ANNUAL REPORT 2016

I — D E — A

IMAGINATION IS ALSO A SUSTAINABLE ENERGY

“Invention is not the product of logical thought.”

— ALBERT EINSTEIN

PROFILE

A company-laboratory of tomorrow’s energies, CNR participates in forging tomorrow’s European energy landscape at local scale. It innovates on a daily basis to invent another, more sustainable world. It draws its dynamism from collective intelligence.

France’s leading producer of 100% renewable electricity (water, wind, sun), and expert in hydroelectric and hydraulic engineering, CNR has designed a unique industrial model around the Rhône concession that combines green electricity production with territorial development.

For more than 80 years, it has operated and managed the River Rhône in the framework of three missions entrusted to it by the State: producing electricity, developing river navigation and irrigating the surrounding agricultural land.

A responsible model of governance, founded on the balance between profit, the general interest and sharing the resources generated from the river, CNR plays a major role in the development of the Rhône basin and the implementation of energy transition at the heart of the territories. Its philosophy: close collaboration with the stakeholders and the spirit of joint creation for the benefit of all.

STRIKING EVENTS —

FEBRUARY

SPOTLIGHT ON HYDROGEN MOBILITY

The Hyway project piloted by Tenerrdis took a new step with the installation at Port de Lyon of a hydrogen filling station managed by GNVert. Developed by McPhy, it permits filling a vehicle with hydrogen in less than 7 minutes. The next step: hydrogen production on site, through the addition of an electrolyser supplied with 100% renewable electricity from CNR.

MARCH

PACT FOR A 2ND CHANCE

CNR signed the pact for a 2nd chance with the Prefecture of Rhône to assist marginalised young job-seekers to find work. Thus, for six months CNR's employees volunteered to help 18 to 25 year olds to build their career project. The scheme provides the possibility of employment with CNR.

APRIL

ENHANCEMENT OF THE RIVER BANKS AT VIENNE

CNR and ViennAgglo signed a partnership agreement to requalify and enhance the banks of the Rhône where it crosses through Vienne. A corbelled green path will be opened in 2019 and participate in the effort made to bring the population to make the river its own. With an estimated cost of €2.85m, the project is funded by the Auvergne-Rhône-Alpes Region, the Isère department, ViennAgglo and CNR, which contributed €900,000.

MAY

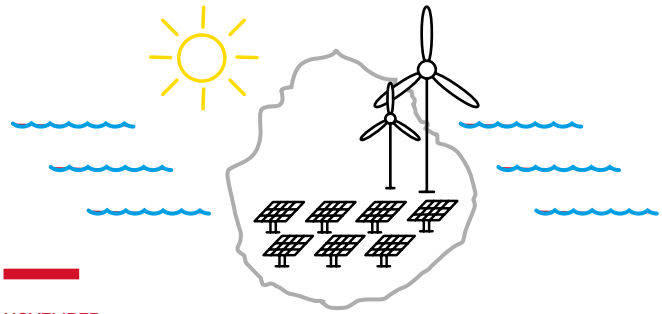
FRENCH-SWISS COOPERATION

400 CNR employees worked for 12 days on the lowering of the reservoir of the Swiss dam of Verbois, in line with a new ten year sediment management plan. It entailed exemplary cooperation between CNR and Services Industriels de Genève to ensure the passage of the sediments accumulated, while taking care to protect aquatic habitats and CNR's structures downstream.

JUNE

2ND YOUTH FOR THE PANAMA CANAL

The inauguration of the new Post-Panamax gauge Panama Canal concludes a gigantic project in which CNR has been involved since 2002, alongside the CPP consortium: the design of a set of huge lock gates to allow the world's largest container ships to pass from one ocean to another. A system modelled and designed by CNR Engineering allows boats to pass through within the time demanded by the Panama Canal Authority (the lock can be filled in less than 10 minutes), while recycling 60% of the water of each lock thanks to side ponds.



JULY

CNR CHARGING POINTS AVAILABLE TO ALL

Even non-subscribers of CNR's network of fast charging points can supply their cars with electricity along the electric corridor that stretches from Lake Geneva to the Mediterranean Sea. It's a first in France. Nomad charging is done via the Gireve platform which makes the different networks interoperable by aggregating the charging data of thousands of electric charging points in Europe.

NOVEMBER

MULTIPLE PRESENCE AT THE COP22

During the COP 22, and at the invitation of the European Commission, CNR presented its project to make Marie-Galante 100% autonomous in renewable electricity. 80% of its energy currently comes from fossil fuels, but this Caribbean island with a population of 12,000 will be supplied continuously with its own green energies by 2020 thanks to wind turbines, solar panels, electricity storage capacities and a smart electricity distribution grid. During the COP22 CNR also signed an agreement with 6 other French organisations to work on new approaches to monitor water resources, by integrating spatial data in view to improving knowledge on the impacts of climate change. Lastly, Initiatives for the Future of Great Rivers gave rivers a voice at Marrakech.

OCTOBER

FOR A FEW MWP MORE

Located on the land of the Chevalet aerodrome, the solar power plant of Aspres-sur-Buëch (5.5 MWc) was inaugurated and will supply 3,700 inhabitants with electricity. The result of close partnership between CNR, the Hautes-Alpes department and municipality, it is the second such plant installed by CNR in this department.

NOVEMBER

FLOOD ON THE LOWER RHÔNE

A peak flood of more than 8,000 m^3/s was recorded at Beaucaire on the night of 22 November. It was the highest discharge measured on the Lower Rhône since the exceptional flood of 2003. All CNR's teams from Lyon to the Mediterranean were mobilised to cope with this major flood episode.

OCTOBER

CNR BOOSTS TOP ROWERS

Following the 3 medals won at the Rio Olympic Games by the French rowing team supported by CNR, and the World Championship won by Augustin Mouterde, it renewed its partnership with the French Rowing Federation for 7 years. The partnership began in 2014.

THE NEW WORLD OF ENERGY IS ON THE MOVE

INTERVIEW WITH **ÉLISABETH AYRAULT**
CHAIRWOMAN AND CHIEF EXECUTIVE OFFICER

What was the context in which CNR was operating in 2016?

ÉLISABETH AYRAULT — It's difficult to take a year separately in today's radically changing energy world. One has to resituate things in time. We're witnessing several phenomena: first, the inevitability of renewable energies. Although France has lagged behind with the development of renewable energies in comparison with other countries, it is now following the movement. It's a sign of hope. Then there are changes in the ways energy is produced and consumed. We're moving towards a world where, in addition to producing and selling energy, green electricity producers must manage it before injecting it into the grid. The third observation is that market prices have become very unstable: prices fell in 2016 to levels bearing no relation with production costs. In addition, for CNR, the water didn't always come at the right time. The Rhône is subject to the effects of climate change. Despite the fact that our average production was satisfactory, our turnover fell by 4%. Notwithstanding the political, economic and dogmatic uncertainties surrounding us, CNR has to set its course and take these changes into account. 2015 was a year of decision-making, with the law on energy transition and green growth, the COP21 and the official establishment of the European Energy Union. A start was made in 2016 to turn the right ideas into actions. CNR's teams worked on the implementation of provisions to contribute to the movement underway. Likewise, we are continuing to transform the 9 commitments we made in the framework of the COP21 into projects.

How would you describe 2016?

É. A. — It was a year of contrast for CNR, with reasons for concern – market prices; the fall in river transport – and reasons for satisfaction. Among the positive elements that demonstrate CNR's capacity for adaptation to the changes occurring in the energy world, there was the commissioning of 100 MW in wind and solar power and the selection of 5 solar power projects in the 3rd call for projects by the Energy Regulation Commission. Our development activities are bearing fruit. Likewise, ADEME selected our project for a river hydrokinetic turbine farm and we went to the COP22 to present our project to make Marie-Galante 100% autonomous with renewable energy. Lastly, after only two years of being launched, Initiatives for the Future of Great Rivers was given the COP22 label, meaning the beginning of awareness of the importance of rivers faced with the challenges of climate change. In-house, CNR laid the foundations of an organisation that will allow it to join this general movement, to either prepare for the extension of its concession beyond 2023, or be faced with competition. Regarding this, we have presented our model in Brussels, just as we have to the French government, so that the Commission can analyse the validity and compatibility of the extension conditions with respect to European law. They have already been included in the Law on Energy Transition.

Doesn't the fall in electricity prices on the wholesale market threaten CNR's redistributive model?

É. A. — I'm not worried. CNR has some of the lowest production costs in the sector, so we have room to manoeuvre. But we can't dissociate CNR from the world that surrounds it. And the fact that the prices on the wholesale market – that's to say the European electricity exchanges – are too low to permit maintaining and renewing existing energy production facilities threatens the entire energy world. If this downward drift of prices persists, it will make things difficult for the actors in the energy market. In France, price levels can be partially explained by the fall in electricity consumption, due to de-industrialisation and energy saving. The increased insulation of buildings in particular has an impact on energy demand, which is a good thing. The injection of renewable energies at marginal cost has also contributed to the fall in market prices. However, the price hasn't fallen for consumers, since the cost of production amounts to one third of the electricity bill. In this framework, it is now necessary to get the consumer to pay the best price while preserving the future and financing the installations of tomorrow. There is also a need to assist the passage from a centralised mode of production based on nuclear energy and large production facilities to 100% renewable production that is decentralised, and where the consumers become actors in energy. I'm sure this will occur in France eventually, in the medium to long term. But how can we organise the progressive increase in the production of different energies, different types of consumption, and different management modes? How can we rebalance short-term positioning with medium and long-term positioning? The question of energy transition has to be answered and the response requires a controlled energy strategy and policy.

"Redistributive models will become increasingly essential since renewable energies are not confined within walls but integrated in territories."

— ÉLISABETH AYRAULT

What actions can CNR take to support river transport?

É. A. — Facilitating navigation on the Rhône is one of our core activities. It comprises maintaining the channel, managing the locks, developing port and industrial sites, and assisting in the training of skippers. We must now communicate on the advantages of river transport, especially its safety, for the transport of hazardous goods, and its environmentally friendly dimension. We have to think globally, on the scale of international transport, to give it greater impact. River-maritime transport will succeed when the impact in terms of CO_2 emission per good transported is evaluated. Promoting river transport requires that all the actors involved work together, in particular within Medlink Ports, the network of multimodal platforms on the Rhône-Saône corridor in which CNR plays an active role. The link with the port of Marseille has been strengthened, tax issues must still be ironed out, the river transport profession has to be federated, and training for skippers needs to be encouraged. We're seeking to facilitate working in common with all the actors of river transport.

What are CNR's advantages in energy transition?

É. A. — There are many. CNR has been producing 100% renewable energy for more than 80 years, and will reach 4,000 MW of installed capacity in 2020. CNR is already engaged in energy transition. The balance between our shareholders is another advantage. We have the chance of having worked with local authorities for decades, and they are present in our capital. They assist the deployment and management of renewable energies on their territories. The State reinforces CNR's vision in the general interest through the Caisse des Dépôts. ENGIE, our industrial shareholder, provides us with its expertise in energy production. We're balanced between public and private management, it's an ideal mix. Our redistributive model will become generalised tomorrow. Populations will increasingly wish to participate in the global framework of the energy sector, and know how electricity production and distribution function.

Part of the value generated from the energy supplied by the territories should be redistributed locally, like CNR does today. With more than 1,400 employees, CNR is a reactive, human scale company whose employees have a sense of responsibility and talents willing to be tapped. They have come up with ideas such as applying DNA techniques to identify the biodiversity of the river, installing hydrokinetic river turbines at Génissiat, setting up nurseries for endemic species to replant river banks, and using a subaquatic camera to characterise the nature of river beds.
Lastly, we are acknowledged as a laboratory for tomorrow's energies. CNR is one of three actors in sustainable mobility auditioned by the National Assembly (the French parliament). It is at the forefront of sustainable hydrogen, the management of energy and its intermittence...
Our project for Marie-Galante, where CNR is positioned regarding production, storage, sustainable mobility, and the aggregation and management of consumption data, proves that we already stand firmly in the future.

How do you envisage 2017?

É. A. — Carrying on from what we've formulated in our strategic plan, I want to defend our model and develop the Rhône, develop our portfolio of renewable energies and increase our capacity to be a laboratory for tomorrow's energies. In-house, I've set three priority objectives: assist the deployment of the new organisation so that it creates value for all, improve our safety results, which is an imperative, and strengthen and showcase our industrial excellence.

How does CNR's new organisation implemented in 2017 favour innovation?

É. A. — The spirit of innovation is linked to the empowerment of each individual in their trade. When everyone feels concerned with what they do, it frees energy. Our new organisation is designed with this in mind. It brings initiatives in the field closer together. The innovation and energy transition department has been set up to give substance to innovation and give it the resources it requires. It carries on from the work started in 2016 to implement the ideas that were fed back via the Innov'Action platform. It is also responsible for imagining breakthrough innovations in sustainable mobility, sustainable hydrogen, virtual plants, and so forth. Being a laboratory for tomorrow's energies must lead us to question ourselves. We absolutely must assist the changes occurring in specialisations, and set the entire company in motion to exploit the still unexplored potentials of water, sun and wind. That is what will maintain CNR's excellence.
Far from relying only on its past, I want CNR to question itself to participate in the adventure of energy transition. I remain optimistic. CNR is endowed with a wide array of talents and plenty of potential. We have a stimulating future.

3 MAJOR FIRSTS IN 2016

Renewable energies represent more than half the world's new electricity production capacities.

The power of wind farms exceeds that of coal-fired power plants in Europe.

Electric cars have exceeded the threshold of 1% of personal vehicles registered in France.

VIEWS FROM DIFFERENT ANGLES

INTERVIEW WITH **MICHEL BLANC** AND **CHRISTIAN MONTEIL**
CHAIRMAN AND VICE-CHAIRMAN OF CNR'S SUPERVISORY BOARD

According to you what is CNR's main contribution to the territories in the context of energy transition?

MICHEL BLANC — In addition to carrying out its core trade, CNR wants to play a role that is just as essential, which is to act as a catalyser for projects and enhance the river with its stakeholders. This leads to benefits for the territories and to the appropriation of the Rhône for all. Its river culture cuts across borders and, regarding this, we want to develop its engineering internationally along with its technical knowhow, its competences involving the natural and human environment of projects. An example of this are the relations forged with the Laotian government, which shows its interest for the contribution that CNR can provide. We're sensitive to the fact that our medium-sized company is capable of driving this modernisation, based on its experience of global river management and its mastery of renewable energies. It benefits from the enthusiastic involvement of its highly motivated young teams that implement its projects.

CHRISTIAN MONTEIL — The municipalities situated along the Rhône and the territories that it crosses form an integral part of CNR. The reflection carried out in the legislative framework has placed emphasis on the daily concerns of the inhabitants.

"CNR acts as a catalyser in the territories."

— MICHEL BLANC

Their daily life is organised in terms of the territory in which they live, and its quality and attractiveness depend on the services it provides, the quality of the air, the balance between economic development and the environment.
In 2016, CNR more than ever acted as a mirror to the questions raised by the population regarding environmental quality. It develops innovations with concern given to improving the conditions of daily life.

How do you see the company's operational management?

M. B. — The management team is excellent. Creative, it adapts its development strategy to a changing world. It endeavours to diversify its renewable energy production and is involved in new activities to widen its choice of resources. It has implemented the reorganisation process well, technically, though the labour dimension has been difficult. Reorganisation is always traumatic, even in the framework of total job security. The objective rationalities are understandable, though time, pedagogy and taking perceptions into account are required for those more difficult to grasp. Those who don't agree should be able to express themselves in a spirit of reciprocal consideration.

C. M. — One speaks of new organisation, but we have to cope with novelty everyday, as individuals, in the family, in the company, and in local authorities. If we had not been visited by novelty 15 years ago, where would CNR be today? Without the arrival of an industrial shareholder, where would we have found our knowhow and our independence? Everything changes, the world, modes of consumption, the reflexes of society... CNR is changing, it is subject to climate change, it no longer sells its energy in the same way or for the same price, not only hydroelectricity, but also wind and solar energy. Reorganisation is inevitable. As for me, I hope that the elected representatives maintain close links with the territorial divisions. CNR has to adapt to be more efficient. But guarantees are also needed for individuals. Even if their jobs are safe, their concern may be due to uncertainty about the company's future.

"CNR develops innovations with concern given to improving daily life."

— CHRISTIAN MONTEIL

That's why it's important to extend CNR concession after 2023. So where does CNR stand?

M. B. — Obviously, it's vital! Enthused by the adrenaline of activity, one needs a feeling of eternity. The barrier represented by the end of the concession doesn't spur one to look ahead. In a company, which is above a collective driving force, personal involvement is essential. The extension of the concession is needed to respond to the imperative of innovation. CNR has changed from depending only on hydroelectricity to diversifying its energy sources. The latter are becoming increasingly structured and important. CNR must be able to project itself locally as much for its decentralised energy production as for its links with the territories. Its long-term commitment will, among other things, take the form of new works to be pursued in the framework of its missions.

C. M. — If I were a legislator, I would focus closely on CNR's model of governance which brings together around the same table local elected representatives, a pubic investor, employees' representatives and an industrial corporation. This model is formidable if everyone keeps to their place, meaning that the industrial corporation does not want to manage everything alone, that the investor is not seeking only financial profit, that the employees' representatives are not union activists and that the elected representatives are not the sole expression of their territory. I'm eager for the concession to be renewed because CNR has built a wonderful model. I hail the work accomplished by Élisabeth Ayrault and the Management Board over the last two years. We're looking forward to a positive result that will give rise to great relief.

M. B. — It will give added adrenaline to our company which is brimming over with dynamism!

INTERVIEW WITH **JULIEN FRANÇAIS**
VICE-MANAGING DIRECTOR OF CNR

"Experts for 15 years in forecasting intermittent energy production and management, we can manage renewable energy for third parties."

