

HYDROGEN, DRIVING THE ENERGY TRANSITION

Buildings • Energy • Industry • Infrastructure • Transportation • Urban development • Water

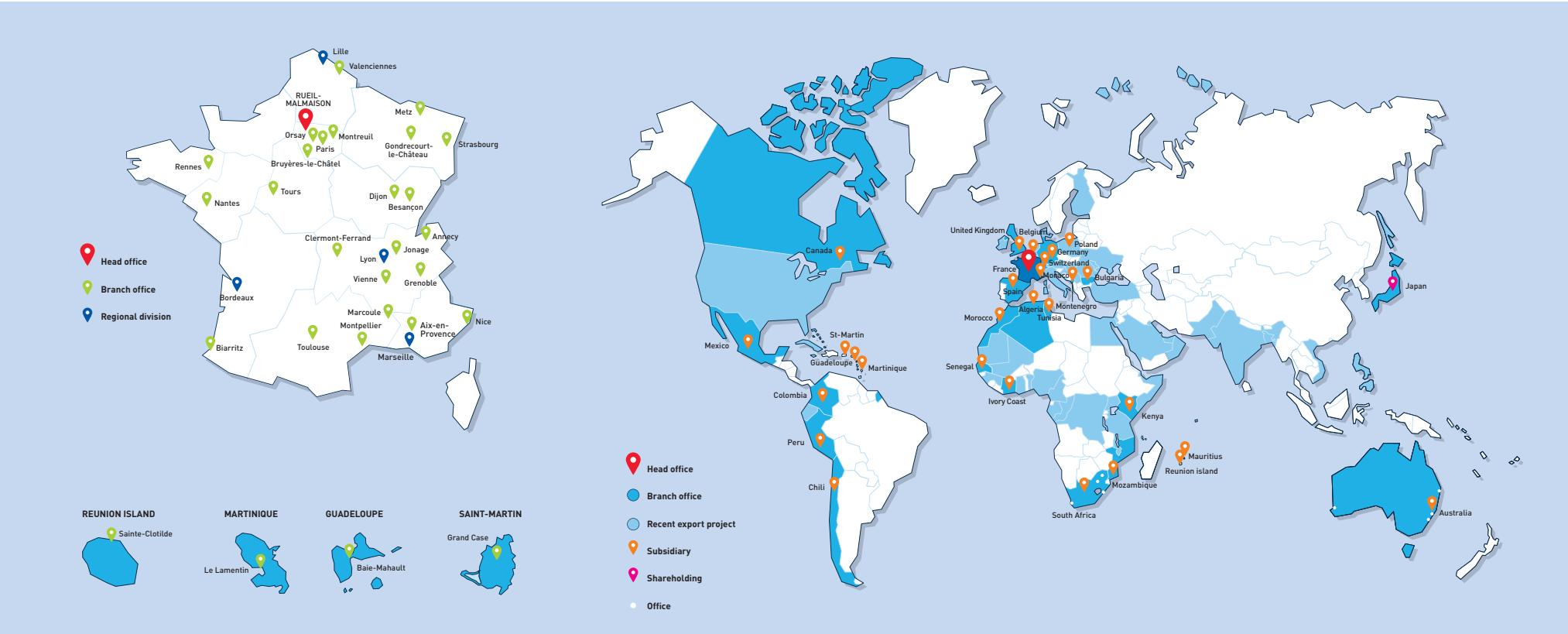
OUR GROUP

A STRATEGIC PLAYER IN THE ENGINEERING SECTOR

Headquartered in Rueil-Malmaison, France, and benefitting from a global presence, Ingérop is an engineering and consultancy group working on addressing today's major challenges to build tomorrow's world.

With ISO 9001, ISO 14001, ISO 45001 and ISO 19443 certifications, the group has built up a solid reputation in every area of the construction industry: buildings, energy, industry, infrastructure & mobility, transportation, urban development, water. Its experienced teams offer cutting-edge, in-depth technical support, covering all project and worksite phases.

A benchmark player in France, Ingérop boasts a strong, steadily growing, global presence. The Group continues to pursue its development, building on its independence in terms of its shareholding structure, its technical expertise, its capacity for innovation and its close relationship with its clients.



