Green Bonds Annual Report 2018

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Letter from the Chairwoman

ADIF-Alta Velocidad continues to strengthen its strategy of commitment to sustainable development, protection of the environment and combat climate change.

Such commitment is based on the very reason d´être of the entity. Thus, it is widely known the greater **environmental efficiency of the railway transport** compared to the aviation and the road. This greater efficiency is particularly significant under the terms of energy consumption and greenhouse gas emissions.

Likewise, it is not possible to obtain the mentioned development of the network if the adequate measures are not adopted so that its design and construction minimize as much as possible the environmental impacts which arise from its implementation. In this sense, the objective lies in obtaining the maximum degree of environmental integration of the new lines, as well as in continuing deepening in the process of environmental integration during the maintenance operations when the new lines start coming into operation. These requirements are implemented in the projects developed by ADIF-Alta Velocidad, which in the year 2018 rose to a total investment volume of 1,310 million euros.

Based on the aforementioned, and on our alignment with the Sustainable Development Goals (SDG) approved by the United Nations in 2015, ADIF-Alta Velocidad has drawn its vision of sustainability in its **Strategic Plan** called "PLAN TRANSFORMA 2020".

In the same line, the last 22 January 2019, it was approved the **Master Plan to Combat Climate Change 2018-2030**, which has as main target the reduction of greenhouse gas emissions in the railway system and in the whole transport sector. This Master Plan answers the Framework Agreement to Combat Climate Change subscribed by ADIF and ADIF-Alta Velocidad with Renfe in March 2018.

On the other hand, in July 2018, ADIF-Alta Velocidad assigned the supply contract of **`green´ electric energy** or with guarantee of origin for the years 2019 and 2020, with the aim of ensuring that the totality of the electric supply for the railway system is performed with renewable energies.

Regarding our finance strategy, after having executed the first issue of green bonds in the year 2017 and in our intention of being configured as a reference issuer in the market of sustainable financing, ADIF-Alta Velocidad performed its **second issue of green bonds** in April 2018 under the frame of its "framework" designated as "dark green". The funds obtained in the same (whose 45% correspond to investors socially responsible) were aimed in their totality to the construction of high-speed lines as well as projects of energetic efficiency (reversible sub-stations).

Based on our criterion of transparency and on the commitments acquired in the mentioned "framework", it appears below the report regarding the green bonds issues corresponding to the year 2018, in which it is gathered the information regarding the mentioned green bonds issues, the investments performed with the funds obtained and the indicators of impacts foreseen, with disaggregated data for each one of the projects financed.

Our intention is to facilitate to our investors all that information that may be of interest, therefore we have decided to publish in addition a "newsletter" with financial information supplemented by relevant contents related to our commitment with the sustainable development.

INTRODUCTION

ADIF-Alta Velocidad is a state-owned public entity ("public business entity") with legal personality, management autonomy and own resources, which operates under the supervision of the Ministry of Development, being responsible of the construction and management of the high-speed railway network of Spain.

As a public service company, we understand that our responsibility before the society is to guide our strategy to improve the life of the people, and this implies facing different challenges which affect us all, both global and local. From the global point of view, such challenges are summarized in the objectives of sustainable development (ODS) formulated by the United Nations in 2015, particularly in those which are more relevant for our organization, answering to the contribution we can perform to the same according to our nature and activity.

Regarding the local challenges, the demands and expectations of our interest groups are summarized in that we must contribute to a safe, efficient and sustainable transport system.

From this point of view, ADIF-Alta Velocidad has a Strategic Plan for the next years which has as high-level model the ODS of the United Nations. Such Plan, called **PLAN TRANSFORMA 2020**, is based on three cornerstones: security, service and sustainability; likewise, it has three levers to speed up the process of transformation: the people, the digitalization and the innovation. These cornerstones and levers are displayed in 15 strategic objectives around which the whole organization if aligned.

In this strategic framework, ADIF-Alta Velocidad maintains a strong commitment with the SUSTAINABILITY, since the whole strategy is aligned with the Sustainable Development Goals of the United Nations, as well as contemplating in the Plan specific strategic objectives which seek to improve our impact in the society from an economic, social, environmental and of good governance of the organization point of view. Thus, for example, the Objective 3.2 of the Strategic Plan of ADIF-Alta Velocidad is to "contribute to a respectful transport with the environment and responsible in the use of resources". To reach it, initiatives have been designed to fight against the climate change, to add projects of circular economy, to apply criteria of ecologic purchase and to strengthen the system of environmental vigilance.

More specifically, regarding our contribution to the SDGs, **the construction and maintenance of High-Speed lines, including those to which the resources obtained with the emission of green bonds have been allocated**, have a positive impact in the following Objectives and Goals of Sustainable Development of the UN 2030 Agenda:

"Resilient infrastructures, inclusive and sustainable industrialization, innovation. **Goal 9.1: "Develop quality, reliable, sustainable and resilient infrastructures**, included regional and cross-border infrastructures, to support the economic development and human well-being, supporting in particular the affordable and equitable access for everyone". The high-speed railway lines are built with the highest standards of quality to ensure its resilience and reliability; in addition, it is applied for their construction and maintenance strict criteria of sustainability and respect to the environment, establishing environmental vigilance measures which ensure the preservation of the natural, cultural and archeological heritage.

"Sustainable cities and communities". **Goal 11.a: "To support the economic, social and environmental positive links between the urban, peri-urban and rural areas strengthening the planification of the national and regional development".** The high-speed railway lines improve substantially, in a planned manner, the connection between the urban, peri-urban and rural areas, facilitating the generation of economic and social links, generating with it opportunities of growth and well-being.

"Combat climate change and its impacts"**. Goal 13.2: "Add measures related to the climate change in the policies, strategies and national plans".** The development of the high-speed network will lead to significant quantities of traffic of the transport by road and of the air transport transferring to the railway, being this one the mode of transport which generates less CO_2 emissions and other greenhouse gases, thus fighting the climate change through a better contribution of the transport sector to the fight against this phenomenon.

As a following step within this strategic approach, ADIF-Alta Velocidad has approved the **MASTER PLAN TO COMBAT CLIMATE CHANGE 2018-2030**, which has as main target the reduction of greenhouse gas emissions in the railway system and in the whole transport sector.

This Master Plan, elaborated jointly with Renfe, answers the Framework Agreement to Combat Climate Change subscribed by ADIF and ADIF-Alta Velocidad with such entity in March 2018, where the general action lines were drawn and it was established the need to perform them through a Master Plan.

The Plan is based on the environmental advantage of the railway regarding other transport means, enhancing the main character that the railway must perform within the transport sector to be able to reach the objectives that both at international, European and national level, have been established regarding the fight against the climate change.

In this sense, the Plan seeks to diminish the emissions in the whole national transport through the capture of traffic by the development and improvement of the railway network. Particularly, the reduction of emissions accumulated up to 2030 due to the modal shift is estimated in more than 8 million tons of CO_2. Likewise, the Plan contains a series of measures of energetic efficiency and decarbonization applied to the railway system as a whole and focused to achieve an accumulated reduction of the energetic consumption in around 5,300 GW/h until 2030. These measures will entail, similarly, a reduction of accumulated emissions in a million and a half tons of CO_2 in the same period. The Plan also envisages among its actions the purchase of green electric energy (with certificates of Guarantee of Origin), which will enable the reduction of accumulated emissions in more than 7 million tons of CO_2 from now to 2030.

Based on the aforementioned, the Plan Director is structured in four strategic lines:

Thus, the Master Plan is framed in the forementioned Goals of Sustainable Development of the United Nations, particularly number 13. Likewise, it is aligned with the European policies and its objectives to 2030 and 2050, established to be able to comply with the target of the Agreement of Paris, which consists in preventing that the increase of global average temperature of the planet exceeds 2 °C, compared to the preindustrial levels.

Based on the policies forementioned, it has been performed, among others, the following noteworthy actions:

ELECTRIC SUPPLY WITH RENEWABLE ENERGIES

In July 2018, ADIF-Alta Velocidad assigned the contract of supply of `green´ electric energy or with guarantee of origin for the years 2019 and 2020, in tele-measured points.

The estimated consumption for the years 2019 and 2020 is 5,982,177 MWh (megawatt-hour)

The objective is to ensure that the totality of the electric supply for the railway system is performed with renewable energies and to fulfill the objectives of economic, environmental and social sustainability.

ADIF-Alta Velocidad, as one of the main agents in Spain of the market of electric energy of high voltage, guarantees the transparency and equity with the bidding companies, supporting the global efficiency of the market of the Spanish energy and the maximum social and environmental profitability of the Spanish railway system.

In this sense, it has to be pointed out that ADIF-Alta Velocidad is the first Spanish public business entity in adding to its biddings of electric supply criteria of provision of origin exclusively `green´, according to its policy of maximum social and environmental respect.

Based on such commitment of sustainability, all the energy supplied will be `green´ energy or with guarantee of origin (GdO) and in accordance as well with the commitment of energetic efficiency and responsible environmental management.

In addition, the bidding envisages the possibility of postponing, of common agreement and under the same conditions, the contracts for the supply of electric energy for the year 2021.

LIFE ZERO IMPACT PROJECT

The LIFE Zero Impact project (Development and demonstration of an anti-bird strike tubular screen for high speed rail lines) financed jointly by the program "LIFE" of the European Commission, in which ADIF-Alta Velocidad is involved, has as main objective the determination of measures of protection of the birdlife through anti-collision screens in high speed railway lines. This project is evaluating the efficiency of a new design of anti-collision screen, based on the concept of "exempt tubes screens". It involves increasing the knowledge about the interaction between the railway infrastructure and birdlife with the objective of introducing improvements of design that guarantee the preservation of biodiversity making thus compatible the infrastructures with the protection of the birds and reducing the impact of the existing and future high-speed lines.

Particularly, the LIFE Zero Impact project has the following objectives:

1. Develop a methodology for the determination of the optimum measures of protection of the birdlife in new lines of high speed.
2. Show the efficiency of a new design of anti-collision screen for birds. This design is based on the concept of exempt tube screen (PTE).
3. Increase the knowledge about the interaction between the railway infrastructure and the birdlife, with the aim of introducing improvements of design which guarantee the biodiversity.
4. Reduce the impact of the existing and future high-speed lines, both in the area of the project and in the populations of birdlife established in protected areas.

In this project an anti-collision screen of birdlife has been implemented in a section of the Spanish railway network of high speed, to evaluate its efficiency and to reduce the environmental impact of this type of railway lines.

The works performed along the first stage of the project have allowed the achievement of the essential objective envisaged: the selection in the area of study of specific sections of high-speed lines adequate for the installation of the barrier exempt of posts, using to that end strictly biological criteria.

Once the section has been chosen to build the barrier, the project of construction was developed and the work executed, having initiated the work studies to check the efficiency of the screen in July 2018.

The results of the effects that the installation of the prototype has in the abundance, the cross-over frequency, the risk of collision and the mortality of birds in the areas of study, will be useful as experimental values for the evaluation of such efficacy compared with the results obtained in the previous studies.

For more information, you may check the Report of Sustainability, Environmental Memory and Management Report of ADIF-Alta Velocidad.

Framework

The “framework” gathers the five components included in the GBP

Use of proceeds
Eligible green projects
Selection process
Management of proceeds
Reporting

ADIF-Alta Velocidad established in **June 2017** a framework aligned with the Green Bonds Principles (GBP) of ICMA, with the aim of **guaranteeing the transparency, disclosure and integrity of its Green Bonds issues**. The mentioned “framework” is available on the ADIF-Alta Velocidad website.

ADIF-Alta Velocidad has fulfilled the commitments established in its “framework”.

The Second Opinion issued by CICERO, qualified as “DARK GREEN”, confirms compliance with ICMA Principles within the framework of ADIF-Alta Velocidad green bonds.

This Opinion is available on ADIF-Alta Velocidad website.

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USE OF PROCEEDS AND ELIGIBLE GREEN PROJECTS

The proceeds from the issuance of green bonds are assigned to the Eligible Green Projects, which include new projects and continuation of ongoing projects, with disbursements of up to 2 years before the bonds are issued and up to 24 months from the date of such bonds issue. In particular, its destination includes two categories:

a. Investments related to new high-speed rail lines and extensions of existing high-speed lines.
b. Investments related to maintenance, upgrade and energy efficiency of the high-speed rail lines.

SELECTION PROCESS

100% of the funds obtained from the inaugural green bond issue made on 28 June 2017 has been allocated to category a) of the Eligible Green Projects mentioned in the previous paragraph.

On the other hand, the funds obtained with the second green bond issue, made on 23 April 2018, has been allocated in a 99.78% to projects of category a) and in a 0.22% to projects of category b).

In particular, the funds have been allocated to the projects below

PROJECTS OF CATEGORY A

- Madrid-Levante High Speed Line.
- Antequera-Granada High Speed Line.
- Valladolid-Burgos-Vitoria High Speed Line.
- Madrid-Extremadura High Speed Line.
- Madrid-Galicia High Speed Line: Olmedo-Lubián-Orense-Santiago Strech.
- High Speed Atlantic Axis: Santiago de Compostela-Vigo stretch.

