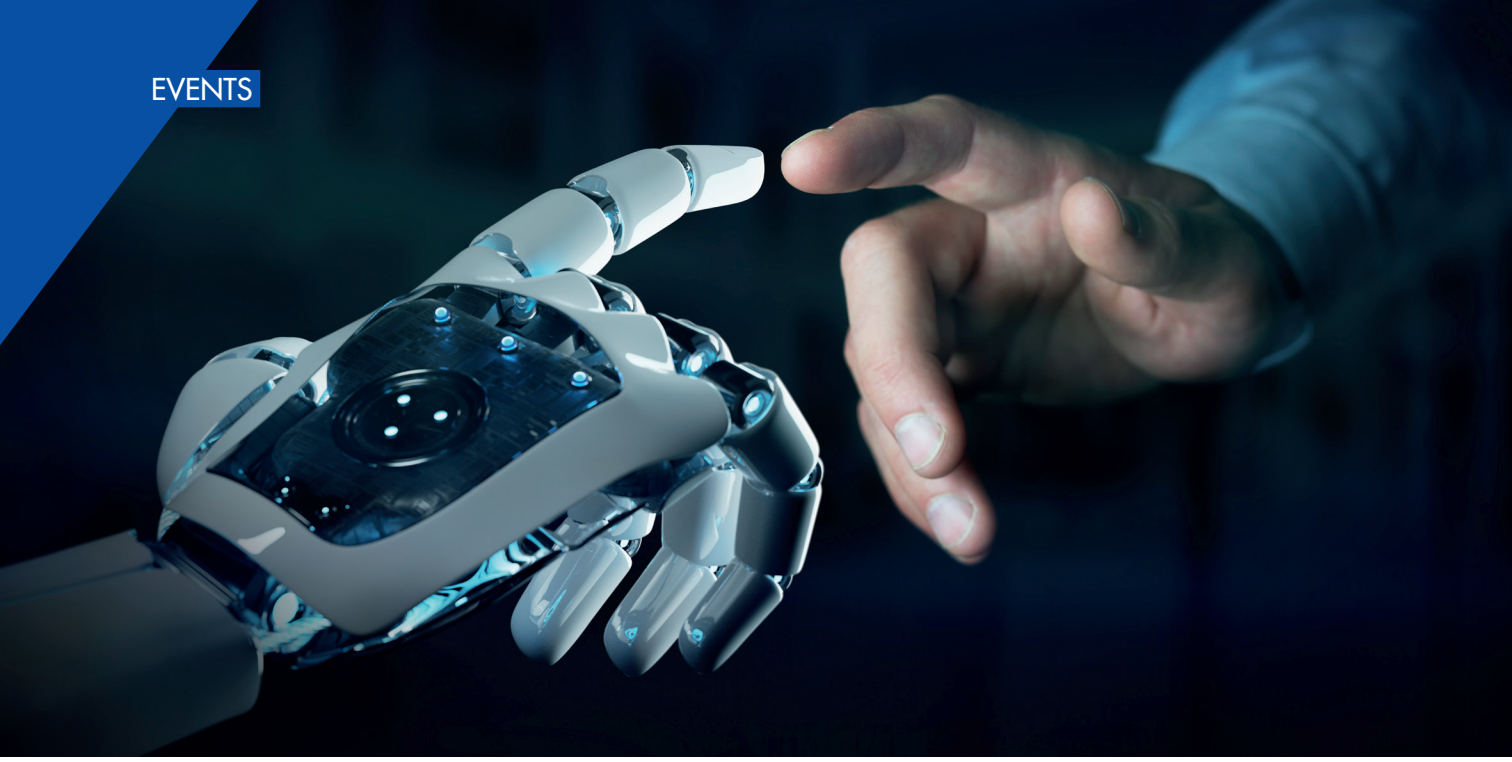
Note (November 22nd)