— JULIEN FRANÇAIS

JULIEN FRANÇAIS — In France, CNR is the only energy manager to be wholly focused on renewable energy. That has led us over the last 15 years to develop expertise in energy production forecasting, managing intermittence and the flexibility of the River Rhône. Our prior experience, maturity and specificity give us the capacity, with COCPIT*, to manage green energy on behalf of third parties, that is to say propose aggregation services for other producers. Our objective, in the short and medium terms, is to be able to aggregate several hundred carbon free MW with our production. This new market is opening up for us with changes in regulations on the support mechanisms for wind and solar power and the end of the obligatory purchase scheme. Henceforth, producers must sell their production directly on the electricity market and abide by the load balancing rules of the electricity grid. As with any other actor, they must declare a day ahead the amount of production they intend to place on the market and they will be penalised if they don't fulfil their commitment.
Our second lever is located with the consumers. We propose a real-time guarantee of 100% renewable production whereas the other producers issue their green certificates on the basis of statistics that do not therefore systematically correspond to instantaneous consumption. Our intention is to succeed in standing out, in order to give our green certificates additional value.
The traceability of green energy will allow consumers to choose and become actors in their consumption.

Moving on to the theme of purchasing, CNR has created a purchasing division. What are the reasons for this change?

J. F. — It's a major change in our organisation. The purchasing function plays an integral role in the company's industrial and financial performance. We wanted to strengthen its operational links with the executives, technicians and project managers. Previously part of the Financial Division, it has become a division in its own right, and is now decentralised for the entire Rhône Valley and responsible for the outlay of the first euro of expenditure. It is not simply a contractual management department. Upstream, in support of the different trades, it encompasses the expression of needs, the search for different suppliers, drawing up specifications, and negotiation. Downstream, it monitors contract life-cycles, the performance of contracts by suppliers, and their modification if necessary. It's also a tool in favour of the company's societal responsibility, through an approach based on local and responsible purchasing.

As the President of Tenerrdis, the renewable energy cluster, how do you judge the impetus triggered in favour of innovation in the Auvergne-Rhône-Alpes Region?

J. F. — Tenerrdis has been awarded a Gold Label by the European Union and groups more than 200 companies in the Auvergne-Rhône-Alpes Region. SMEs and VSEs, which make up 70% of its members, work alongside major groups in the energy sector, research centres, training organisations and territorial authorities. They are all active in making innovation a collaborative objective for the benefit of energy transition, and the competitiveness and development of the region's businesses.
In 10 years, more than 250 projects have been developed for an investment of €1.7 billion in R&D and innovation. They involve sectors that have always been at the forefront such as hydroelectricity, since the Auvergne-Rhône-Alpes Region is the largest producer of hydroelectricity in Europe. They also involve solar energy, with the INES**, CEA's reference centre, renewable hydrogen, with the installation in the region of 80% of the companies in France involved in the sector, grid management, energy storage, biomass and biogas. CNR is fortunate to be a part of this ecosystem. As a laboratory for tomorrow's energies, we pursue our development by taking a collaborative approach. Innovation is not a creative act done in isolation. Tenerrdis's partners mutually provide ideas, technologies, service components, and access to clients. These exchanges occur smoothly and simply. Most of the major innovative projects in which we are involved, such as hydrogen mobility and hydrokinetic river turbines, are developed in the framework of Tenerrdis, or with partners with whom we've had contacts.

* Intermittent production management and optimisation centre.
** National institute of solar energy.

INTERVIEW WITH **DIDIER LHUILLIER**
VICE-MANAGING DIRECTOR OF CNR

You joined CNR in October 2016. How would you describe the company?

DIDIER LHUILLIER — CNR's corporate culture is very strong. The employees express their attachment to the company through their keen interest in its missions, there's a strong spirit of solidarity and readiness to act. For example, during the floods of November, certain employees on holiday called to know whether they could be useful. Often, one enters CNR young and stays until one retires. Sometimes, several generations of the same family have been employees. It's totally different from the industrial companies I've worked for in the UK and Canada, where one is an employee of one company one day and of another the next. CNR's human heritage is exceptional. But we can strengthen our level of excellence by opening out more to the outside, by exchanging more within the

company, and by capitalising on our good practices. We have to improve our maintenance operations by standardising them all along the Rhône, to improve reliability, and optimise lead times and costs. There is also an impetus at work in the new organisation. It caused stress and anxiety, equivalent to the employees' attachment to CNR. But the changes we're going through also represent a source of opportunities. The management wants everyone to benefit from them and be happy in their work. Measures will be implemented with a major training plan comprising 10,000 hours, in addition to the 51, 000 hours of training usually given. It's an opportunity to learn the new practices and trades that are evolving in CNR.

19 hydropower plants, 19 dams, 14 wide gauge locks, 5 locks for pleasure boats, 400 km of dikes... How does CNR manage this vast concession?

D. L. — Everyday management of the concession and the ongoing maintenance of our installations is the responsibility of the 4 territorial divisions that rely on three cross-disciplinary divisions – asset management, operational coordination and safety, and maintenance. The goal is to ensure hydraulic safety, by maintaining the height of the Rhône according to the specifications given to us.

"There is also an impetus at work in the new organisation."

— DIDIER LHUILLIER

Our structures are old though their operation and maintenance rely on a lot of new technologies and automation. Dams and locks are both controlled remotely by centralised management centres. This operational model has drawn interest from a large number of river management bodies around the world, which come regularly to visit our installations. Our 19 dams are managed synchronously with the run of the river, with control systems developed in-house that allow us to modulate production in order to sell at the best price on the markets, by slightly raising the water height at each dam during off-peak hours and lowering it when demand for electricity is high. Our reserve capacity over one day is 1,000 MW. Likewise, by combining digitisation, high definition cameras and a high throughput network, we can control all the locks from Lyon to the Mediterranean remotely with several operators and provide skippers with a quality service while ensuring total safety, 24/7. As for the dikes, we have started to use drones and airplanes to carry out topographical surveys by laser (Lidar) and by a photogrammetric system for land and site monitoring. These surveys are quick and exhaustive and complete and refine the measures carried out by surveyors and visual monitoring.

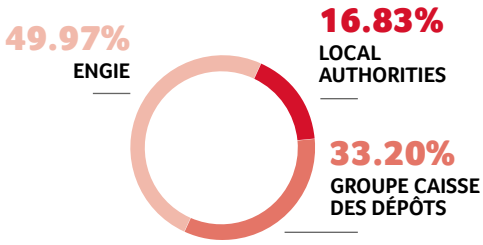
The new organisation implemented on 1 April 2017 strengthens CNR local roots via its 4 territorial divisions. Why is it an essential step for ensuring energy transition?

D. L. — Our local roots are longstanding due to the closeness of our relations with the population of the Rhône Valley, the elected representatives of its municipalities and the users of our concession. It gives us unique confidence to develop renewable energy projects close to consumers, by reconverting industrial wastelands, by building solar power plants on carparks, such as in the industrial zone of Salaise-Sablons, and by launching crowdfunding campaigns. The success of the crowdfunding campaign for the windfarm of Planèze in Ardèche exceeded our expectations. It proves the strong attachment of the community for renewable energies and the trust that they place in CNR. Over the years, the company has shown that it says what it does and does what it says. CNR is a reliable and credible operator with a genuine desire to develop the territories and improve interaction between consumers and the Rhône. This encounter is just beginning and will become increasingly close.

GOVERNANCE AND ORGANISATION

CNR is a joint stock company in the general interest managed by a Management Board and administered by a Supervisory Board. A mostly public owned company – Groupe Caisse des Dépôts and local authorities – CNR's leading industrial shareholder is ENGIE.

SHARE DISTRIBUTION



THE SUPERVISORY BOARD

This auditing body examines the accounts and ensures the efficiency of CNR's management. The Supervisory Board is chaired by Michel Blanc. It is composed of:

13 shareholders' representatives,

2 government representatives,

3 employees' representatives.

Gathered in the Supervisory Board, the energy producer ENGIE and the Groupe Caisse des Dépôts provide their competences and specific knowhow alongside the local authority shareholders. A subtle balance between public and private interests, CNR cultivates a strong industrial identity and great attachment to the values of public service.

THE MEMBERS OF THE SUPERVISORY BOARD

Michel BLANC
Chairman of the Supervisory Board

Christian MONTEIL
Vice-Chairman of the Supervisory Board, representing the department of Haute-Savoie, President of the Departmental Council of Haute-Savoie

Shareholders' representatives

Groupe Caisse des Dépôts
Françoise TAUZINAT

Auvergne-Rhône-Alpes Region
Laurent WAUQUIEZ
President of the Auvergne-Rhône-Alpes Regional Council

Provence-Alpes-Côte d'Azur Region
Philippe MAURIZOT

Bouches-du-Rhône Department
Marie-Pierre CALLET

Physical persons proposed by the shareholders

Groupe ENGIE
Bernard GUIRKINGER
Jérôme TOLOT
Gwénaelle HUET
Didier ENGELS
Jean-Baptiste SÉJOURNÉ

Groupe Caisse des Dépôts
Emmanuel LEGRAND
Philippe BLANQUEFORT

Government representatives appointed after proposal by the French government

Isabelle ANDRIVON
Charles CLÉMENT-FROMENTEL

Representatives of CNR's employees

Éric CHALAYE
Yves LOPEZ
Sophie VASSEAUX

The following persons also attend the Supervisory Board meetings: Olivier David, Government Commissioner, Nathalie Deguen Government Comptroller and the Secretary of the Works Committee.

THE MANAGEMENT BOARD

It is composed of three members: A collegial management body, it manages the company in conformity with statutory and legal provisions. It decides and implements CNR's major strategic, commercial and technical orientations.

It is composed of three members:

- **Élisabeth AYRAULT**
  Chairwoman and Chief Executive Officer
- **Didier LHUILLIER**
  Vice-Managing Director
- **Julien FRANÇAIS**
  Vice-Managing Director

In the front row from left to right: Jean-Louis Mathurin; Laurent Tonini; Cécile Magherini; Thomas San Marco; Élisabeth Ayrault; Christophe Dorée; Muriel Loquet.
In the second row from left to right: Éric Divet; Pierre Meffre; Christian Orvoën; Valérie Chabrier; Pierre-Jean Grangette; Julien Français; Sylvain Colas; Stéphanie Plantier; Frédéric Storck; Christian Heimburger; Bertrand Porquet; Didier Lhuillier; Philippe Armand; Pascal Albagnac; Jean-Luc Pagliardini; Philippe Magherini.

ORGANISATION CHART

On 1 April 2017

ÉLISABETH AYRAULT
Chairwoman and Chief Executive Officer

- **THOMAS SAN MARCO** — General Secretary
- **SYLVAIN COLAS** — Director of Communication
- **JEAN-LOUIS MATHURIN** — Director of Engineering and Major Projects
- **PIERRE MEFFRE** — Director of Port Development and Missions in the General Interest
- **FRÉDÉRIC STORCK** — Director of Energy Transition and Innovation
- **Internal auditing**

DIDIER LHUILLIER
Vice-Managing Director

- **PHILIPPE ARMAND** — Director of Maintenance
- **VALÉRIE CHABRIER** — Director of Operational Coordination and Safety
- **ÉRIC DIVET** — Director of Asset and Concession Management
- **PIERRE-JEAN GRANGETTE** — Director of Energy Sales
- **CÉCILE MAGHERINI** — Director of New Energies

TERRITORIAL DIRECTORS

- **LAURENT TONINI** — Haut-Rhône
- **CHRISTIAN ORVOËN** — Rhône-Saône
- **CHRISTOPHE DORÉE** — Rhône-Isère
- **PASCAL ALBAGNAC** — Rhône-Méditerranée

JULIEN FRANÇAIS
Vice-Managing Director

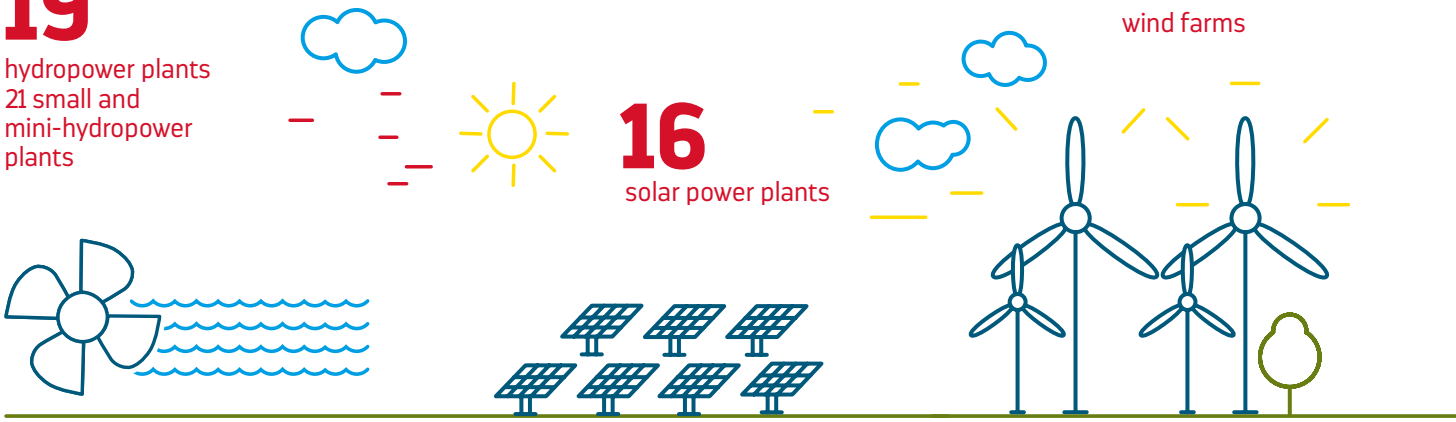
- **CHRISTIAN HEIMBURGER** — Director of Human Resources and Safety
- **MURIEL LOQUET** — Director of Purchasing and Logistic Services
- **PHILIPPE MAGHERINI** — Legal Affairs Manager
- **JEAN-LUC PAGLIARDINI** — Director of Information and Digital Systems
- **STÉPHANIE PLANTIER** — Director of Finance and Cost Control
- **BERTRAND PORQUET** — Director of Strategy, Environment and Marketing
- **Internal audit / Middle Office / Information systems security**

KEY FIGURES 2016

19
hydropower plants
21 small and mini-hydropower plants

16
solar power plants

37
wind farms



100% RENEWABLE PRODUCTION ASSETS

84,720
containers transported
(- 13%)

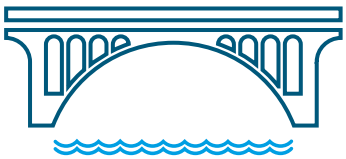
330 km
of wide gauge navigable waterway

4.85
million tons transported
(- 5% versus 2015)

91,046
lock passages between Lyon and the Mediterranean (- 2.8%)

206,396
pleasure boaters
(+ 1.5%)

27,000 ha
of concession
(14,000 ha of river, 13,000 ha of land including more than 800 ha of industrial and port sites and enterprise zones)



19
dams

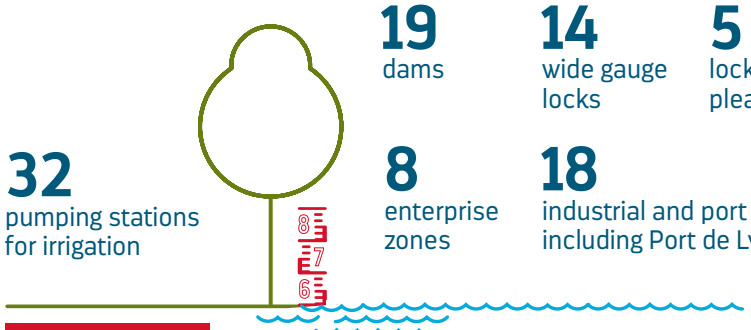
14
wide gauge locks

5
locks for pleasure craft

32
pumping stations for irrigation

8
enterprise zones

18
industrial and port sites including Port de Lyon

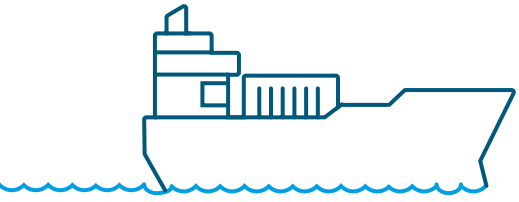


OTHER ASSETS

3,553 MW
of installed capacity

=

15.4 TWh (+ 7%)
produced



RIVER TRANSPORT

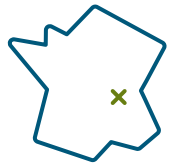
RESULTS

€1,056 M
in gross turnover

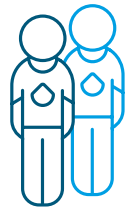
€93 M
net income

REDISTRIBUTION

€127
of hydraulic fees
paid to the State



More than €30 M
a year to assist the territories
by virtue of the missions
in the general interest

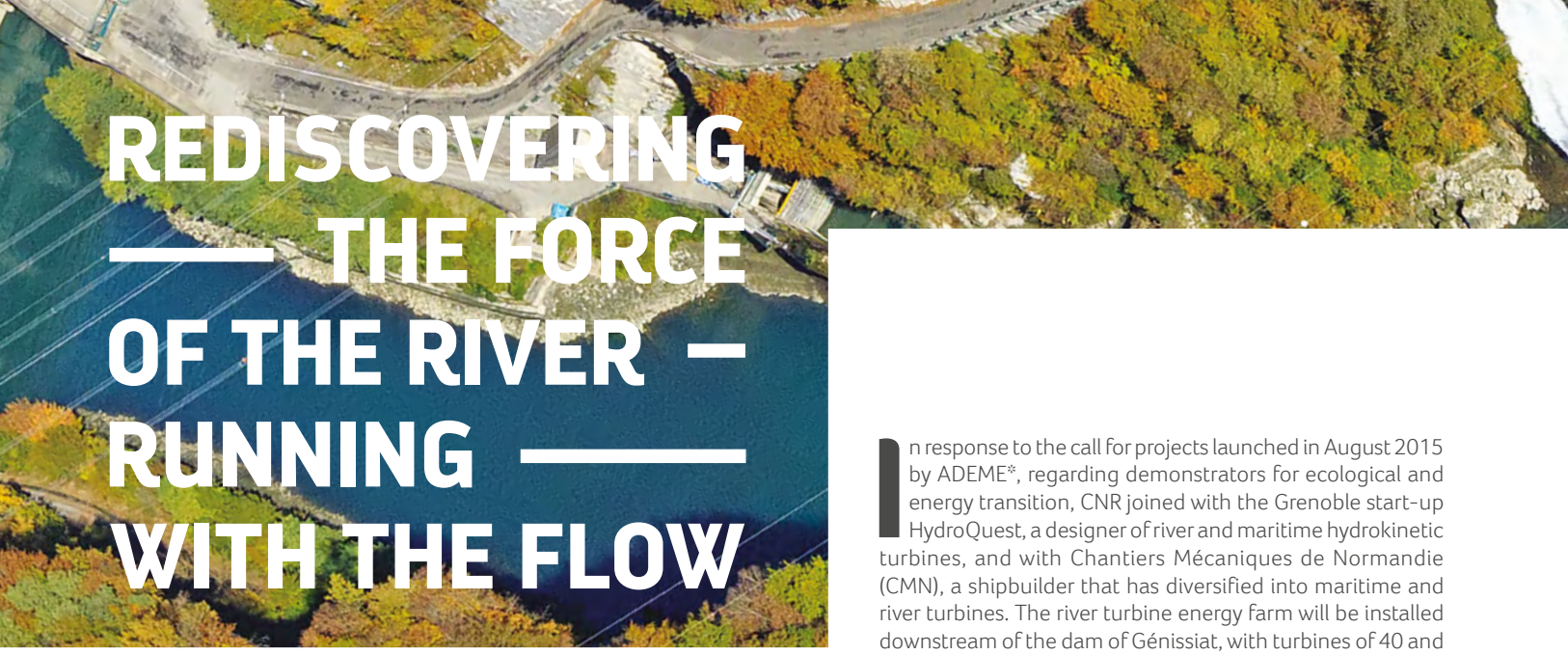


14,500
direct and indirect jobs
generated in the Rhône Valley

1,355
full-time employees
on 31/12/2016

Innovation at every level of CNR is the absolute condition for accomplishing energy transition. A corporate laboratory for tomorrow's energies, we work on emerging sectors and on new uses of electricity, in partnership with some of the most efficient actors on the market. Endowed with our culture based on the river, we also participate in meeting the challenges of other countries.