7 CORE BUSINESS AREAS



Water

Design of hydraulic infrastructures and river works.
Creation, extension or redevelopment of port areas.
Promotion of controlled development to preserve natural environments.



Buildings

Support all types of building projects at every stage of their development by mastering all the current and future technical, digital and environmental challenges.



Industry

Meet the needs of industrial needs at every stage of their projects - from process definition to delivery of buildings and facilities - while actively positioning itself in the sectors of the future.



Energy

To be a strong and committed player in the energy transition, in the production and distribution of green energy and in the decarbonisation of all industrial activities.



Infrastructure

Provide technical expertise and a high level of advice during the design, construction and maintenance stages of major infrastructure, engineering structures and civil engineering, as well as for all mobility projects.



Transportation

Design and develop all eco-responsible modes of transport taking into account the challenges of multimodality and the best possible user experience.



Urban development

Work to transform cities into low-carbon territories that are resilient and adapted to climate change.



SERVICES COVERING EVERY STAGE OF A PROJECT

ASSISTANCE TO THE OWNER

- Feasibility studies
- Traffic and socio-economic studies
- Audit, diagnostic & expertise
- Consultancy & master plan
- Planning

DESIGN & CONSTRUCTION MANAGEMENT

- Project management
- Industrial architecture
- Engineering & BIM design
- Environmental studies
- Statutory processes / Installations classified as environmental protection (ICPE)
- Construction design & Complex design calculations
- Spatial coordination
- Administrative procedures
- Procurement
- Management, scheduling and coordination of the construction
- Tests & Commissioning
- Assistance with operation & maintenance

DESIGN & BUILT

- Engineering, procurement, construction
- Turnkey project

A BROAD RANGE OF SKILLS AND EXPERTISE

PROJECT MANAGEMENT

- Systems Engineering
- Risks analysis
- Building permit application
- Documentary Management
- Works oversight
- Scheduling & coordination
- Tests & Commissioning
- Assistance with operation & maintenance

ENVIRONMENT

- Environmental analysis
- HAZOP, FMECA, ATEX analysis
- Statutory processes / Installations classified as environmental protection (ICPE)
- Assistance with obtaining ISO / HQE certification

GRANTS & FUNDING

- Advice on grants & funding
- Preparation of applications
- Calculation of the overall cost (CAPEX / OPEX / TCO)

MANUFACTURING

- Industrial architecture
- Flow studies and management
- Production simulation
- Conversion process
- Spécial machines
- Handling
- Factory 4.0

CONSTRUCTION

- Geotechnics
- Roads and External Works
- Foundations / Infrastructures
- Steel structures
- Structural works
- Finishings & fittings
- Building shell & walls
- Architecture
- Building economics

UTILITIES

- Fluids (gases and liquids)
- Heating
- Ventilation
- Air conditioning & cooling
- Nuclear ventilation & clean room

ELECTRICITY

- Power voltage
- Low voltage - communications
- Fire protection system
- Instrumentation & control
- Automation & industrial computing
- Oversight / CTM

BIM

- BIM Management
- Spatial coordination
- Digital engineering AR / VR
- Cybersecurity