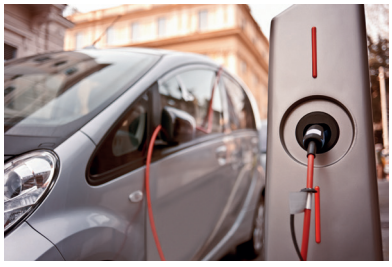
GDP is a very imperfect tool for measuring the impact of the energy transition on economic growth (both in volume and in price) and its evolution. It neglects the qualitative aspects, summarized by the environmental, social and governance standard (ESG), that have quantitative consequences. The Academy calls for the acceleration of work on this issue. It also debates the growth and degrowth notions. It is now necessary to go beyond this opposition and reconcile economy and ecology. The Academy advocates territorially sustainable growth (also financially). Companies must also uphold the ESG standard, especially since these criteria are in line with the Sustainable Development Goals worldwide.

For a Europe that fosters the emergence of champions

Note (November 22nd)

The world polarizes around rivalry, or even conflict, such as between the United States and China. Paradoxically This situation is an opportunity for Europe to pursue ambitious and active policies consolidating its industrial base, thus promoting the creation of national or European champions in various sectors. Then Europe must especially develop its competition policy by taking into account the global competitive environment.





Thematic sessions

- Progress report on COVID
- How will the autonomous vehicles fit into tomorrow's mobility?
- New microprocessor paradigms
- Plastic recycling: cutting-edge industrial technologies needed to face major societal challenges
- AI: scientific challenges, social impacts, entrepreneurial realities
- Digital twins
- Modelling in the light of major health, social and environmental events
- Progression from R&D, through technology and innovation to human progress: where do we stand?
- Mission Perseverance, the Martian robot
- MOOCs and training: a new contract?
- The challenges of aeronautics
- Debating the Pierre Veltz's book "Desirable economy: a world without fossil energy"
- Geopolitics of technologies
- Geological storage of CO_2
- Handling controversies, in theory, and in practice
- Technological advances in sail traction over the past 20 years and those possible in the coming years
- When will 5G be genuinely deployed?

Conferences & Symposia

- What kind of vision and strategy for a decarbonized and desirable city?
- The future as a legacy (tribute to Jacques Lesourne)
- Energy or data: do we have to choose?

D.R.

Meeting-debates

- Bruno Maquart, Chair of Universcience
- Delphine Ernotte, President of France Télévisions
- Sylvie Retailleau, Chair of the Université Paris-Saclay
- François Bayrou, High Commissioner for Planning
- Valérie Verdier, CEO of the Institut de Recherche pour le Développement (IRD)
- Zhongchao Han, Director of the National Stem Cell Center of China and member of the Academy
- Paul-François Fournier, Executive Director of the innovation division at BPIfrance
- Jean-Luc Van Den Heede, French sailor

Annual seminar

Achieving the 2030 goals in order to successfully transform the society by 2050

This seminar was essentially focused on identifying choices that must be made in various fields in order to succeed in the social transition, especially with regard to the objectives of sustainable development. Key questions were addressed like the strategy of industrialization, the technical culture of society and the impact of society on transition, the role of France in geopolitics, and energy options. The general debate amongst academic members led to publishing 6 notes.

Annual convention and 20th anniversary of the Academy

Achieving the 2030-2050 transitions

This annual convention was also the opportunity to celebrate the 20th anniversary of the Academy.

A celebratory evening was held at the chapel of the Arts et Métiers museum. The following day was organized around several speakers at the Maison de la Chimie with BPIfrance, the Foundation Arts et Métiers and the Foundation of the National Academy of Technologies of France. It was followed by 350 attendees on-site and online. Academy members and invited personalities discussed the energy transition, the cultural transition and the relationship between society and technology, and the industrial transition with the impact of digitalization on industry and the economy. Frédérique Vidal, Minister of higher education, research and innovation, Valérie Masson-Delmotte, one of GIEC co-chairs and an Academy member, and Thierry Breton, European Commissioner, also gave a speech.