E
A
nnovate



REDISCOVERING THE FORCE OF THE RIVER — RUNNING WITH THE FLOW

A world first in terms of size, a pilot project to install a farm of 39 hydrokinetic river turbines launched by CNR in partnership with HydroQuest and CMN was selected by ADEME in November 2016 in the framework of the Investments for the Future Programme. It will be commissioned in 2018.

2 MW
of installed capacity

6,700 MWh
of annual average production

2,700 inhabitants
supplied with electricity

2,000 tons
of CO_2 emissions avoided annually

An investment of €12 M
of which half was funded by the State in the form of a subsidy (€2 M) and a reimbursable advance (€4 M).

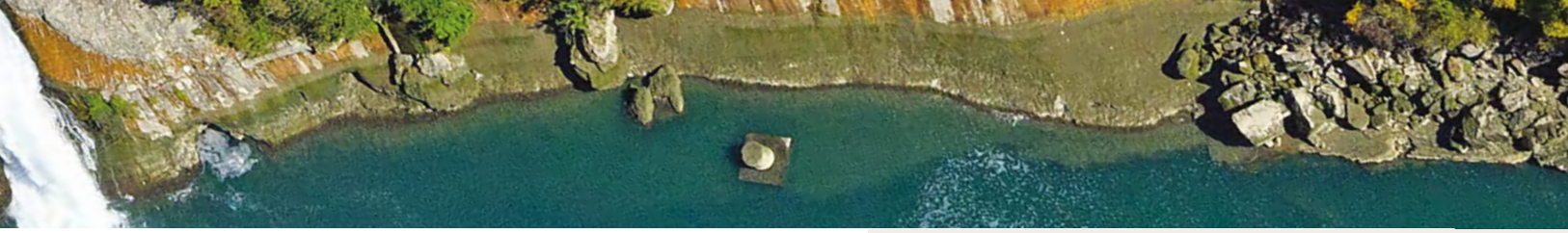
In response to the call for projects launched in August 2015 by ADEME*, regarding demonstrators for ecological and energy transition, CNR joined with the Grenoble start-up HydroQuest, a designer of river and maritime hydrokinetic turbines, and with Chantiers Mécaniques de Normandie (CMN), a shipbuilder that has diversified into maritime and river turbines. The river turbine energy farm will be installed downstream of the dam of Génissiat, with turbines of 40 and 80 kW distributed over 2 km, with one unit every 150 metres. CNR will ensure the operation, maintenance and hydroelectric engineering. This joint industrial venture sprung from the idea of a CNR employee to supply a remote facility in the gorges of the Rhône. It was then subjected to a multidisciplinary study within the company.

GREEN, LIGHT, DISCREET, CONTINUOUS

A hydrokinetic turbine converts kinetic energy into electricity in the same way as a wind turbine. However, its output is better, as the density of water is around 850 greater than that of air. In addition, it operates 24/7 and its installation does not require any cumbersome infrastructure. The technology chosen by CNR is the result of 10 years of research. "*Assembled on a double vertical rotating shaft, the HydroQuest turbine has one or two stages in order to adapt to the depth of the water and harness the energy present as optimally as possible*", says François Simon, Chairman of Hydroquest. "*It's fastened to a barge anchored to the river bed by a micro-pile. Since it's submerged it's invisible to both eye and ear. It's also equipped with a self-cleaning trash-rack and its maintenance is ensured simply by lifting it out of the river and onto the barge*". Tests have already been carried out to determine the performances and outputs of the turbine, a mock-up of which was presented at the COP21. A prototype in French Guyana, which supplies a village in the middle of the Amazon region – a world first – proved its robustness in heavily loaded water. Another first is a machine on the Loire linked to the national electricity grid. Located in the centre of Orleans in a Natura 2000 site, it demonstrated that its environmental impact was the lowest of the systems used to generate renewable energy.

AN INTERNATIONAL SHOWCASE

"*The Génissiat farm is an essential step in our development, since it represents the commercial launch of our hydrokinetic turbine. Since nearly 90% of our market is located abroad, it's vital to have*



"We're proud to participate in energy transition at the international level and in the emergence of the industrial hydrokinetic turbine sector in France."

— JEAN-FRANÇOIS SIMON, HYDROQUEST

a showcase of its size in France in order to be visible internationally. The backing of a reputed energy producer and the State are solid guarantees of credibility", exclaims Jean-François Simon enthusiastically. "To a great extent the rivers in France have been equipped with hydropower infrastructures whereas a large number of regions in Africa, America and Asia are under-equipped: 1.5 billion people, 2/3 of whom live in Africa, have no source of electricity supply. Emerging and developing countries vitally need electricity generated locally for their economic growth. We are positioned on sites where our prices will be competitive in comparison to fossil fuels. We hope that this project, organised pragmatically and efficiently with CNR, will give us the opportunity to pursue our partnership, by building partnerships outside France".

*Agency for the Environment and Energy Management

INTERVIEW WITH **RÉGIS LE BARS**
MANAGER OF ADEME'S CARBON-FREE ENERGY PROGRAMME

Why did ADEME choose the river hydrokinetic turbine project at Génissiat?

RÉGIS LE BARS — This project is funded in the framework of the Investments for the Future Programme (PIA), for which ADEME acts as agent for the government, and is part of the programme of Demonstrators for Ecological and Energy Transition. We funded it after having carried out a technical, economic and financial analysis carried out by our experts, as it perfectly matches the PIA's objectives. It offsets the risks taken by industrial companies to develop innovative technologies and innovative solutions that contribute to energy transition and permit the actors to position themselves on new markets. There's a lot of synergy between the three partners and their competences give plenty of assurance that the project will achieve its aims: CNR's expertise in river engineering and its knowledge of the Génissiat site are combined with HydroQuest's leading edge hydrokinetic turbine technology. Lastly, CMN's industrial capacity no longer needs demonstrating and it will lead to creating and maintaining jobs in France, not only to install this farm but above all to install future commercial farms.

What does the future hold for river hydrokinetic turbines in France and elsewhere around the world?

R. L. B. — I don't foresee the future of these commercial farms in France since the cost of the energy produced will remain higher than that of other renewable energies. The first market surveys have shown that Africa and South America appear to be promising markets, since resources are abundant and have not yet been exploited. It's necessary to use this first pilot farm, the first of its kind in the world, to demonstrate the pertinence of the technology and convince future investors.

MIXING GAS AND WATER

CNR is exploring the potential of green hydrogen by participating in pilot power-to-gas projects and in hydrogen mobility. Through its involvement in mass storage, it anticipates and promotes the exploitation of its wind and solar energy production. It also intends to develop its services in energy grids.

It is necessary to find an economic and efficient solution for the large scale and lasting storage of the electricity generated by intermittent energies that is not immediately consumed on the electricity grid, and to make it available as a function of demand. Converting surpluses of renewable electricity into hydrogen could be a way of filling the gaps in intermittence.

THREE BRANCHES FOR THE HYDROGEN SECTOR

Power to gas consists in using green electricity to separate the hydrogen (H) and oxygen (0) of water by electrolysis and then storing the hydrogen obtained in the gas grid. It can then be injected directly or after having been converted into synthetic methane by reaction with CO_2, a step that optimises bulk storage, without having to adapt the gas grid. The green hydrogen can also be supplied to an industrial client to replace hydrogen produced from fossil fuels. Lastly, it can be used to fuel electric cars that can also run on hydrogen. Equipped with a fuel cell which produces electricity from hydrogen and oxygen, cars fuelled in this way have a longer range than electric cars powered only by batteries, thereby increasing the attractiveness of green mobility.

"Electricity, gas and heat grids have to be combined to optimise energy efficiency. There's a strong demand from the territories."

— PATRICK PRUNET, GRTGAZ

JUPITER 1000: *POWER TO GAS* AT FULL SCALE

CNR is a partner of GRTgaz in the Jupiter 1000 demonstrator, due to be commissioned in 2018. This project combines *"all the links of the Power to Gas (P2G) sector to transform surplus green electricity into hydrogen, build and accommodate electrolysis, methanization and CO_2 capture systems, inject the gas into the grid, transport it, make the electricity grid more flexible,"*

PARTNERS
OF PROJECTS

JUPITER 1000

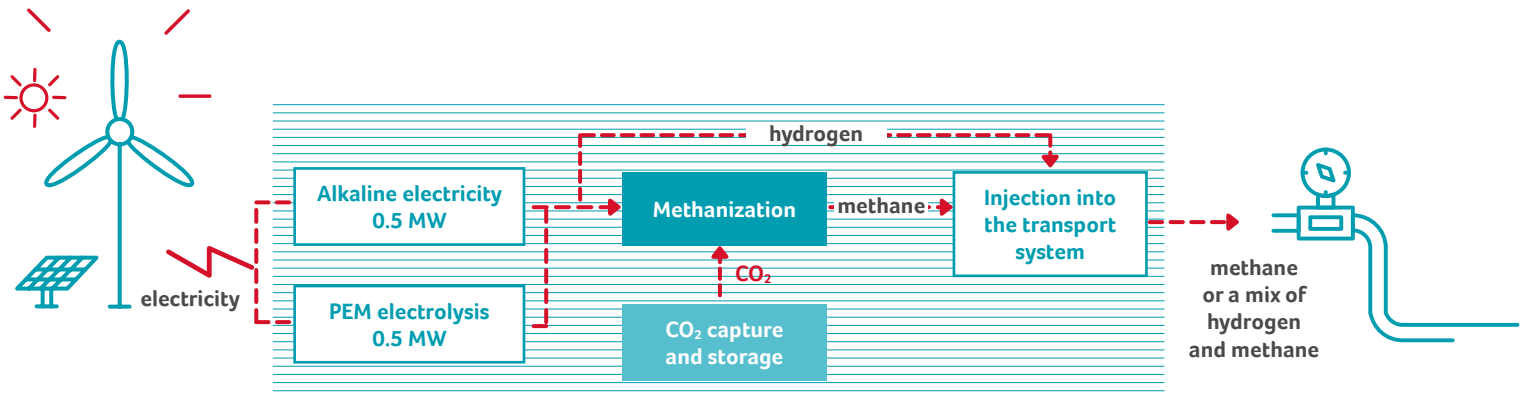
GRTGAZ, LEAD PARTNER, ATMOSTAT, CEA, CNR, LEROUX & LOTZ, MCPHY, PORT DE MARSEILLE-FOS, TIGF.

This project bears the label of the Capenergies cluster and is subsidised by Europe (FEDER), the State through ADEME (Investments fir the Future Programme) and the Provence-Alpes-Côte d'Azur Region.

HYWAY

COORDINATED BY TENERRDIS, WITH AIR LIQUIDE, CEA, CNR, ENGIE, GEG, MCPHY, SYMBIO.

This project receives funds from the government via ADEME, and from Europe (FEDER) and the Auvergne-Rhône-Alpes Region.



THE JUPITER 1000 PROJECT

says Patrick Prunet, the GRTgaz project manager. With an electrolytic output of 1 MW, and installed on the industrial and port site of Fos-sur-Mer, this demonstrator will be the first of this scale in France. CNR will provide the wind energy required to produce hydrogen. It will control two electrolysers remotely. The CO_2 will be captured in industrial chimneys nearby. "*Jupiter 1000 will serve to validate power to gas technologies and the underlying economic model. We also have to make strategic proposals regarding paths of development for P2G*", explains Patrick Prunet. "*The operation of the electrolyser will be tested, in particular with an emerging membrane technique more compact than the alkaline solution, and very reactive when starting up. We're going to study methanization using an innovative production process that optimises the conversion of hydrogen into methane and the dimension of the unit used. We also have to check the impact of hydrogen on the gas grid, evaluate the admissible rate of injection, and its behaviour in the industrial processes of companies downstream. Our business model will therefore be built on strong data – the lifetime of installations, yields, and maintenance costs. Lastly, we'll draw up a road map for deploying P2G facilities.*" In addition, links to heating grids will be examined. "*Green gas injected into the gas grid will be used in particular to produce electricity. Heat has to be captured and exploited at every step of conversion to optimise yields and make the process profitable.*"

HYWAY: HYDROGEN BOOSTS ELECTRIC MOBILITY

The aim of the HYWAY project is to develop carbon-free mobility between Lyon and Grenoble. In 2016, a charging point was installed at Port de Lyon, open to fleets of Renault Kangoo ZE-h2 that can fill-up with hydrogen in less than 7 minutes. Equipped with an H2 kit composed of a hydrogen tank and a fuel cell, they have a range of 300 km, i.e. twice that possible with the battery model. This opens up perspectives for urban logistics. The Lyon station will be replaced by another with greater capacity (80 kg/day) before 2018. Hydrogen will be produced on site by an electrolyser controlled by CNR and supplied with 100% renewable electricity. Once again, this global solution which couples production equipment and the hydrogen charging point will be developed with McPhy, the designer and producer of hydrogen production, storage and distribution units. "*The fast response time of the electrolyser will be perfectly adapted to the intermittence of renewable energies and provide flexibility and convenience to the grid*", emphasises Bertrand Amelot, McPhy's Sales and Marketing Manager. "*Our partnership with CNR, the acknowledged leader in renewable energy production, provides mutual technical, economic and strategic advantages. We can better envisage hydrogen production and storage in a complete energy system, from well to wheel. We are building concrete economic models, that encompass optimising production costs and selling hydrogen on the market, for both mobility and industry. Lastly, CNR's capacity to federate stakeholders in the service of long-term territorial development allows us to work with local authorities on solutions to promote the renewable hydrogen sector. As an SME, we appreciate this balanced partnership which permits both accelerating the launch of the H2 in Auvergne-Rhône-Alpes and ensuring its continuation through time.*"

> ***"It's important to have solid partners like CNR in France, so we can then develop internationally."***
>
> — BERTRAND AMELOT, MCPHY

ALTERNATIVE — MOBILITY BREAKS — THROUGH THE RANGE BARRIER

By positioning itself as a fuel supplier, CNR contributes to laying the foundations of carbon-free mobility and new sustainable uses. It also seeks to harmonise the intermittence of renewable energies with the flexible consumption of electric vehicles.

Electric mobility is gaining ground. In 2016, the number of electric cars among the personnel vehicles registered in France exceeded the threshold of 1%. Although their development is useful for reducing pollution and improving the quality of air in cities, they can only help to reduce CO_2 emissions if they run on green electricity. The transport sector is currently responsible for 28% of greenhouse gas emissions in France.

SYNERGY BETWEEN INTERMITTENCE AND MOBILITY

By committing itself to the market for electric mobility, CNR has taken the course set during the COP22, with the goal of reaching 20% of electric vehicles by 2030. Its objective is to use the storage capacity of the batteries of electric car fleets (local authorities, companies, carparks, condominiums, etc.) by offering electricity charging during the cheapest periods via charging points in communication with each other. This system will help to reduce peaks in consumption. CNR will thus become an aggregator of scattered consumption in addition to being an aggregator of decentralised production.

CHARGING WITH 100% CLEAN ELECTRICITY IN 30 MINUTES

CNR is completing its electric corridor during the first six months of 2017. It will comprise 27 fast charging points supplied with CNR's hydroelectricity installed every 30 km on the secondary road network stretching from Lake Geneva to the Mediterranean. Six of the charging points are shaded by solar panels (8 MWh/year/shade). Installed in collaboration with local authorities, this 560 km electric corridor is operated by Freshmile, a start-up specialised in software dedicated to e-vehicle charging *via* the interoperable GIREVE[1] platform and can be used by any car driver whether they subscribe to the service or not.