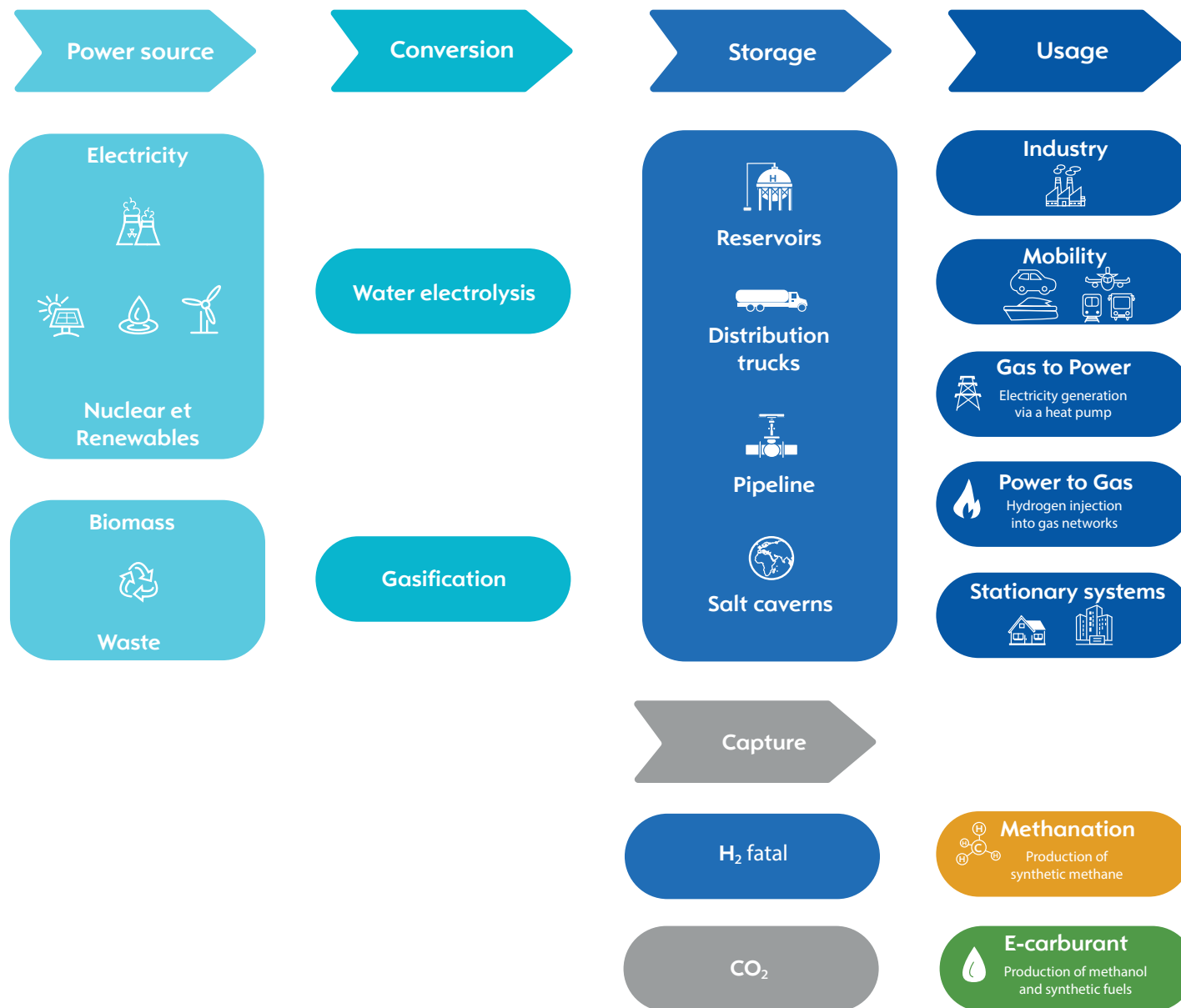


OUR VISION

Committed and responsible, Ingérop makes the ecological and energy transition its core focus. Externally, this is reflected in the expertise and practical solutions that Ingérop offers its clients to meet these challenges. Internally, this goal is expressed in innovation and research programmes on these issues allied with a requirement to be a benchmark for excellence.

Ingérop sees hydrogen as a means of decarbonising a range of economic sectors, industry and mobility in particular, and of improving the efficiency of renewable energies.

For almost 10 years, our group has been expanding its expertise in this field. Thanks to its multi-disciplinary skills base, the group is positioned across the entire hydrogen value chain, with assignments covering general consultancy, consultancy to contracting authorities, project management and turnkey operations.