PROJECTS OF CATEGORY B

- Reversible Substations.

PROJECTS OF CATEGORY A

Madrid-Levante High Speed Line.

Nowadays it is in operation the high speed to Valencia and to Alicante.

During 2018, the expansion works from two to four tracks of the Madrid-South High-Speed Line have continued, as planned, between Madrid (Atocha) and Torrejón de Velasco, and the works inside the Atocha-Chamartín tunnel; and the test phase has continued, even continuing in 2019, which will enable the operation of the line.

Likewise, the works in the Monforte del Cid-Murcia and La Encina-Xátiva-Valencia sections continue.

The Monforte del Cid-Murcia section consists of 65 Kms. The execution of these works will allow the traffic of travelers in high speed until Murcia. At the end of July 2018, the provisional access track to Murcia has been put into operation, thus allowing to release, to a large extent, the current track of the work in operation and to continue with the burying of entry to Murcia. In addition, during 2018, the assembly works of track, civil protection, energy and security and maintenance installations. Finally, the works of execution of the phase I of the accesses to Murcia have continued, and the bidding of the actions corresponding to the phase II has been initiated (which includes the burying of the station).

The ongoing works in the La Encina-Xátiva-Valencia section will allow the traffic of travelers in high speed, maintaining a conventional network line through which the freight traffic will pass and of medium distance and commuter travelers.

Antequera-Granada High Speed Line.

It is foreseen that in the following months the actions in this line will conclude.

During the year 2018 the works of platform have finished, track assembly, catenary and installations, being in test phase of ERTMS N2.

The achievement of these works will allow the traffic of travelers in high speed from the Córdoba-Málaga line, in service, until Granada.

Valladolid-Burgos-Vitoria High Speed Line.

It is in service the section between Valladolid and Venta de Baños, under construction between Venta de Baños and Burgos and without works initiated between Burgos and Vitoria.

During 2018, between the stations of Valladolid and Venta de Baños (39.3 kms.), within the LAV Valladolid-León, the works have concluded, and such section is in service.

The infrastructure works have continued, track assembly, electrification and remote control, and security and communications installations, being almost concluded, with the exception of the Estépar-Variante de Burgos section. The conclusion of this section will entail the connection of Burgos in high speed for travelers.

Madrid-Extremadura High Speed Line.

In the year 2018, according to the foreseen program, the platform works continued of the works between Tayuela and Badajoz, included the connection branches in Plasencia, and the connection branches to the North and South of Cáceres, having initiated as well the works of drafting of the projects of platform adaptation between Tayuela and Plasencia. Thus, the platform between Plasencia and Cáceres has progressed much, being almost finished between Cáceres and Badajoz and remaining only the by-pass of Mérida.

During 2018, it has concluded as well the track assembly between Mérida-Badajoz, and it is almost finished the renewal of track Aljucén – El carrascalejo; being in phase of drafting the projects of renewal of track, adaptations and links between Monfragüe and Plasencia, and the renewal of accesses to the stations of Cáceres, Mérida, Aljucén and Badajoz; and in addition, the project of duplication of railway track between Cáceres and Mérida has been initiated.

Likewise, in this year 2018 the bidding of the contract of the electric substations of traction and transformation centers in the Plasencia Badajoz section has been initiated; areas of Cañaveral, Carmonitas and Sagrajas.

Regarding the installations, the execution of installations of civil protection and security in tunnels continue, having started the installation works of security and communications, and the GSMR between Plasencia and Badajoz.

The drafting of the projects of architectural actions in the stations of Cáceres, Mérida, Plasencia and Badajoz has concluded.

This line has been designed so that the traffic that circulates along the same is apt for travelers and freight.

Madrid-Galicia High Speed Line : Olmedo-Lubián-Orense-Santiago stretch.

The section between Olmedo and Zamora is in service, and the Zamora-Lubián and Lubián-Ourense sections are under construction.

The implementation by sections has been foreseen, being the following the one corresponding to Zamora-Puebla de Sanabria. The line has been designed for travelers' traffic.

Olmedo-Zamora: This section of 99 kms. has implemented the 17 December 2015 (as most representative elements of this section, stand out 20 viaducts which add a length of 4.66 kms.). During 2018, the remodeling works of the station of Zamora have concluded.

Zamora-Pedralba de la Pradería: With 110 kms. length, the route comprises five subsections, four of which are completely finished, being the most characteristic singular works: 7 tunnels (4.5 kms.) and 14 viaducts (4 kms.). During 2018, the platform works have concluded, with the exception of the Cernadilla-Pedralba section. The execution of the central sections has continued as well as the track assembly; it has continued the execution of the offices and premises aimed for the maintenance of the track; the works of the overhead contact and energy line have continued, security installations, fixed and mobile telecommunications, as well as those of civil protection and security, and finally, it can be highlighted that the actions in the substations of energy have concluded and the works of remote control of energy have been initiated.

Pedralba de la Pradería-Ourense: It consists of 22 subsections. The tunnels predominate in the layout, reaching a total length of 125 kms., against the 9.4 km of viaducts. During 2018 12 subsections have been finished; it has been requested a reception of another one of them, and in the remaining 9 subsections their execution has continued. Likewise, the bidding of the works of assembly of base mounts, track assembly, overhead contact line and associated systems, centers of self transformation and energy remote control, installations of protection and security in tunnels.

Taboadela-Ourense (14 Kms. along current corridor + 2 Kms. of connection branch): During 2018, the works of the branch of connection in Taboadela and the remodeling of the station of Ourense have started (adaptation of tracks and platforms); the contracts have been assigned of the third rail and infrastructure Taboadela-Ourense and the track gauge of Taboadela, track assembly in connection branch and remodeling of the station of Taboadela; the bidding of the contracts of supplementary actions Taboadela-Ourense has been initiated, and the installations of the overhead contact line and associated systems Pedralba-Taboadela-Ourense, and finally, the execution of the new high-speed station of Sanabria has initiated, in addition to having tendered the work of the station Puerta de Galicia.

High Speed Atlantic Axis: Santiago de Compostela-Vigo stretch.

This action is in service.

The investment performed corresponds mainly with the platform works and with the update of the signaling system. The line is apt for traffic of travelers and freight.

PROJECT INDICATORS OF CATEGORY A

The indicators analysed for each of the selected projects are summarized below:

	SAVINGS						
	External Costs (Thousand euro)	Time (Thousand hours)		Modal Transfer (Thousand travelers KM Transferred)		Tons of CO_2 (Tons)	
	30 years	30 years	Annual average	30 years	Annual average	30 years	Annual average
Madrid - Levante HSL	16,247,439	283,178	9,439	95,507,061	3,183,569	3,898,322	129,944
Antequera - Granada HSL	2,283,881	56,478	1,883	26,727,956	890,932	1,360,089	45,336
Valladolid - Burgos - Vitoria HSL	4,733,151	114,677	3,823	60,397,188	2,013,240	2,625,652	87,522
Madrid Extremadura HSL	4,832,143	123,826	4,128	46,031,797	1,534,393	4,270,103	142,337
Madrid-Galicia HSL Olmedo-Zamora-Ourense-Santiago de Compostela Strech	5,580,692	202,905	6,763	38,502,437	1,283,415	3,839,225	127,974
Madrid-Galicia HSL Santiago de Compostela-Vigo Strech	2,265,564	84,509	2,817	7,508,705	250,290	711,214	23,707
TOTAL	**35,942,870**	**865,573**	**28,853**	**274,675,144**	**9,155,839**	**16,704,605**	**556,820**

PROJECTS OF CATEGORY B

Reversible Substations.

Implementation in six substations of a recovery system of the energy coming from the regenerative braking of the trains. This system will allow the return of the braking energy to the network of distribution and the use of such energy for the functioning of railway installations.

Particularly, the authorised contract includes the works for the installation of a converter that recovers energy of the regenerative braking in the substations of **Alcorcón, Guarnizo, Olabeaga, Getafe, Martorell and Arenys de Mar**.

This system to recover the energy generated in the braking of the trains and not exploited by other circulations improves the energetic and environmental performance of the railway transport, reducing its energy needs and gaining in competitivity as sustainable transport system, at the same time that it helps reduce the emissions of CO_2 to the environment and, therefore, to the fight against the climate change.

MANAGEMENT OF PROCEEDS

Until the total allocation of the net amount of the issues made on 28 June 2017 and the 23 April 2018 to Eligible Green Projects, ADIF-Alta Velocidad has provisionally invested the unallocated funds in remunerated bank accounts.

The audit firm Grant Thornton, designed by ADIF-Alta Velocidad has verified the method of internal monitoring and the allocation of the funds to the Eligible Green Projects. **The reports of the auditors, are attached to this document**.

REPORTING

Up to the expiration date of the Green Bonds issued, ADIF-Alta Velocidad will publish each year on its website (http://www.adifaltavelocidad.es) the following information:

- Annual update of the funds intended for the Eligible Green Projects.
- Expected impact metrics.
- Annual report from auditors or of a third party who verifies the internal method of traceability and the allocation of funds to the Eligible Green Projects.

Issues

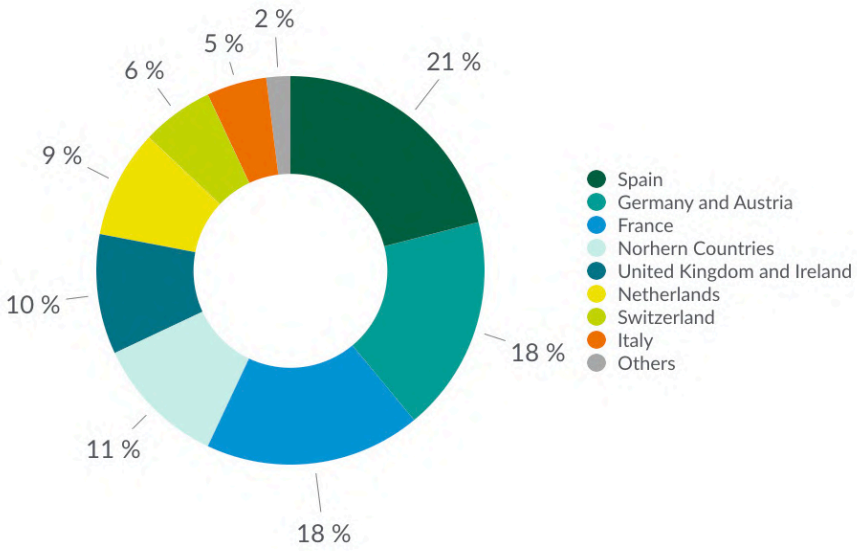
INAUGURAL ISSUE

The inaugural issue of ADIF-Alta Velocidad in format Green Bond was performed on 28 June 2017 amounting to 600 million euros.

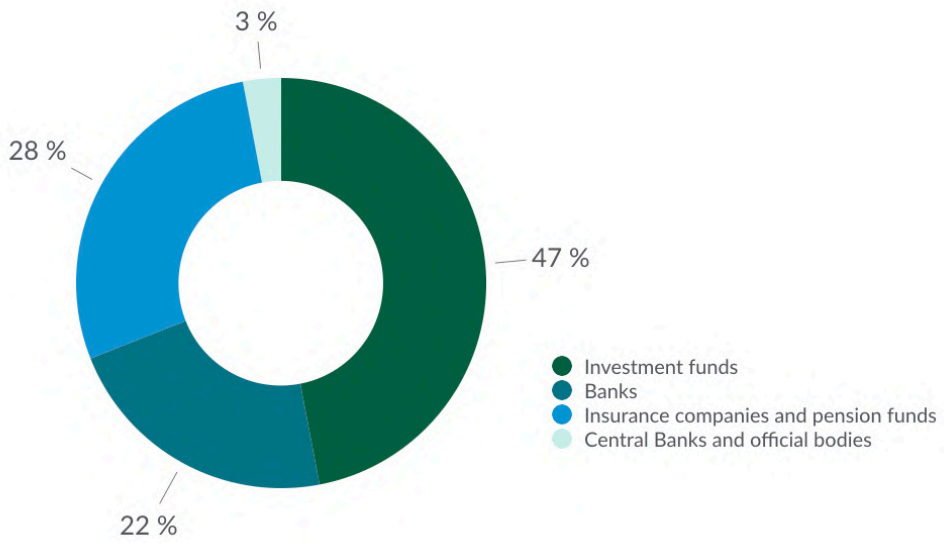
Issuer:	Adif Alta Velocidad
Volume:	600.000.000 EUR
Ratings (Moody's/Fitch):	Baa3/BBB+
Pricing Date:	28 June 2017
Disbursement date:	5 July 2017
Maturity:	5 July 2023
Ranking:	Senior Unsecured
Format:	Fixed type

