


# ACTIVITY REPORT 2020 / THE ESSENTIALS







Founded in 2000, the National Academy of Technologies of France (NATF) brings together 337 academics, including four Nobel Prize winners, all experts in their respective fields, and coming from very diverse backgrounds: industrial and academic researchers, economists, sociologists, architects, doctors... It analyses the opportunities and risks linked to new technologies and is committed to improving the attractiveness of technological professions, particularly for young people and women. The Academy makes proposals and recommendations to public authorities, socio-economic players and citizens in order to make better use of technologies for the benefit of people, in accordance with its motto: reasoned, chosen and shared progress.

NATF is pursuing an intense international activity. First of all, in Europe: it is a member of Euro-CASE, an association under French law and hosted within its premises. The Secretary General is a member of the Academy. NATF also participates in the work of SAM/SAPEA on behalf of the European Commission. Beyond its bilateral cooperation with several countries, NATF is a member of CAETS, which brings together the academies of thirty 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 2020

## JANUARY

- Prospects for photovoltaic technology up to 2030. Session organised by Jean-François MINSTER.
- DNA: reading, writing, storing information. Session organised by François KEPES.



## FEBRUARY

- Attractiveness of the professions, attractiveness of the territories and challenges for industry (report).
- Big Data: and what about ethics? (report)

## MARCH

- Position Paper of the National Academy of Technologies of France on the National Low Carbon Strategy (NLCS) and on the Multiannual Energy Programming (MEP)

## APRIL

- Advisory Note from the National Academy of Technologies of France on the presence and activity of the coronavirus sars-cov-2 in wastewater (Position Paper).



- For a virtuous circulation of data (Position Paper).
- Covid-19 crisis - speeding up the digital transformation: for a more agile and less dependent France (Position Paper).

## MAY

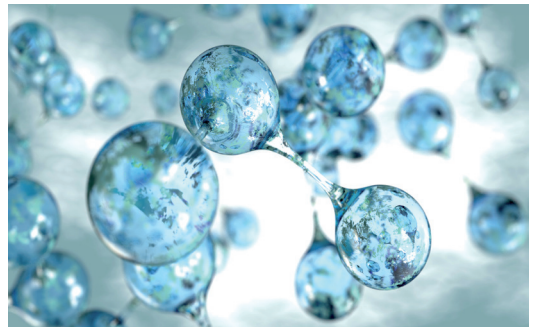
- Additive manufacturing: opportunity, necessity? Academic session.

## JUNE

- Covid-19 crisis - Accelerating the digital transformation: For a more agile and less dependent France (Position Paper).

## JULY

- The role of hydrogen in a decarbonised economy (report).

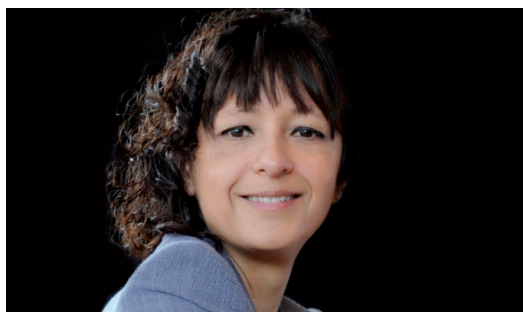


## SEPTEMBER

- Feedback from the management of large projects. Joint report of the National Academy of Technologies of France and the Air and Space Academy.

## OCTOBER

- On October 7, 2020, the Nobel Prize in Chemistry was awarded to two women: the French Emmanuelle Charpentier, member of the National Academy of Technology of France and the American Jennifer A. Doudna for the CRISPR-Cas9 genome editing tool.



- Electricity, Hydrogen and biogas: what energy solutions for tomorrow's sustainable mobility? (Online forum).
- DNA Colloquium, polymers and Big Data, in partnership with the CNRS.

## NOVEMBER

- Colloquium on brain-machine interfaces in partnership with the CNRS.
- Science and technology in primary school: a decisive issue for the future of tomorrow's citizens. Joint report with the Academy of Sciences.

## DÉCEMBER

- 10 questions about seeds.
- The Academy moves to Le Ponant, Paris 15<sup>th</sup>.