The 3 Grand Prix for startups in the field of the energy transition, and in partnership with the Foundation Arts et Métiers, were awarded to EIFHYTEC (1st), WaterHorizon (2nd) and BeFC (3rd).

The Science Fiction short story prize in partnership with Usbek & Rica and Roland Lehoucq was awarded to "Jonas" by Gaëtan Maran.

New members

Each year, the Academy recruits new members through a rigorous co-optation process that ensures, among other things, the diversity of expertise and professional backgrounds in order to amplify the Academy's field of thinking and action. In this way, 23 new members were elected to join the Academy.

BIGOT Bernard
Director-general of the ITER organization

CLAIR Chloé
CEO of the Nam R startup

CRÉMIEUX Anne-Claude
Professor in infectious diseases

DEMASSIEUX Nicolas
Former research director of the Orange research labs

DUPUIS Marie-Claude
Strategy, sustainable development and real estate director at RATP

GLACHANT Matthieu
Professor of economics at Mines Paris – PSL and director of i3-CERNA

GUILLOU Hervé
Chairman of the marine industry sector committee and VP of the general armaments council

IRACANE Daniel
Senior advisor for international strategy at CEA

JEGO-LAVEISSIERE Mari-Noëlle
Deputy CEO in charge of Orange's operational activities in Europe (outside France)

LAMBERT Florence
CEO of Genvia

LAURENT Caroline
Director of orbital systems at Cnes

LEFÈVRE Hervé
CSO of iXBlue

LE GALL Jean-Yves
Chair of Université Paris-Saclay's strategic advisory board, former president of Cnes, CEO of Arianespace and chair of the council of Esa, honorary ambassador and former president of the IAF

LE PAPE-GARDEUX Claude
VP of AI, optimization, reliability and analytics at Schneider Electric

LINTZ-LAMPEL Yannick
Director of the arts of Islam department at the Louvre and general heritage curator

MARTY Alain
CSO of Carbios

NOGUÉ François
HR director of SNCF

PLATEAU Brigitte
Professor at Grenoble INP–UGA and policy officer for European alliances strategy

POSTEL-VINAY Grégoire
Head office of strategy intelligence at Ministry of Economy & Finance (DGE)

SEMERIA Marie-Noëlle
CTO of TotalEnergies

SERVAL Thomas
Co-founder and CEO of Baracoda

TAILLANDIER Anne-Sophie
Director of TeraLab

VAN PETEGHEM Marc
French naval architect

FRANCE

The Academy has set itself the strategic objective of strengthening its ties with the business world. It is regularly solicited by the Government and the Parliament and independently picks its own fields of study that will contribute to public policies.The Academy expresses views on the major challenges facing society today such as restoring France's sovereignty and the renewal of its industry. It closely follows the actions of the Government in the framework of the France Relance and France 2030 plans and the acceleration strategy of the 4th future investment program. It works with diverse French instances and bodies on economics, finance, innovation, industry matters, and on own studies.

INTERNATIONAL

DELEGATE
Bruno Revellin-Falcoz

DEPUTY DELEGATE
Gérard Creuzet

In 2021, international relations were active despite the unavailability of travel due to the pandemic. Relationships have been developed within CAETS, which now includes 31 countries worldwide, and Euro-CASE in Europe. Thanks to the development of websites, the flow of information on the work carried out by the academies has been strengthened. Our Academy (NATF) plays a central role at the international level. In Europe, it leads Euro-CASE, whose General Secretary is one of our Academy's members and whose headquarters are located here. On the global level, NATF is a major actor via its involvement in the activities of CAETS.

AFRICA

The "Africa Group" is a think tank and project group dedicated to the understanding of the African continent and strengthening the links with the French-speaking countries of West Africa. In 2021, the group organized the first edition of a continuing learning seminar for young African engineers and technical managers. Called "Frontiers of Engineering", this event is intended to be held every year. It is designed in partnership with the National Academy of Science and Technology of Senegal (ANSTS), the National Polytechnic Institute Houphouët-Boigny (INP-HB) and the magazine and professional network CIO-Mag. Numerous external speakers offered participants in-depth insights into 2 digital themes: agriculture and health. The next edition in 2022 should focus on 2 new themes: the city and energy.

