

2021 Green Bond Report

Editorial

Resilience: the mechanical property of a material that determines its resistance to shock. The concept of resilience was first applied in the field of psychology to describe a person's ability to build a life and subsist amid traumatising conditions. In the IT world, it refers to a system's capacity to keep operating even if it breaks down. The broader usage of resilience connotes the ability of an ecosystem, habitat or group of individuals to recover after a catastrophic external event.

Resilience has become a fact of life at a time of repeated and simultaneous humanitarian crises in public health, society, economy, ecology, and terrorism. When paired with calls for sincere commitments, first and foremost in terms of energy. It also provides insight for strategic decisions made by nations, communities, and businesses, endlessly being asked to stay the course while anticipating, adapting, and regaining the meaning and purpose of what they do.

The current situation demands that resilience is an integral part of how a transport network is designed and built – because now more than ever, climate hazards have put these critical strategic systems in an exceedingly vulnerable position. Société du Grand Paris took an uncompromising approach to overseeing the new metro system's development with a view to keeping infrastructures from ageing too quickly, by prioritising sustainability and high-quality materials, and focusing on how best to prepare for damage-related maintenance. From the rails, overhead lines, tunnels, overpasses, stations, and operating centres: everything related to running the new metro system has to be redesigned to withstand a traumatic climate event, and the operational and economic aftermath. While there is still much debate about the magnitude, impact and duration of such a climate-related event, it will be part of our reality. Société du Grand Paris also opted to use the same approach in all areas where the concept of resilience played a role.

For Société du Grand Paris, this report is an opportunity for transparency and candour. It owes as much to the project's investors and institutional partners, and the future passengers on the 200 km railway deserve this as well. While compiling this report, we were constantly aware that the element of surprise is inherent to all crises, and that the next one will be as unexpected as all those that have come before. Yet, as a leading project developer, our role is to inform the public that every construction sector – from builders and urban planners, to rail equipment makers – is asking themselves the hard questions, now and forever innovating, and always looking ahead. And that we are prepared.

Jean-François Monteils

Chairman of the Société du Grand Paris Management Board

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A vital project for tomorrow

By building 200 km of new automated metro lines connected to the existing infrastructure, along with 68 additional stations, Société du Grand Paris is developing the Greater Paris region and enhancing its appeal.

Société du Grand Paris is a public establishment of an industrial and commercial nature (EPIC). It is wholly owned by the French government and was instituted by the Grand Paris Act of 3 June 2010. Its primary purpose is to "design and develop the overall plan for the set of infrastructure projects that make up the Grand Paris Express, and oversee the construction of the lines, fixed structures and facilities, the construction and development of stations and interchanges as well as the procurement of the rolling stock that will run on this infrastructure".

The four new Grand Paris Express lines (15, 16, 17, and 18), as well as the extension of Line 14 to the north and the south, will be connected to the existing transport network.

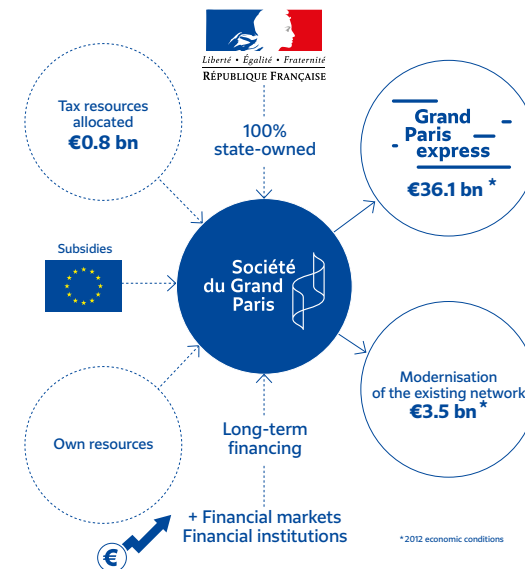
As an "urban, social and economic project of national interest" that aims to promote "sustainable and inclusive economic growth and driving job

opportunities in the Greater Paris region", the Grand Paris Express will boost the region's appeal and maintain its competitive edge on the world stage.

With 200 km of new automated metro lines around the French capital, effectively doubling the existing metro network, as well as 68 additional stations, the Grand Paris Express offers solutions to the challenges the region has been grappling with in recent years: increasing mobility for everyone, reducing social and geographical inequality, and improving quality of life while benefiting the environment. The new metro will also help reduce greenhouse gas emissions, with annual savings of 755,000 to 1.3 million tonnes of CO₂ equivalent once it is completed.

Thanks to the Grand Paris Express, the Paris region will be bigger, greener, and more united than ever.

Société du Grand Paris financial model



A project designed for resilience to climate change

Grand Paris Express's resilience to climate change is a constant concern of Société du Grand Paris. A two-pronged strategy was developed to mitigate the project's climate impacts, and to adapt it to current and future climate conditions.

While concern for climate change and capping temperature increases at 1.5°-2°C¹ are not new, COVID-19 showed us how vulnerable society can become when dealing with and adapting to today's social, economic, and environmental problems. Society needs to be more resilient.

As an industry leader with a consequential role to play, in 2020 Société du Grand Paris began analysing the resilience of the Grand Paris Express when faced with public health crises. In 2021, it further evaluated the vulnerability of the Grand Paris Express to climate risks and how it manages risks, in an effort to fortify the network's resilience in line with medium- and long-term advances in mobility and the appeal of the regions through which the new metro travels. The scope of the analysis covered a number of the Grand Paris Express transit system's components and categorised them by the network's overhead sections, underground sections, and passenger areas.

This 2021 edition of the Green Bond Report on the Grand Paris Express's climate resilience is based on the recommendations issued by the Task Force for Climate-related Financial Disclosures (TCFD)². It also includes:

- A two-sided approach to the materiality concept: the impact of climate change on building the Grand Paris Express and the impact of Société du Grand Paris's activities on climate change;
- The latest known advances on a unified taxonomy³: the potential of helping to achieve the first two environmental objectives set by the European Union (mitigate climate change and adapt to climate change), and of complying with the Do No Significant Harm principle (DNSH).

Our project to analyse the Grand Paris Express's resilience and to take appropriate action is in the interest of continuous improvement, hence cannot be seen as complete. In fact, Société du Grand Paris has onboarded the skills it needs to proactively approach all of these topics, a move driven by a desire to gain deeper know-how on the matter by conducting comparisons to networks exposed to extreme conditions and tracking its actions in this area.

Furthermore, since no assessment of resilience to climate risks is complete without looking at how all local stakeholders in a given area interact, this project must be done in tandem with the other regional project developers and anyone involved in the Grand Paris Express project as a whole.

1. The Paris Agreement (Art. 2), 12 December 2015, entered into force on 4 November 2016.

2. Task force on the publication of information about climate change.

3. Regulation (EU) 2020/852 of the European Parliament and of The Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment and amending Regulation (EU) 2019/2088.