OUR SERVICES

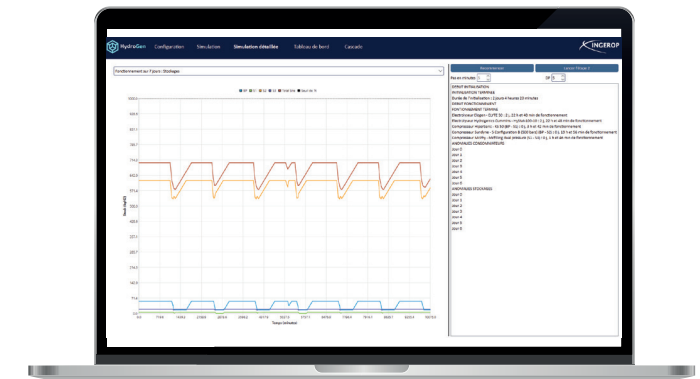
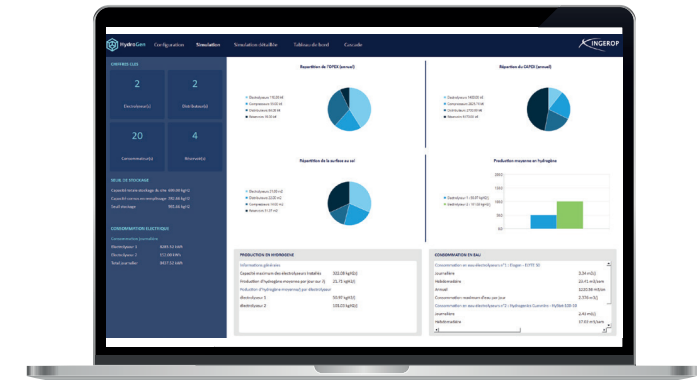
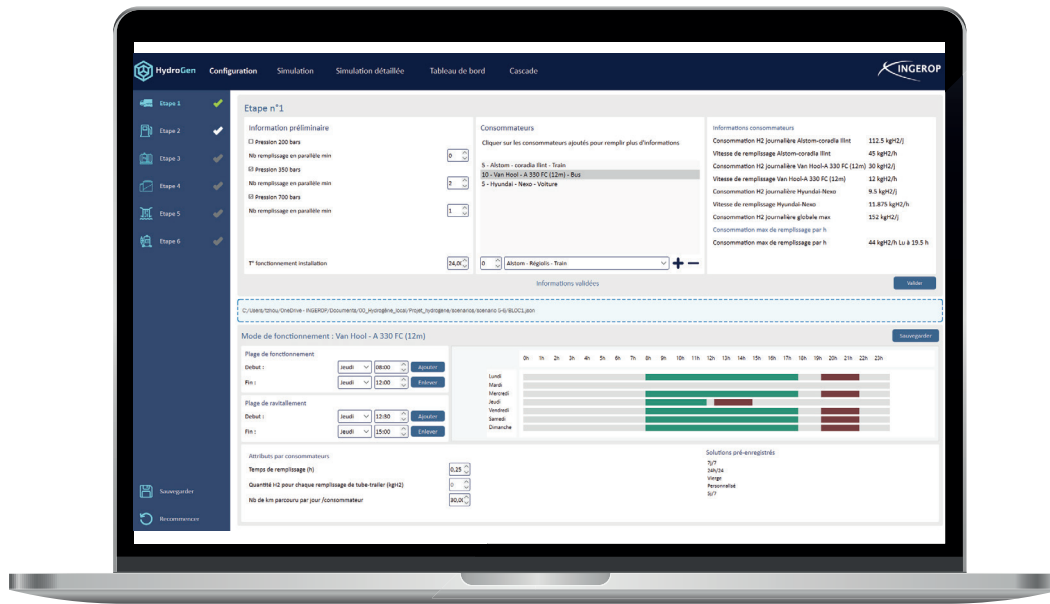
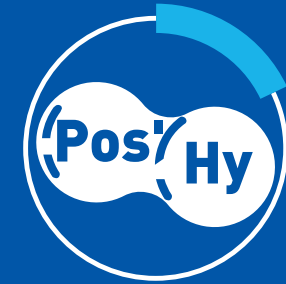
Ingérop has developed a unique tool for designing the entire hydrogen chain, from production to distribution, including compression and storage.

Suitable for projects involving mobility, industry or energy storage, for both public and private clients, it provides a valuable methodology in how to design and develop facilities.

It can be used to identify all the data needed to design an infrastructure in line with the client's prerequisites, to select the all the necessary equipment (electrolysers, storage tanks, compressors, distribution stations, etc.), and to analyse the environmental aspects (surface area required, environmental risks, regulations, etc.) and the project's energy and economic consumption.

Lastly, it can be used to rapidly simulate a range of scenarios for a given project, in relation to a site, a location, a given solution, etc., and to determine investment and operating costs. It facilitates choices and trade-offs and helps to optimise the balance between hydrogen production, storage and distribution, according to the usages specific to each project.