CANADA

New cooperation has been established with the Canadian Academy of Engineering. It is marked by the will to set up regular exchanges on various technological topics.

CHINA

After a joint work with the Chinese Academy of Engineering on nuclear power and its environment, both academies continued their studies on hydrogen. Exchanges are continuing on detection systems for dermatological pathologies. Tuberculosis: a joint project group with the French Academy of Medicine and its Chinese counterpart is analysing the conditions for eradicating this infectious disease in China. The group interviewed the best experts in the world and reviewed the state of the art of technological, therapeutic, and screening advances. It also compares the epidemiology, characteristics, diagnostic methods, prevention and treatment in France and China as well as the policies implemented in both countries. A report is currently being finalized.

GERMANY

NATF and acatech, its German counterpart, maintain regular interactions that cover all the technological activities of the two countries. Within the framework of the creation of the GAIA-X European platform, launched at the initiative of Germany and France, both academies have jointly continued their work. The same applies to public opinion surveys about technology.

INDIA

NATF continues its exchanges with the Indian National Academy of Engineering (INAE) on the fields of energy and digital.

JAPAN

The international conference of the STS (the Science and Technology in Society forum) was organized by videoconference. Chaired by the Prime Minister, it brought together a large number of participants on energy and environment, ICT, smart cities, innovation, health, resources, education.

UNITED KINGDOM

Upon invitation of the Royal Academy of Engineering (RAEng), NATF has participated in several workshops in areas related to the coronavirus.

UNITED STATES OF AMERICA

The United States National Academy of Engineering (NAE) has presented the Technological Grand Challenges Program in the context of the UN Sustainable Development Goals.

CAETS

The annual conference of the Council of Academies of Engineering and Technological Sciences (CAETS) was held in September 2021. Under the title "Engineering a better world: Smart Society" specialists from around the world discussed energy, engineering education, communication with the public, sustainable development goals and inclusion and gender. The next edition will be hosted by NATF in Versailles from September 26th to 29th 2022. 2021 also saw growth in CAETS' activities, including the adoption of new, more dynamic operating procedures. CAETS also issued a statement on behalf of all member academies following the Glasgow COP 26 in November, defining engineering's commitment to helping governments achieve the climate COP goals.

The CAETS Energy Committee, under the leadership of Yves Bamberger, conducts a series of studies to shed light on the decarbonization of the most emitting end-use energy consumption outside of transportation. Seven groups have been formed between the partner academies on major themes such as sustainable buildings and cities, steel industry, oil industry, food and agriculture… Sustained efforts in R&D should help find new solutions to reach new horizons. However, the necessary changes also have economic, industrial, environmental and societal dimensions… This work will continue in 2022 and the committee will submit its report to the public authorities and energy stakeholders in the various countries at the 2022 edition of the annual conference.

Euro-CASE

GENERAL SECRETARY: Yves Caristan.
Patrick Maestro will succeed him in 2022.

BOARD OF DIRECTORS: Representatives of the Academy:
Bruno Revellin-Falcoz, Gérard Creuzet.

CHAIR: Tuula Teeri (Sweden)

VICE CHAIR: Eloy Alvarez Pelegry (Spain)

TREASURER: Ric Parker (Great Britain)

The Euro-CASE association gathers the academies of technology and engineering of 23 European countries and the National Academy of Technologies of France is a founding member.

Since the withdrawal from Euro-CASE of the Technical Chamber of Greece, Greece is now represented as an observer by the Hellenic Engineering Academic Community (HEAC). This consortium is composed of the School of Electrical and Computer Engineering, the National Technical University of Athens, the Institute of Petroleum Research (IPR-FORTH), and the Chemical Process & Energy Resources Institute (CERTH).