Société du Grand Paris's climate risk strategies

A TWO-PRONGED STRATEGY

Société du Grand Paris assessed the energy and climate aspects from the inception of the Grand Paris Express during the preliminary research phase. Thus, the new metro system's planning and design principles accounted for global warming's potential impacts on the project through two additional policies: mitigation of the project's climate impact, and its adaptation to the current and future climate.

Policy on mitigating climate change impact

With regards to reducing future climate risks, Société du Grand Paris set out to limit greenhouse gas (GHG) emissions while building the Grand Paris Express by at least 25% compared to baseline levels⁴. In order to implement the resources needed to reduce emissions, the major "construction and equipment" activities with GHG potential were determined in the project's development phase.

Policy on adapting and reducing climate vulnerability

Société du Grand Paris is focusing on making the Grand Paris Express less vulnerable to climate risks by ensuring adaptation measures are considered and implemented at every phase of the project, from design and construction to the network's operation, upkeep, and maintenance.

As the project developer, when it comes to operating and maintaining the network, Société du Grand Paris will be providing directives to apply in extreme circumstances to those who maintain and operate the Grand Paris Express. An initial study was conducted at a macro level to put together a preliminary picture of potential risks and to assess the Société du Grand Paris's policies. It recently completed the physical risk analysis for the Grand Paris Express to evaluate its overall degree of resilience.

Société du Grand Paris governance and climate and ESG risk management

In accordance with the commitment to guarantee fulfilment of an environmentally sustainable and socially responsible project, Société du Grand Paris accounts for these issues on every level of its organisation.

In 2019, it established a CSR roadmap⁵ and assigned implementation to the Supervisory Board. A core tenet of the roadmap is climate change adaptation. This was also written into Société du Grand Paris's risk management policy, updated in 2020 to improve how the risk is managed and controlled.

In 2011, a scientific committee began supporting the Management Board to comprehend the project's economic challenges and benefits. It offers advanced knowledge and a set of best practices that are helping appreciate and value its impact. Most notably, its work has shown that the project is significantly helping to reduce urban sprawl, which contributes to climate change.

At the end of 2021, Société du Grand Paris formed the Strategy, Environment and Innovation department which plays an instrumental role in writing environmental policies and procedures. It also works closely with all of the project and executive departments.

⁴ 2018 CarbOptimum® baseline scenario

⁵ Corporate social responsibility

What are climate risks?

CLIMATE HAZARDS

A climatic phenomenon or event that at the time of occurring is of an intensity or has a geographical and temporal probability of occurrence likely to cause loss and damage to that which is exposed to it.

CLIMATE RISK

Potential impact based on the hazard's type, intensity, and probability of occurrence, and the level of exposure and vulnerability.

PHYSICAL VULNERABILITY

Sensitivity of the transit infrastructure's components to the hazard based on their physical characteristics.

SOCIAL VULNERABILITY

Sensitivity to the hazard on the transport system's operation and services.

CLIMATE RESILIENCE

Capacity to withstand a climate disaster and continue activities as climate conditions change by reducing losses and damage.

Background information

The planet's average temperature rose nearly 0.85°C from 1880 to 2012, but in line with regional climate model predictions, the changes observed in France and in Paris reached an increase of 1.3°C between 1901 and 2012. Minimum temperatures rose 1.6°C from 1901 to 2000, and began noticeably accelerating in the second half of the 20th century. Since 1954, a sharp increase in maximum temperatures was observed at 0.3°C each decade. The average number of days in Summer (maximum temperature of over 25°C) rose in Paris by four days every 10 years and varied widely.

Climate change studies conducted for the Île-de-France regional climate plan showed a rise in temperatures in Summer and Winter, as well as a higher frequency and intensity of Spring precipitation. These shifts in the climate are likely to trigger extreme weather events such as heat waves, floods, and droughts with periods of rain that cause excess water run-off and landslides.

These effects, therefore, create a need to increase the area's resilience, or its capacity to adapt to the hazards that pose a threat, to protect people and infrastructures from these dangers.

For instance, it has been observed that the layout and activities of the greater Paris area are causing local temperatures to rise. This urban heat island phenomenon is resulting in overnight yearly average temperature differences of 2.5°C between Paris and neighbouring rural areas such as Vexin and the Rambouillet and Fontainebleau forests.

These effects, therefore, create a need to increase the area's resilience or capacity to adapt to the hazards posing a threat, to protect people and infrastructures from these dangers.

During high-pressure conditions with low winds and clear skies, for example a heat wave, these variations can reach 10°C. In the 2003 heat wave, Paris was 4°C to 8°C hotter than the less urbanised areas surrounding it. Several cities have experienced urban heat island events, but Paris is especially sensitive to the extreme heat the phenomenon brings.

The effects of climate change are now quite obvious and will become significantly greater. Most notably, Météo France currently ascertains that heat waves are longer and more intense. There is over 10% more precipitation in Winter and less in Summer.

Although climate change is to blame for multiple physical risks to network infrastructures, a key component of urban resilience is adapting to this new reality.

In terms of public transport on a broader level, the rise in average temperatures, longer and more intense Summer heat waves and droughts, and more frequent fire outbreaks are generally the risks threatening the electric traction equipment and rail expansion because fires are likely to occur in an increasing number of places and heat waves will slow down maintenance work. Furthermore, floods, whatever their cause, or indeed landslides could lead to traffic interruptions if infrastructures are structurally damaged or sections of the network are destroyed at the local level. Lastly, an emphasis is currently being put

on how the existing links between the networks affect their degree of vulnerability. For instance, numerous telecommunications networks and electrical grids are located extremely close to railways: rail and telecommunications networks rely on electricity from the grid. Additionally, the majority of these systems is digitised for the most part, which means they heavily depend on telecommunications networks. Yet, adaptation measures are mainly implemented by sector and remain partial, so these interdependencies are not fully being taken into account.

Although climate change is to blame for multiple physical risks to network infrastructures, a key component of urban resilience is adapting to this new reality.

Grand Paris Express has limited exposure to the main climate risks such as droughts and heat waves since 90% of the infrastructure is built underground. Société du Grand Paris, the maintenance operator, and all the stakeholders are conducting risk analyses and taking special measures for the remaining, more exposed overhead portions, such as moving them away from the rails and clearing brushwood. While these more exposed lines may be contained and a relatively small part of the network as a whole, they are still critical components that pose a systemic vulnerability for the entire infrastructure.

Risks that Société du Grand Paris is anticipating

The Grand Paris Express is the type of project that requires an environmental assessment phase. The purpose of the process is to ensure that environmental issues are being considered during project development, to assess its potential impacts on a range of environmental topics, and to propose special measures to prevent and reduce such effects, or offset them when necessary. The environmental assessment programme also serves to provide the project developer and

Adaptation measures are being considered and implemented at every phase of the project, from design and construction to the network's operation, upkeep, and maintenance.