POS'HY,
A UNIQUE SIZING TOOL

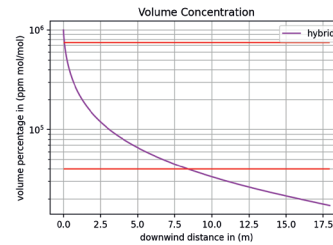


OUR MODEL FOR CALCULATING HYDROGEN EXPLOSIONS

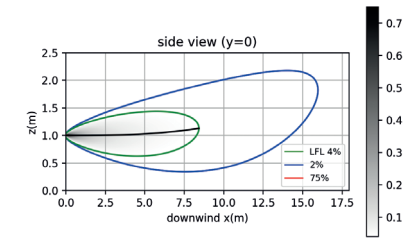
- Advanced seismic studies (non-linear dynamics, push-over)
- Rapid dynamics
- Fire resistance
- Digital twin for structures

Model of gas cloud propagation in the event of a hydrogen leak, developed by Ingérop

The aim is to characterise the explosive potential: mass of hydrogen with a concentration greater than 4% (lower flammable limit) and position of the cloud.



Concentration profile at the centre of the cloud



Concentration cloud shape > 4 %

The mass of hydrogen is obtained by integrating the concentration with the volume of the cloud.

Assessing the effects of the explosion: LS-DYNA or Europlexus finite element numerical analysis software.

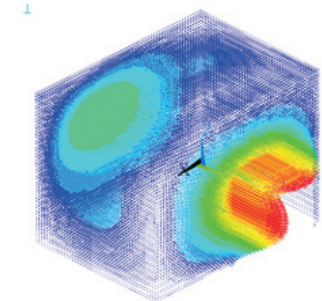
On humans

Drawings of zones that comply with regulatory thresholds for overpressure peaks, used to define restricted access zones: indirect effects (glass breakage) / irreversible effects / lethal effects.

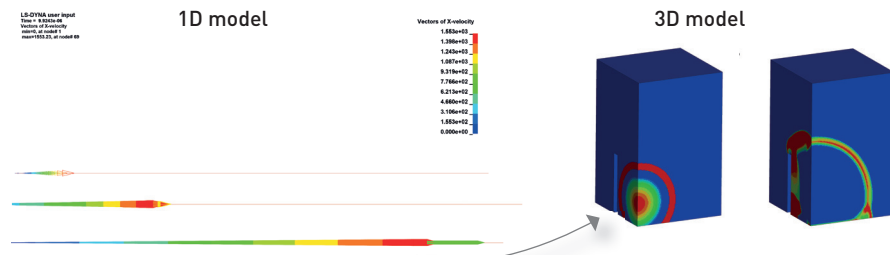
On structures (reinforced concrete, steel, masonry)

Several possible levels of analyses:

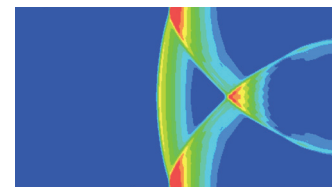
- Simplified: use of graphs to obtain an equivalent load to be applied to the structures (TNO method, UFC3-340, etc.),
- Advanced: explicit dynamic shock wave calculations performed on LS-DYNA using air and fireball modelling. This method is used to factor in the presence of obstacles between the source of the explosion and the target under study, or the effects of confinement, and to calculate the stresses on the structure. The structure's strength can then be checked using linear or non-linear dynamic calculations.



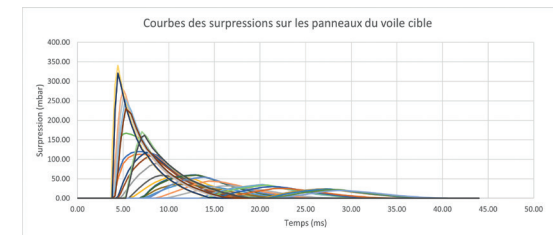
Explosive deformation of a reinforced concrete structure (internal explosion)



Successive pressure calculation models (remapping)