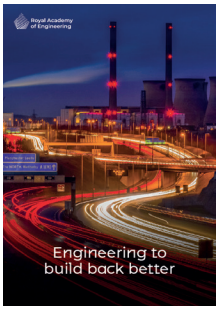
Working platforms

Several members of NATF contribute to the work of the Euro-CASE platforms:

- Participation of young people in the Academies' work: Philippe Jamet, Claudine Schmidt-Lainé
- The challenges of science and technology in the post-covid period: Erol Gelenbe

Annual Conference

The 2021 annual conference was organized by the Royal Academy of Engineering in Great Britain (RAEng) on the theme "Engineering Building Back Better". The Academies of Engineering in Belgium will host the 2022 edition on September 19th in Brussels.



SAPEA

Initiated in 2017, SAPEA (Science Advice for Policy by European Academies) is part of the European Commission's Science Advice Facility. This project is funded by the Horizon 2020 program (6 million euros) over 5 years and has been extended by the Commission until April 2022. It relies on the collaboration of 5 European academic networks: Academia Europaea, the European Federation of Academies of Sciences and Humanities (ALLEA), the Scientific Advisory Council of European Academies (EASAC), the Federation of European Medical Academies (FEAM) and Euro-CASE. SAPEA aims to bring together the independent scientific expertise of more than 100 European academies from over 40 countries. Several reports have been made in this framework with the collaboration of NATF: Cybersecurity in the European Digital Single Market, Explanatory Note on New Techniques in Agricultural Biotechnology, Food from the Oceans, Improving Authorization Processes for Plant Protection Products in Europe, Novel Carbon Capture and Utilization Technologies, A Scientific Perspective on Microplastics in Nature and Society, Transforming the Future of Aging, Scientific Advice for Policymaking, A Sustainable Food System for the European Union, Biodegradability of Plastics in the Open Environment, and A Systemic Approach to the Energy Transition in Europe. 2022 will see the launch of the second part of this consortium, SAPEA+, funded under the Horizon Europe program.

Frontiers of engineering

The exchange cycles organized by Euro-CASE and the American National Academy of Engineering (NAE) aim at bringing together young engineers and scientists from Europe and the United States. The 2020 symposium was held virtually last November on several topics: machine learning for emerging networks, applications and uses of graphene, improving the reliability and the resiliency of electric power grids, technologies for the detection and treatment of Dementia. The next cycle (2022/2023) will be organized by the IAS (Slovenia) and the NAE (USA).

ORGANISATION & GOVERNANCE

The National Academy of Technologies of France is an administrative national public establishment placed under the protection of the President of the Republic. The Minister in charge of Research ensures its supervision. Its headquarters are located at the Ponant, 19, rue Leblanc in the 15th arrondissement of Paris since December 1, 2020. The Academy is composed of elected members who consult each other to examine and approve publications, general orientations and programming activities by plenary session assembly.

EXECUTIVE BOARD AND ACADEMIC COUNCIL

Executive board of 2021:

CHAIR Pascal Viginier
VICE-CHAIR Dominique Vernay
GENERAL DELEGATE Edwige Bonnevie
HONORARY FORMER Chair Bruno Jarry
With the participation of the Program Committee Chair

2022-2023 term:

CHAIR Denis Ranque
VICE-CHAIR Yves Bamberger
GENERAL DELEGATE Paul Friedel
HONORARY FORMER CHAIR Pascal Viginier

The Academic Council is an advisory board that takes part in decisions submitted to a vote in plenary session. It is composed of the 4 members of the Executive board and 12 additional elected or designated members.