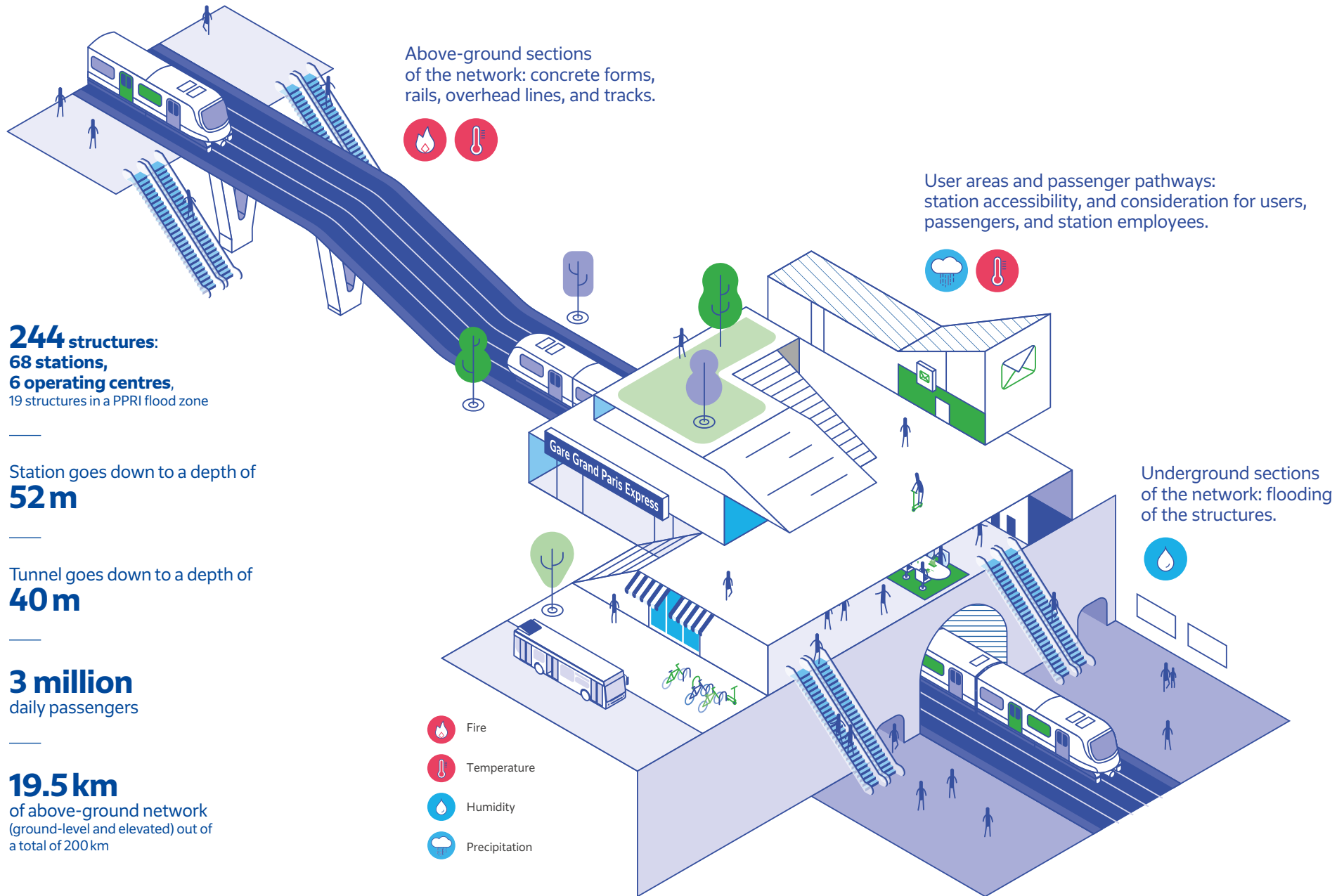
competent authorities insights on the project, as well as inform the general public and ensure it is involved.

More in-depth assessments were then conducted as part of an impact study for each section of the Grand Paris Express, which is kept updated as the project progresses.

In terms of building the Grand Paris Express, this mainly entails accounting for water-related risks caused by the expected excess precipitation (flooding), droughts (clay soil contraction and expansion), and temperature variations for the network's above-ground sections (see diagram on pages 16-17). The Grand Paris Express's resilience to these events also contributes to the overall resilience of public transport in Île-de-France because it intersects with existing networks that are older and thereby more vulnerable.

Adaptation measures are being considered and implemented at every phase of the project, from design and construction, to the network's operation, upkeep, and maintenance. As the project developer, when it comes to operating and maintaining the network, Société du Grand Paris will be offering provisions to apply in extreme circumstances to those who maintain and operate the Grand Paris Express.

Climate risks facing the Grand Paris Express



244 structures:
68 stations,
6 operating centres,
 19 structures in a PPRI flood zone

Station goes down to a depth of
52m

Tunnel goes down to a depth of
40m

3 million
 daily passengers

19.5km
 of above-ground network
 (ground-level and elevated) out of
 a total of 200 km

WATER-RELATED RISK (FLOODING)

Since the Grand Paris Express is so close to the Seine and Marne rivers, Société du Grand Paris has determined flood-prone zones based on the PPRI (flood risk prevention plans) in force in the areas it runs through, and has assessed the risks they pose to the project. Based on this information, it drew up a flood risk control strategy which it shared with government agencies and factored into the design of the structures (see inset on page 20). First and foremost, the strategy aims to ensure that all the regulatory requirements are taken into consideration, specifically in terms of how each facility is applying the provisions on volume containment in these flood expansion areas.



In an effort to bolster the future network's resilience, in some cases the strategy sets higher objectives than regulations require. The plans include:

- Designing facilities that can withstand floods reaching higher levels than the 1910 baseline
- Using high-performance removable protection devices that can be quickly set up if a flood is forecast during the operating phase
- Applying building techniques that factor in flood risks by determining the flood level in the construction phase and planning the appropriate control scenarios

It should be noted that from a **resilience perspective** – and in support of the PPRI that agrees to these exceptions – the flood strategy may lead to adapting some of the stations to create inter-modal connections with river transit.

In an effort to bolster the future network's resilience, the strategy sets higher objectives than regulations require.

With regards to rainwater management, provisions have been established for each worksite to collect, store, and dispose of it at adapted flow levels. These measures contribute to limiting network obstructions and urban run-off. Moreover, all of the companies involved in the building phase are required to implement a flood warning and control procedure that is primarily based on monitoring flood risks, evacuating rubble/equipment/ machinery depending on the alert level, installing protective apparatus around sensitive work areas, and quickly closing them when necessary. The 2019 flood did not shut down worksites, but it did result in implementing surveillance and security programmes for the construction zones.

THE SOCIÉTÉ DU GRAND PARIS FLOOD STRATEGY

IN THE CONSTRUCTION PHASE

A flood forecasting and crisis management procedure has been established, as have processes that maintain the integrity of excavations and facilities so work can quickly recommence as soon as flood waters recede.


IN THE OPERATING PHASE

Three flood water levels have been set to ensure the works are protected in the operating phase, and subsequently secure train circulation and infrastructure resilience.

– **"Flood protection" level** for which the structures are permanently planned and adapted, and the preferred protection solution is to elevate them.