Coupon:	0,80% annual, ACT/ACT
Benchmark:	Interpolated 6Y SPGB (SPGB 01/23 and SPGB 10/23) at 0.514%
Reoffer Spread:	+33 p.b.
Final profitability:	0,844%
Final price:	99,744%
Net amount:	597,864,000 EUR
Listing:	AIAF / English Law
Funds use:	Finance and/or refinance Eligible Green Projects

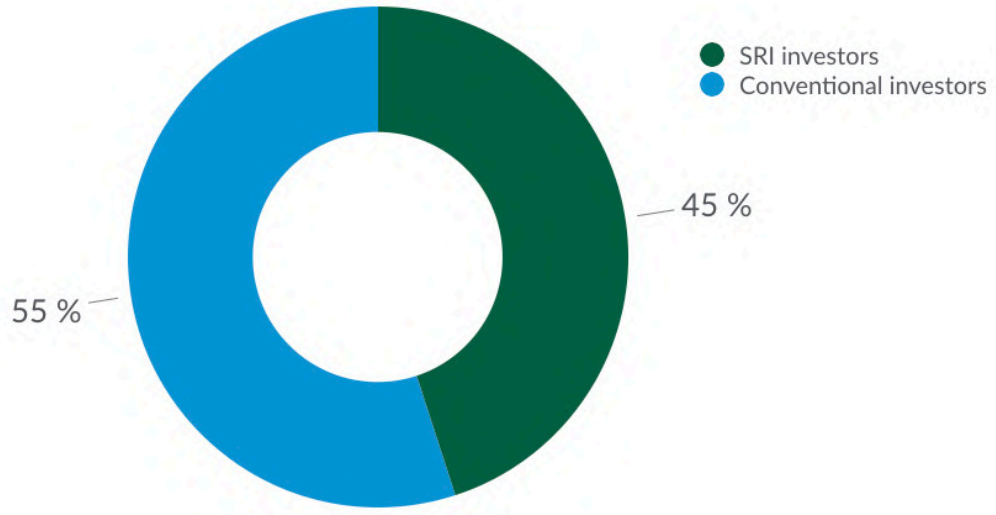
GEOGRAPHICAL DISTRIBUTION



INVESTOR CATEGORY



SRI INVESTORS VS CONVENTIONAL INVESTORS

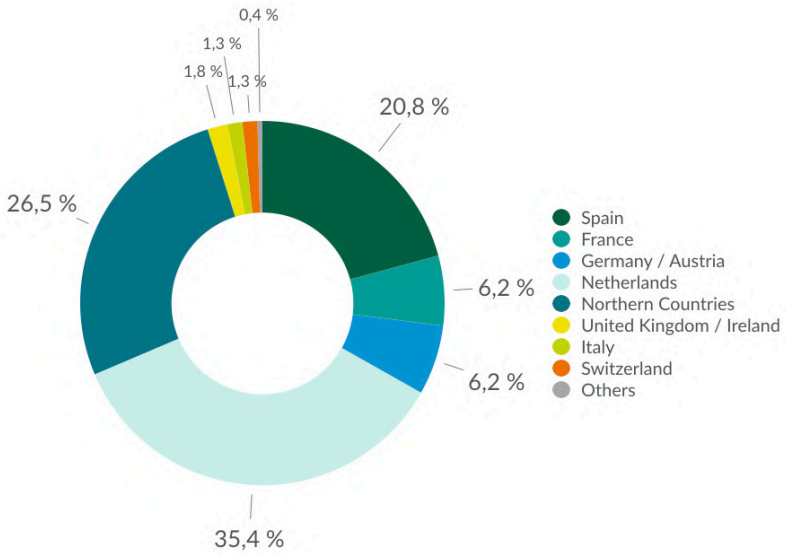


SECOND ISSUE

The second issue of ADIF-Alta Velocidad in format Green Bond was performed on 23 April 2018 amounting to 600 million euros.

- **Issuer:** Adif Alta Velocidad
- **Volume:** 600.000.000 EUR
- **Ratings (Moody's/Fitch):** Baa2/A-
- **Pricing Date:** 23 April 2018
- **Disbursement Date:** 4 May 2018
- **Maturity:** 4 May 2026
- **Ranking:** Senior Unsecured
- **Format:** Fixed type
- **Coupon:** 1,250% annual, ACT/ACT
- **Benchmark:** SPGB 04/26 a 1,95%
- **Reoffer Spread:** +34 p.b.
- **Final profitability:** 1,336%
- **Final price:** 99,352%
- **Net amount:** 595,212,000 EUR
- **Listing:** AIAF / English Law
- **Funds Use:** Finance and/or refinance Eligible Green Projects

GEOGRAPHICAL DISTRIBUTION



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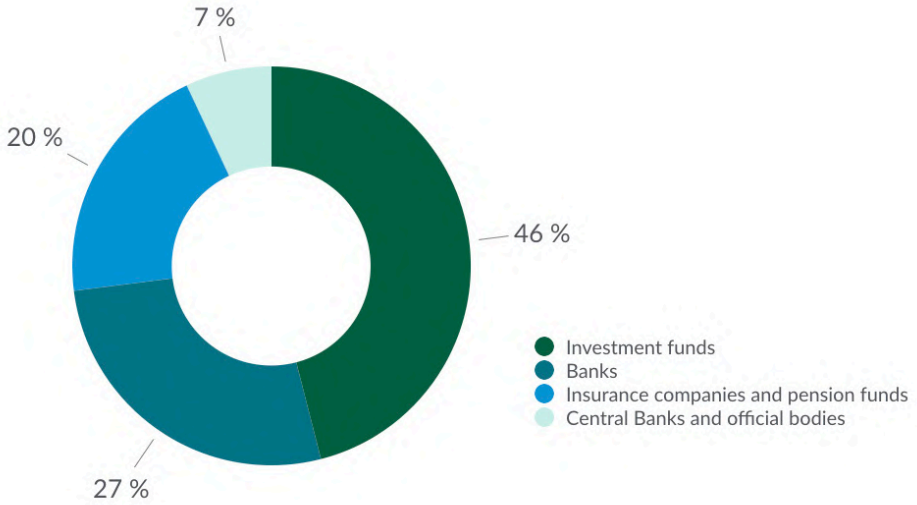
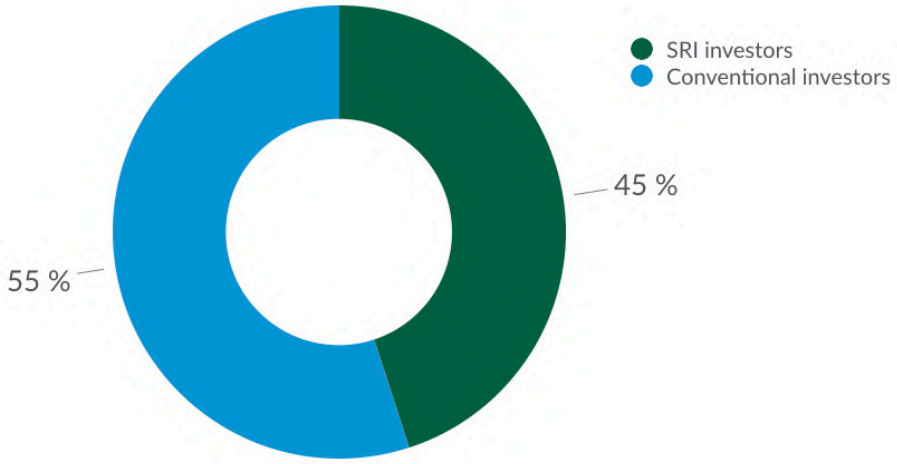


SRI INVESTORS VS CONVENTIONAL INVESTORS



We set out below the report corresponding to such issues.

Expected Impact metrics

Brokendown by lines

Investments in new high-speed rail lines and extensions of the existing high-speed lines

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INTRODUCTION 1

In the present document appear the indicators of socio-economic savings established in the high-speed projects which are involved in the emission of green bonds performed by ADIF Alta Velocidad.

These indicators, which are defined in a chapter below, are the following ones:

a. Saving of External Costs, expressed in thousands of euros.
b. Time Saving, expressed in thousands of hours.
c. Modal Transfer, expressed in thousands of traveler's km transferred from the different means of transport to the high-speed railway mean.
d. Saving of Tons of CO_2.

The high-speed lines analysed as **green projects** are the following ones:

- Madrid – Levante High Speed Line.
- Antequera – Granada High Speed Line .
- Valladolid-Burgos-Vitoria High Speed Line .
- Madrid – Extremadura High Speed Line.
- Madrid – Galicia High Speed Line: Olmedo-Zamora-Ourense-Santiago de Compostela stretch.
- Atlantic Axis High Speed Line: Santiago de Compostela-Vigo stretch.

PREVIOUS CONSIDERATIONS 2

The estimation of the indicators of socio-economic savings of each high-speed railway project is performed from studies of profitability or analysis cost-benefit performed by ADIF High Speed in each one of the lines analyzed, which follow the methodology and criteria established by the European Commission of Regional Policy in the document "Guide to Cost-benefit Analysis of Investments Projects. Economic appraisal tool for Cohesion Policy 2014-2020", published in 2014.

These cost-benefit analyses are based, in turn, on previous studies which provide the needed data for the estimations of socio-economic profitability, which without being exhaustive are:

- Demand (of travelers and in the case of high-speed lines of mixed traffic, also of freight) both of the situation without project and of the situation with project, both needed for the differential calculus of the savings.
- Modal split within the transport system.
- Transfer of passengers/goods to the railway mode in the project situation (in this case the new high-speed line), for each one of the existing modes in the project scope.
- Flows of traffic generated/induced: additional traffic caused by the improvement of the transport after the implementation of the analysed project, in this case, the high-speed railway line.
- Times of travel in each mode of transport by the Origin-Destination relationship, as well as the savings of time caused by the modalshift.

The **demand variables** needed for the estimation of the indicators that are the subject of this report are the ones below:

Travelers km transferred (thousands)
- of the private vehicle
- of the bus
- of the conventional train
- of the airplane

AV Travelers km (thousands)
- Captured
- Induced

Hours saved (thousands)
- Time savings (thousands of hours) Obliged
- Time savings (thousands of hours) Not Obliged

Tons km (thousands)
- Transferred from the truck (ton*km in truck)
- Captured (ton km in Railway)

The cost-benefit analysis use a period of analysis of 30 years since the implementation of the high-speed line, a period that meets the one mentioned in the document "Guide to Cost-benefit Analysis of Investments Projects. Economic appraisal tool for Cohesion Policy 2014-2020" for railway projects.

Table 2.1 European Commision's reference periods by sector

SECTOR	REFERENCE PERIOD (years)
Railways	30
Roads	25-30
Ports and airports	25
Urban transport	25-30
Water supply/sanitation	30
Waste management	25-30
Energy	15-25
Broadband	15-20
Research and Innovation	15-25
Business infrastructure	10-15
Other sectors	10-15

Source: ANNEX I to Commission Delegated Regulation (EU) No 480/2014

DEFINITION OF THE INDICATORS 3

SAVINGS OF EXTERNAL COSTS 3.1

The indicator “Saving of external costs” shows the socio-economic benefits monetized which are calculated in each study of profitability, caused by the improvement of the conditions of the transport by the project and the savings which the users experiment.

To this indicator of saving of external costs, the following concepts are grouped in a single value:

A. TIME SAVINGS

Time savings are calculated for the travelers captured (flow Origin/Destination (O/D) of travelers) by the new railway services, as a difference between the time in situation without project (or of reference) for a displacement in the mean used in such scenario, and the time in railway used in the scenario with project.

As a result, the savings of time are differentiated depending on the O/D and on the mean of departure of each traveler captured by the railway.

The savings of time are obtained, therefore, directly from the results of modelling of the situation of reference and from the one of the project.