PARTNERS OF PROJECT

THE RIVER'TRI WASTE COLLECTION
SUEZ, LEAD COMPANY, COMPAGNIE FLUVIALE DE TRANSPORT (CFT), CNR AND VNF.

Labelled by LUTB and the Rhône Plan, this project is subsidised by Europe (FEDER), the Auvergne-Rhône-Alpes Region, the City of Lyon, VNF and ADEME.

MOBILE RIVER WASTE COLLECTION IN LYON

Since the end of 2016, a mobile river waste collection barge has been open in the city centre of Lyon on Saturdays. This experimental service will be deployed throughout the city, on the rivers Soane and Rhône. Moored at Quai Fulchiron, recyclable wastes are deposited on a barge that returns in the evening to Port de Lyon, where they are unloaded onto trucks to be transported to their different recycling processes. "*The societal benefits of this project go beyond reducing the carbon footprint*", says Ferenc Szilagyi, Urban Distribution Market Manager at CFT. Among its 200 units, France's leading river vessel owner has chosen that best adapted to the needs of the project and fitted it out to accommodate skips and a secured waste deposit system. A platform is intended for palleted goods, and urban distribution trials are scheduled in mid-2017. "*The barge provides a neighbourhood service without making traffic denser with either trucks or cars. It doesn't occupy land and it avoids nuisances in the centres of districts.*" The push-tow vessel will be equipped eventually with an electro-hydrogen propulsion system. It will charge at the CNR station at Port de Lyon. "*We've come half way. The technical part is almost complete. Now we have to deal with regulatory, safety, funding and supply issues.*"

(1) Consortium for nomad electric vehicle charging, of which CNR is a founding member.

THE ELECTRIC CORRIDOR IN 2016

2,558
charges

35.7 MWh
supplied

INTERVIEW WITH **JOSEPH BERETTA**
PRESIDENT OF AVERE*

What is the present situation of electric mobility?

JOSEPH BERETTA — It's no longer a niche phenomenon. It's become concrete and is developing on every front – private vehicles, utility vehicles and car-sharing. The growth in the number of chargeable electric and hybrid vehicles around the world reached 42% in 2016. In France, more than 30,000 were placed on the market and more than 100,000 are on the road.

What are the barriers for the development of electric mobility and how can they be overcome?

J. B. — The biggest barrier is the lack of public information. Efforts must be made to teach and communicate in order to explain that the main difficulties have been solved, or are about to be. When taking into account government subsidies, the purchase price of an electric vehicle is equivalent to that of an internal combustion vehicle. Its operating cost is €2 for 100 km. As for range, car-makers can now ensure 300 km. A major programme to mesh France and Europe with charging points along major corridors has been launched. To facilitate journeys, progress has been made with charging interoperability via platforms such as GIREVE. This makes it possible to charge anywhere and via any operator. It is also necessary to develop a charging point reservation system so drivers can plan their journeys.

What role can local authorities play?

J. B. — Everyone has a role to play in promoting electric mobility! Both local authorities and the State must set the example by equipping their fleets with electric vehicles. They must install charging points in public spaces, in line with the programme of the General Commissariat for Investment, which has been joined by national charging operators like CNR, Sodetrel and Bolloré. The vehicle constructors must make available maintenance and repair services. Lastly, companies and condominiums can apply for financial aid to install charging points.

* National Association for the Development of Electric Mobility.

WHEN — THE VIRTUAL LAYS THE WAY — FOR REALITY

Bearing the Rhône Plan label, a 3D river navigation simulator with an integrated control cabin was inaugurated in April 2016 in the Promofluvia training centre at Port de Lyon. The first of its kind in France, it has been developed since 2009 under the supervision of CNR, with five partners, major actors in river navigation and transport.

Navigating on the Rhône is difficult, especially due to the discharges, winds and currents, and several arduous sections to negotiate; likewise on the Soane, where it passes through Lyon and several sectors upstream. The coming retirement of a large number of skippers, the launching of new vessels adapted to current logistics requirements, and the dynamism of river tourism make it necessary to rapidly train conscientious and professional pilots who respect the river and its other users.

EXPERIMENTATION AND ADVANCED TRAINING

The Promofluvia simulator is designed for beginner and experienced skippers, so they can experiment with the varied navigation conditions encountered on the Rhône and the Soane, refine their skills and master their vessels more safely and more economically. It reproduces 70 km of navigable waterway (with locks, bridges, banks, beacons, etc.), including 15 difficult sites. It models the

PARTNERS OF PROJECT

NAVIGATION SIMULATOR

CEREMA *(centre for studies and analyses of risk, environment, mobility and development),* **CAF** *(Comité des armateurs fluviaux), the associations* **FLUVIA** *and* **PROMOFLUVIA, VNF** *(Voies navigables de France),* **CNR.**

behaviour of 5 types of vessel representative of the fleet on the Rhône, loaded or empty, as a function of variable parameters: weather, currents, river traffic, sailed by day and by night, and so forth. It also permits dealing with alarms and breakdowns. In addition to a control cabin and an instructor's station, it has a room with 4 secondary pilot stations, to monitor the simulation in real-time and to replay it following a review. The main control cabin is equipped with a cylindrical screen 10 m long and 1.70 m high, with a panorama of 240°, and a rear view screen. It is equipped with interchangeable controls that are the same as those found on a real vessel, whether for a pusher boat, a self-propelled barge or a river cruise ship.

A JOINT VENTURE

The investment of €2.7 M was funded by all the partners of the project and by the European Union. CNR took charge of 43%, including the construction of the training centre. It produced the currentology data and worked with 3 engineering offices to build a 3D visual rendition in real-time (Alyotech, Polymorph, CL Corporation). Furthermore, skippers from different companies contributed to modelling the sites and performing tests on the simulator.

INTERVIEW WITH **MONIQUE NOVAT**
RHÔNE-SAÔNE REGIONAL DIRECTOR OF VNF *

What does the navigation simulator provide to training and improving the professional skills of skippers?

MONIQUE NOVAT — Navigation is learned by navigating. But hours of practice are needed before one can become a fully-fledged skipper. The navigation simulator makes it possible to learn when faced with situations never encountered and save time during apprenticeship. The faster the skippers gain experienced, the better. This tool meets three training needs of different levels: it is an aid for beginner skippers; it helps skippers to discover the specific characteristics of the Rhône-Saône basin, where navigation conditions are very difficult, by testing critical sectors; and lastly, it provides advanced training by testing crisis scenarios and honing reflexes, for example, in the case of fog, wind or when coming across a boat that has taken the wrong side of a bridge pier. This simulator contributes to preventing accidents. The reason for investing in it is to guarantee safe and secured transport. This has become all the more important now the number of river cruise ships is increasing. The growth in the types of users in the Rhône-Saône basin – goods transport, passenger transport, pleasure boating – demands great vigilance.

What do you feel is essential for driving the development of river goods transport on the Rhône-Saône corridor?

M. N. — River transport is not taken for granted in France, contrary to driving on the road. It doesn't belong to our culture, unlike in Belgium, the Netherlands or Germany. So it's necessary to build a river culture and emphasise the benefits of river transport, which is safe, secure and done in bulk, to ship very large tonnages over long distances. And it's much less pollutant than road transport per ton carried. Its not only suitable for bulk products – cereals, coal, wood, salt, gravel, etc. – but also for containerised goods and it is especially well-adapted to the transport of hazardous goods and heavy loads. Medlink Ports is responsible for convincing the actors of the logistics sector to use river transport. A policy for modal transfer should be implemented through the Rhône Plan, with investments in infrastructures, ports and the fleet to improve the performance of the waterway. Lastly, it is necessary to target the community more closely by making it more aware of the river, particularly by developing new uses, such as river-borne waste collection. Innovation is crucial, whether it concerns urban logistics, the propulsion of pusher boats or river information systems.

* Voies Navigables de France

IDEAS — KNOW NO FRONTIERS

As both designer and operator of hydroelectric and hydraulic structures, CNR has unique knowhow that it exports well beyond the banks of the Rhône, to other parts of France and to thirty countries around the world. Its global and pragmatic approach is fuelled by experience acquired from extremely varied geographical, technical and sociocultural contexts. It can also rely on the competences of its physical and numerical modelling laboratory*. CNR intends to use its rich project based culture to meet the challenges facing it and is greatly attached to proposing ecologically friendly river engineering solutions.

In 2016, CNR strengthened its presence in Vietnam after operating there for more twenty years, by opening a branch office in Hanoi. This office will serve as the bridgehead for developing its engineering consultancy services in Southeast Asia, an increasingly dynamic region with strong potential with respect to rivers.

20%
reduction of suspended matter produced in the ports of Viet Tri and Ninh Phuc

$10 M
engineering contract won by CNR

WIDE GAUGE TRANSPORT ON THE RED RIVER

The first phase of works carried out under the supervision of the Vietnamese government in the delta of the Red River ended in 2016. Chosen in 2011 during an international call for tenders, CNR was entrusted with the mission to design river and port sites and oversee their construction. Two branches of the Red River, each 160 km long, were developed to allow boats weighing up to 3,000 tons (instead of only 1,000 tons) pass between the sea to the east (China Sea) and the industrial and port site of Viet Tri, 70 km

PARTNERS OF PROJECT

IMPROVING NAVIGATION CONDITIONS ON THE DELTA OF THE RED RIVER

Ministry of Transport of Vietnam, PMU *(prime contractor),* **VIPO** *(Vietnamese engineering office),* **CNR, TRACTEBEL Engineering France** *(engineering consultancy).*

The project is funded by the World Bank (1st phase: $229 M).

from Hanoi. In all, the project involved thirty construction sites, cutting across meanders, modifying banks, dredging beds, etc. The port of Viet Tri and that of Ninh Phuc, which serves the province of Nimh Binh, were reconfigured and their pollutant emissions reduced (installation of a waste water treatment plant, construction of storage hangars, etc.).

TRANSFERS OF TECHNOLOGY & INNOVATION

10 CNR engineers, including an expatriate who directed operations on site, were involved for 6 years. They worked in close collaboration with VIPO, a Vietnamese engineering office, and local enterprises, thus ensuring the transfer of competences and technologies. For example, to stabilise the mouth of the north branch of the Red River, a region subject to typhoons and severe coastal erosion, only Vietnamese companies were employed, though most were unfamiliar with marine works. The complex and long system of dikes and breakwaters makes use of information from the largest developments of this type in the world. It incorporates two major innovations: the creation of a self-cleaning access channel in the sea (with groynes) that will drastically reduce the hitherto costly daily dredging, and the plantation behind the dikes of 80,000 trees belonging to local species.

SOCIOLOGICAL AND FOOD SECURITY CHALLENGES

The Red River supplies a quarter of the country's agricultural production, thus throughout the project, the teams worked closely with the population and took into account the rhythm of crops when planning the works. The families expropriated received compensation through the offer of land elsewhere or training courses for those preferring to change trade.

* CACOH, Hydraulic structure behavioural analysis centre

INTERVIEW WITH **LUIS C. BLANCAS**
TRANSPORT EXPERT WITH THE WORLD BANK

What are the economic stakes behind the development of the navigable waterways of the Red River for Vietnam?

LUIS C. BLANCAS — Vietnam is one of the countries in the world that most relies on navigable waterways for transporting goods*. Thus they are vital for the Vietnamese economy, to ship bulk products year round, and increasingly for containerised products. Moreover, river transport is not only less expensive than other modes of transport, especially road transport – the other mode of transport most used in Vietnam – it also generates fewer carbon emissions. So it plays a key role: it favours economic growth and mitigates risks of climate change, two major priorities for the Vietnamese government. That's why the World Bank has funded the project to develop transport in the north delta.

What were the World Bank's demands for this project, regarding the environment, safety and the population?

L. C. B. — The funds granted by the World Bank represent much more than the simple mobilisation of capital in the framework of a concession contract. It introduces rigorous environmental, social policy, fiduciary and technical safety standards. It guarantees that the investments minimise environmental impacts, that the funds are used efficiently, with a good quality/price ratio, and that the local communities are consulted, protected and, when necessary, correctly compensated to offset the effects of the project. To satisfy this demand, we called on specialised supervision and technical design services capable of integrating means for protecting the environment and which involve the local communities while improving river transport conditions at the same time.

What was specific about this project in comparison to comparable development projects in Southeast Asia?

L. C. B. — Part of the infrastructure developed, notably the access channel and the bypass of the Lach Giang estuary, is unique in the region. It is very large, built in the open sea, and subject to a changing and unpredictable climate which not only made its construction very complex, but also made it necessary to ensure a high level of resilience. Another specific characteristic is that the project is built wholly by Vietnamese companies, which have gained valuable experience that will serve them elsewhere, for the benefit of Vietnamese growth and the development of its infrastructures.

* The waterway accommodates nearly 60% of Vietnamese goods transport.

ONE INVENTER – MAY CONCEAL ANOTHER

CNR launched the Innov'Action approach to showcase the creativity of all its employees and encourage each of them, whatever their specific trade, to give life to innovation on a daily basis.

In March 2016, a platform was opened on CNR's Intranet to progressively gather the employees' ideas. It received 142 proposals in one year on subjects as wide-ranging as safety, maintenance, impact reduction and time management. These projects are selected by a committee of twelve people from different divisions in the company, in view to assigning the human and/or financial resources necessary for their incubation or implementation. Twenty ideas have already been selected. An internal competition was organised from June to October to distinguish 5 innovations, already developed or at prototype stage, for which the Innov'Action prize was awarded at the 2017 New Year Greetings Ceremony. Of the 31 proposals, mostly from different CNR teams, a jury of 17 employees (territorial division, support division, Port de Lyon and CACOH) selected 10 projects that were then submitted to the Management Board. The latter chose 3 projects, including one concerning security. The jury chose its favourite, and the employees voted to choose the winner of the Public Prize. More than 500 people took part in the vote.

◀ SPECIAL JURY PRIZE
Plant desilting system

Andéol BOUVAREL - Francis BRUN - Jérémy GASPAROUX - Mohamed AHMANE - Marie BEAREZ, award presenter, member of the jury.

Installed around the drainage pumps and in the drainage chamber of the hydropower plant of Bourg-lès-Valence, this system does away with the need to call on a cleaning company every year. It represents a saving for CNR and improves safety and working conditions.

▲ MANAGEMENT BOARD PRIZE

Teaching kit for monitoring hydraulic structures

Gilles PIERREFEU - Jérémie MAURICE - Mikaël DUMAS

Intended to improve understanding the stakes of monitoring structures, this interactive and transportable kit is designed for the technical personnel responsible for monitoring, for other CNR employees and the public outside the company. It explains the physical phenomena that affect hydraulic structures simply and quickly in a collaborative manner.

▼ MANAGEMENT BOARD PRIZE

SECURITY CATEGORY

Tool for dismantling hydroelectric turbines

Michel FALLET - Pascal COFFY - Sébastien GIGOT

This tool permits the removal of a turbine runner without dismantling a blade. It reduces the time needed to disassemble turbine units by two weeks, meaning a 10% decrease in downtime.

◀ MANAGEMENT BOARD PRIZE

Characterisation of river beds by subaquatic camera

Christophe MORA - Jérémie MAURICE - Lionel MERIC - Thierry FRETAUD (represented by Carole WIRZ)

Coupled to a sonar device usually used to detect objects in the Rhône, this tool facilitates and improves the reliability of analysis of sediments in turbid water by minimising analysis costs. It could be marketed internationally.

31 projects
in competition

▼ PUBLIC PRIZE

Handling tool for opening cast iron manhole covers

Jean-Philippe RANC

Simple to use this tool improves work safety when opening cast iron manhole covers (80 kg).

We are proud to develop our production assets
to generate energies from water, sun and wind,
and to develop river transport in an epoch
when the world must change direction.
Our ambition is to remain the No. 1 reference
in energy transition at the service of the territories.


evelop
A

RENEWABLE TERRITORIES ARE INEVITABLE

INTERVIEW WITH **JEAN-LOUIS BAL**
PRESIDENT OF THE SYNDICAT DES ENERGIES RENOUVELABLES

The Syndicat des énergies renouvelables (SER) represents 380 enterprises working in different fields of green energy. Dedicated to developing the share of renewables in French energy production, it defends the interests of its members nationally and internationally.

$300 billion
invested in renewable energies around the world

The white paper issued by the SER published in 2016 speaks of the economic revolution of renewable energies. In what way is it an economic revolution?

JEAN-LOUIS BAL — Today, this economic revolution above all involves solar and wind power, the two main renewable energies, not counting hydroelectricity, which has reached maturity in France and cannot be developed much more. On the international level, their costs have fallen spectacularly, especially for solar energy, which has dropped to €30/MWh in calls for tenders. By way of comparison, the production cost of the nuclear power plant of Hinkley Point C in the united Kingdom is estimated at €110/MWh, and that of "traditional" nuclear energy at €50/MWh. France has still not reached these price levels, though it doesn't have the same levels of sunshine

> ***"Renewable energies are no longer perceived as a burden in the combat against climate change but as an opportunity for economic and social development."***
>
> — JEAN-LOUIS BAL

or wind as other countries. The projects carried out are also smaller. Nonetheless, the most recent calls for tenders have highlighted very competitive costs in solar energy, lower than € 70/MWh, instead of €300/MWh in 2010. That is where the economic revolution lies. In 2004, the development of renewable energies represented $40 billion in investments per year around the world versus $300 billion today. At the time, it was mainly the industrialised countries, above all Germany, which led the trend, with the chief target being industrial development and combating climate change. Right now, the locomotives are the emerging countries like China, South Africa, India, Brazil, Chili, etc. which are seeking to satisfy fast growing electricity consumption at the most competitive price. Renewable energies are no longer seen as a burden but as an opportunity for economic and social development. That was one of the reasons why the COP21 was a success. In the future, the need to innovate will move downstream, not so much to improve the competitiveness of production facilities as to manage and integrate these "non-controllable" energies in electric systems. Hence the interest in studying storage, whether hydraulic (STEP) or by battery, in hydrogen production, and in the digital management of balancing production with consumption.