– **"Exceptional flood protection" level** where the object is to protect structures from water infiltration during an R1.15 water level rise, which is calculated by multiplying the speed of the 1910 water flows that the French government estimates will occur every 500 years. This is done with protective measures that are adjusted based on the type of structure and the local environment. Permanent structures are engineered and sized to be fitted with temporary equipment and withstand the stress (civil and hydraulic engineering), and include storage areas for the temporary apparatus.

– **"Minimum operating flood limit" level** over which the transit infrastructure operates at a deficit with partial service provided when the risk is considered too high to people and property.

 **Watch this video to learn more about how water is controlled and read actual examples of the measures in place.**



DROUGHT-RELATED RISKS

The risks of the surface clay soil contracting and expanding as a result of potentially more frequent severe droughts that cause compaction or swelling which affects buildings with shallow foundations. These hazards have been studied, and the Grand Paris Express does not show any vulnerability to this risk.

TEMPERATURE CHANGE-RELATED RISKS

The infrastructures and rolling stock are designed and selected to ensure the network continues operations under stressful climate conditions, for example during times of heavy snow or high temperatures. To reduce the negative heat island effects in a dense urban area, each station is adapted as best as possible to its immediate environment. These installations are also designed for “heat comfort” to remain at a comfortable temperature for users, even during extremely hot or cold periods.

Risks assessed in a comprehensive study of the physical vulnerability of structures in terms of climate scenarios

Société du Grand Paris hired climate strategy consulting firm Carbone 4 to research the sensitivity of components likely to be impacted by the list of the most probable climate hazards, and to map the most affected sections of the Grand Paris Express. To this end, Carbone 4 pinpointed the risks by mapping out the hazards at the macro level based on the climate scenario analysis.

The scope of the study included the network's above-ground sections (e.g. rails, electrical supply, concrete and metal structures), the network's underground sections, and the passenger areas (elevated and underground stations).

The study accounted for five major climate trends (temperature, fire, precipitation, humidity, and strong winds) from 15 related hazard indicators.



Temperature
(average temperature increase, extreme temperatures, heat waves, etc.)



Precipitation
(drought, flood, snow, etc.)



Fire



Humidity



Wind

The study was based on forecasts taken from the Drias portal using the RCP 8.5 scenario in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) for 2055 and 2085. The climate data are from the set of Euro-CORDEX models (including CNRM, IPSL and other climate centre models).

The study aims to prove that the Grand Paris Express is resilient and can continue operating under the future climate conditions that are currently being predicted. Over their lifetime, the Grand Paris Express structures will theoretically experience few direct effects overall, particularly from gradual temperature increases. However, the elevated sections of the Grand Paris Express transit system will be more susceptible to extreme climate events (Lines 17 and 18, and ground-level structures) in terms of heat waves and brush fires. While they will withstand these increasingly frequent or more extreme events, the quality of the service during these periods may not necessarily be upheld in those areas – but the rest of the network will not be impacted.

FLOOD RISKS FOR UNDERGROUND STRUCTURES

Climate change will not affect the tunnels and underground structures located 20-40 metres below the surface. The fact that 90% of the Grand Paris Express is built underground is an advantage, but makes it quite vulnerable to flooding and sudden groundwater surges.

The study aims to prove that the Grand Paris Express is resilient and can continue operating under the future climate conditions that are currently being predicted.

Consequently, protective equipment for the structures has been deployed, plus they have been resized as needed and elevated.



Since the infrastructure crosses flood-prone areas, the stations and security structures are installed in high-risk zones and require special accommodations in their design and operation. If, according to the models, the exposure to risks associated with heavy precipitation and flooding is gradually evolving, the higher frequency of these events, with potentially significant consequences, cannot be ruled out. The objectives of the Société du Grand Paris's flood control strategy, which are included in each line's works contracts, exceed the regulatory requirements. At the French government's request, Société du Grand Paris issues an annual compliance report on these provisions.

Consequently, protective equipment for the structures has been deployed with the necessary resizing and elevation where required. These measures are

integrated at every project phase, mainly for the purpose of hydraulic flow transparency during flood periods, flood volume compensation and flood-resistant material use.

THE RISKS OF HIGH HEAT AND BRUSH FIRES FOR ABOVE-GROUND STRUCTURES

These potential climate change effects will likely most impact the overhead surface-level structures on Lines 17 and 18, as well as the above-ground parts of stations and utility structures, overpasses, embankments, open trenches, and buildings, and more generally maintenance facilities and storage depots.

In compliance with building codes, current standards, and other specifications such as Eurocodes, climate conditions were factored into the Grand

Temperature spikes and heat waves may affect components in the Grand Paris Express network by warping concrete, rails, and roads.

Paris Express infrastructure's design and building phases, so events like rising temperatures have a minimal direct impact on the underground structures. As for the transit system and the above-ground sections of the Grand Paris Express (third rail, electrical supply, and surface structures), this will be more vulnerable to extreme temperatures and, to a lesser degree, brush fires.



Temperature spikes and heat waves

may affect components in the Grand Paris Express network. The concrete path in the above-ground area resists the stress of rail expansion, and there is no risk of warping. The overhead contact system programme accounts for a wide ambient temperature range for the system's size (-25°C < T < 50°C).

The rise in average temperature plus the gradual decline in sub-zero days and snow events are advantageous for the metal parts, the durability of the road materials, and the operating systems for the Grand Paris Express lines, thereby making metro traffic reliable.



Brush fires (and forest fires in the outer suburbs) will become more frequent because the extreme temperatures and lack of rain will further dry out vegetation. As a consequence, the vegetation around the exterior tracks

must be controlled by clearing brush, monitoring track-side zones, and limiting new plantings in the vicinity. This aspect takes on even more urgency for Line 18's elevated sections and on the ground in wooded areas to keep traffic safe and ensure that personnel and emergency crews have access provision.

RISKS OF HEAT AND HEAVY PRECIPITATION ON USERS AND PASSENGER ROUTES

Weather conditions such as high and extreme temperatures (heat waves) may also affect the comfort of users, passengers, and station employees. Passenger comfort is provided on trains and in the stations by controlling temperatures based on a number of temperature thresholds. The air-conditioning systems inside the trains are designed to adjust the temperature

Since the Grand Paris Express is fully automated and undergoes routine maintenance to prevent any wear, safety and traffic levels are guaranteed and barely impacted by the weather.

down by 7°C when it reaches 35°C. If it exceeds this temperature, the temperature will maintain a steady interval from the outside temperature to prevent a heat transfer loop.

With regards to the stations, the solar filters on the exterior walls, insulating green rooftops, and low thermal flooring materials will also help ensure user comfort and consume less energy which, for example, will cut down the use of air

The operator could use extra vigilance during such climate-related events to ensure that passenger routes remain comfortable and services continue.

conditioning and heating systems. Technical facilities are also air conditioned to keep computer systems in proper working order.

Since the Grand Paris Express is fully automated and undergoes routine maintenance to prevent any wear, safety and traffic levels are guaranteed and barely impacted by the weather.