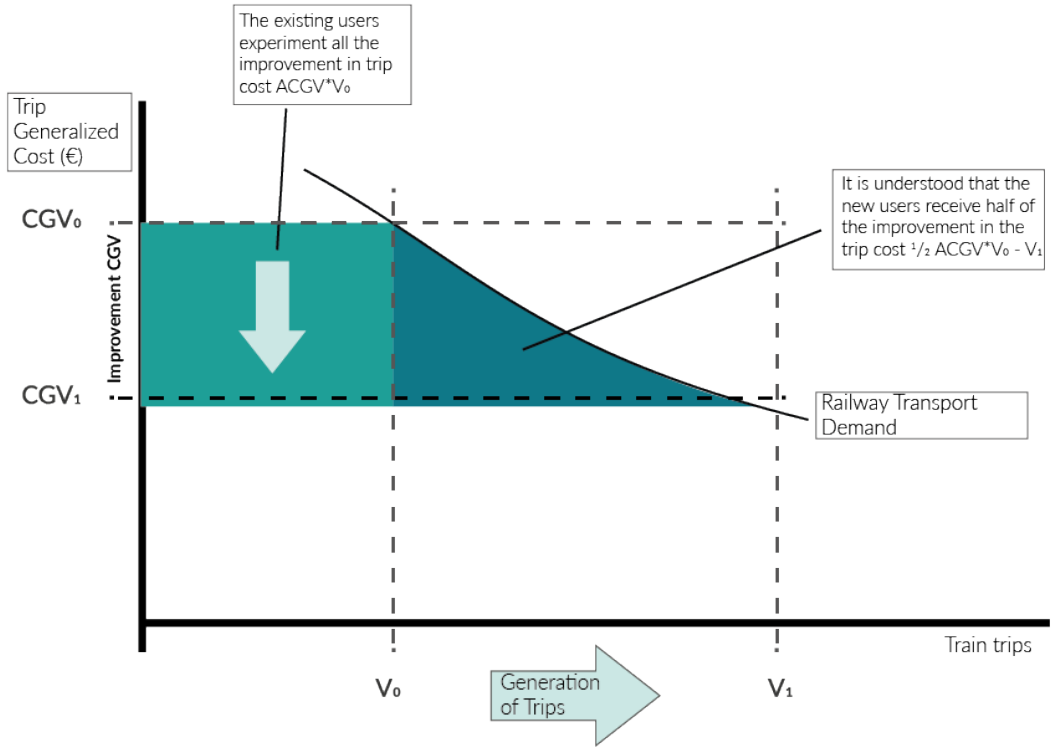
The monetary valuation of the time is performed in each study of profitability from the values of €/hour of the European project “Developing Harmonized European Approaches for Transport Costing and Project Assessment (HEATCO)”, differentiated according to the reason for travel (Obliged/work and not obliged/remaining reasons).

B. NET SURPLUS OF THE CONSUMER OF NEW PASSENGERS- GENERATED/INDUCED TRAFFIC

As it has been previously described, generated or induced traffic is understood as the new users who perform their travel thanks to the improvement performed by the implementation of the project of new railway infrastructure, and which in the situation of reference, where the transport does not improve, do not perform the travel.

In order to estimate the monetary valuation of the consumer surplus of these new travelers in each relation Origin-Destination, it is used the methodology that establishes the Guide of Analysis of Cost Benefit of Projects of Investment, published by the European Commission of Regional Policy in 2014, known as the rule of the half.

CALCULATION OF THE NET SURPLUS OF THE CONSUMER OF NEW TRAVELERS. "RULE OF THE HALF"



C. SAVINGS OF RUNNING OR OPERATION COSTS OF OTHER MODES (DIFFERENT TO THE RAILWAY ONES)

The collection of travelers coming from other means by the new railway services causes a global decrease of running or operation costs in these means.

The monetization of this saving is obtained through the product of the number of travelers transferred from the different means of transport to the railway, by the unit operation cost by traveler in its mode of origin.

D. SAVING OF ACCIDENTS

The variation of cost of accidents comes from the different probability of suffering accidents between the railway mean in project and the mean of origin of the travelers captured or transferred to the railway.

For the monetization of this saving it is calculated the product of the number of travelers transferred from the different means of transport to the railway, by the unit cost of accidents by traveler in their mean of origin.

E. SAVING OF ENVIRONMENTAL COSTS

It comprises the ensemble of the environmental savings caused by the project, and includes:

- Saving in net costs by impact in the climate change. It corresponds to the costs to be prevent the negative effects of the climate change caused by the emissions of Greenhouse Effects (GEI). For the sector of transports the pertinent emissions are carbon dioxide, nitrogen dioxide and methane.
- Saving in net costs by impact in the atmospheric pollution. Referred to the costs by the effects adverse of the atmospheric pollution (mainly particles, nitrogen oxides, sulphur dioxide, volatile organic compounds and ozone): effects on health, the buildings and materials and the harvests.
- Saving in net costs by impact in the noise or acoustic pollution. For this type of projects, the incidence of the global impact can be very low or almost negligible. Its main incidence is in the sections of transit along the cities affected by the project, and its effect is usually reduced by corrective measures, such as acoustic screens.
- Saving in net costs by indirect environmental impacts. Related to indirect effects of the transport activity, such as the production of energy (fuels and electricity), the one of vehicles and the one of infrastructure.
- Saving in net costs by impact in the loss of biodiversity. Both the atmospheric pollution, and the fragmentation of habitats by the infrastructures can affect negatively the biodiversity.
- Saving in net costs by impact in the pollution of soil and water, derived from the negative impacts in the pollution of soil and water of the transport infrastructures, as well as the pollution by heavy metals or hydrocarbons.
- Saving in net costs by impact in the nature and landscape. It comes related to the costs estimated necessary to improve the existing infrastructures according to the needs of the environment. They are repair and balancing costs.
- Saving in net costs by urban effects. Related to the cost caused by the traffic in urban areas, particularly for the non-motorized transport due to the lack of space and the time lost by the citizens who go walking due to barrier effects.

For the estimation of these environmental savings and their monetization, the unit costs are used of the “Study of External Costs of the Transport in Europe” performed by ce Delft, INFRAS and Fraunhofer in November 2011, (hereinafter Study of External Costs) elaborated by request of the European Commission, and whose scope of reference is the EU-27, together with Switzerland and Norway.

In this Study of External Costs, the average unit costs of the EU appear for each one of the concepts involved in the environmental costs, as well as for the cost of accidents, and expressed in euros by 1,000 travelers-km and in euros by 1,000 tons km in the case of the goods.

In the following tables it appears the value of the study:

Total unitary external costs in the EU-27 by mean of transport for travelers and freight

Table 2 Total external costs 2008 for EU-27* by cost category and transport mode

TOTAL COSTS PER COST CATEGORY									
	ROAD					RAIL		AVIATION	WATERBORNE (freight)
	Passenger cars	Buses & coaches	Motorcycles & mopeds	LDV	HDV	Passenger transport	Freight transport	Passenger transport (cont.)	Inland waterways
Cost category	**Mio €/a**	**Mio €/a**	**Mio €/a**	**Mio €/a**	**Mio €/a**	**Mio €/a**	**Mio €/a**	**Mio €/a**	**Mio €/a**
Accidents	157,105	6,839	22,584	18,677	19,604	238	71	223	0
Air pollution	26,636	3,347	1,696	5,933	12,995	1,092	483	426	782
Climate change high scen.	84,135	5,060	1,597	14,787	18,845	630	413	22,166	516
Climate change low scen.	14,407	866	273	2,532	3,227	108	71	3,796	88
Noise	8,201	865	2,076	2,094	3,537	477	476	457	0
Up- & downstream Proc. high scen.	27,679	1,568	523	4,765	5,802	3,354	1,947	3,356	194
Up- & downstream Proc. low scen.	16,621	855	325	2,777	3,270	1,633	1,078	1,849	113
Nature & landscape	3,008	149	75	284	1,293	75	21	296	64
Biodiversity Losses	1,152	212	20	208	893	1	1	40	69
Soil & water pollution	1,582	485	40	601	1,629	220	164	0	0
Urban effects	4,814	232	116	1,035	965	229	59	0	0
Total (high scenario)	**314,310**	**18,757**	**28,727**	**48,384**	**65,564**	**6,318**	**3,636**	**26,964**	**1,625**
Road congestion (delay costs): min	98,416	4,836	2,439	13,827	26,695	:	:	:	:
Road congestion (delay costs): max.	161,331	7,729	3,841	27,633	42,660	:	:	:	:

Data include the EU-27 with the exemption of Malta and Cyprus, but including Norway and Switzerland; ":": not applicable. Total excluding congestion costs

Source: Study of External Costs of the Transport in Europe. CE Delft, INFRAS and Fraunhofer 2011

Unitary external costs by mean of transport for travelers and freight

Table 14 Average external costs 2008 for EU-27* by cost category and transport mode (excluding congestion)

AVERAGE COSTS PER COST CATEGORY													
	PASSENGER TRANSPORT							FREIGHT TRANSPORT					
	ROAD				RAIL	AVIATION	TOTAL	ROAD			RAIL	WATERBORNE	TOTAL
	Passenger cars	Buses & coaches	Motorcycles & mopeds	Total road passenger transport	Passenger transport	Passenger transport (cont.)		LDV	HDV	Total road freight transport	Freight transport	Freight transport	
Cost category	**€/(1,000 pkm*a)**	**€/(1,000 pkm*a)**	**€/(1,000 pkm*a)**	**€/(1,000 pkm*a)**	**€/(1,000 pkm*a)**	**€/(1,000 pkm*a)**	**€/(1,000 pkm*a)**	**€/(1,000 tkm*a)**	**€/(1,000 tkm*a)**	**€/(1,000 tkm*a)**	**€/(1,000 tkm*a)**	**€/(1,000 tkm*a)**	**€/(1,000 tkm*a)**
Accidents	32.3	12.3	156.6	33.6	0.6	0.5	29.0	56.2	10.2	17.0	0.2	0.0	13.4
Air pollution	5.5	6.0	11.8	5.7	2.6	0.9	5.2	17.9	6.7	8.4	1.1	5.4	7.1
Climate change high scen.	17.3	9.1	11.1	16.3	1.5	46.9	17.6	44.5	9.8	14.9	0.9	3.6	12.1
Climate change low scen.	3.0	1.6	1.9	2.8	0.3	8.0	3.0	7.6	1.7	2.6	0.2	0.6	2.1
Noise	1.7	1.6	14.4	2.0	1.2	1.0	1.9	6.3	1.8	2.5	1.0	0.0	2.1
Up- & downstream Proc. high scen.	5.7	2.8	3.6	5.4	8.1	7.1	5.7	14.3	3.0	4.7	4.2	1.3	4.4
Up- & downstream Proc. low scen.	3.4	1.5	2.3	3.2	3.9	3.9	3.3	8.4	1.7	2.7	2.4	0.8	2.5
Nature & landscape	0.6	0.3	0.5	0.6	0.2	0.6	0.6	0.9	0.7	0.7	0.0	0.4	0.6
Biodiversity Losses	0.2	0.4	0.1	0.2	0.0	0.1	0.2	0.6	0.5	0.5	0.0	0.5	0.4
Soil & water pollution	0.3	0.9	0.3	0.4	0.5	0.0	0.4	1.8	0.8	1.0	0.4	0.0	0.8
Urban effects	1.0	0.4	0.8	0.9	0.6	0.0	0.8	3.1	0.5	0.9	0.1	0.0	0.7
Total (high scenario)	**64.7**	**33.8**	**199.2**	**65.1**	**15.3**	**57.1**	**61.3**	**145.6**	**34.0**	**50.5**	**7.9**	**11.2**	**41.7**
Total (low scenario)	***48.1***	***24.9***	***49.4***	***49.4***	***9.8***	***15.0***	***44.3***	***102.8***	***24.6***	***36.1***	***5.3***	***7.7***	***29.7***

Data include the EU-27 with the exemption of Malta and Cyprus, but including Norway and Switzerland. Data do not include congestion costs.

Source: Study of External Costs of the Transport in Europe. CE Delft, INFRAS and Fraunhofer 2011

TIME SAVING 3.2

This indicator, is the saving, expressed in thousands of hours, which experiment the travelers captured by the high-speed railway. The estimation is performed as difference between the time of the travel in situation of project (time of travel of each user between an origin and a destination in the railway mean with the new high-speed line), and the time in situation of reference or without project (time of travel of each user between an origin and a destination in the transport mean used originally).

MODAL TRANSFER 3.3

This indicator is the result of the travelers captured and generated/induced by the high-speed railway as difference between the demand between the situation without project (or of reference) and the situation with project, in all transport means.

In this indicator of modal transfer appear the travelers-km (in thousands) who change of mean, passing to the railway as a result of the improvement of the transport that experiment the users by the new high-speed railway line.

In the situation of project, the travelers in high speed railway include the travelers generated/induced, who have already been previously defined.

SAVING OF TONS OF CO_2 3.4

For the estimation of this indicator the factors of emission of CO_2 obtained in the Study of External Costs have been used. These factors, measured in grams of CO_2 by vehicle km, have been calculated for each country, differencing by transport mean, both for freight and for travelers.

In the table below the values of these factors of emission of CO_2 can be observed, where the values corresponding to Spain have been highlighted in yellow.