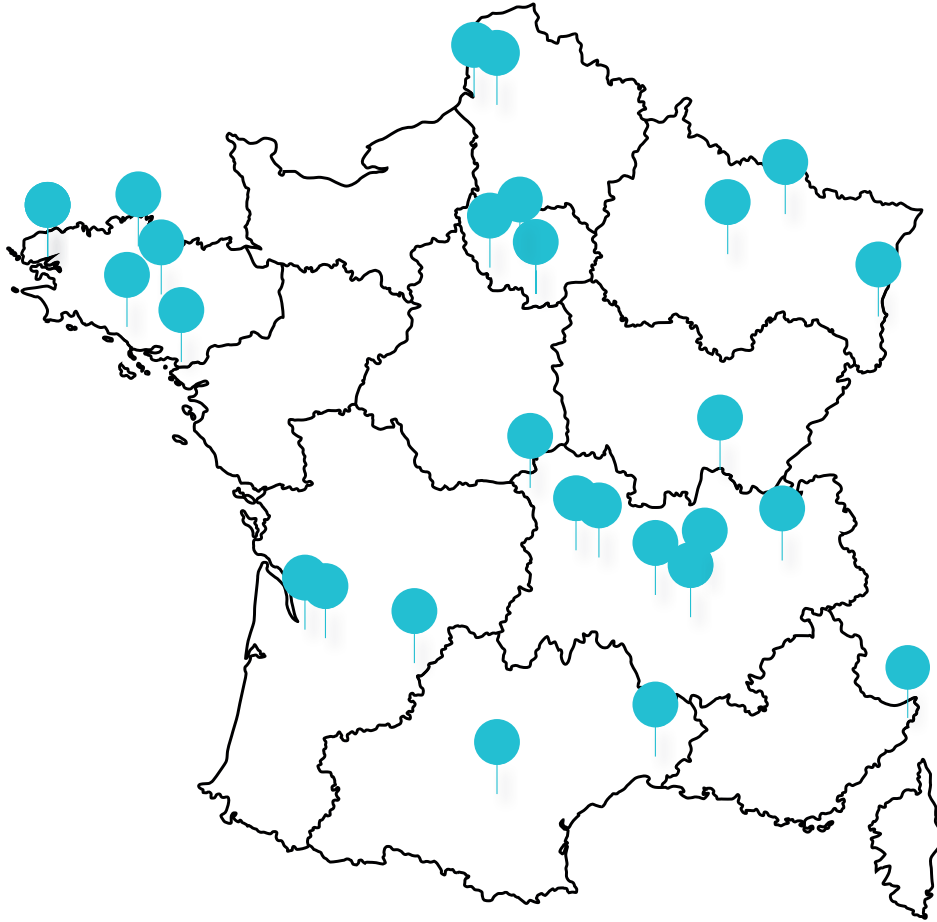


Propagation of overpressure in a corridor



Overpressures applied to the structure

A FEW REFERENCES



Buildings



Energy



Industry



Infrastructure



Transportation



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MOBILITY

VSH project > HYNAMICS

Design and construction of two hydrogen production/distribution facilities (5 MW) dedicated to mobility projects.

Development of a hydrogen train project > AUVERGNE-RHÔNE-ALPES REGION

Consultant to the Contracting Authority for the implementation of 3 hydrogen-powered trains. Technical and economic study of the hydrogen production/distribution facilities and a train depot, preparation of the tender documents, monitoring of construction and operation.

Production/distribution infrastructure > CAF (EX-ALSTOM)

Design and construction of a mobile hydrogen production/distribution station for train testing.

Construction of a line of 10 hydrogen-powered buses > SYNDICAT MIXTE DES TRANSPORTS EN COMMUN - CLERMONT-FERRAND

Consultant to the Contracting Authority for the implementation of a hydrogen-powered bus line. Benchmarking of rolling stock and hydrogen production plants. Technical and economic study and project set-up (bid €/km), preparation of tender documents and follow-up.

Bus line > BORDEAUX MÉTROPOLE

Project management for the design and construction of a depot and a «zero emission» bus line.

Boat-bus port infrastructures > LORIENT AGGLOMÉRATION

Project management for the design study of the berthing pontoons for the boat-buses, as well as the hydrogen distribution and connection infrastructure for the boats.

Creation of a local hydrogen ecosystem > CONSEIL DÉPARTEMENTAL - DORDOGNE

Consultant to the Contracting Authority for a study of the technical and economic opportunity and feasibility with regard to the production of decarbonised hydrogen in the Dordogne. Partners: Enooia and Seiya Consulting.