Accessibility to the stations and inter-modal hubs may become difficult during extreme climate events, such as heavy snow. Although these events will become even rarer in Île-de-France, these conditions may hinder user accessibility to the network and services. At the operator's discretion, in addition to the planned equipment and design elements, it could use extra vigilance during such climate-related events to ensure that passenger routes remain comfortable and services continue.

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Activities to secure financing are ongoing

Since the Grand Paris Express project began seeking funding, Société du Grand Paris has been able to raise €25 billion in investments, including €22.5 billion under its 100% green EMTN programme.

Since the Grand Paris Express project began seeking funding, Société du Grand Paris has been able to raise €25 billion in investments, including €22.5 billion under its 100% green EMTN programme. This financing is 70% of the total €35 billion debt ceiling needed to fund the project. There have been 18 bond issues over three years (four issues in 2021). Once again this year, all of its bonds issued under the EMTN programme comply with the 2018 Green Bond Principles and are certified by the Climate Bond Initiative.

Société du Grand Paris consolidated its project fundraising strategy through pre-financing. Backed by its sound funding model, solid reputation, Aa2 Moody's rating and AA Fitch rating, as well as investor trust, in 2021 Société du Grand Paris was able to issue €6.5 billion in debt under its 100% EMTN programme towards future needs.

– **April 2021:** €2 billion issue of 25-year maturity bonds (2046) with the tightest new issue concession for Société du Grand Paris,

– **August 2021:** €1.5 billion issue of 15-year maturity (2036),

– **November 2021:** issue of a double tranche at 10 and 30 years for €1.25 billion and €1.75 billion, respectively.

Société du Grand Paris also received backing through bilateral financing from the European Investment Bank, enabling it to diversify its funding and respond to its requirements. €1.5 billion of the construction costs for Line 15 South came from two drawdowns of two amortising loans. A total of €8 billion in financing was raised in 2021.

The initiatives undertaken secured Société du Grand Paris's position as a major player in green finance and showcased its vital role in transforming the greater Paris area. It thereby confirms its commitments to control funding by issuing bonds at a faster pace while financing conditions remain favourable.

In 2021, Société du Grand Paris expanded its Green Euro Medium Term Note programme from €20 billion to €30 billion which further encouraged it to keep the funding policy on course and secure its debt. Once again, it fulfilled its commitments to exclusively use the proceeds of its 100% green EMTN funding programme for the Grand Paris Express, and to regularly update

investors on the project's progress and environmental benefits.

As a player in the green finance sector, **Société du Grand Paris must follow best market practices.** To this end, it complies with the GBPs (2018 Green Bond Principles) and has its bond issues certified by the CBI (Climate Bond Initiative) via Sustainalytics. Once again this year, Société du Grand Paris has

maintained its commitment to Finance for Tomorrow¹ and the Corporate Forum on Sustainable Finance².

Société du Grand Paris continues to further the growth of green finance by contributing to the dialogue and think tanks. It is also still a benchmark player heavily involved in events on regional planning, transit expansion, and urban development.

		
		
<p>2020 Green Bond of the year, supranational, sub-sovereign and agency (SSA) by Environmental Finance SGP EUR 1bn 1.70% 30 years</p>	<p>2020 and 2021 Largest Certified Climate Bond & Largest Subnational Green Bond by the Climate Bonds Initiative</p>	<p>2020 Euro rising star Issuer by MTN-i</p>

1. Finance for Tomorrow is an initiative set up by Paris financial market players to promote sustainable finance in France and around the world. It helps redirect financial flows towards the inclusive, low-carbon economy in line with the Paris Agreement and the UN SDGs (Sustainable Development Goals).

2. One year on from the Paris Green Bond Pledge, which was one of the key achievements of the 2017 Climate Finance Day, Ørsted, RATP, SNCF Réseau, Société du Grand Paris, SSE, Tennet, Terna, Tideway, and Vasakronan came together to form the Corporate Forum on Sustainable Finance, also known as "the Forum".

The Forum aims to create a permanent network to encourage businesses to share their opinions and ideas. It brings together green bond issuers, who are committed to advocating and growing the market for sustainable finance, helping to effectively combat climate change and promote a sustainable and responsible society.

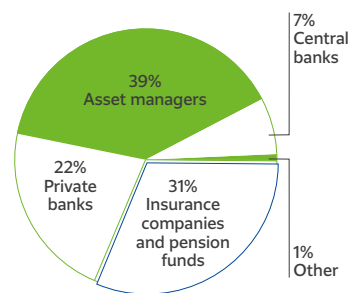
These transactions have helped finance eligible projects that meet the criteria set out in the framework. All the bonds issued by Société du Grand Paris qualified as Green Bonds.

Transactions in 2021

Transaction summary				
Issuer	Société du Grand Paris			
Rating	Aa2 (Moody's) and AA (Fitch)			
Date	29 April 2021	24 August 2021	16 November 2021	16 November 2021
Maturity date	10 May 2046	2 September 2036	25 November 2031	26 November 2051
Amount in bn €	2	1.5	1.75	1.25
Coupon	0.875	0.3	0.3	1
Issue spread	OAT+20	OAT+21	OAT+23	OAT+23

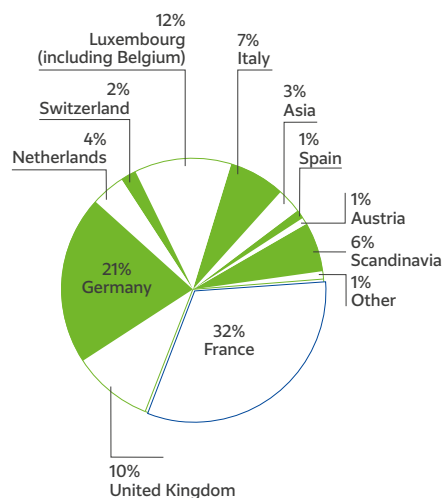
Type of investors and geographical distribution for all bond issues

Investors by type



Over 460 investors

Geographical distribution



Investments directed solely to the project

A major transport infrastructure project like the Grand Paris Express will have an impact on both the environment and the economy and must be built on solid management principles.

The bonds issued by Société du Grand Paris as part of its 100% green EMTN programme require it to demonstrate the environmental impact of the Grand Paris Express, in addition to providing a report to investors on how funds are allocated to the completion of the new metro lines.

Principles of the programme

High-quality transport and major infrastructure drive economic growth. A major transport infrastructure project such as the Grand Paris Express doesn't just transform mobility, it also changes urban development and the structure of the city itself.

The economic impact of the Grand Paris Express is, in fact, one of the purposes of the Greater Paris Act for major transport infrastructures. By virtue of its population and business activities, the Île-de-France region is already the top contributor to French GDP. The Grand Paris Express will further boost its growth.

Société du Grand Paris' programme is also aligned with the Green Bond Principles developed by ICMA¹ in 2018:

– The Société du Grand Paris Green Bond Framework is also fully in line with the work that the European Commission has been carrying out since 2018 with the TEG (Technical Expert Group) and the latest developments on the EU Green Bond Standard that the European Union plans to implement. As such, the framework is eligible for the Taxonomy proposed by the TEG² and adopted by the European Union, as well as the DNSH³ (Do No Significant Harm) criteria. In March 2021, the Société du Grand Paris framework was updated. The different versions of the Green Bond Framework are available on the Société du Grand Paris website.