# ACTIVITY REPORT 2020

THE ESSENTIALS

## OVERVIEW

POSITION PAPERS AND PUBLICATIONS	8
EVENTS	10
PARTNERSHIPS	11
ORGANISATION AND GOVERNANCE	14

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ENERGY  
TRANSITION  
AND HEALTH  
CRISIS:

## TECHNOLOGIES, A FACTOR FOR ENHANCING RESILIENCE

For the whole world, Europe 2020 has been marked by an unprecedented health and economic crisis. France, one of the European countries most affected, has made the health of its citizens a priority. It has also, in concert with the European Community, implemented an unprecedented recovery plan to support its economy while accelerating the transformation towards a less carbon-intensive, more resilient and more sovereign economy.

This crisis has highlighted, and sometimes amplified, the role of technology in the functioning of our society, particularly in the digital field: teleworking, medical teleconsultation, e-commerce are the most visible examples. Paradoxically, it has accelerated our trajectory towards carbon neutrality due to transport restrictions and has made us aware of the fragility of our societies and the importance of climate and ecological risks.

The links between the fourth industrial revolution and climate change have thus become clearer as a result of this crisis and some countries, such as

the United States, are returning to the COP21 agreement.

Life sciences and technologies have of course been at the heart of the race to gain knowledge about the virus, to understand it and to model the epidemic; a race in which international cooperation has been intense and crucial. It should be emphasised that it was a major technological breakthrough, resulting from public and private research work, that made it possible to develop a vaccine less than a year after the appearance of a virus; and that "cooperation", a mixture of cooperation and competition, is currently being implemented to produce these vaccines at the rates needed to contain the epidemic.

France has many assets allowing it to develop an economy and jobs for the future. Although too many sectors of activity have suffered greatly from the health crisis, many leading French companies have made the fight against global warming an opportunity for responsible development, a choice confirmed by this crisis.

Europe is accelerating its Green Deal (-55% CO<sub>2</sub> from 2030) to turn it into an economic advantage and is accelerating its industrial and digital sovereignty. The European Commissioner for the Internal Market, Thierry Breton, a member of our Academy, is particularly active: in the digital sector, the adoption of a Digital Act and the sovereign hosting of data with the Gaia-X project are all responses in favour of a necessary European rebound. The National Academy of Technologies of France is, along with other Cigref\* partners, involved in the organisation and governance of the French GAIA-X Hub, which is responsible for federating the various stakeholders in this initiative. In the field of energy, after fostering the emergence of a new European battery industry, an ambitious hydrogen plan is taking shape.

The year 2020 has thus been very intense in terms of academic work and cooperation in various domains. The taking of position in publications on the detection of Covid in wastewater, on the potential and challenges in the hydrogen sector, on the storage of information in DNA and on the importance of sustainable development objectives (SDOs) as a framework for public policy are outstanding examples of our achievements in 2020.

We have also had a particularly active contribution on the multiannual programming law for research and the convention on digital education. We have also carried out a great deal of joint work with the Academies of Science, Medicine, Agriculture and Moral and Political Sciences on Covid, Fake news, scientific and technological training and artificial intelligence.

Finally, 2020 marked the 20th anniversary of our young Academy, born at the dawn of this new millennium. The crisis has not allowed us to celebrate this important milestone. However, on this twentieth anniversary, we wanted to rejuvenate our visual identity and adopt a new logo and its adaptation for social networks.

Internationally, we will continue our support to Euro-CASE and will continue to provide experts for SAPEA studies whose work for the European Commission is recognised for its quality. We will also establish an ongoing relationship with the French elected members of the European Parliament and with French parliamentarians. We will maintain privileged bilateral relations with Germany and Sweden and, despite the Brexit, with Great Britain.

Our institution will organise, in liaison with the Quai d'Orsay and the French Development Association, the "Frontières de l'ingénierie" (Frontiers of Engineering) programme which will take place at the end of April in Yamoussoukro (Ivory Coast).

Our cooperation with China will continue on three themes: energy, with focus on hydrogen; industry, with focus on additive manufacturing; and health, with focus on tuberculosis and dermatology.

Finally, we have taken responsibility for organising CAETS 2022 in Versailles, France, on the theme of technologies for health.