Table 50 CO_2 (exhaust) emission factors

	PASSENGER TRANSPORT						FREIGHT TRANSPORT				
	ROAD				RAIL	AVIATION	ROAD			RAIL	WATERBORNE
Unit	Passenger cars	Buses & coaches	Motorcycles	Total road passenger transport	Passenger transport	Passenger transport (incl. LTO)	LDV	HDV	Total road freight transport	Freight transport	Inland waterways
	g/vkm	g/vkm	g/vkm	g/vkm	g/train-km	g/vkm	g/vkm	g/vkm	g/vkm	g/train-km	g/vkm
Base	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008
Source	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE	TREMOVE
Country											
Austria	188	586	84	198	942	11,980	268	634	394	802	25,400
Belgium	195	615	79	198	401	11,778	240	751	415	4,089	20,660
Bulgaria	174	566	51	202	1,338	16,804	221	617	357	2,200	21,312
Czech Republic	188	556	77	186	1,334	11,787	221	721	393	1,666	22,226
Denmark	198	626	80	211	4,932	13,128	213	707	383	5,809	n, a,
Estonia	226	623	65	226	4,498	8,896	231	627	367	36,355	n, a,
Finland	213	648	81	220	217	12,869	232	712	397	4,762	21,667
France	196	636	84	198	1,043	14,200	254	663	327	1,137	19,882
Germany	212	672	94	215	1,928	14,844	276	680	415	3,036	21,667
Greece	185	581	79	172	6,467	19,830	219	633	361	6,934	n, a,
Hungary	193	552	74	188	1,530	13,342	225	599	353	2,936	22,664
Ireland	186	630	76	198	6,435	19,045	200	633	349	13,336	n, a,
Italy	188	352	86	192	879	17,610	271	707	421	494	19,882
Latvia	223	669	84	220	4,655	11,251	230	616	362	41,610	n, a,
Lithuania	203	598	71	194	9,069	10,210	222	656	371	35,202	21,667
Luxenbourg	196	618	76	204	50	6,398	209	670	367	5,371	20,660
Netherlands	210	747	74	214	188	14,193	256	741	422	2,843	21,317
Norway	207	608	69	210	757	13,155	214	679	373	2,949	n, a,
Poland	181	576	69	180	1,366	13,071	215	665	369	1,815	14,939
Portugal	192	615	75	190	2,720	16,553	221	760	406	5,436	n, a,
Romania	186	561	56	175	2,293	12,715	224	610	357	5,932	22,825
Slovakia	189	544	84	197	1,797	13,703	218	546	331	2,290	22,694
Slovenia	192	596	75	172	1,269	6,838	223	661	373	1,437	n, a,
Spain	191	607	57	192	1,018	20,654	211	699	378	3,149	n, a,
Sweden	230	585	81	234	112	15,210	225	684	382	900	n, a,
Switzerland	208	630	64	205	0	12,151	240	661	403	583	21,667
United Kingdom	231	820	97	237	1,123	17,795	234	815	406	7,434	21,317
TOTAL	**204**	**607**	**79**	**206**	**1,314**	**15,887**	**242**	**696**	**381**	**3,420**	**21,431**

Data source: TREMOVE (2010)

From the factors of emission corresponding to Spain in the previous table, measured in grams of CO_2 by vehicle km, and the ratio by occupation (travelers by vehicle) used in each profitability study, are obtained the values needed to perform the estimation of the saving of tons of CO_2 for each project evaluated, shown in the table below.

Values for Spain of the Study of External Costs

	Conventional railway	Bus	Car	Plain	A. Railway
g CO_2 / vehicle-km	1018	607	191	20654	1018
Average occupation	180	39	1,8	150	260
g CO_2 / traveler-km	5.7	15.6	106.1	137.7	3.9
kg CO_2 / traveler-km	0,0057	0,0156	0,1061	0,1377	0,0039

	Freight railway	Freight truck
g CO_2 / vehicle-km	3149	699
average load	400	11.8
g CO_2 / ton-km	7,9	59,2
kg CO_2 / ton-km	0,0079	0,0592

The total saving of emissions of CO_2 (in tons) is calculated as application of the ratios of the previous table to the travellers.km and tons.km, captured and induced by each high-speed project.

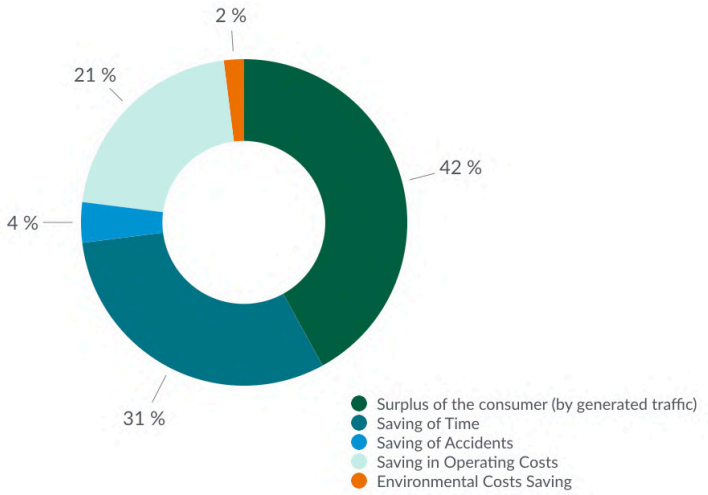
MADRID - LEVANTE HIGH SPEED LINE 4

SAVINGS OF EXTERNAL COSTS

These results are calculated for a period of evaluation of 30 years since the implementation of the first phase of the project (2011).

The total savings (expressed in VAN to 2011 at 3% thousand Euros of 2011) of this line is the one below:

SAVINGS (Thousands of Euros of 2011)	16.247.439
Surplus of the Customer (by generated traffic)	6,855,188
Saving of Time	5,018,366
Saving of Accidents	695,771
Saving in Operating Costs	3,390,155
Saving of environmental costs	287,959



TIME SAVINGS 4.2

The total hours saved along the 30 years of the study are summarized in the following chart:

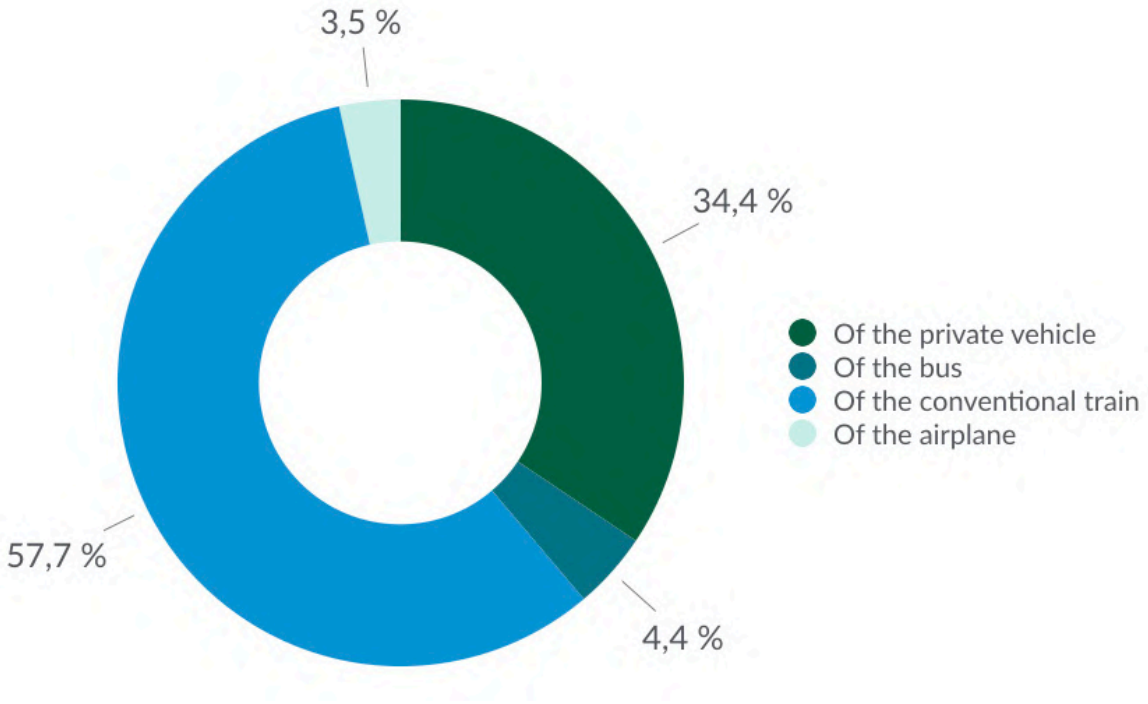
GLOBAL SUMMARY	TOTAL (30 years)	AVERAGE ANNUAL SAVING
Thousands of hours saved	283,178	9,439

MODAL TRANSFER 4.3

Below appear summarized the Travelers km transferred of each mean and the graphic of percentages of modal transfer:

TRAVELERS KM TRANSFERRED (thousands)	TOTAL (30 years)	ANNUAL AVERAGE
of the private vehicle	32,838,353	1,094,612
of the bus	4,197,197	139,907
of the conventional train	55,095,573	1,836,519
of the airplane	3,375,938	112,531
TOTAL Thousands Travellers.km transferred	95,507,061	3,183,569

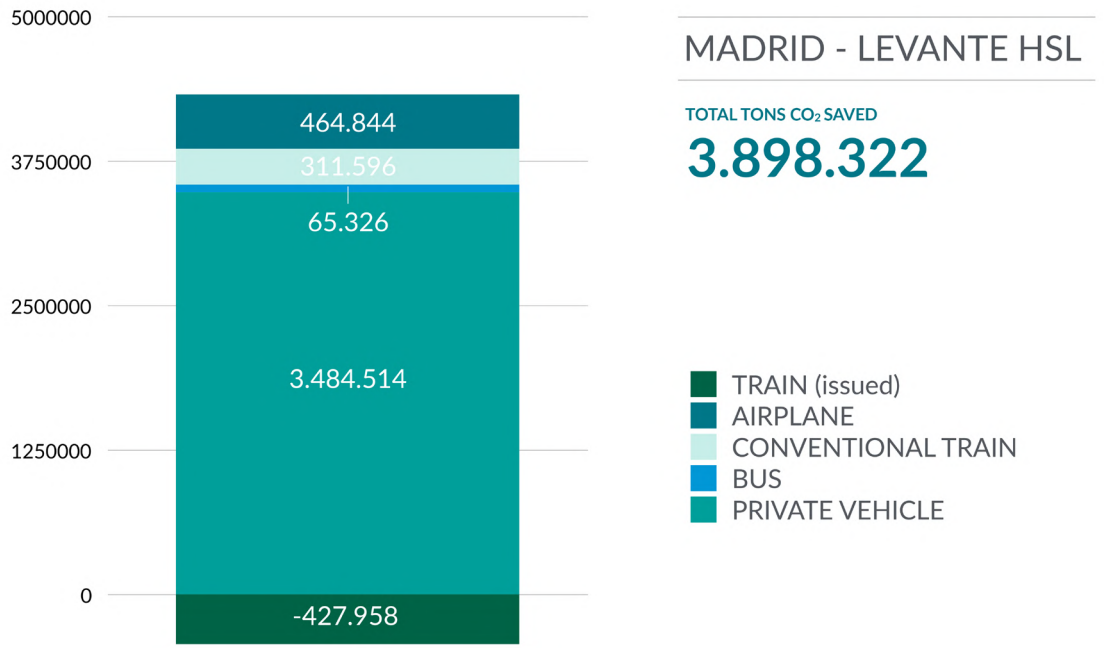
On the other hand, it can be noted that the total traveler's km in high speed, a 14.4% corresponds to the travelers induced. From the travelers transferred, the greater percentage comes from the conventional train itself with a 57.7% and after the private vehicle with a 34.4%.



4.4 SAVING OF TONS OF CO_2

The savings of CO_2 by the travelers km transferred of each mean of transport for the total of the period of analysis (30 years) are the ones below.

MADRID-LEVANTE HSL	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Ton CO_2 saved from the private vehicle	3,484,514	116,150
Ton CO_2 saved from the bus	65,326	2,178
Ton CO_2 saved from the conventional train	311,596	10,387
Ton CO_2 saved from the airplane	464,844	15,495
Ton CO_2 issued from the train	-427,958	-14,265
TOTAL Tons CO_2 SAVED	3,898,322	129,944



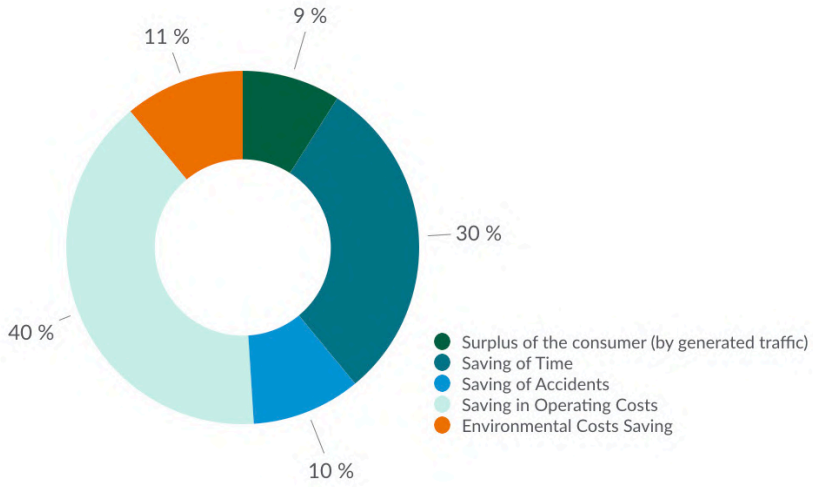
ANTEQUERA - GRANADA HIGH SPEED LINE 5

SAVINGS OF EXTERNAL COSTS 5.1

These results are calculated for a 30 years period since the implementation of the first phase of the project (2015).