– The first Second Opinion, issued by Sustainalytics in 2018, confirmed this alignment with the GBPs. The latest version of the framework gave rise to an updated Second Opinion, issued by Sustainalytics in 2021. The different versions of these Second Party Opinions (SPOs) are available on the Société du Grand Paris website.

Société du Grand Paris has complied with the principles established by the Climate Bond Initiative (CBI) as well as those in the Low Carbon Transport Eligibility Criteria appendix (V1.0)⁴. Sustainalytics is tasked with ensuring compliance with the principles on behalf of the CBI. The 2020 version of the certification issued by Sustainalytics is available on the Société du Grand Paris website.

The 2021 version of the (Green Bond Framework) is available on the Société du Grand Paris website, together with all the financial publications.

<https://www.societedugrandparis.fr/investir>

PROJECTS RECEIVING INVESTMENT

The Green EMTN programme is dedicated exclusively to financing the Grand Paris Express.

The net proceeds of the green bond issues are **allocated to investments made by Société du Grand Paris as part of the Grand Paris Express project**, representing the “eligible assets”. These assets include all investments made in the current year and/or over the two years prior to the issue.

All infrastructure and project management investments for the new Grand Paris Express automated metro lines are eligible:

– the construction of new lines and extensions: close to 200 km of new automated metro lines in addition to the existing 200 km in Île-de-France;

– the construction and development of 68 new stations and six operating centres.

1. ICMA: International Capital Market Association.

2. https://ec.europa.eu/info/publications/sustainable-finance-technical-expert-group_en.

3. DNSH: Do no significant harm to the environment

4. The Low Carbon Transportation appendix is available on the Climate Bond Initiative website.

DETAILS OF ELIGIBLE ASSETS

LINE 15 WEST

- 11 stations**, 10 with connections to the RER, metro, or tram system
- 22.4 km** of automated metro lines
- 14 municipalities** served across 2 departments
- 600,000 passenger trips** per day forecast

LINE 15 SOUTH

- 16 stations**, all with connections to the RER, metro, or tram system
- 37 km** of automated metro lines
- 22 municipalities** served across 4 departments
- 300,000 passenger trips** per day forecast

LINE 15 EAST

- 12 stations**, all with connections to the RER, metro, or tram system
- 23 km** of underground lines
- 13 municipalities** served across 2 departments
- 300,000 passenger trips** per day forecast
- 675,000 local residents** served

BY 2030, LINE 15 WILL FORM A 75-KM RING AROUND PARIS.

LINE 18

- 10 stations**, 3 with connections to the RER, metro, or tram system
- 35 km of automated metro lines** including 14 km of elevated lines
- 13 municipalities** served across 3 departments
- 150,000 passenger trips** per day forecast

LINE 14 SOUTH

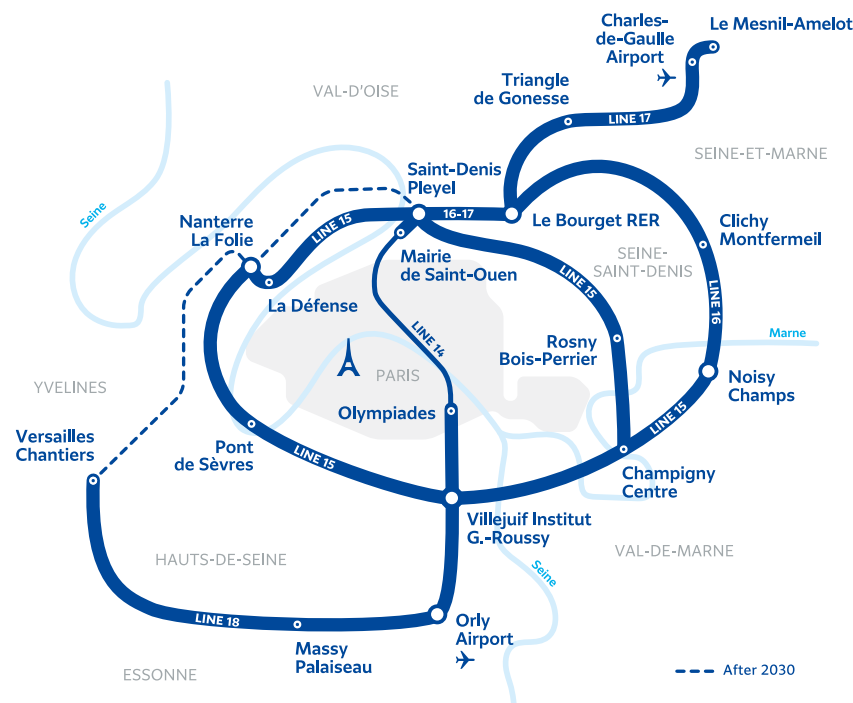
- 7 stations**, 5 with connections to the RER, metro, or tram system
- 14 km** of automated metro lines
- 13 municipalities** served across 3 departments
- 300,000 passenger trips** per day forecast

LINE 17

- 9 stations**, 5 with connections to the RER, metro, or tram system
- 27 km** of automated metro lines, including 5.5 km of elevated lines
- 13 municipalities** served across 3 departments
- 130,000 to 160,000 passenger trips** per day forecast during trade shows
- 40 to 50 million passenger trips** forecast annually

LINE 16

- 10 stations**, 8 with connections to the RER, metro, or tram system
- 29 km** of automated metro lines
- 16 municipalities** served across 3 departments
- 200,000 passenger trips** per day forecast



2021 allocation

As from 31 December 2021, the allocation capacity is €16.8 billion and breaks down as follows:

- Unallocated balance from previous years, or €8.8 billion (A).
- Net 2021 issues from the 100% green EMTN programme, or €6.4 billion and funds raised from the BEI, or €1.5 billion (B).

In €	
Unallocated balance on 31 December 2021 (A)	8,852,986,854
Total raised in 2022 (B)	7,926,999,500
2021 total to allocate (C)	16,779,986,354

For 2021, the scope of eligible assets is €3.6 billion (D).

Updating the framework in March 2021 made it possible to expand the type of eligible expenditures while maintaining the same asset scope. Expenditures are now shown as distributable for eligible assets or otherwise. This expansion enables the funding of expenditures such as wages, financial fees, and ancillary costs, as well as impact studies, audits, and consulting services that directly and indirectly support the Grand Paris Express, the eligible asset. A three-year retroactive clause was applied in accordance with the commitment taken in the framework and approved by the Second Opinion issued by Sustainalytics.

The table below details the 2021 allocation based on eligible investments and adjustments for the new eligible asset scopes in compliance with the updated framework.