Can the French target of 23% renewable energy in the energy mix be reached by 2020?

J.-L. B. — Renewable energies now make up 15% of the energy mix in France. Taking the current trend into account, we'll reach only 17 to 18% by 2020. It's illusory to think we'll catch up. However, the outlook is positive, with the programme of calls for tenders for solar and wind power. Advances are also expected regarding hydrogen production, bio-methane and heat produced from biomass and geothermal energy. Once renewable energies have achieved a high level of penetration, it will be possible to imagine interconnections between gas, electricity and heating grids, which will require a lot of smart and digital technology.

What do you think of the European directive on renewable energies?

J.-L. B. — Generally, we take a positive view of this project. We appreciate that it points out that energy doesn't stop at electricity but also concerns heat production and transport, and that the European Union wants to coordinate energy policies. However, we have several reasons for concern. The goal of 27% renewable energies in the energy mix by 2030, meaning an increase of 7% in 10 years, does not appear very ambitious, compared to the previous directive which foresaw 20% by 2020, meaning an increase of 10% in comparison to 2010, with binding objectives set State by State. Set for the whole of Europe, the targets for 2030 will only be binding collectively. How will they be distributed between the member States? The attempts of the General Direction on Competition to impose technological neutrality in the calls for tenders, which would put all the different forms of renewable energy in competition with each other on the sole basis of the cost of a MWh also give rise for concern. This calls into question the possibility for the member States to choose and plan their own energy mix, and provides no room for anticipation for the different energies. Lastly, the European energy package fails to attribute a value on the cost of CO_2 emissions. A signal on prices is required to change the behaviour of businesses. The quota system for the major emitters of CO_2 doesn't work due to the over-generous distribution of free quotas. These quotas are being purchased at €5 per ton of CO_2. A price of €30 per ton is necessary to have an genuine impact on emissions, with a regular hike in prices. This would allow reducing and even eliminating subsidies for renewable energies, and be a much healthier way of going about things.

How can the wishes of local authorities to invest in energy transition be taken into account?

J.-L. B. — They should be encouraged. It's a way of exploiting local resources for the benefit of the local economy. Individual and collective self-consumption is another facet of the economic revolution of renewable energies. For all that, solidarity between the territories must be maintained, by continuing governance at the national level, via the gas and electricity grid managers. Energy positive territories will produce for less well-endowed territories. Thus the grids will have to change. Except for a few pioneers, local authorities don't really know how to go about developing renewable energies. This movement is in need of aid, hence the interest of public-private partnerships in the framework of simplified joint stock companies or semi-public companies.

ALTERNATIVE ELECTRONS BOOST PROGRESS

With 100 MW of wind and solar energy commissioned in 2016, CNR has achieved 75% of its target for diversifying its energy mix. 2016 was an exceptional year that highlighted the effort of development accomplished for more than a decade.

With 5 wind farms and 2 solar power plants commissioned in 2016, CNR increased its wind and solar power capacities by nearly 25%. In four years, it aims to reach 4,000 MW of installed capacity in renewables in France and 300 MW abroad.

457 MW OF WIND POWER

In 2016, 86 MW of wind power was commissioned in northwest France by CNR, with three new farms in Somme, one in Loire-Atlantique and one in Mayenne, to reach 457 MW of installed capacity at the end of the year. This also included a record: 18 turbines (42 MW), making it CNR's largest wind farm, at Arguel, where it supplies electricity for 30,750 inhabitants. In these regions, CNR deploys its installations in partnership with EnergieTeam, a local developer that has acted as its relay in the field since 2007. It has the advantage of knowing the territory, its elected representatives and decision-makers, and has contacts with the population. Nonetheless, CNR is not simply an investor. It participates fully in managing the construction of the wind farms and is currently building 2 in Somme and 4 in Oise. It is also carrying out its own projects in the Rhône Valley, such a Saint-Georges-

WIND AND SOLAR POWER IN FIGURES

457 MW
wind power

61 MW
solar power

106 MW
installed capacity in southeast France (61 MW in solar power and 45 MW in wind power)

412 MW
of installed capacity in north and west France, all in wind power

840 GWh
of annual output, i.e. the electricity consumption of 350,000 people

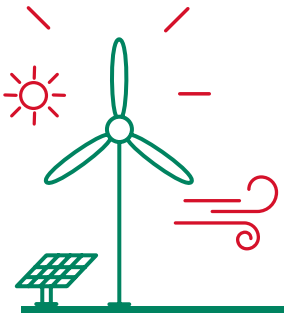
les Bains, in Ardèche, where works are in progress. In territories where land is often scarce, it focuses on renovating old wind farms, generally built on the windiest sites, to give them a second industrial life. This is what it did in 2015 at Rochefort-en-Valdaine (Drôme) where 10 wind turbines were dismantled and equipped with new motors, blades and the pods of a similar model, according to the retrofit technique. The investment will be amortised before 2019.

61 MW PRECISELY UNDER THE SUN

The importance of solar energy is growing and CNR is continuing its involvement by commissioning the plants of Beaucaire in Gard and Donzère in Drôme (13.5 MW). Installed on trackers, their panels follow the trajectory of the sun, thereby optimising production. CNR called on the aid of the French solar power sector and local companies to build it. Awnings comprising solar panels were installed on the carpark of the hydropower plant of Vallabrègues, in Beaucaire, in January 2017. The 5 CNR projects selected for the 3rd call for projects for large photovoltaic installations organised by the Ministry of the Environment, Energy and the Sea in December 2015 (with a total capacity of 18 MWc) will be operational in 2017 and 2018. Located in Bourg-lès-Valence and Roche-de-Glun in Drôme, in Avignon Courtine in Vaucluse, in Upaix in Hautes-Alpes and in Susville in Isère, they represent an investment of €21 M. In February 2017, CNR was once again awarded projects totalling 18 MWp in the framework of the 4th call for offers from the Energy Regulation Commission (1st period).

THE EFFICIENCY OF THE RHÔNE MODEL

In a ferociously competitive environment, CNR stands out by transposing to wind and solar power the dimension that makes its management of the Rhône concession so strong: partnership, local roots, energy management, and the sustainable operation of its assets. Positioned well upstream of calls for tenders, it works closely with local authorities to identify sites for territorial



A NEW IDEA

An alternative solution for saving

On 1 March 2017, CNR launched its first crowdfunding campaign *for its future wind farm at Planèze, located in Saint-Georges-les-Bains in Ardèche in response to the increasingly strong desire of consumers to participate in the development of renewables, and faithful to its model in which the income generated from harnessing natural resources is redistributed. This operation is the realisation of one of the 9 commitments made for the COP21. With 5 wind turbines (11.5 MW), this installation will produce the equivalent of the annual electricity consumption of 8,500 people. CNR called on Enerfip, a crowdfunding platform specialised in energy transition. Bonds of a value of €10 were issued in three lots. The first was reserved for the neighbouring population, the second to CNR's employees and the third to the general public. The ceiling of the collection (€300,000) was reached in only 5 days for the local population. This led to a second campaign. CNR plans to offer this type of alternative savings scheme for its other projects.*

COCPIT

With its intermittent production operating and optimisation centre (COCPIT), CNR is capable of reliably predicting its production generated from water, sun and wind on the basis of meteorological forecasts, and adjusting it with precision to variations of demand and fluctuations of prices on the European markets, while conforming to the imperatives of hydraulic security and river navigation, and that of selling at the best price.
COCPIT can also aggregate the green energy of other producers in order to sell it on the market.

development. With its solar power plants, installed outside agricultural areas and natural habitats, it gives new life to industrial wastelands and polluted and degraded terrains that cannot be used for other purposes and which it restores. It purchases shares in semi-public companies or opens the capital of its project companies to local authorities in order to develop its assets, as authorised by the law on energy transition. In March 2017, it launched a crowdfunding campaign for the future wind farm of Planèze. CNR also attaches great importance to the environmental dimension of its projects which it manages with sustainability in mind, as they have a lifetime of 30 years. For example, the solar power plant next to the aerodrome of Chevalet at Aspres-sur-Buëch (5.5 MWp), Hautes-Alpes, was inaugurated in 2016 and planted with local species that are used by a livestock breeder for grazing. CNR develops, operates and manages green energy on the markets, and makes lasting commitments to the territories.

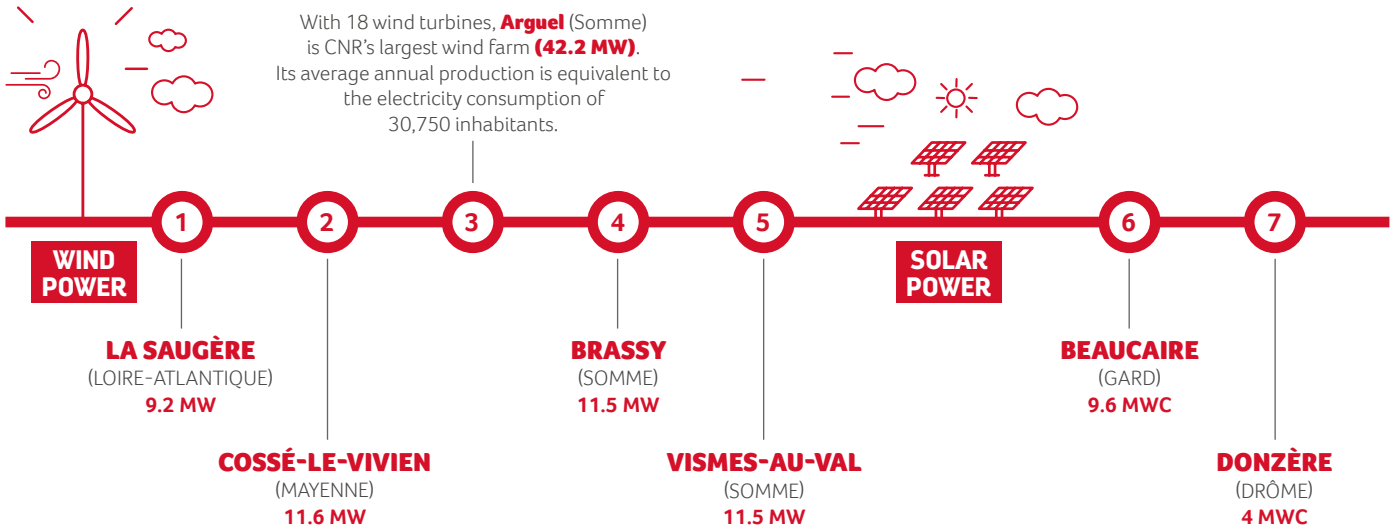
A FOOT IN GERMANY

CNR is getting ready to develop its assets in Germany, via its partnership with the Green Finance Corporation, for a wind farm project of 20 MW close to Hamburg. In addition, entering the German market for renewable energies, more mature than the French market, will allow it to become familiar with different administrative procedures, more competitive energy marketing methods and techniques as yet little known in France, such as repowering.

HEAD IN THE CLOUDS

After being subjected to a full scale test on the roofs of CNR's head office in Lyon in 2016, the system for very short term forecasting of falls in solar power production due to passing clouds should be deployed at all CNR's solar power plants in 2017. Based on hemispheric image analysis algorithms, this system was designed by Axis and Tenevia. It is used for the real-time visualisation of local cloud cover. Having short term forecasts makes it possible to imagine the smart management of storage or additional production resources to offset intermittence and that participate in balancing the electricity distribution grid. By developing this tool, CNR is bolstering its production forecasting system, vital for its role as aggregator.

WIND FARMS AND SOLAR POWER PLANTS COMMISSIONED IN 2016



A FUTURE FOR THE WATERWAY

€4 M
invested by CNR in 2016
to optimise its port sites and facilities and to build new infrastructures.

Marked by sluggish conditions, 2016 proved to be a difficult year for river traffic on the Rhône. Nonetheless, CNR believes in the development of the waterway as an alternative to road traffic and aims to make river navigation play a role in the green economy of the 21st century.

Developing river navigation on the Rhône is one of CNR's three historic missions. Thus it develops and manages port infrastructures and enterprise zones close to wharfs linked to both rail and road, bringing the river and land closer together. It maintains the navigable channel and, via its navigation management centre, ensures the security and fluid passage of traffic. No less than 18 multimodal platforms, one every 20 km, are located along the Rhône from Lyon to the Mediterranean. Port de Lyon is the bridgehead of this network equipped with port facilities that accommodates a total of 230 industrial and logistics companies on more than 800 ha of land. To ensure the best possible service to skippers, CNR manages and monitors its 14 wide gauge locks remotely 24/7 365 days a year. It optimises lockage time and provides information on traffic in real-time.

LESS TRAFFIC

In a lacklustre economic environment, river traffic on the Rhône fell by 5% in 2016. Floods, labour disputes and the temporary non-availability of the lock of Bourg-lès-Valence also had a negative impact on navigation. Container traffic was particularly hard hit (- 13%). Port de Lyon set a new record with more than 12 million tons of goods handled. But its activity (+ 2%) was driven in particular by strong growth in its rail traffic (+ 8%), in particular on its links to Luxembourg and Belgium. Container transport makes up more than 50% of its activity, though here again there was a slight downturn in river traffic (- 2%).

THE RHÔNE'S ADVANTAGES

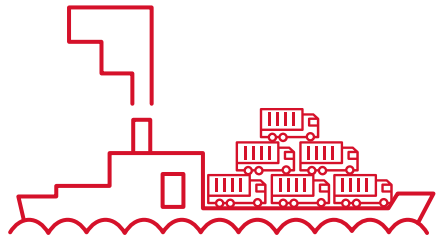
The Rhône, extended to the north by the wide gauge section of the Saône, nonetheless presents many advantages for reducing heavy goods traffic on the north/south corridor. Providing direct access to the ports of Fos-Marseille and Sète, it opens out to the Mediterranean Sea and the rest of the world while its rail links can transport goods to the heart of Europe. It could handle 4 times more goods than today and is the only route for transport in the Rhône Valley free of bottlenecks. What is more, customs declarations can be made on board in electronic form, thus simplifying procedures.

CLEAN TRANSPORT

The development of river transport is an integral part of the directions set out in the Law on Energy Transition. Per ton transported, it consumes 75% less fuel and emits 75% less CO_2 than road transport. The negative externalities (noise, pollution, congestion, etc.) are estimated at €3 to €4 per ton over 350 km for river transport, versus €12 for road transport. Lastly, river navigation brings goods into the heart of large cities. Hence Port de Lyon supplies Lyon with fuels, salt for snow clearance and construction materials.

GROWING ATTRACTIVENESS

CNR is promoting the transfer of goods traffic to the Rhône in partnership with Medlink Ports and optimising its port facilities. Founded in 2015, the Medlink Ports agency strengthens cooperation between the actors of the river and the ports of the Rhône-Saône corridor to improve the river supply chain and highlight the advantages of river transport to the business community. An offer was created under the Medlink Safe label in July 2016 with the river operators Logirhône and Greenmodal, to encourage shippers of hazardous materials to choose the waterway between Fos and Lyon. The aim is to increase the share of the Rhône in this activity from 4% to 20% from now to 2020. 16 companies have already been given the Medlink Safe label which accords them maximum safety conditions for a reasonable price. CNR has continued its reflections on the development of the port of Avignon Courtine which will eventually accommodate a combined port and transport platform covering nearly 70 ha. It signed an agreement with the semi-public company Inspira in December 2016 to bolster their cooperation to develop a multimodal industrial park on 340 ha, of which 100 ha is earmarked for the port. Development works will be carried out on CNR's concession to facilitate the installation of companies as from 2017. CNR will provide €5 M in funds, in particular to benefit innovative projects such as Inspir'Eco, a tool designed to aid the installation of companies that implement the principles of the circular economy, and Cashemir, which is aimed at using solar electricity to produce hydrogen for industry and transport. In addition, in 2016 CNR built a 180 m long wharf upstream of the lock of the Barcarin canal: skippers wanted an extension of the mooring points where they had to wait, sometimes for 5 to 6 days, for the authorisation to sail downstream to the Port of Marseille.

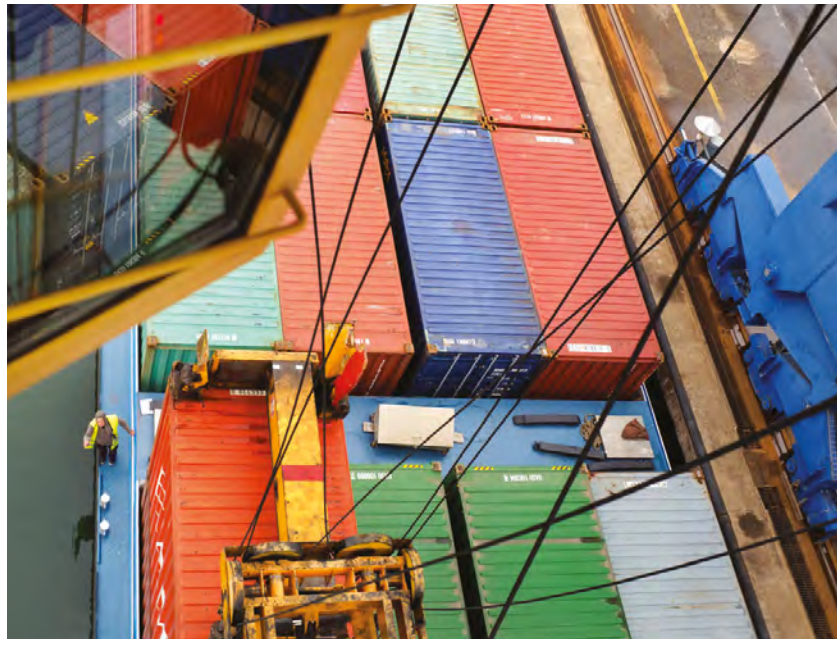


A push-tow convoy
composed of 2 barges
can transport as much as
220 20-ton trucks (4,400 t)

A NEW IDEA

The Lamure-Lambert parliamentary report

***In their report on the Grand Port Maritime de Marseille and the Rhône-Saône corridor**, presented to the Prime Minister in July 2016, Élisabeth Lamure, senator of Rhône, and François-Michel Lambert, MP for Bouches-du-Rhône, considered that the Rhône Valley should be viewed globally, by taking into account the economic impact of goods transport infrastructures and enterprise zones along the river. Their recommendations included drafting a strategic master plan of the enterprise zones and a blueprint for the port and the range of influence of the city of Lyon; appointing an inter-ministerial delegate for the economic development of the Rhône-Mediterranean corridor; widening the mission of Medlink Ports to cover every mode of transport in its perimeter; and setting up an inter-Mediterranean port coordination council.*



INTERVIEW WITH **CHRISTINE CABAU-WOEHREL**
CHAIRWOMAN OF THE GRAND PORT MARITIME DE MARSEILLE
CHAIRWOMAN OF MEDLINK PORTS

"The river has advantages in terms of sustainable transport and supply chain management."
— CHRISTINE CABAU-WOEHREL

Why is it important for the Grand Port de Marseille to develop navigation on the Rhône-Saône corridor, especially the link with Port de Lyon?