*Pascal Viginier*

\* Cigref: Club informatique des grandes entreprises françaises - Information technology club for large French companies

Texts approved in 2020

### Feedback on the management of major projects

Joint report voted on 8 January

The National Academy of Technologies of France and the Air and Space Academy have been interested in the skills and methods needed to manage major projects. Feedback from major projects, analysis of the strengths and weaknesses of French engineering consulting, in an international context, were analysed in order to draw lessons for future projects. As a result, the importance of the human factor in project management has been highlighted.

### Attractiveness of the professions, attractiveness of the territories and challenges for industry

Report voted on 8 January

The industry is being rebuilt in the territories, but the fact that matching job offers with candidates is often difficult, or is confronted with shortages, is hampering its growth and modernisation. These tensions raise questions about the attractiveness of professions and territories, an attractiveness based on the collective image of industry and related jobs. Therefore, the Academy recommends an ambitious and voluntarist policy on the part of all players to develop vocational training and industrial employment in the territories.

### Position paper of the National Academy of Technologies of France on the National Low Carbon Strategy (NLCS) and on the Multiannual Energy Programming (MEP)

Urgency notice voted on 12 February

As part of the final consultations on the NLCS and MEP, the Academy issued its Position paper on the chances of achieving the objectives set for different sectors. These objectives seem unrealistic to the Academy. The success of these policies requires a strong carbon price signal and the appreciation of the European and international dimension of the ecological and energy transition.

### For a virtuous circulation of digital data

Urgency notice voted on 10 April

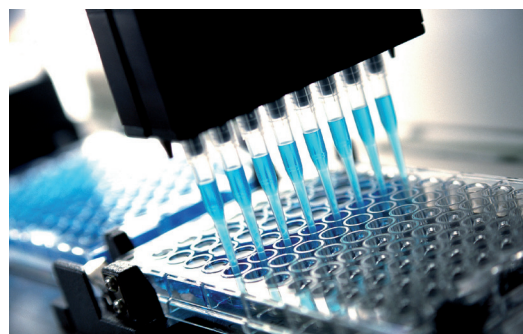
The covid-19 pandemic revealed and accelerated the use of digital technology, in particular for evaluating its propagation and for a better follow-up of a patient or even predicting the evolution of his disease and thus better fighting against the pandemic. The circulation of digital data can ensure a more resilient society, while respecting its

fundamental values and laws. A label for virtuous and secure solutions of data circulation could be introduced at European level.

### Advisory note from the National Academy of Technologies of France on the presence and activity of the coronavirus sars-cov-2 in wastewater (Position paper)

Urgency notice voted on 24 April

The National Academy of Technologies of France considers it important to advance knowledge on the development, removal, inactivation of viruses in wastewater and their transfer to the environment, particularly with regard to SARS-CoV-2, in order to adapt strategies for disinfection and use of treated wastewater. It stresses that such research will contribute to the understanding of the current pandemic and future epidemics and their progression.



### Archiving mega-data beyond 2040: the DNA track

Report voted on 8 July

The reading, writing and storage of information using nucleic acids are experiencing spectacular advances, opening up new prospects for regenerative and genomic medicine, biotechnology and academic research. Recommendations are issued in the fields of reading, writing and storage of information on polymers, such as DNA strands, and, in particular, on the regulatory and organisational conditions needed for taking advantage of these advances at national level.

### COVID-19 crisis - Accelerating the digital transformation: For a more agile and less dependent France

Urgency notice voted on 15 June

The temporary confinement of the country due to the health crisis has accelerated the use of digital techniques by society to compensate for the travel limitations. New uses and applications have



emerged in many fields. To support and accelerate this dynamic, the Academy recommends the deployment of digital platforms adapted to each domain. They must be based on the standards born out of the Franco-German initiative to federate a sovereign GAIA-X cloud.

### **Ten questions to Bernard le Buanec on seeds**

[Ten questions to, 8 July](#)

The debate on seeds and crop varieties is particularly divisive in France. Scientists, or technologists, political decision-makers, whistle-blowers, the media and agricultural and plant improvement professionals often have different frames of reference. In addition, many radio and television programmes on seeds are often very general and without contradictory debates. These 10 questions aim to provide our citizens with the essential elements for understanding, based on scientific publications.