The total of the savings (expressed in VAN at 2015 to 3% thousand Euros of 2015) of this line is the one below:

SAVINGS (Thousands of Euros of 2015)	2.283.881
Surplus of the Consumer (by generated traffic)	205,709
Saving of Time	683,677
Saving of Accidents	240,372
Saving in Operating Costs	909,627
Saving in environmental costs	244,497



SAVINGS OF TIME 5.2

The total hours saved along the 30 years of the study are summarized in the following chart:

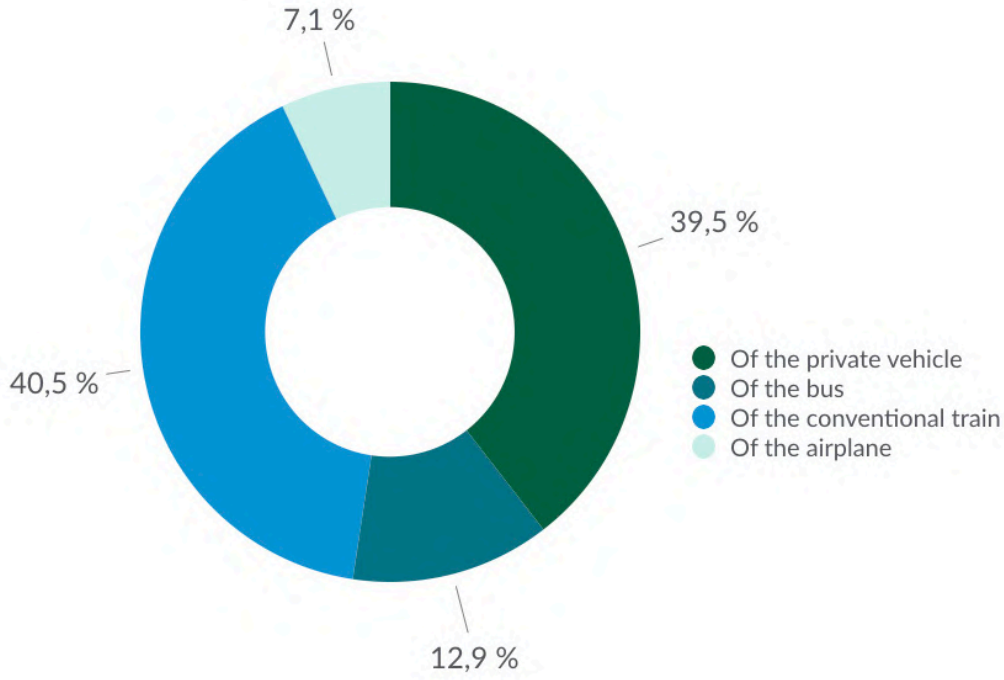
GLOBAL SUMMARY	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Thousands saved hours	56,478	1,883

MODAL TRANSFER 5.3

Below appear summarized the Travelers km transferred of each mean and the graphic of percentages of modal transfer:

Travelers km transferred (thousands)	TOTAL (30 years)	ANNUAL AVERAGE
from the private vehicle	10,554,836	351,828
from the bus	3,444,035	114,801
from the conventional train	10,834,862	361,162
from the airplane	1,894,223	63,141
TOTAL Thousands of Travellers.km transferred	26,727,956	890,932

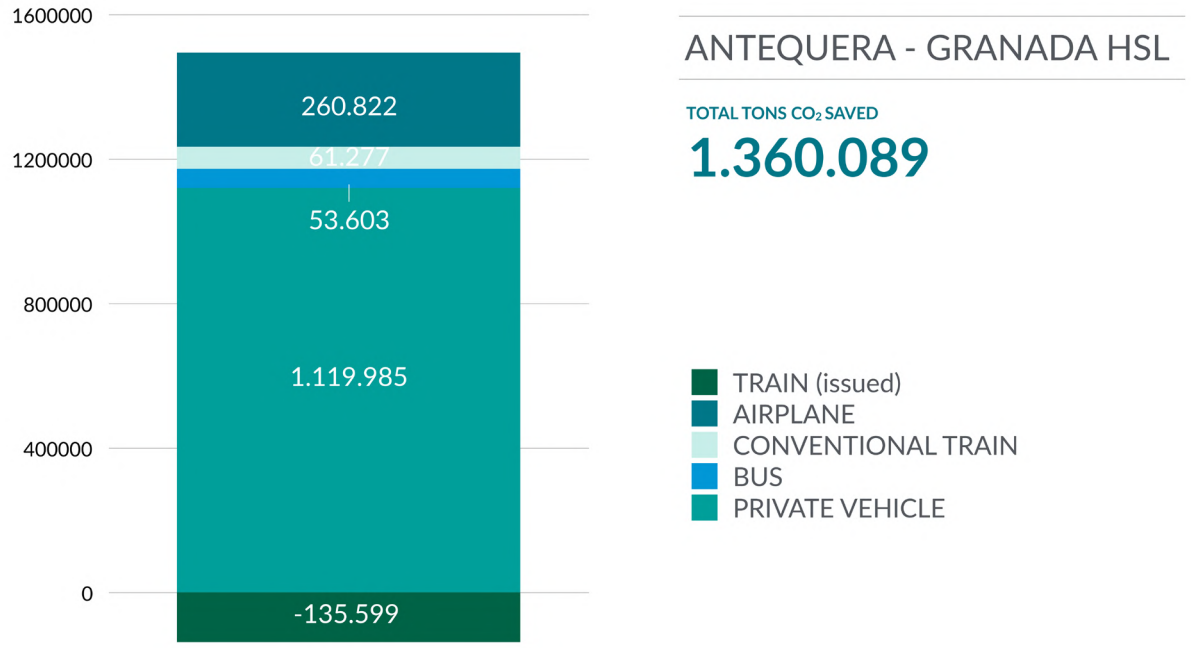
On the other hand, it can be observed that the total travelers km in high speed, a 15.1% corresponds to the travelers induced. From the travelers transferred, the greater percentage comes from the conventional train itself with a 40.5% and after the private vehicle with a 39.5%.



5.4 SAVING OF TONS OF CO_2

The savings of CO_2 by the travelers of each mean of transport for the total of the period of analysis (30 years) are the ones below.

ANTEQUERA - GRANADA HSL	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Ton CO_2 saved from the private vehicle	1,119,985	37,333
Ton CO_2 saved from the bus	53,603	1,787
Ton CO_2 saved from the conventional train	61,277	2,043
Ton CO_2 saved from the airplane	260,822	8,694
Ton CO_2 issued ofromthe train	-135,599	-4,520
TOTAL Tons CO_2 SAVED	1,360,089	45,336



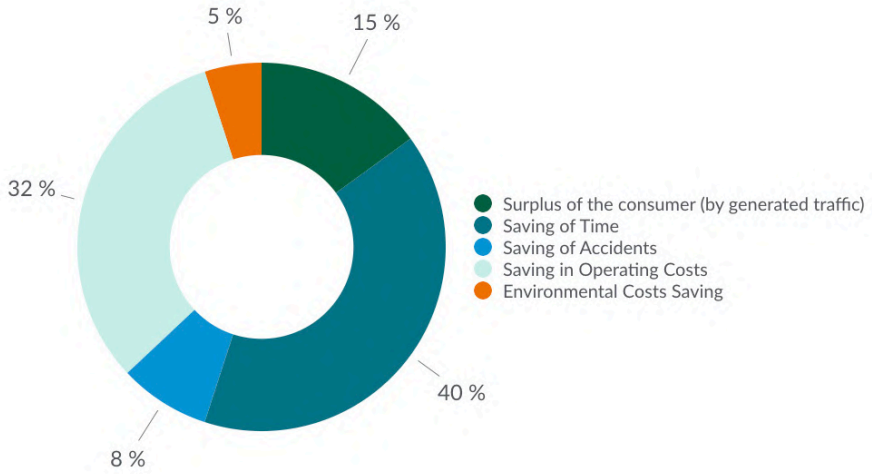
VALLADOLID - BURGOS - VITORIA HIGH SPEED LINE 6

SAVINGS OF EXTERNAL COSTS 6.1

These results are calculated for a 30 years period of evaluation since the implementation of the first phase of the project (2019).

The total savings (expressed in VAN at 2019 at 3%, thousands of Euros of 2016) of this line is the one below:

SAVINGS (Thousands of Euros of 2016)	4,733,151
Surplus of the Consumer (by generated traffic)	697,189
Saving of Time	1,915,172
Saving of Accidents	353,545
Saving in Operating Costs	1,514,149
Saving in Environmental Costs	253,096



SAVINGS OF TIME 6.2

The total hours saved along the 30 years of study are summarized in the chart below:

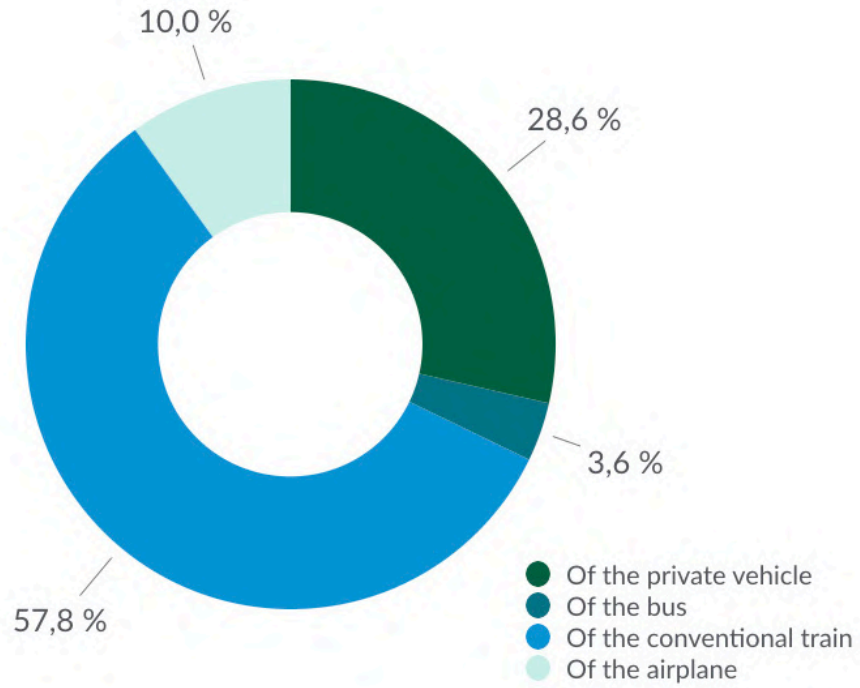
GLOBAL SUMMARY	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Total Thousands of hours saved	114,677	3,823

MODAL TRANSFER 6.3

Below appear summarized the Travelers km transferred of each mean and the graphic of percentages of modal transfer:

TRAVELERS KM TRANSFERRED (thousands)	TOTAL (30 years)	ANNUAL AVERAGE
from the private vehicle	17,281,210	576,040
from the bus	2,156,858	71,895
from the conventional train	34,945,031	1,164,834
from the airplane	6,014,088	200,470
TOTAL Thousand Travellers.km transferred	60,397,188	2,013,240

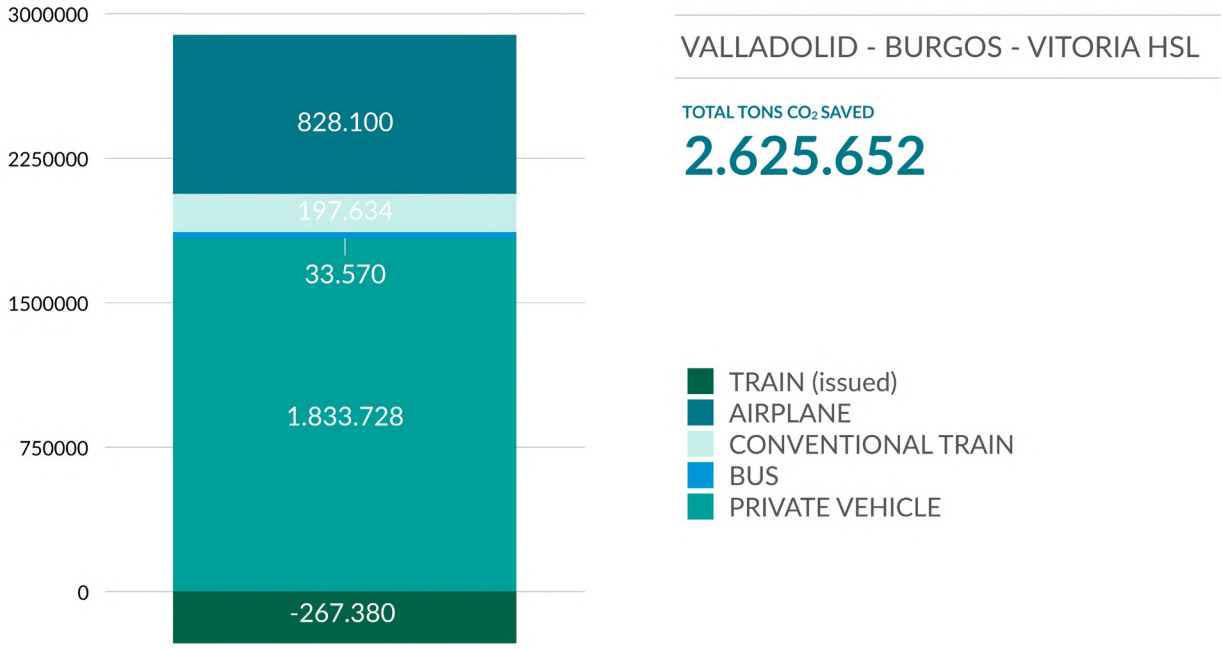
On the other hand, it can be noted that the total travelers km in high speed, a 12.5% corresponds to the travelers induced. From the transferred travelers, the greater percentage comes from the conventional train itself with a 57.9% and after the private vehicle with a 28.6%.