2019-2020 ADJUSTMENT + 2021 in €				
	Wages	Operation	Investment	Total 2021 allocation
Non-distributable expenditures	199,534,401	297,036,405	76,463,044	573,033,851
Distributable expenditures		386,687,482	2,600,046,161	2,986,733,643
Pont de Sèvres/Noisy-Champs (Line 15 South)		114,470,868	900,897,170	1,015,368,038
Noisy-Champs/Le Bourget RER/ Saint-Denis Pleyel/Mairie de Saint-Ouen (Lines 14 North, 16 and 17)		39,756,569	687,820,859	727,577,428
Pont de Sèvres/Saint-Denis Pleyel (Line 15 West)		28,653,277	17,574,891	46,228,168
Saint-Denis Pleyel/Champigny (Line 15 East)		11,537,981	18,932,323	30,470,304
Le Bourget/Le Mesnil-Amelot (Line 17 North)		3,538,791	111,157,829	114,696,620
Orly/Versailles (Line 18)		9,338,405	297,752,793	307,091,199
Land management		108,722,143	114,158,038	222,880,181
Olympiades/Orly (Line 14 South)		70,669,447	451,752,259	522,421,706
TOTAL	199,534,401	683,723,887	2,676,509,205	3,559,767,494 (D)

At the end of 2021, the total unallocated amount was €13.2 billion (E). This sum remains set aside for allocation and is prioritised for allocation in 2022 and beyond.

It is the difference between the allocation capacity on 31 December 2021 (€16.7 billion) less the 2021 allocated scope (€3.6 billion).

The remainder that has been allocated breaks down as follows:

- €484 million (F) prioritised for assignment to the Line 15 South eligible asset in accordance with bilateral contracts with the European Investment Bank (€1.5 billion raised with the BEI).
- €12.7 billion (G) for the rest of the eligible asset scope.

In €	
2021 allocation (D)	3,559,767,494
Remainder to be allocated 2022 (E = C - D)	13,220,218,860
Remainder to be allocated BEI 2022 (F)	484,631,962
Remainder to be allocated 2022 (G) = (A) + (B) - (C) - (D) - (F)	12,735,586,898

100% of investments and expenditures were made in France, specifically in the Île-de-France region.

100% of the funds raised in 2020 and 2021 are or will be allocated to finance eligible assets. This exclusively represents financing (no refinancing whatsoever).

Fund management policy

Société du Grand Paris, which is subject to the French rules on public sector budget and accounts management (GBCP), can only temporarily invest the value in euros of the proceeds from its Green Bond issues in the Treasury account before such funds must be allocated definitively. On 31 December 2021, the cash flow balance in the Treasury account was €14.862 million (includes the 2021 unallocated amount: €13.220 million).

Grant Thornton assurance report

The allocation of funds to eligible projects is certified by the Statutory Auditor, Grant Thornton.

AN EXTRACT OF THE GRANT THORNTON ASSURANCE REPORT APPEARS BELOW. THE FULL REPORT IS AVAILABLE ON THE SOCIÉTÉ DU GRAND PARIS WEBSITE

Responsibility of the Statutory Auditor

Our responsibility is to provide a reasoned opinion on the basis of our work presenting a conclusion of moderate assurance on:

- Whether the projects included in the report comply, in all material aspects, with the eligibility criteria set out by the Company in the framework
- The correct allocation of the proceeds of the Green Bond issues and the amounts allocated to each project
- Whether the temporary investment of the proceeds of the Green Bond issues is compliant
- Whether the techniques applied by Société du Grand Paris to determine the performance and impact indicators comply, in all material aspects, with the methodology laid out in the framework.

However, we are not in a position to express opinions on:

The project eligibility criteria approved in the Second Party Opinion issued by *Sustainalytics*; the use of funds allocated to eligible projects subsequent to their allocation; how eligible projects impact efforts to reduce greenhouse gas emissions.

Conclusion

Based on the work performed, nothing material has come to our attention that causes us to believe that the information* published in the 2021 Green Bond Report is subjective or in violation of the Framework.

*The information

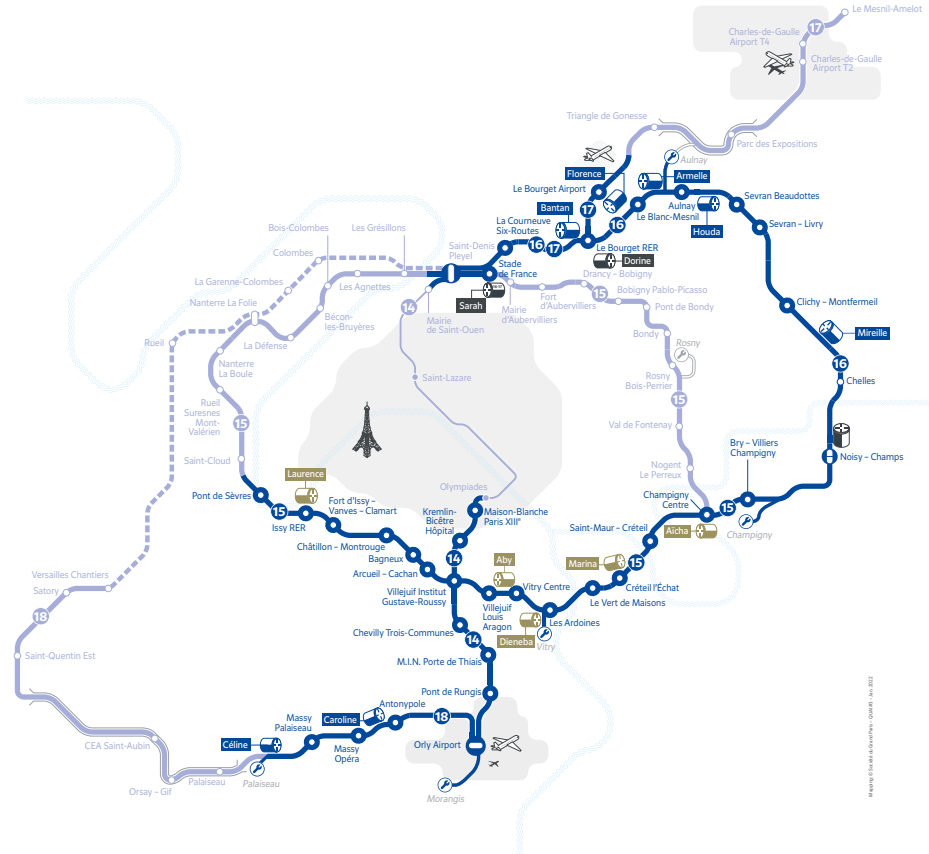
- List of eligible assets (page 32) - 2021 allocation (page 34) - Fund management policy (page 37) - Performance indicators: Percentage of local residents who agree with Société du Grand Paris's proposals, real estate projects awarded to developers, independent VSEs/SMEs that have worked on the worksites since the beginning of the project, total amount paid to independent VSEs/SMEs for the contracts in progress, hours of work completed by the long-term unemployed as of 31 December, rubble reuse, and restored surface offsets (page 41).

The Grand Paris Express at the half-way mark

The project has entered the industrialisation phase, with fast growth in the number of worksites and the arrival of the rolling stock.