### **The role of hydrogen in a decarbonised economy**

[Report voted on 29 July](#)

The Academy presents the major challenges for hydrogen to play a role in the ecological transition and industrial development. It defines priorities for the uses of decarbonated hydrogen, taking into account the often-neglected economic aspects. It advocates the development of a French and European industry covering the entire chain from production to use of hydrogen and targeting world markets. Finally, it recommends to further increase the research and development effort.

### **Brain-Machine Interfaces: Medical Application Testing, Technology and Ethical Issues**

[Joint report with the National Academy of Medicine, October 28<sup>th</sup>](#)

The medical applications of the Brain-Machine Interface (BMI) aim to restore the mobility of one or more limbs following an accident or illness. Global research is exploding and the arrival of very high-level technology companies in a purely academic landscape augurs well for rapid developments in this highly competitive field. The Academies recommend public support for academic research and research by start-ups, and the creation of a networking infrastructure for public and private research units working in the field. This theme should also be included in the future European R&D programmes of H2020 and Horizon Europe.

### **Science and technology at primary school: a decisive issue for the future of tomorrow's citizens**

[Joint report with the Academy of Sciences, November](#)

The Academies emphasise the importance and necessity of education for all pupils, from the earliest age, that includes mathematics, natural sciences, computer science and technology, and of adequate training for schoolteachers. The current attention to environmental themes offers a cross-curricular opportunity to strengthen S&T education in schools.



### **Inter-seasonal heat storage in the residential and tertiary sector: a way to reduce our carbon footprint**

[\(Communication, 9 December\)](#)

Inter-seasonal heat storage is particularly suitable for heating, cooling and chilling uses in the residential and tertiary sectors. While this approach makes it possible to reduce the share of fossil fuels in energy consumption – and is deployed in several countries outside France – it is very little developed inside France. The Academy presents technologies for thermal energy storage, describes systems suitable for large-scale inter-seasonal storage in the residential and tertiary sectors and reckons the obstacles to their deployment in France.

### Thematic sessions

- Photovoltaic prospects up to 2030
- DNA: reading, writing, storing information
- Will technology exclude workers in the future (Part 1)? Media, AI and quantum computing at CES 2020 (Consumer Electronics Show 2020) (Part 2)
- Technologists, technologies and diversity
- Radio makes its digital transition (Part 1) – Ensuring the success of France's contribution to the Sustainable Development Objectives (SDOs) (Part 2)
- Fake news
- Epidemic developments and related issues
- A diplomatic and military challenge for the energy transition: oil (Part 1) - The purse or life? The lockdown analysed by economists (Part 2)
- Additive manufacturing: opportunity, necessity?
- Progress report on two ongoing studies
- The holistic role of platforms in the digital transformation (Part 1) – Exit from nuclear power by producing all of France's electricity from renewable energies? (Part 2) - The actors of the sustainable city: change or disappear? (Part 3)
- The evolution and aftermath of the pandemic COVID-19
- Freshwater issues in France
- SDG, resilience
- Projects of technical and industrial culture for investments of the future
- Battery technologies: challenges and prospects
- Will new technologies invade our kitchens?

### Conferences & Symposia

- DNA, polymers and big data
- Colloquium organised with the CNRS, in partnership with the Foundation of the National Academy of Technologies of France and the Foundation Arts et Métiers
- Brain-machine interfaces
- Colloquium organised with the CNRS, in partnership with the Foundation of the National Academy of Technologies of France and the Foundation Arts et Métiers

### Meetings-debates

- Dominique Gaillard, President of France INVEST
- Marie-Claude Dupuis, Director of Strategy, Innovation and Development, RATP Group
- Cédric O, Secretary of State for Digital Transition and Electronic Communications
- Jean-Pierre Bourguignon, President of the European Research Council
- Guillaume Boudy, Secretary General for Investment
- Laurence Tubiana, Director of the European Climate Foundation

### Annual Seminar

#### Which technological transitions for which ecological transition?

The theme of the annual seminar was chosen to contribute to the reflection of the Academy's divisions and enrich their systemic vision with a view to finalising their roadmap 2021-2022, i.e. the subjects on which the Academy could work and give advice, in particular to move towards the achievement of sustainable development objectives.