CHRISTINE CABAU-WOEHREL — One has to think on the scale of a port system in order to efficiently serve French companies and make them competitive on international markets. The efficiency of the Grand Port de Marseille for its clients is not restricted to the quayside. Our development strategy is adapted not only as a function of our situation on the coast but also in connection with our hinterland, in which the Rhône-Saône river corridor plays an extremely important role. Our river hinterland on this north-south axis stretches almost to Dijon, and much further north when combining rail links. We are lucky in that we benefit from the wide gauge waterway of the Rhône, with the city of Lyon lying within our adjacent hinterland. However, at present we estimate that only about 55% of the containers shipped from and to Lyon transit via Marseille.
This isn't a normal situation as the natural maritime port of Lyon is Marseille. We have to work to recover most of the remaining 45% which leaves for the ports in northern Europe. They are on the verge of saturation due to the congestion of container shipping lanes, which impedes the competitiveness and fluidity of goods movements. The Grand Port de Marseille has proved its capacity to operate regularly and reliably over the last five years. And when shipping goods to and from Lyon, the shortest and most economically interesting route, in addition to maritime transport, whatever the mode, is to pass via the Port de Marseille. Furthermore, since 1 December 2016, companies can pay VAT in French ports. There's no longer any objective reason not to choose the river Rhône and the Port de Marseille.

How can river transport attract clients when it takes 24 to 30 hours to transport goods by barge from Lyon to Marseille in comparison to 3 to 4 hours by road and less than a day by rail?

C. C.-W. — Today, modes of bulk transport, meaning rail and river, do not operate in competition but in synergy. Judicious supply chain management consists in reserving the road for very urgent goods and distributing the other goods to bulk modes. The river takes more time than rail or road, but it's not a handicap. It's an opportunity to formulate smart combinations. The river is beneficial for sustainable development with respect to flow management. It avoids bottlenecks during peak periods. When breaking up loads, vehicles can park free of charge on river port sites for several days. It's an advantage for certain deliveries and certain clients. The river is also an advantage regarding stock management. Shipping by barge is equivalent to a having a floating warehouse.

How can more river traffic be generated?

C. C.-W. — Actions to achieve this are being carried out in several directions in Medlink Ports. The first is organisational and consists in setting up a process for facilitating river transport – Medlink Safe for the transport of hazardous goods, Medlink + for simplifying customs procedures via computer links between the platforms, etc. The second direction is pedagogical and aims to familiarise companies with the river. River logistics are neither more nor less complicated than other modes, once one is informed. The third direction is commercial. It entails carrying out actions to promote and set up tools adapted to increasing competitiveness. The fourth direction involves operation to facilitate navigation, improve wharf facility management, ensure more reliable transit times, etc. Lastly, the logistics professionals that have opted for river transport have to share their good practices with all the actors of the river and explain why they've made this choice and the advantages they gain from it.

Advance with our level of exigency and expertise in managing and operating the River Rhône, in line with our commitments to achieve industrial excellence. Our objective is to better harmonise our economic, environmental and security challenges and improve our reactiveness to respond to the imperatives of hydraulic safety and river navigation.


A
nhance

BETTER PREVENT THAN CURE

In 2016, CNR carried out 205 maintenance, electromechanical and civil engineering operations requiring an outlay of €79 M to conserve its production facilities and its river concession in optimal working condition.

Throughout the year, CNR's teams monitor and maintain the installations on the Rhône – dams, hydropower plants, locks, dikes, etc. – in conformity with a management system certified ISO 9001. The aim is to prevent failures and damage liable to jeopardise the hydraulic safety and operation of the plants or bring navigation to a standstill. Besides daily operational visits to check the absence of leaks or overheating, for example, the condition of the structures is evaluated during monitoring operations, soundings and inspections, that every year give rise to about a hundred reports that are sent to the relevant authorities. Thus, foreseen and scheduled, maintenance operations not only permit better control of risks, they also reduce installation downtime and optimise costs in comparison to operations performed to respond to crisis situations.

INNOVATIONS FOR MAINTENANCE

Thanks to technological advances, CNR perfects its controls and works to detect failures from the earliest stages by developing new measurement tools and improving the performance of its actions. In 2016, it developed a new system of connected sensors that reduces turbine reassembly time, by informing the operators of the adjustment values necessary to align the shafts. It was necessary to invent a WIFI solution to communicate the data despite the electromagnetic fields and in conformity with safety constraints. A new biological process using bacteria to prevent deterioration by calcite in drains was also tested at the Caderousse plant. CNR is also working on several scientific research projects to improve dike monitoring and maintenance. They concern the use of bacteria as biocalcification agents to strengthen dikes (BOREAL project bearing the label of the

MOBILISATION

On 1 October 2016, a transformer of the Caderousse hydropower plant caught fire. Thanks to the action of the CNR teams and the rapid intervention of the fire-brigade of Gard and Vaucluse, the fire was extinguished in just over two hours, and river traffic was restored after being stopped for six hours. The structure was progressively repaired and the automatic control system was restarted on 18 October. This step meant that it was no longer necessary for the teams to work in shifts to operate the structure from the dam, which they had done since the fire.

AXELERA cluster), the control of dike permeability by an optical fibre system (with IRSTEA) and automatic dike monitoring by drones (with IGN). An automatic lock chain lubrication system was also developed. Its uses a 50th of the oil consumed by manual lubrication and should extend their lifetimes. Lubricant tests are also being carried out to select lubricants with the least environmental impact.

INTERVENTIONS ON THE INDUSTRIAL FACILITIES

Among the most striking works of the year were those performed on the hydropower plants of Vaugris and Avignon. Involving ten mechanics at each site, the works began in mid-2015 and terminated at the end of 2016. At Vaugris, the alternator of turbine unit G3 was replaced after dismantling the turbine unit. At Avignon, the entire turbine unit G3 was dismantled in order to renovate the turbine and the rotor and replace the alternator. It was the first operation of this magnitude since it was commissioned in 1973. The renovation of G2 at Seyssel continued until January 2017 and that of the units of Bourg-lès-Valence started 6 years ago also came to an end. A new tool designed by CNR's teams was used to renovate the distributor of turbine unit G1 at Bollène. It avoids having to disassemble the rotor (250 t), a usually very cumbersome operation, and provides greater safety and comfort to the technicians. Also of note is the reinforcement of 550 m of the reservoir dike at Angles, in Gard, by the construction of a drainage blanket, a project that required displacing the side channel. Many other works involved the maintenance of dam gates and the electric systems of items of equipment. The programme to acquire strategic spare parts continued in order to ensure works can be performed securely in the future, and emergency plans were formulated.

MAINTAINING THE RIVER CONCESSION

For the 63rd year running, spring started with CNR carrying out the annual maintenance of its locks. Ten days when 300 people (employees of CNR and external companies) relay each other in a race against time to observe the structures in dry state and keep them in good condition. Seals are replaced, anti-corrosion protection applied, concrete renovated, etc. These operations contribute to the safety of the vessels, people and property around the locks and to the quality of the service provided to the skippers. The works are planned hour by hour and sometimes programmed several years in advance. The large scale operations carried out in 2016 included the replacement of the gates of Saint-Vallier lock, the chains of the downstream gate at Bollène, and cables and rolling and guidance bearings at Pierre-Bénite. The upstream gate of Vallabrègues lock was fully renovated for the first time since it was opened in 1970.

IDEA FOR TOMORROW

CNR is strengthening its monitoring and predictive maintenance strategy with a project for the early monitoring of hydroelectricity facilities *to observe the condition of the machines in real time. The objective is to detect operating anomalies liable to lead to serious failures, in order to forestall damage, and to identify health indicators for the production units in order to better target maintenance activities. The research projects use sensors and big data to identify critical changes in the alternators, test transformer aging markers and monitor the different operating parameters of turbines, by detecting abnormal vibrations, for example.*

THE RIVER IS NO PLACE FOR A RELAXING LIFE

CNR monitors and maintains the bed of the Rhône to ensure it flows smoothly. In addition to maintaining the industrial and river structures, sediment management is vital in order to prevent the aggravation of flood risks, ensure safe navigation, favour the ecological balance of the river and avoid damage to the dams and locks.

In 2016, CNR carried out 16 major dredging operations by limiting their impact on the environment as much as possible. It contributes to a large project performed collectively: that of the Rhône sediment management master plan. Supervised by the DREAL Auvergne-Rhône-Alpes, this project is jointly funded by the Rhône Mediterranean Corsica Water Agency, EDF and CNR, the body ordering the study.

FRENCH-SWISS COOPERATION

In May 2016, 1.92 million tons of sediment (silt, sand, clay) transported by the River Arve, a tributary of the Rhône immediately downstream of Geneva, and accumulated at the Swiss dam of Verbois were flushed in the framework of exemplary cooperation between CNR, the Société des Forces Motrices de Chancy-Pougny and the Services Industriels de Genève. The operation lasted 12 days and required more than 400 CNR employees. It was performed according to an innovative procedure to protect aquatic habitats and preserve the structures downstream, in particular the reservoir of Génissiat dam. Studied since 2012 with the Swiss and French authorities, the new procedure used to manage flushing the sediments of the Rhône consisted in partially lowering the water level of the Swiss dam every three years and organising punctual dredging after the floods of the Arve, while taking care to control the rate of fine particles suspended in the water – a criterion already applied for a long time by CNR.

REMOVING GRAVEL

The gravel trap in the bed of the River Drôme, at its confluence with the Rhône, was emptied from August 2016 to February 2017, for an investment close to a million euros.
A second phase will take place this summer. This structure, which was last dredged in 2003, holds from 20,000 to 40,000 m^3 of materials transported every year by the river. Alluvial forests and habitats of community interest were preserved as well as possible during the operation.

REACTIVITY

On 13 February 2016, the system used to fill the lock of Bourg-lès-Valence with water was obstructed following a massive influx of sediments (43,000 m^3) within only 4 months, at the confluence between the River Isère and the Rhône. CNR mobilised 50 people in 8 hour shifts to restore river navigation in 4 days, helped by the civil security department, and thanks to a temporary chamber filling system. The lock was restored to normal operation a week after the incident.

At the dam-hydropower plant of Génissiat during the sediment management operations. From left to right: Jérôme Barras, Director of SFMCP, **Élisabeth Ayrault,** Chairwoman and CEO of CNR, **Christian Brunier,** Managing Director of SIG, **Laurent Touvet,** Prefect of Ain, in office up to 22/08/2016.

The restoration of woodland, the installation of bat roosts and the creation of forest glades are scheduled at the end of the works. The 400,000 m^3 of gravel removed will be used for construction and for the ecological restoration of the former borrow pit of Freydières located 10 km upstream.

BRINGING WATER BACK TO OXBOWS

The hydraulic and ecological restoration of the bypassed section of the Rhône at Donzère-Mondragon, begun in the framework of CNR's missions in the general interest, continued with the launching in September 2016 of works to refill the oxbows with water, according to a master plan drawn up with local actors. The project entails reconnecting these former and dried up branches of the Rhône to the main channel of the river in order to improve flows and recreate the dynamics favourable for biodiversity. Actions including removing the sediments, dismantling the Girardon spurs, tearing out the invasive plants and restoring aquatic habitats are scheduled. The works will stretch some 30 km and last until 2019, carried out by sector from 1 September to 28 February each year. The first section, between Donzère and Pierrelatte, has been completed.

DEMOLISHING THE GIRARDON SPURS

An experimental project to demolish the Giradon spurs on the Rhône was carried out from November 2016 to March 2017 on the banks of the Ile des Graviers along the bypassed section of the Rhône of Péage-de-Roussillon. Designed at the end of the 19th century, these rock-fill structures were used to divert the current towards the centre of the navigation channel to ensure a sufficient draught for boats and favour the natural removal of sediment from the river bed. However, with the accumulation of sediments, the bypassed section of the Rhône narrowed and dense vegetation colonised the banks. The latter have been restored along 1,000 m to give the river a more natural aspect and facilitate flood expansion.

CHIPS AND STONES

Between October and December 2016, 15,000 m^3 of sediments were reinjected into the bypassed section of the Rhône of Chautagne to stabilise its bed and create a habitat propitious for nesting and feeding aquatic species. The theoretical approach usually taken was backed up with in situ measures to determine the hydraulic conditions favourable for shifting the sediments. Painted stones were used so that their trajectories could be observed visually, after which stones were fitted with electronic chips. This innovative method showed that the sediments were shifted more easily than predicted by the theoretical calculations. 1,000 stones were fitted with chips to monitor how the sediments injected were distributed with time.

IDEA FOR TOMORROW

Hydro-sedimentary rebalancing in the Loire.
Backed by its experience of sediment management on the Rhône and the hybrid modelling capacities of its laboratory, CNR was chosen by VNF in September 2016 to oversee a project to rebalance the hydro-sedimentary conditions of the Loire in association with Egis Eau. The objective of the project is to reconstitute the bed of the river upstream of Nantes by favouring the deposit of part of the sand carried by the water. It is also necessary to improve the Loire's connections with its secondary branches, backwaters, marshes and flood plains that contribute to the river's ecological wealth. Filling these wetlands is vital for the equilibrium of the ecosystems. CNR will design a long-term scheme (40 to 70 years) by coupling a numerical hydro-sedimentary model with a 35 m physical model bed installed at CACOH. The methodology implemented is at the forefront of current scientific practices. Measurement campaigns were performed at the beginning of 2017 to improve knowledge of the sediment dynamics of this section of the river subject to a tidal regime, calculate the dimensions of the future structure and optimise the design of the physical model. These campaigns made use of a subaquatic camera developed by CNR's employees.

EVEN THE TINIEST LIVES COUNT

CNR manages a concession covering 27,000 ha of land and river with more than 100 preserved natural sites that host a wealth of plant and animal species. Thanks to its concession environmental management plan, it is able to combine the preservation of biodiversity with hydraulic security, the safety of the neighbouring population, energy production and economic development.

400 ha
of farmland

1,000 ha
assigned to grazing

CNR places respect for the environmental at the heart of its territorial development activities. It continually improves its practices to preserve the habitats and species of the Rhône Valley, whether in the framework of maintaining its concession, mitigating the impacts of its activities or improving knowledge of the ecosystems in which it acts. It acts in concert with the territorial authorities, environmental associations and institutional actors, as well as the scientific community and innovative enterprises in the Rhône Valley to provide a high quality environment to the surrounding population. Officialised in the environmental management plan applied to the concession in the framework of its policy to harmonise the challenges facing it, its action in favour of biodiversity contributes to making the green and blue corridor a reality and more globally to the adaptation of the national strategy for biodiversity 2011-2020. It also participates in accomplishing the objectives of the Water Management and Development Master Plan (SDAGE) to ensure the good ecological state of the Rhône. The sustainable management of its concession is carried out in synergy with programmes to restore natural sites and preserve species performed in the framework of its missions in the general interest.

SUSTAINABLE DIKE MANAGEMENT

The vegetation on CNR's dikes has to be cleared so they can be monitored visually. It is also necessary to fell the trees growing on these earth structures that are weakened by their roots, leading to flows of water inside them. Falling trees also present a hazard for strollers. When planning its actions, CNR takes into account the breeding, nesting and migration periods of the animals that live or stop over on its 400 km of dikes, not to mention protected plant species.
It has forbidden the use of all phytosanitary products. Scything, brush clearing, felling and root removal are done mechanically or manually. CNR also entrusts 1,000 ha of dikes to local livestock breeders so their herds can graze on them and thus maintain the grasslands dry along the Rhône Valley.

INVASIVE PLANTS AND R&D

CNR uses several methods to fight against invasive plants such as Japanese knotweed which can impede access to the banks, harm local species and cause logjams: repeated scything and covering under felt, large scale sieving and crushing of the contaminated earth to remove the rhizomes, etc. To confine and attempt to eradicate this plant classed among the 100 most

harmful species by the International Union for Conservation of Nature, it is exploring the possibilities provided by plants whose proximity and the substances they secrete are harmful to it. To do this its teams are carrying out experiments in the laboratory, greenhouses and plots.

LOCAL PLANTS IN A SHORT CIRCUIT

Acting on the idea of one of its employees, CNR is behind the initiative to set up a wild plant production activity called Local Plant. The aim is to eventually obtain around thirty species of the Rhône Valley for restoration operations intended for ecological habitats and for plantations carried out by CNR or local authorities in the Rhône Valley. In addition to ecological consistency, it contributes to the success of plantations and combats invasive plants. At the end of 2016, CNR prepared a plot of nearly 3 ha on its concession, at Soyons, intended for an experimental nursery. Cuttings of willow and black poplar were planted at the beginning of 2017. The plantations of the different species will cover a period of 3 years.