6.4 SAVING OF TONS OF CO_2

The savings of CO_2 by the travelers km of each mean of transport for the total of the analysis period (30 years) are the ones below.

VALLADOLID - BURGOS - VITORIA HSL	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Ton CO_2 saved of the private vehicle	1,833,728	61,124
Ton CO_2 saved of the bus	33,570	1,119
Ton CO_2 saved of the conventional train	197,634	6,588
Ton CO_2 saved of the airplane	828,100	27,603
Ton CO_2 issued of the train	-267,380	-8,913
TOTAL Tons CO_2 SAVED	2,625,652	87,522



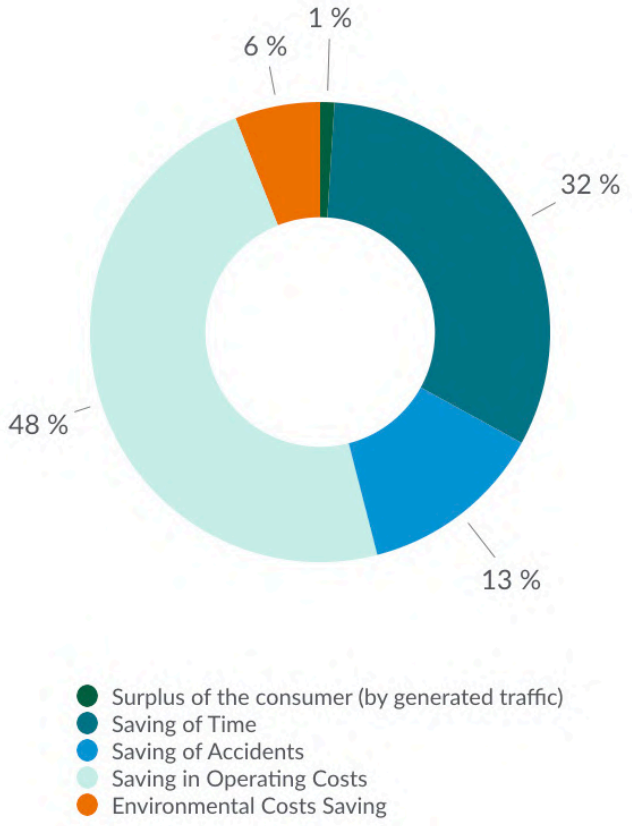
MADRID - EXTREMADURA HIGH SPEED LINE 7

SAVING OF EXTERNAL COSTS 7.1

These results are calculated for a 30 years period since the implementation of the first phase of the project (2019).

The total savings (expressed in VAN at 2019 at 3%, thousand Euros of 2015) of this line is the one below:

SAVINGS (Thousands of Euros of 2015)	4,832,143
TRAVELLERS	
Surplus of the Consumer (by generated traffic)	56,896
Saving of Time	1,539,693
Saving of Accidents	564,623
Saving in Operating Costs	2,187,992
Saving in environmental costs	195,553
FREIGHT	
Saving of Accidents	55,335
Saving in Operating Costs	153,249
Saving in Environmental Costs	78,803



SAVINGS OF TIME 7.2

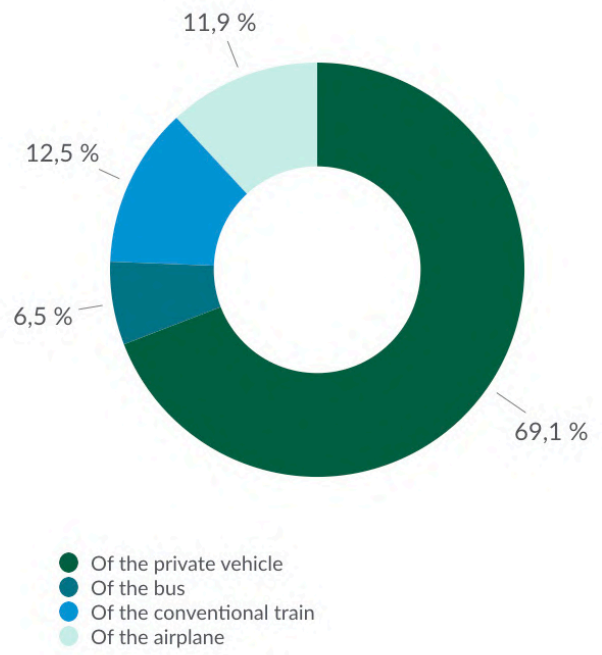
The total hours saved along the 30 years of study are summarized in the chart below:

GLOBAL SUMMARY	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Thousand hours saved	123,826	4,128

MODAL TRANSFER 7.3

Below appear summarized the Travelers Km transferred from each mean and the graphic of percentages of modal transfer:

Travelers km transferred (thousands)	TOTAL (30 years)	ANNUAL AVERAGE
from the private vehicle	31,844,059	1,061,469
from the bus	2,982,067	99,402
from the conventional train	5,731,036	191,035
from the airplane	5,474,636	182,488
TOTAL Thousands of Travellers.km transferred	46,031,797	1,534,393

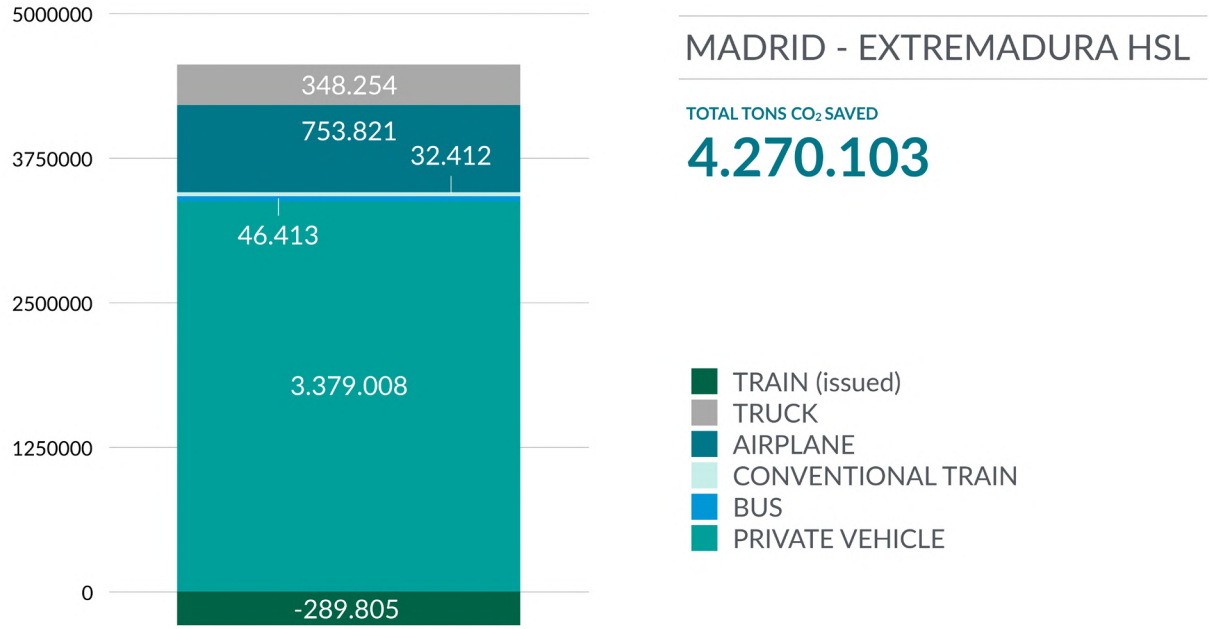


On the other hand, it can be noted that the travelers km in high speed, a 7.9% corresponds to the travelers induced. From the travelers transferred, the greater percentage comes from the private vehicle with a 69.2% and after the private vehicle with a 11.9%.

7.4 SAVING OF TONS OF CO_2

The savings of CO_2 due to the travelers km transferred of each mean of transport for the total analysis period (30 years) are the ones below.

MADRID - EXTREMADURA HSL	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Ton CO_2 saved from the private vehicle	3,379,008	112,634
Ton CO_2 saved from the bus	46,413	1,547
Ton CO_2 saved from the conventional train	32,412	1,080
Ton CO_2 saved from the airplane	753,821	25,127
Ton CO_2 saved from the truck	348,254	11,608
Ton CO_2 saved from the train	-289,805	-9,660
TOTAL Tons CO_2 SAVED	4,270,103	142,337



MADRID - GALICIA HIGH SPEED LINE 8

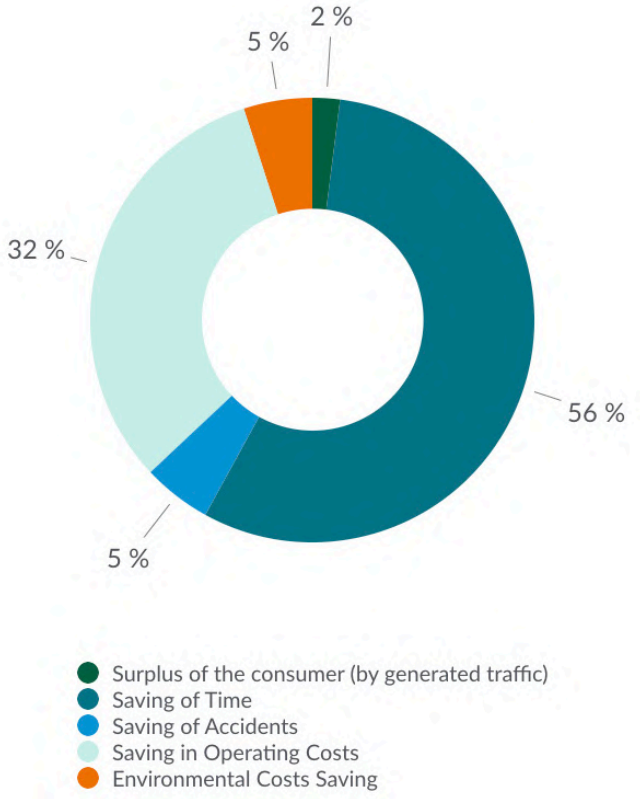
Olmedo - Zamora - Ourense - Santiago de Compostela Stretch

SAVINGS OF EXTERNAL COSTS 8.1

These results are calculated for a period of evaluation of 30 years since the implementation of the first phase of the project (2015).