## FRANCE

One of the priorities of the National Academy of Technologies of France is to develop its relations with the world of education and training, particularly through actions in the regions, with the Foundation La main à la pâte and now the Maisons pour la science. In 2020, we have had a particularly active contribution on the multiannual programming law for research and the convention on digital education.

It is one of the academy's recognised strengths to be well connected to the business world. It has made this strength the theme of its triennial agreement with the CNRS and is seeking to extend it to other organisations (such as Inria, CEA or Inserm). In 2021 the meetings of the cénacle of business leaders will resume, under the chairmanship of Jean-Pierre Raffarin.

Cédric O, Secretary of State for Digital Transition and Electronic Communications, has entrusted Cigref, the association of major French companies and public administrations, and its partners - the Systematic Paris-Region competitiveness cluster and the National Academy of Technologies of France - with the mission of organising the French GAIA-X Hub. He was thus confirming the announcement made by Bruno Le Maire, Minister of the Economy, Finance and Recovery, at the GAIA-X Summit on 18 November 2020.

The Scientific Council of the Parliamentary Office for the Evaluation of Scientific and Technical Choices, renewed in February 2020, is composed of twenty-four high-level personalities, including seven members of the National Academy of Technologies of France. The Academy is regularly called upon to shed light on the studies conducted by Opecst.

## INTERNATIONAL

### DELEGATE

Bruno Revellin-Falcoz

### DEPUTY DELEGATE

Gérard Creuzet

In 2020, in spite of coronavirus-related travel restrictions, multilateral international relations activities have been quite dynamic. These multilateral activities have developed within CAETS, which now brings together 30 countries around the world, and Euro-CASE. Thanks to the setting up of appropriate websites, the circulation of information on the work of the academies has been intensified.

### AFRICA

The Academy and its Foundation have initiated two projects in West Africa, led by Bruno Jarry and Patrick Ledermann: the dissemination of the TINA digital learning technology, and the "Frontières de l'ingénierie" (Frontiers of Engineering) seminar in April 2021 in Yamoussoukro (Ivory Coast), which will bring together 40 young French-speaking engineers from the region).

### GERMANY

The National Academy of Technologies of France and the German acatech maintain regular relations that cover all the technological activities of both countries.

Exchanges took place on the management of the pandemic in its technological as well as economic aspects. Within the framework of the creation of the European GAIA-X platform, launched at the initiative of France and Germany, the two academies decided to set up a working group.

### CHINA

Work with the Chinese Academy of Engineering (CAE) covers nuclear energy and its environment as well as hydrogen. A joint report on hydrogen strategy is expected by the end of 2021. Exchanges are continuing on additive manufacturing, tuberculosis and systems for detecting dermatological pathologies.

### KOREA

The National Academy of Technologies of France has participated in the CAETS Energy Committee, led by the National Academy of Engineering of Korea (NAEK) to finalise the report approved in Seoul.

### CAETS

The annual conference of the Council of Academies of Engineering and Technological Sciences was held by videoconference from Seoul.

Under the title *Engineering a better world: Smart Society*, specialists from all over the world exchanged views on energy, sustainable development goals, diversity and inclusion, education/training, and communication with the public.

### Euro-CASE

The European Council of Applied Sciences, Technologies and Engineering (Euro-CASE) is an association of the academies of technology and engineering of twenty-three European countries, of which the National Academy of Technologies of France is a founding member.

#### SECRETARY GENERAL

Yves Caristan, member of the National Academy of Technologies of France

#### BOARD OF DIRECTORS

Representatives of the National Academy of Technologies of France, Bruno Revellin-Falcoz, Gérard Creuzet

### Working platforms

Several members of the National Academy of Technologies of France have contributed to the activities of Euro-CASE working platforms:

- Engineering Education, with the publication of the report on "Challenges and opportunities for future engineering education in Europe";
- The Future of Work;
- Early Career Professionals, which studies the relationship between young engineers and scientists and academia.

### Covid -19

Euro-CASE has taken a positive stance on the European recovery plan. In addition, the association has created a working group on science communication in a post-Covid world.