TRACKING FISH DNA

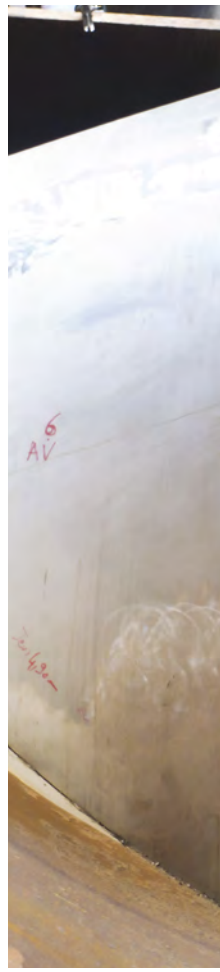
Used experimentally to establish a map of the fish species populating the Rhône, the environmental DNA (eDNA) method was validated in spring 2016, in partnership with Spygen, a biotech company specialised in biodiversity inventories. This innovative process, spotted by a CNR employee, consists in isolating and identifying traces of deoxyribonucleic acid that the fish leave in water. It had never been experimented previously in a river. The results of samples taken during a single campaign from a hundred points on the Rhône between Switzerland and the Mediterranean, several of its wetlands and its main tributaries, are comparable to the data collected year after year by fishing.
All the areas of distribution of the species were identified, for both migrating fish like shad and eel and rare species like the rock pickerel, observed at Avignon.
Improving knowledge of habitats permits, for example, verifying the correct operation of fish passes, and ensuring that sediment dredging is conducted in such a way as to minimise its impacts on aquatic fauna.

IDEA FOR TOMORROW

In March 2017, in partnership with the Syndicat mixte d'hydraulique agricole du Rhône (SMHAR) and Suez, CNR answered a call for projects from the ADEME* for eco-efficient agriculture. *The aim of the partners is to develop technology that will provide the farmers of the Rhône valley with the strict amount of water they need for their crops, at the most appropriate moment. This will not only save water resources, but also the electricity needed to pump and route it to the farms. This controlled irrigation will rely on CNR's meteorological forecasting tools, on its capacity to predict the evolution of energy prices, and on data relating to the water requirements of crops and the water content of soils at a given time T. Synergies could also be found between the flexibility of irrigation and the intermittence of wind and solar energies. This project demonstrates CNR's involvement in favour of new eco-agricultural practices.*

** Agency for the Environment and Energy Management*

MOBILITY OPENS UP NEW PATHS



The diversity of trades and specialties at CNR is rare, offering its employees lasting career opportunities and trajectories. For its human resources management, this wealth implies a long term vision that places internal mobility and the recruitment of young talent to the fore while favouring the transmission of knowhow.

The competences at CNR are extremely varied and include operations and maintenance technicians, energy traders, electrical mechanics specialised in strong currents, civil engineering technicians, hydraulics and mechanical maintenance engineers, concession managers, meteorologists and the sales personnel of port and industrial sites. This is due to the company's history and its missions linked to the global management of a river and its specific industrial environment. With almost two thirds of its workforce assigned to operating and maintaining its structures, which often date back several decades, the profiles sought demand specific technical aptitudes that, in addition to theoretical knowhow, are learned in the field, notably through apprenticeship.

UPGRADING COMPETENCES

Because understanding of how its facilities function is assimilated through time, CNR first offers the posts that become available to its employees. The priority given to internal mobility is backed by a strong training policy. Upgrading competences can take the form of mobility pathways, generally lasting 6 months, with learning in real work situations, supervision by a tutor and knowledge acquisition during training courses. In 2016, a documentarist with the information systems department became a support technician for the energy division. Sometimes mobility also involves a period of professionalization, with work/study programmes, that can last a year, for example, for a technician to become a maintenance technician by obtaining a technical degree, it takes two years for an accountant to become a chief accountant, three years for a mechanic to become a hydromechanics engineer, and so forth. E-learning courses have been proposed since 2016 so that everyone can progress at their own rhythm, to learn a foreign language, learn to use a new office management application, improve their professional efficiency or mode of management, or launch into methods for personal development.

HUMAN RESOURCES IN FIGURES

1,355
full-time employees at the end of 2016

80%
of employees attended training in 2016

More than 51,000 hours
of training given in 2016

1 week
of training/employee/per year on average

IDEA FOR TOMORROW

***In parallel with setting up its new organisation**, CNR is considering grouping its practical training in a single place. This idea stems from the training effort that will accompany the installation of the Maintenance Division on 1 April, in order to harmonise practices all along the Rhône. The organisation could also be strengthened by the installation of mock-ups and test benches.*

CAPITALISING ON EXPERIENCE

Although the transmission of professional knowhow is done on a daily basis, through teamwork, CNR is concerned with capitalising its employees' expertise more formally.
The training courses provided in-house are developed with the aid of experts in their field, some of which also act as instructors. Employees on the point of retirement and, via the subsidiary CNR Intergénérations, retired employees, are also asked to intervene as they represent the memory of the installations and the events that have occurred on the Rhône. Thus, in 2016, they provided their aid to training on the alignment of turbine shafts, and to a training course on flood management. Since the last major flood occurred in 2003, it was important to transmit the experience of those who had lived it and know the legal risks, in order to cope with this type of event under optimal conditions. No less than 280 employees benefitted from this training lasting a year. The seniors also contributed to setting up a training course on the prevention of mechanical risks. Since security is closely linked to everyday experience, their knowhow acquired during their professional lifetime is precious. It helps their young colleagues to carry out their trades under the best conditions.

OPENING OUT TO YOUTH

Transmitting knowhow is also done through work/study courses. In 2016, they represented nearly 5.7% of CNR's workforce, in fact higher than the regulatory obligation (5%). Every year, nearly half of those who desire, and who are already familiar with CNR's trades and practices, are hired on a full-time basis. In 2016, the company celebrated the 5th year of its innovative Form'Avenir scheme developed with the Institute of Industrial Resources of Lyon (AFPI rhodanienne). These contracts are focused on two technical skills, namely mechanical and operational maintenance. These professional work/study training contracts last 13 months; the theoretical courses are dispensed by both CNR and AFPI rhodanienne. In 5 years, 24 jobseekers have benefitted from Form'Avenir of whom 20 have been recruited.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dvance

Encouraging the initiatives that thrive in the Rhône Valley in a spirit of dialogue runs true to our identity as a company acting in the general interest rooted in the territories. We support projects that serve sustainable development, whether they concern energy, river transport, the environment, agriculture, solidarity, education, culture or sport.

WATER ENTHUSES LIFE INTO THE TERRITORIES

Halfway through its 3rd missions in the general interest, CNR has devoted €95 M to the territories of the Rhône basin. It distributes its actions in a balanced way between energy and electric mobility, river navigation, the environment, and enhancing its tourism and heritage attractions. The return to the community of part of the resources generated by the river, which belongs to all, is driven by a long-term vision of the Rhône Valley's development.

CNR acts with, through and for the territories that lie along the Rhône. It is investing €160 M over five years in the framework of its 3rd plan of missions in the general interest (2014-2018), drawn up jointly with the State, local authorities and actors in business and civil society. For the most part, its actions are integrated in the Rhône Plan, a major project for the territory of the Rhône-Saône basin. It is the leading private contributor, and provides a quarter of the funds committed. Its goal is the same whether it provides its support to those behind projects or carries them out with other partners: that of handing on an enhanced river and territory to future generations, economically, environmentally and socially.

IN FAVOUR OF SUSTAINABLE AGRICULTURE

The new orientations of the 3rd plan include aiding agriculture in the valley to integrate the issues of climate change and sharing water resources. Thus CNR is returning to one of its historic missions: irrigation. This direction took on greater importance in 2016. The first agreements were signed with the chambers of agriculture in view to reducing the vulnerability of farms confronted by flooding. In 5 departments 80 dossiers were identified as being eligible for aid to protect hangars, herds and equipment. The project to use the water of the Rhône to irrigate north Vaucluse and south Drôme, involving 500 farmers, started in June under the aegis of the government. Moreover, the collaboration begun in 2015 with the Auvergne-Rhône-Alpes regional chamber of agriculture and ISARA Lyon, a agronomic, food and environmental engineering school, continued in view to improving knowledge of the agronomic potential of CNR's land and experiment with agro-ecological practices. Another example of innovative cultivation methods supported by CNR is aquaponics, a form of integrated aquaculture that combines growing plants and fish breeding. Aquaponie Valley, a start-up in Drôme, uses this method to produce organic algae, spirulina. This experiment also has a social facet as it favours the social and professional integration of vulnerable persons. From now to the end of 2017, the results obtained should lead to the next step of industrial production.

FLUIDIFYING THE BLUE CORRIDOR

The fish pass of Sauveterre dam in Gard will be completed in 2017. Coupled with a small hydropower plant, that of Logis Neuf was commissioned in 2016
at Pouzin dam. These facilities contribute towards restoring the blue corridor and reaching the objectives of the Rhône-Mediterranean master plan for the development and management of water and the migrating fish management plan.

A SOFTER MODE

Half the length of the ViaRhôna, an 815 km cycle track that will link Lake Geneva to the Mediterranean Sea by 2020, lies on CNR's concession. CNR contributes to the funding of different sections laid by the territorial authorities and to promoting their use. The track extends the Route du Rhône in Switzerland and is part of the European network of green cycle tracks. At present 600 km of track has been completed.

ACHIEVEMENTS 2016

VIARHÔNA
200 KM NONSTOP

With a 40 km link in Isère opened in May, between the bridge of Groslée and Sault-Brénaz, the ViaRhôna cycle track now has a continuous stretch of 200 km from the Swiss border to Lagnieu in Ain. Framework agreements were signed in December with the departments of Vaucluse and Gard, for 53 km between Lapalud and Sorgues, and 40 km between Villeneuve-lès-Avignon and Fourques, respectively.

FISH AND ENERGY
NO MORE BARRIERS

In the process of completion, the fish pass of Sauveterre dam (Vaucluse) comprises a collection channel downstream of the plant that guides the fish towards the entrance of the pass. The structure also includes a small hydropower plant to generate an attraction flow. It is composed of 40 successive basins that shad and eel can take to swim up and downstream the river without coming up against the 10 m high dam.

DISCOVERY ITINERARIES
IN CONNECTED MODE

With Mhikes, CNR has developed a free mobile application for hiking and biking. 11 discovery itineraries accessible to both sports lovers and families can already be downloaded from www.mhikes.com. It's a way of discovering the itineraries that can be taken along the Rhône using only one's mobile, without map or book. The application also invites its users to take a pause in natural habitats, CNR's structures and local tourist curiosities.

BEES ARE
GUARDIANS OF BIODIVERSITY

A precious pollinator, the bee is victim of pesticides, intensive farming and the destruction of plant diversity. 30 to 40% of its population is wiped out every year in France. A signatory of the "bees are guardians of the environment" charter of the National Union of French Apiculture, CNR has been committed since 2013 to preserving bees and supporting apiculture in the Rhône Valley. It prohibits phytosanitary products to maintain its land and deploys its Bee and Company programme with a large number of partners in the apiculture sector. In particular, it makes its land available to beekeepers. It has financed an educational apiary open to the public on the Ile de la Barthelasse and managed by the Beekeepers' Union of Vaucluse. The Union of Professional Beekeepers of Rhône-Alpes has set up a swarm nursery to help young beekeepers faced with population losses. CNR also backs the association's BeeTRIP project to develop apiculture in Auvergne-Rhône-Alpes. Over a period of 4 years, bee colonies will be observed along transhumance circuits (sites propitious for pollen gathering along which beekeepers install their hives), in view to optimising honey production.

THE MISSIONS IN THE GENERAL INTEREST IN FIGURES

Investments for the 3rd plan (2014-2018) on 31 December 2016

€31 M
Energy and sustainable mobility

€19 M
Economic and tourism development

€25 M
Water resources and biodiversity

€20 M
River transport

OUR VALUES BRING US TOGETHER

CNR has always taken on its social corporate responsibility, in line with its policy of sharing the wealth generated by the river, the balance between the general interest and private interest, harmonising the different uses of the water and nurturing its roots in the territory. Formalised in its CSR policy, its commitment to sustainable development is present in all its missions.

6.9%
The rate of employment of handicapped persons in the company, higher than the average for companies in France (3.3%) and the legal obligation (6%)

€535,000
Of purchases made from the protected and adapted sector, i.e. 26 full-time jobs

CNR's societal responsibility is present in many forms and goes beyond regulatory obligations attached to the Rhône concession. It underpins all its activities, those of an environmentally friendly industrial company, a promoter of sustainable mobility, a company open to consultation and the participatory economy, and a laboratory of tomorrow's energies. But above all, CNR is dedicated to enhancing its human wealth, not only internally but also in the territories, via civil society. The culture of sustainable development is present in its 128 CSR actions that it implements in the field..

ENVIRONMENTAL EDUCATION

In 2016, CNR continued to support a large number of environmental education and sustainable development projects: making young people aware of the Rhône's importance with Unis-Cités Auvergne-Rhône-Alpes and the Ligue de l'Enseignement, a study project in a high school of Valence on the rivers Rhône and Senegal, a roaming discovery of the river by Lyonnais schoolchildren with Péniches du Val de Rhône, sustainable development voyages at Vienne with primary schools, a visit by schoolchildren to the hydropower plant of Bollène and of the general public to the exterior of the Génissiat site in summer, and so forth. These are all projects that encourage people to embrace the river in their culture. Like every year, CNR's teams prepared for the European Sustainable Development Week, to make their trades better known to the public: 40 actions were carried out, all bearing the label of the Ministry of the Environment, Energy and the Sea. Several internal actions were also carried out to encourage environmentally friendly conduct every day. A green IT plan is being set up to reduce the energy consumption of CNR's information systems by 20%. Organic products are henceforth proposed to the company's restaurant at its head

office in Lyon. Every Thursday, the forecourt hosts a community and organic market where local producers sell their products to the people of the district and the company's employees.

SUPPORT FOR SUSTAINABLE MOBILITY

CNR encourages its employees to use clean transport modes. Electric bicycles are made available to them at head office and at CACOH. Financial aid is also offered to them to purchase an electric vehicle or bicycle. Information on the corporate mobility plan is disseminated at CNR's head office during the Sustainable Mobility Week and an inter-company mobility plan has been launched at Port de Lyon. In addition, in one year, CNR has doubled its fleet of electric vehicles, thus reducing the average CO_2 emission of its car fleet to below 100 g per km.

PROMOTING DIVERSITY

Eager to ensure equal job opportunities, CNR has worked for several years to prevent discrimination. In 2016, disabled persons made up 6.9% of its workforce. Via its responsible purchasing policy aimed at the protected and adapted sector, CNR also favours the professional and social integration of this population. In addition, it promotes the professional integration of young people through the Form'Avenir (cf. page 51) scheme, discovery training courses and its participation in career guidance days and meetings between pupils and enterprises, organised in particular by the foundation Agir Contre l'Exclusion. CNR is also committed to developing the role of women in the company. The 4th agreement on professional equality between women and men (2016-2019) was signed to this end with all the trade unions.

BETTER QUALITY OF LIFE AT WORK

In 2016, more than 200 employees attended a training course on the quality of life at work, in the form of an interactive theatrical piece, in order to share the stakes in play. In an approach for mutual help, a scheme was proposed to employees to donate days earmarked for holidays or overtime recovery if their children fall ill.

SOLIDARITY-BASED PARTNERSHIPS

CNR forges links with several actors of the social and community sector. It provides financial and logistic support to 10 Food Banks of the departments of the Rhône Valley and favours the benevolent involvement of its employees in local actions and in the national collection organised by the French Federation of Food Banks. In November 2016, it supplemented the 80 kg of foodstuffs collected in-house with 550 kg of rice from the Camargue. It also contributed its financial and logistics aid to Energies Without Frontiers, which operates in Laos, so that it could equip a village with a well and another with sanitary installations. With the association Janus, it organised 6 excursions for the inhabitants of Vénissieux including the discovery of the Rhône by bicycle. With the Emergence foundation, It assisted social utility projects in Lyon. Furthermore, CNR gave a second life to the computer hardware that it is shedding, namely 300 computers every year. It gives 10% to associations and 90% to social economy organisations – Recyclé in Allier and TriRa in Isère – that overhaul them and resell them at affordable prices to low wage earners. The collection of personal mobile phones was also organised with Ateliers du Bocage which acts in favour of disabled and marginalised persons.

Julien Français, Vice-Managing Director, Pierre Meffre, Sustainable Development Manager and the teams of the Rhône Food bank during the national collection.

WE LOVE EXPLOITS

CNR wants the population of the Rhône Valley to regain possession of their river. It does this by forging partnerships with associations and local authorities that share its values to organise sport and cultural projects that showcase the Rhône and spread its renown beyond the valley, to the rest of France and even to Rio, where the French rowing team shone in the Olympic Games.

In the world of sport, CNR's partnership policy privileged nautical sports and activities practiced on the banks of the Rhône, on the ViaRhôna in particular. In the cultural world, it works to enhance heritage and events that express the valley's identity. The aid CNR provides in favour of both sport and the arts helps them to stand out and gain recognition; an additional asset for the Rhône and the development of renewable energies.