Design of a hydrogen distribution plant > LIDL FRANCE

Project management for the design and construction of a hydrogen compression, storage and distribution platform to recharge forklift trucks.

Infrastructure de production et distribution > RÉGAZ BORDEAUX

Project management for hydrogen production and distribution (1 MW) dedicated to mobility projects.

Technical and economic study on the deployment of a hydrogen infrastructure > NOUVELLE AQUITAINE REGION

Study on heavy road and sea mobility: current situation, development prospects, network of hydrogen production and refuelling infrastructures and economic analysis of the infrastructure. Partners: Enooia and Seiya Consulting.

Feasibility study on decarbonising the transportation network > PRINCIPALITY OF MONACO

Feasibility study aimed at transforming the bus fleet into a «zero emission» fleet within 10 years. The study focuses on the propulsion energy options for the new bus fleet (BioGNV, electric and hydrogen) and the infrastructure required.

INDUSTRY

Fuel cell manufacturing plant > [SYMBIO](#)

All Trades (TCE) design of a 23,000 m² production plant (clean rooms), R&D centre, service building and hydrogen filling and distribution platform.

PEM electrolyser > [H2X ECOSYSTEMS](#)

Design, development and production of the first containerised PEM electrolyser prototype.

Construction of a gas platform > [PRAXAIR SAS](#)

Construction of a building and a 3,500 m² hydrogen filling and distribution platform.

Production and distribution of hydrogen and oxygen for plasma furnaces > [CLIENT CONFIDENTIAL](#)

Project management for the 4 MW hydrogen and oxygen production, storage and distribution system.

Thermal oxidation unit > [VYNOVA PPC](#)

All Trades project management for a VOC thermal oxidation unit with a capacity of 9,000 Nm³/h.

ZEDC project > [AIRBUS](#)

Feasibility study for a building to house hydrogen tank production process equipment used in the development of zero-emission aircraft.

Vacuum pumping unit > [ARIANE GROUP](#)

Project management for the modification of an existing pumping unit for a CVI chemical deposition process linked to an induction furnace.

Hydrogen production > [EREN GROUPE](#)

Feasibility study for a pilot site for the production of hydrogen by physical-chemical reaction of aluminium.

BUILDING

Fuel cell research and testing > [MULHOUSE ALSACE AGGLOMÉRATION](#)

Development of a fuel cell combined with a heating system and photovoltaic electricity generation, as part of the European ENE-FIELD programme. Consortium comprising: GRDF, Engie-Lab (ex-Crigen), RBZ, Stihlé and Ingérop.

3-track maintenance workshop for hydrogen-powered train sets > [SNCF](#)

Project management for the design and construction of a depot for ALSTOM trains. Technical and economic study, project set-up, preparation of tender documents and follow-up.

ENERGY

Hydrogen production and distribution > [ENGIE SOLUTIONS & CNR](#)

Project management for the construction of hydrogen production and distribution infrastructures (20 MW) to supply industrial sites.

MOBHLYS project > [AÉROPORTS DE LYON](#)

Consultant to the Contracting Authority for hydrogen and photovoltaic power stations.

Zero Emission Valley Project > [HYMPULSION](#)

Consultant to the Contracting Authority for the purchase of renewable hydrogen (15 MW) to supply 16 distribution plants.

Hydrogen production > [LINDE](#)

Project management for the design and construction of a 300-bar high-pressure hydrogen production line.

Production and distribution of hydrogen for a methane plant > [ENGIE SOLUTIONS & ENGIE GREEN](#)

Feasibility study for a 4 MW hydrogen production plant, used to produce synthetic methane (combination of CO₂ and H₂).

HYPSTER project - Hydrogen storage demonstrator > [STORENGY](#)

Project management for the construction of a hydrogen production and storage facility in a salt cavern.

Production of green hydrogen and injection into a natural gas distribution network (Power to Gas) > [REGAZ BORDEAUX](#)

Project management for the infrastructures of the green hydrogen production system for mobility and injection into a natural gas distribution network.

Alimentation d'une cogénération et de véhicules > [MOBHY](#)

Feasibility study for hydrogen production and distribution infrastructures (5 MW).



HELPING YOU DEVELOP YOUR PROJECTS IN RENEWABLE AND LOW-CARBON HYDROGEN



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