2021 worksites

76 km of tunnels dug by the end of 2021



Data as at January 2022

- Tunneling machine: in operation
- Tunneling machine: onsite assembly
- Tunneling machine: scheduled for 2021
- Tunneling machine: dismantling
- Station in civil engineering phase
- Operations centre in civil engineering
- Civil engineering works
- Name of tunneling machine
- Grand Paris Express
- Commissioned post-2030
- Overhead section
- Grand Paris Express station
- Other station
- Operations Centre
- Connecting track
- Current Line 14

Feedback on the 2021 milestones

Since the Grand Paris Express project broke ground in 2016, new milestones have been reached every year towards the ultimate goal of opening for initial service in 2024, and to extend Lines 14 and 15 South. Below are a handful of milestones the project accomplished in 2021.

— **February 2021:** Dieneba, the last tunnel boring machine on Line 15 South, went into service,

— **April 2021:** tunnel borer Valérie completes spectacularly and connects Lines 15, 16 and 17 with Line 14 in Saint-Denis Pleyel,

— **May 2021:** the French Prime Minister tours Line 17 and confirms the Grand Paris Express will be fully completed,

— **June 2021:** work begins to lay out and equip the Saint-Denis Pleyel station,

— **July 2021:** contract is awarded for all trades to begin building Le Bourget Airport station as well as two adjacent service structures on Line 17,

— **July 2021:** Line 16's first tunnel borer, Inès, crosses the finish line at the Hugo facility in Le Blanc-Mesnil,

— **August 2021:** footbridge installed linking the Pont-de-Sèvres station on Line 15 South to La Seine Musicale,

— **September 2021:** Société du Grand Paris issues three more calls for expression of interest to reuse the soil excavated from the Grand Paris Express worksites,

— **September 2021:** Line 18's first tunnel borer, Céline, is christened at the Camille Claudel structure in Palaiseau,

— **September 2021:** tender call launched for the second design-build contract for the section and Line 15,

— **October 2021:** first lab tests conducted on the ultra-low carbon concrete voussoirs. They are installed a few months later on Line 18. At the same time, Société du Grand Paris steps up its environmental goals at worksites,

— **October 2021:** Île-de-France Mobilités and Société du Grand Paris choose Alstom to supply rolling stock for Line 18,

— **October 2021:** The Grand Paris Express's 35 worksites welcome 14,000 visitors for an open house day, and to KM9, which symbolically celebrates the beginning of construction work on line 18,

— **December 2021:** the tunnel for Line 15 South is completed! Now the tracks and all the railway equipment can be installed.

Impact and performance indicators

Performance indicators		Impact indicators	
The Grand Paris Express uses performance indicators to track project-related progress.			
Percentage of local residents who agree with Société du Grand Paris's proposals (individuals outside professional business activities)	85.9%	Ex-ante estimate of greenhouse gas reductions (tonnes of CO2 equivalent/year)	28 to 51 million tonnes by 2070
Budget allocated to hub studies	€6,150,000*	Millions of tonnes of earth excavated	23,371,132 since the beginning
Real estate projects awarded to developers	10 projects*		In 2021: 7,451,924
Independent VSEs/SMEs** that have worked on the worksites since the beginning of the project	3,577*	Spoil recycling	49.1%: since the beginning of the project
Total amount paid to independent VSEs/SMEs** for the contracts in progress	€1,577 M*		In 2021: 4,060,221 tonnes of materials reused*
Target amount contracted to date for independent VSEs/SMEs****	€1,903 M*	Restored surface offsets	In 2021: 16% of waste was transported all or part of the way to its final disposal site by river
Hours of work completed by the long-term unemployed as of 31 December	3,141,686.53 hours*		Forest offsetting: 16.74 hectares in 2021 40.91 hectares since the beginning of the project*
Hours of work earmarked for the long-term unemployed as of 31 December	3,184,198 hours*		Ecological offsetting: 21.57 hectares in 2021 39.47 hectares since the beginning of the project*

* Data verified by the statutory auditor.

** Independent VSEs/SMEs: Under 25% of the capital/voting rights held by a third party business, according to the definition of very small, small, and medium enterprises in Recommendation 2003/361/EC. The VSE/SME category is provided for information.

*** Now includes agreements made with social housing authorities in addition to individual agreements closed on 31/12/2021.

**** 36 contracts and 2 contracts ended.

Overall conclusions

Naturally, the challenges associated with the Grand Paris Express project have required Société Grand Paris to undertake a comprehensive, responsible, and innovative approach as a result of its environmental, social, and economic commitments.

The new metro will make life better and easier for millions of Île-de-France residents by providing them a lower carbon and more sustainable alternative. The regions and their biodiversity are also being taken into account as the project is being built. The Grand Paris Express project is a force that will transform the city and result in new more energy-efficient development projects near the stations.

These various aspects of the project have been mentioned in recent Green Bond Reports. With the 2021 Green Bond Report, Société du Grand Paris is once again proving its ability to overcome environmental challenges.

In 2021, a total of €3,560 million was allocated from a total debt estimated at €35 billion, or 10.2%.

Applying this percentage to the figures from the updated 2018 CarbOptimum® gives the following impact assessment*:

In millions of tonnes of CO ₂ equivalent	Timescale: 2070	
	Total	2021 share
Low	-27.4	-2.8
High	-51.3	-5.2

Developed by Stratec for Société du Grand Paris, the CarbOptimum® program makes it possible to quantify the Grand Paris Express's carbon footprint. Upgrading the software provided the option to reframe the carbon trajectory as follows:

By 2070, according to the forecasting scenario, the finding is positive: CO₂ emissions will be reduced by 27.4 M-51.3 M tonnes of CO₂ equivalent.

* Excluding refinancing.

CarbOptimum® Methodology

Société du Grand Paris has developed CarbOptimum®, a proprietary tool to assess the reduction in greenhouse gas emissions.

This life cycle carbon calculator takes into account five direct and indirect sources of emissions, which can be generated or prevented:

1. Studies and pre-construction works
2. Infrastructure construction
3. Infrastructure operations
4. Impact on mobility in the Paris region
5. Impact on regional development

CarbOptimum® uses a transparent methodology similar to those used by the Greenhouse Gas Protocol and Bilan Carbone®, which are recommended by ADEME (French environment and energy agency).

TO LEARN MORE

All the documentation on this Green Bond programme (*Green Bond Framework*, *Second-Party Opinion*, *Climate Bond Initiative Certification*, *Green Bond Investor Presentation*, etc.) is available on the Société du Grand Paris website on the "Finance Durable" (sustainable finance) page.

<https://www.societedugrandparis.fr/investir>

[Framework](#)

[Second opinion](#)

[CBI](#)

[Grant Thornton Assurance Report](#)

[Société du Grand Paris 2021 Activity Report](#)

[56th report of the National Transport Accounts Commission \(in French\)](#)

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The 2021 version of the Green Bond Framework is available on the Société du Grand Paris website, together with all the financial publications.
<https://www.societedugrandparis.fr/investir>

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