ROWERS MAKE IT TO THE PODIUM

Begun in 2014, CNR's partnership with the French Rowing Federation (FFA) reflects the performances to which a shared love of the Rhône can lead. This partnership was renewed for 8 years after the French rowing team won 3 medals at the Rio Olympic Games. CNR has undertaken to support the French rowing teams to help them prepare for the 2020 Olympic Games, as well as the 21 clubs of the Rhône Valley, whether to develop rowing as a sport, organise local competitions or improve the facilities for volunteers, especially regarding safety. The objective is to give the young a taste for the discipline and respect for the river, train the champions of the future and act in favour of disabled persons. CNR also backs 3 international rowers in the framework of the Pact for Performance launched by the Secretary of State for Sports, intended to help high level sportsmen and women to enter professional life when their sports careers are over: Jérémie Azou (Olympic gold medallist in 2016), Noémie Kober and Augustin Mouterde (world champions in 2016). A student at INSA Lyon, the latter carried out his internship at CACOH. Since 2014, CNR's action has helped to increase the number of young rowers in the Rhône Valley by 12%, and there are now 8,000 of them. What is more, between two Olympiads, the rowers of the FFA have won 36 medals at world level and 18 at European level.

€2 M
budget partnership (education, sport, culture, environment, solidarity)

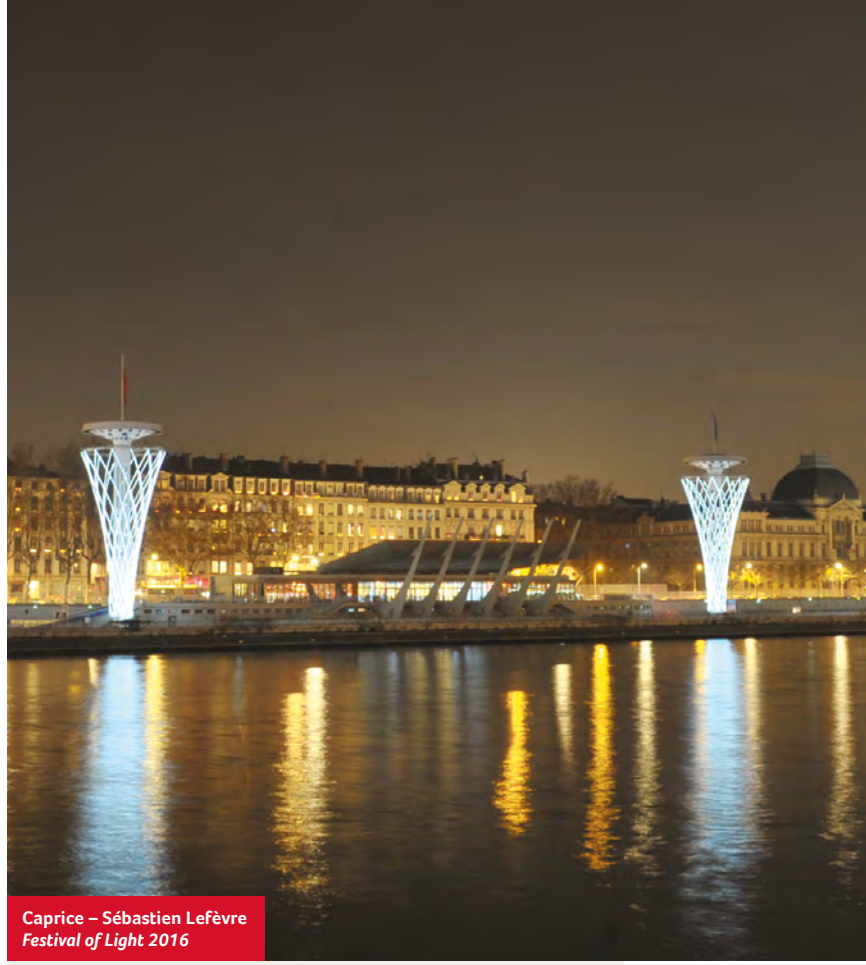
300 collaborative actions
including 200 supported by the territorial divisions

SPORT ALL ALONG THE LINE

CNR's actions alongside sports associations are many and varied. By signing a partnership for 2016-2018 with the Rhône-Alpes jousting and nautical rescue league that gathers 23 clubs and 1,500 members, it officialised its longstanding attachment to a historic sport. It contributed to organising competitions, maintaining the jousting basins and learning the sport. In particular, it is present at the French jousting championships at Ternay, and it has helped in the purchase of a set of electric motors to equip 2 demonstration boats. Among the other sports events it sponsored in 2016 was the first round of the French Cyclo-cross Cup, starting from the hydropower plant of Gervans in Drôme, the National Handisports Grand Prix for the young at Montélimar, the Pierra Menta, an international alpine skiing competition in Beaufortain and the final of the French National Canoe-Kayak Cup 2 at Yenne, in Savoie. Also of note were Lyon kayak, which brought together more than 2,200 people on the water, the Pilatrail organised in the Pilat Regional Park and the Lyon urban trail, where more than 10,000 runners rediscovered their city in a new way.

GIVING LIFE TO CULTURAL HERITAGE

For the 12th year running, CNR contributed to the Festival of Light by backing the installation Caprice created by the Lyonnais artist Sébastien Lefèvre (Le Pilote Productions), which illuminated the Rhône swimming pool (Tony Bertrand nautical centre). Supplied by 100% renewable electricity produced by CNR, this work combined artistic creation and energy efficiency. Beyond the city of Lyon, CNR's cultural sponsorship stretches from Lake Geneva to the Mediterranean. In 2016, it backed such events as Jazz at Vienne, the Camargue and Delta Festival, the Sud Arles and the Estival Bellegarde.



Caprice – Sébastien Lefèvre
Festival of Light 2016

CNR'S PARTNERSHIP POLICY

CNR's patronage and sponsoring actions are selected and monitored by its Patronage and Sponsoring Committee, which upholds the goal of excellence, professionalism and ethics. The committee sits 4 times a year to examine together the projects submitted to it. Composed of a general delegate and a representative from most of the divisions, its role is to guarantee the homogeneity, transparency and ethical nature of the partnerships forged and their geographical distribution all along the Rhône Valley. It pays especial attention to ensure that the operations backed by CNR are legal and conform to the principles of sustainable development. Only projects that involve education, sport, culture, the environment and solidarity can be chosen. CNR's scope of action totally excludes mechanical and violent sports, pollutant activities; initiatives of a political, sectarian, or xenophobic nature, contrary to the company's values or which present a conflict of interest with its activities. Each partnership is subject to a contract that stipulates the amount, the term and obligations in return, if any, as well as the conditions of performance. An evaluation of the actions carried out is organised every year.

THE GREAT RIVERS HAVE SOMETHING TO TELL US

An organisation founded by CNR in 2014, and chaired by the academician Erik Orsenna, Initiatives for the Future of Great Rivers (IFGR) held its 2nd and 3rd sessions in 2016 and launched a series of conferences for the general public. Its credibility has been acknowledged by international organisations that fight against climate change.

20
panellists
representing 12 countries of the 5 continents

15
rivers
under study

A whistle blower, a hub of initiatives and a model for unorthodox collective work, IFGR is a forum of international and multidisciplinary exchange on the management of rivers around the world, faced with climate change and environmental challenges. Its objective is to share experiences and good operating practices relating to rivers, whether for drinking water and food security, irrigation or combatting floods and submersions, producing hydroelectricity or ensuring carbon-free transport. Another of its objectives is to also make known, to both decision-makers and the general public, the contribution that rivers can make to a more sustainable mode of development.

RESPONSES TO CLIMATE CHANGE

IFGR meets for four days twice yearly during which its panellists, comprising specialists of rivers, managers, representatives of institutions and international experts gather to work on concrete solutions. Organised in Quebec in April 2016, the second session dealt with the Port of Montreal and the Saint Lawrence River, in relation with the Great Lakes. Ten general recommendations were issued on the adaptive management of water resources and the social acceptability of port developments. Workshops were also held on social resilience and risk culture, and on new energy models based on the river. The conclusions of the works were presented to an assembly of the stakeholders.

"Treated with greater respect, exploited with more ambition, the great rivers could contribute to a new mode of developpment that everyone knows is necessary."

— ERIK ORSENNA

A PLEA FOR THE DELTAS AT THE COP22

In October, in Avignon, IFGR focused on the Camargue region and widened its reflection to other deltas. These fertile zones with rich biodiversity are the home of 8% of the world's population. Exposed to extreme climatic phenomena, they are at the front line of current problems. Deltas are threatened by pollution, the reduction of river discharges and accumulating sediment and, in time, by subsidence and rising sea levels. Drafted at the end of this third session bearing the COP22 label, the plea "For those who live in deltas" was taken to Marrakesh in November 2016, to call for generalised action before we reach the threshold of irreversibility. These exchanges lead to innovations and encourage a new outlook on river management more respectful of the life deltas.

INCREASING AWARENESS OF THE LIFE OF RIVERS

In order to enrich national and international debates on energy transition and setting the foundations of a sustainable world, IFGR not only stakes on a multidisciplinary approach but on interventions at local scale to increase the awareness of the general public. Several conferences for the general public have been organised: the place of the river in the geopolitics of the 21st century at Vienne, Intersecting viewpoints on the Rhône-Loire at Angers, Invitation to a voyage along the River Niger on the 5th anniversary of Quais du Départ at Lyon, and Rivers and Health at the Camargue Regional Park. A writing competition called "Tell me your river" was also launched for 2016-2017 for primary school classes in the town of Vienne, the city of Lyon, and that of Cayenne in French Guyana. The children can therefore discover the economic, scientific and cultural life attached to rivers.

TOWARDS PARTNERSHIPS

Furthermore, IFGR aims to develop academic and entrepreneurial projects with start-ups. An initiative was begun with the National School of Architecture of Lyon in Lyon in 2016 to envision the Rhône Valley through one of its particularities: that of the coexistence of the river and the urban environment, from its source to its estuary. Other partnerships should also emerge in 2017, notably with the Federal Polytechnic School of Lausanne.

Session of Initiatives for the Future of Great Rivers at Avignon

FINANCIAL RESULTS

— Find the CSR reporting and sustainable development indicators on cnr.tm.fr

I. CNR'S ACTIVITY

The global production of the CNR Group rose by 1 TWh in comparison to 2016. The production of the Rhône (excluding small hydropower plants) amounted to 14.49 TWh, i.e. 0.95 TWh more than in 2015. It was satisfactory for the first 7 months of the year, before stagnating in the last quarter due in particular to poor meteorological conditions that began in August.

This production is close to the average over the past 10 years. Production outside the Rhône amounted to 842 GWh for an installed capacity of 538 MW on 31 December 2016. Nearly 100 MW was commissioned during the year (86 MW in wind power and 13.5 MW in solar power).

Finally, CNR ended the year with a gross turnover of €1,056 m and a net income of €92.8 m.

II. CNR INCOME STATEMENT

in €M

CNR	2015	2016	Variation
GROSS TURNOVER	1 097	1 056	- 41
EBIT	174	139	- 35
NET INCOME	105	93	- 12

III. CONSOLIDATED ACCOUNTS

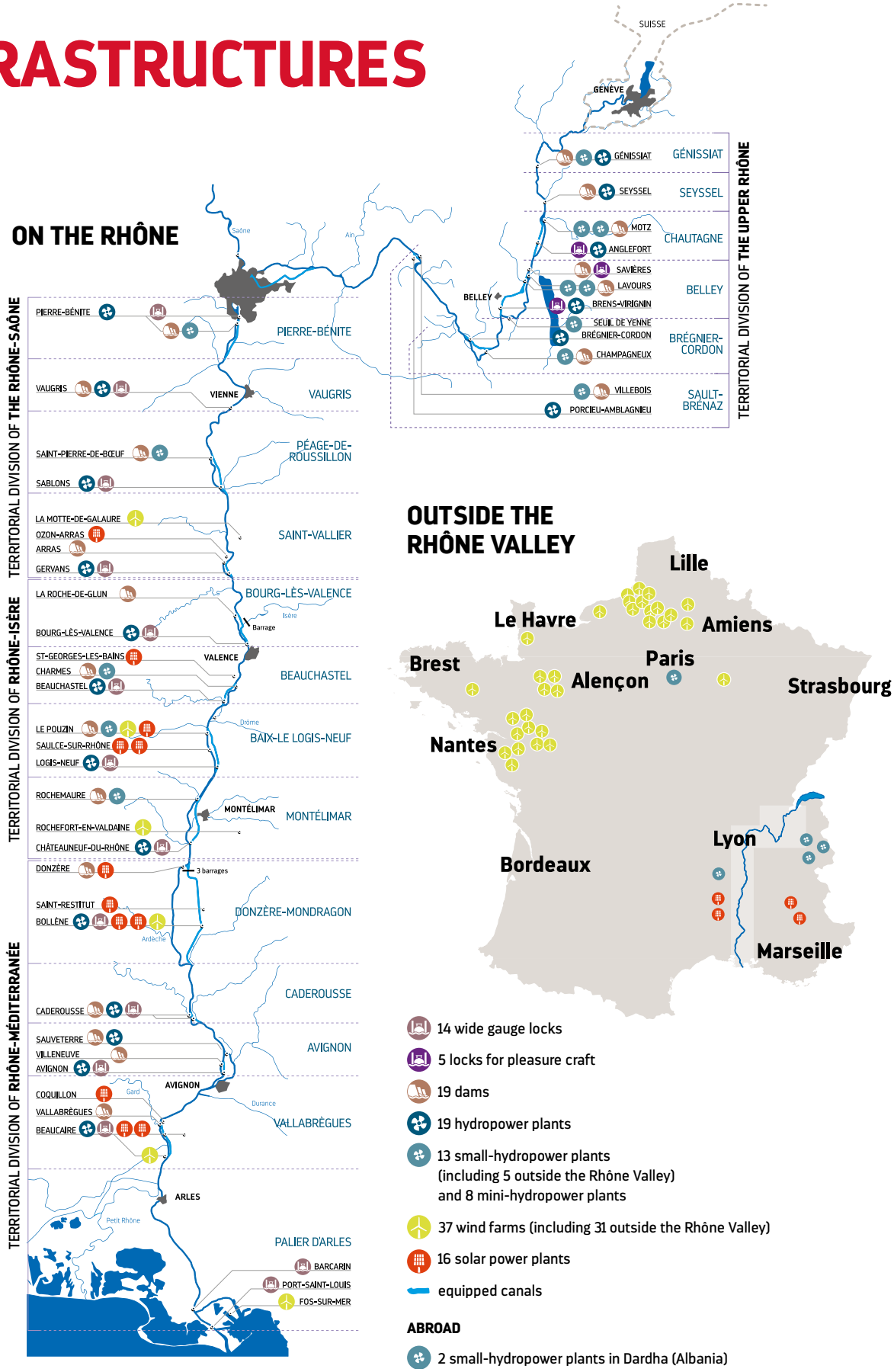
in €M

The fall in CNR's income and the rise in importance of the development subsidiaries lead to a decrease in CNR's contribution to the consolidated income of the CNR Group.
This contribution is nonetheless large insofar as CNR's contribution represents 89% of the consolidated income of 2016 (this contribution was 94% in 2015).

The following table permits understanding the structure of the consolidated income:

CNR'S NET INCOME ON 31/12/2016	92.754
Net income of subsidiaries excluding depreciation allowance and tax	9.717
Other restatements specific to CNR	- 11.872
CONSOLIDATED NET INCOME (GROUP SHARE)	90.599

INFRASTRUCTURES



OUTSIDE THE RHÔNE VALLEY

- 14 wide gauge locks
- 5 locks for pleasure craft
- 19 dams
- 19 hydropower plants
- 13 small-hydropower plants (including 5 outside the Rhône Valley) and 8 mini-hydropower plants
- 37 wind farms (including 31 outside the Rhône Valley)
- 16 solar power plants
- equipped canals

ABROAD

- 2 small-hydropower plants in Dardha (Albania)

For the third year running, CNR wanted to offset the greenhouse gas emissions of its annual report, as well as those of all its other editions. These emissions linked to design, fabrication and transport have been estimated at 41 tons of CO_2 equivalent. This amount is fully compensated by the support given to a project to distribute improved cooking equipment in Cambodia which permits a 25% reduction in the use of wood for cooking fuel, decrease the use of forestry resources which make up 80% of the country's energy needs, and reduce cooking fumes noxious for the population. The amount of this compensation will go to the NGO GERES – Groupe Énergies Renouvelables, Environnement et Solidarités – which carries out this project in the field. Thanks to this action, CNR responds to a twofold challenge: that of reducing its own carbon footprint and that of supporting vulnerable populations to undertake low carbon development.

For more information on carbon offsetting:

info-compensation-carbone.com
co2solidaire.org
geres.eu

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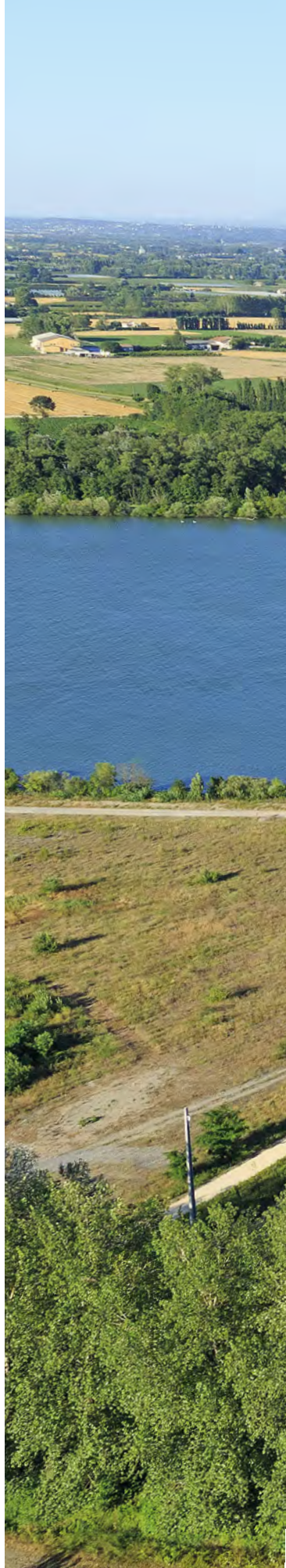

The emissions of CO_2 generated by this document are fully offset by the funding of a project reducing deforestation in Cambodia