9 SECTIONS

- Food and health
- Culture, recreation
- Education, training, employment and work
- Energy
- Environment and the impact of climate change
- Housing, mobility and cities
- Industry and services
- Digital
- Technologies, economies, and societies

2 DEDICATED MISSIONS

- Technologies and gender diversity
- Young people and the National Academy of Technologies of France

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FUTURE PROSPECTS
BY THE PRESIDENT ELECT

Our priorities for 2022 follow the same path as summarized by Pascal Viginier at the beginning of this report. They aim to make our Academy a "Trusted Third Party", competent and independent, on issues related to technologies and their adoption by society, in pursuit of the general interest and in line with our motto: *Sharing a reasoned, chosen progress*.

The Academy is strengthened by the diverse and complementary skills and experiences of its members. The quality of its work is recognized. It is knowledgeable about the world of research, an irreplaceable source of technologies, but also about the world of industry, which is the necessary vector for their development and deployment. The independence of the Academy is built on the ethics of its members, the rigor of its processes and the collegiality of the development and validation of its work. All of these qualities constitute an even more important base when we see a paradox developing in society with, on the one hand, increasing and systemic use of technologies in all their forms and, on the other hand, growing doubts as to their social usefulness and the legitimacy of the experts.

To accomplish its mission and fully realize its project, the Academy must further increase its presence and improve its impact in serving public authorities and citizens.

We live in a world that is increasingly technological, but also increasingly complex. Whichever way we turn, challenges, even revolutions, about climate, energy, food, health, digital… are systemic. This requires a global understanding and coordination, whilst more and more actors are now autonomous and decentralized. In all countries, and even more so in a country like France with a Jacobin tradition, the government must assume a large part of the role as an architect. In recent years, in France, the State has begun to step into this role, to provide a framework for action for everybody and to act against industrial decline. But much remains to be done and our Academy is at its service for enlightenment.

To do this, the Academy will first ensure that its work is properly targeted, by striking a balance between forward-looking analyses of emerging issues, including their social utility, broad syntheses that can provide the foundations of new policies, and, finally, the clarification of already existing

topics that are subjects of controversial debate. In the latter case, the objective is not to provide our fellow citizens with a "ready to think" plan, but to listen to the stakeholders, learn about the various arguments, rational or not, and shed light on the matter in a rigorous and global way, based on existing and still to be developed knowledge.

This is how, among other instances, we will continue and initiate work in areas as diverse as: the contribution of technologies in improving access to healthcare, the manufacturing of food by cell culture, the quantitative and qualitative needs for technological skills in the engineering and service industries, including technology training for teachers, the transition or rather the energy revolution and the conditions for making it a success, such as the price of CO_2, heat and power storage options, or operational solutions for decarbonizing buildings and transportation, strategic technologies and materials for energy and digital transformations, technologies for the management of freshwater resources, technical objects, their life, their future and their role in society and in the environment, the determinants of social acceptance of the 5G mobile network, and more generally the determinants of the citizens' trust or distrust in technologies.

Our Academy is committed to promoting training and education in technologies, as well as fostering the attractiveness of technological careers. Following its previous reports on the teaching of technology in primary and middle schools, this year will be focused on the teaching of mathematics in close connection with science teaching, the key foundations of engineering education. It will continue its actions initiated in 2020 promoting technology among young people and enhancing the presence and visibility of women in technological fields.

While continuing our cooperation with our foreign counterparts, primarily in Europe, we have undertaken to organize the 2022 edition of the annual CAETS Conference in France next September. It will be dedicated to breakthrough technologies for healthcare. As mentioned earlier in this document, CAETS is the worldwide network of Academies of Engineering.

In order to carry out its missions, the Academy will also have to work on increasing its audience: intensifying its contacts with public authorities, cooperating with major institutions and other academies in France and Europe, and developing its communication with different target audiences.

In 2022, the Academy will continue to adapt its way of working to the changing health situation and will remain fully committed to its missions.

With the new Executive board and the new Academic Council, with the heads of our Sections and of our Committees, and by seeking the maximum involvement of our members, all of whom are volunteers, we are resolutely committed to pursue the efforts of our predecessors to fully bring to life our beautiful motto, for the common good.

Denis Ranque

NATIONAL ACADEMY
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