### Annual Conference

The Croatia Academy of Technologies (HATZ) organised the 2020 Euro-CASE annual conference on the theme "Challenges of the European Energy Transition". It was held in the form of a videoconference. The 2021 edition on 25 November will be held in London and will be organised by the Royal Academy of Engineering (RAEng) of the United Kingdom.

### SAPEA

Launched in 2017, SAPEA is part of the European Commission's Scientific Advice Mechanism. SAPEA aims to bring together the independent scientific expertise of more than one hundred European academies from over 40 countries.

This project is financed by *Horizon 2020* to the tune of €6 million over 4 years from 2017 onwards. The Commission has recently extended the project for one additional year until December 2021. It is based on a consortium of five European academic networks: Academia Europaea – the Pan-European Academy of Sciences Humanities and Letters, ALLEA - the European Federation of Academies of Sciences and Humanities, EASAC - the Scientific Advisory Board of European Academies, FEAM - the Federation of European Academies of Medicine, and Euro-CASE for the Academies of Technology.

### The reports

Since 2017 the National Academy of Technologies of France has participated in the preparation of several reports: *Cybersecurity in the European Digital Single Market*; *New Techniques in Agricultural Biotechnology*; *Food from the Oceans*; *Improving Authorisation Processes for Plant Protection Products in Europe*; *Novel Carbon Capture and Utilisation Technologies: Research and Climate Aspects*; *A Scientific Perspective on Microplastics in Nature and Society*; *Transforming the Future of Ageing*; *Making Sense of Science for Policy under Conditions of Complexity and Uncertainty*; and *A Sustainable Food System for the European Union*.

Currently, Euro-CASE is in charge, for the SAPEA consortium, of drafting a report on adopting a systemic approach to the energy transition in Europe. It will be published in the first quarter of 2021.



### SAPEA+

SAPEA and the European Commission have started negotiations for the continuation of their collaboration after 2021. A new contract with the consortium, SAPEA+, would be financed by *Horizon Europe*.

### FRONTIERS OF ENGINEERING

The exchange cycles organised by Euro-CASE and the American National Academy of Engineering (NAE) aim to bring together young engineers and scientists from Europe and the United States. The symposium, which was scheduled to take place in the United States in 2020, has been postponed to 2021. It will be organised by the Royal Swedish Academy of Engineering Sciences (IVA) and the American National Academy of Engineering (NAE) at Nokia Bell Labs.

### UNITED STATES OF AMERICA

The American National Academy of Engineering presented the programme of great technological challenges as part of the sustainable development objectives defined by the United Nations. This programme aims to provide scholarships to young students, in conjunction with the Chinese Academy of Engineering and the Royal Academy of Engineering of the United Kingdom.

### INDIA

The National Academy of Technology of France continues its exchanges with the Indian National Academy of Engineering (INAE) on technological themes of the future with a view to setting up joint working groups.

### JAPAN

The annual international conference of the STS (Science and Technology in Society) Forum was organised in the form of a videoconference. Chaired by the Prime Minister, it brought together a very large number of participants on the themes of energy and the environment, ICTs and intelligent cities, innovation, health, resources and education.

### UNITED KINGDOM

At the initiative of the Royal Academy of Engineering of the United Kingdom, the National Academy of Technologies of France has participated in several working groups relating to the coronavirus: detection systems, tests, masks, technologies for protection against nosocomial diseases.

### PLENARY ASSEMBLY

As a political and deliberative body, it adopts opinions and reports, approves general guidelines and the programme of activities. It is composed of 334 full and emeritus members.

### OFFICE

As an executive body, the Bureau is composed of the President, the Vice-President, the General Delegate and the outgoing President. The President of the Programme Committee also participates.

### ACADEMIC COUNCIL

The Academic Council is an advisory board for decisions put to the vote of the assembly. It is composed of the 4 members of the Bureau, 5 ex officio members and 7 elected members.

### DIVISIONS

The mission of the ten divisions is to develop a forward-looking vision of their field of interest:

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

The Office may also set up interdivisional project groups on topical technological issues.

Studies carried out at the request of institutions, public authorities and partners may, if necessary, be the subject of an emergency adoption procedure.

### MISSIONS

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

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