The total savings (expressed in VAN at 2015 at 5.5%, thousand Euros of 2012) of this line is the one below:

SAVINGS (Thousands of Euros of 2012)	5,580,692
Surplus of the Consumer (by generated traffic)	125,238
Saving of Time	3,122,052
Saving of Accidents	287,101
Saving in Operating Costs	1,760,930
Environmental costs savings	285,371



SAVINGS OF TIME 8.2

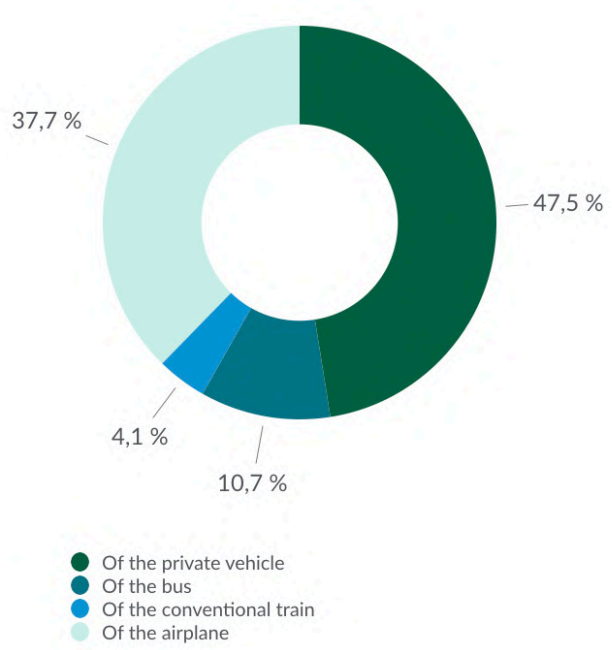
The total hours saved along the 30 years of the study are summarized in the following chart:

GLOBAL SUMMARY	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Thousands of hours saved	202,905	6,763

MODAL TRANSFER 8.3

Below appear summarized the Travelers km transferred of each mean and the graphic of percentages of modal transfer:

TRAVELERS KM TRANSFERRED (thousands)	TOTAL (30 years)	ANNUAL AVERAGE
of the private vehicle	18,275,843	609,195
of the bus	4,111,011	137,034
of the conventional train	1,589,269	52,976
of the airplane	14,526,314	484,210
TOTAL Thousands of Travellers.km transferred	38,502,437	1,283,415

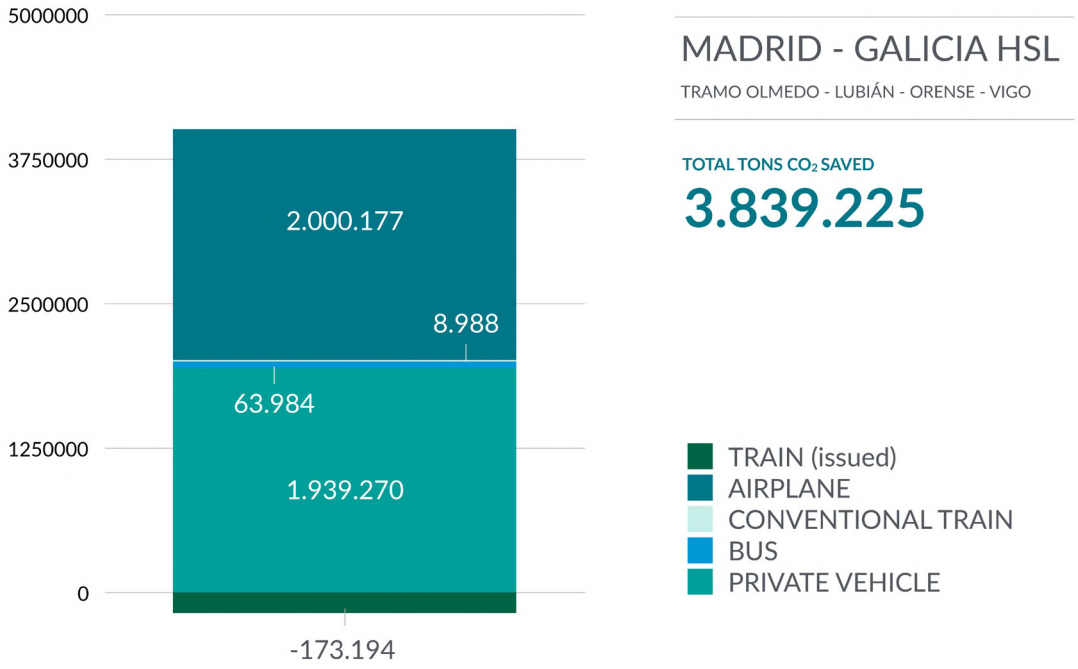


On the other hand, it can be highlighted that the total travelers km in high speed, a 7.6% corresponds to the travelers induced. From the travelers transferred, the greater percentage comes from the private vehicle with a 47.5% and after from the airplane with a 37.7%.

8.4 SAVING OF TONS OF CO_2

The savings of CO_2 by the travelers km transferred from each mean of transport for the total of the analysis period (30 years) are the ones below.

MADRID - GALICIA HSL	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Ton CO_2 saved from the private vehicle	1,939,270	64,642
Ton CO_2 saved from the bus	63,984	2,133
Ton CO_2 saved from the conventional train	8,988	300
Ton CO_2 saved from the airplane	2,000,177	66,673
Ton CO_2 issued from the train	-173,194	-5,773
TOTAL Tons CO_2 SAVED	3,839,225	127,974



ATLANTIC AXIS HIGH SPEED LINE 9

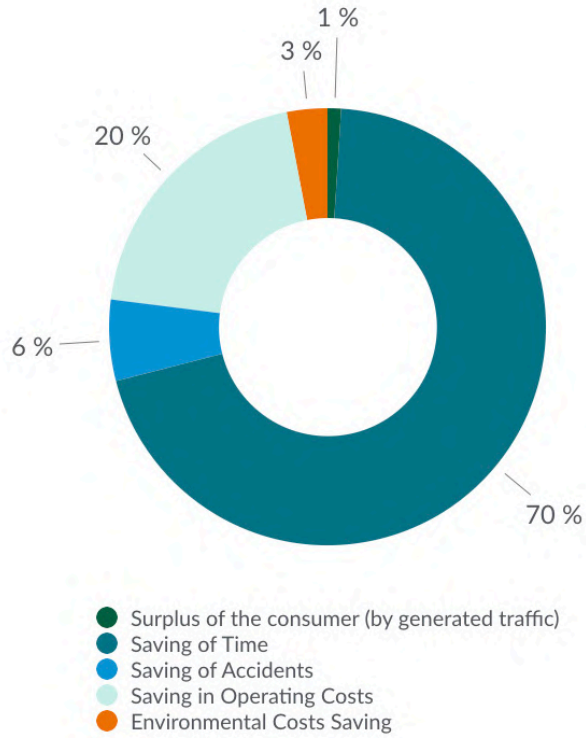
Santiago de Compostela - Vigo Strech

SAVINGS OF EXTERNAL COSTS 9.1

These results are calculated for a period of evaluation of 30 years since the implementation of the first phase of the project (2016).

The total of the savings (expressed in VAN at 2016 at 3%, thousands of Euros of 2015) of this line is the one below:

SAVINGS (Thousands of Euros of 2016)	2,265,564
Surplus of the Consumer (by generated traffic)	23,650
Saving of Time	1,592,161
Saving of Accidents	132,420
Saving in Operating Costs	461,022
Environmental Costs Saving	56,311



SAVINGS OF TIME 9.2

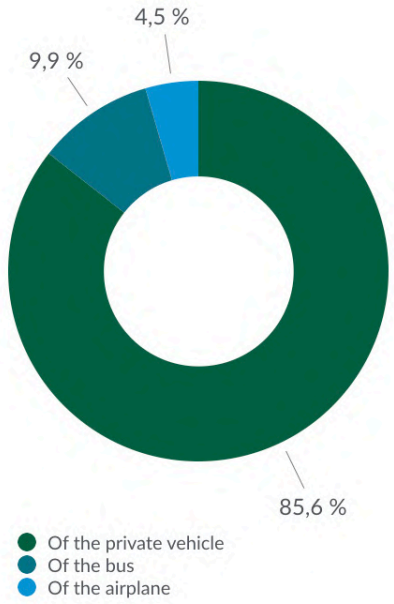
The total hours saved along the 30 years of the study are summarized in the following chart:

GLOBAL SUMMARY	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Thousands of hours saved	84,509	2,817

MODAL TRANSFER 9.3

Below appear summarized the Travelers km transferred from each mean and the graphic of percentages of modal transfer:

TRAVELERS KM TRANSFERRED (thousands)	TOTAL (30 years)	ANNUAL AVERAGE
from the private vehicle	6,427,144	214,238
from the bus	741,883	24,729
from the airplane	339,677	11,323
TOTAL Thousands of Travellers.km transferred	7,508,705	250,290

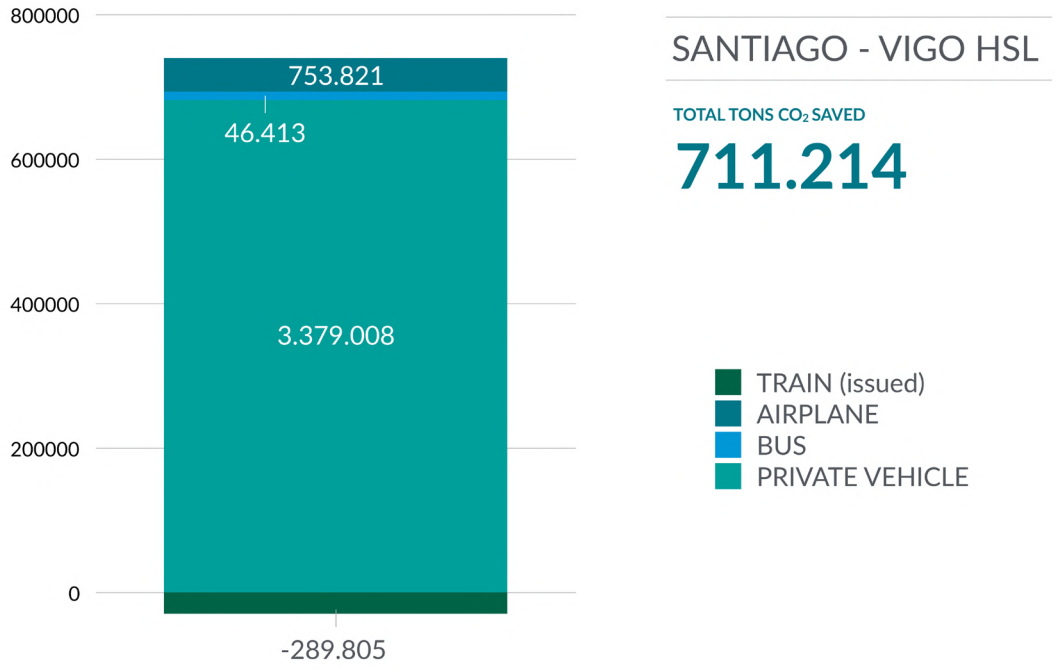


On the other hand, it can be highlighted that from the total travelers km in high speed, 1% corresponds to the travelers induced. From the travelers transferred, the greater percentage comes from the private vehicle with an 85.6% and afterwards from the bus with a 9.9%.

9.4 SAVING OF TONS OF CO_2

The savings of CO_2 by the travelers km transferred from each mean of transport for the total of the analysis period (30 years) are the ones below

SANTIAGO - VIGO HSL	TOTAL (30 years)	ANNUAL AVERAGE SAVING
Ton CO_2 saved from the private vehicle	681,991	22,733
Ton CO_2 saved from the bus	11,547	385
Ton CO_2 saved from the airplane	46,771	1,559
Ton CO_2 issued from the train	-29,096	-970
TOTAL Tons CO_2 SAVED	711,214	23,707



Expected impact metrics

Reversible substations

Investments in maintenance, upgrades and energy efficiency of the high-speed rail system

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Below it appears the estimation of saved energy and avoided emissions of CO_2 once the systems that recuperate energy have been implemented in the substations indicated.

		Energy saved (GWh)	Emissions avoided (ton CO_2)
Reversible substations	Installation of a converter which recuperates energy of the regenerative braking in the substation of Alcorcón	2,531	585
	Installation of a converter which recuperates energy of the regenerative braking in the substation of Guarnizo	1,146	265
	Installation of a converter which recuperates energy of the regenerative braking in the substation of Olabeaga	2,217	513
	Installation of a converter which recuperates energy of the regenerative braking in the substation of Getafe	1,303	301
	Installation of a converter which recuperates energy of the regenerative braking in the substation of Martorell	1,728	400
	Installation of a converter which recuperates energy of the regenerative braking in the substation of Arenys de Mar	1,526	353
	Total 6 substations	**10,451**	**2,417**

Allocation of funds to elegible green projects

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As mentioned at the beginning of this report, the net amount of the funds obtained from the first Green Bond of ADIF-Alta Velocidad, have been completely applied to the category of Eligible Green Projects: "Investments related to new lines and expansions of existing lines", established in the Green Bond Framework.

This category includes project of construction of high-speed lines that are already been executed or planned to be executed, as well as lines already put into service.

Below it appears in detail such investments, performed during the years 2016 and 2017.

Table 1

HIGH SPEED LINES	Executed amount 2016-2017 (thousands of euros)	Funding with Green Bond 2017 (thousands of euros)	Green Bond allocation (%)
MADRID-LEVANTE H.S.L.	320,270.50	**103,808.89**	17.36%
ANTEQUERA-GRANADA H.S.L.	138,402.20	**61,704.95**	10.32%
VALLADOLID-BURGOS-VITORIA H.S.L.	87,601.37	**32,792.84**	5.49%
MADRID-EXTREMADURA H.S.L.	131,475.62	**62,765.02**	10.50%
GALICIA H.S.L. (OLMEDO-LUBIAN-ORENSE-SANTIAGO)	509,034.44	**302,804.52**	50.65%
ATLANTIC AXIS (SANTIAGO - VIGO)	48,267.75	**33,987.78**	5.68%
TOTAL	1,235,051.88	597,864.00	100.00%

On the other hand, the net amount of the funds obtained from the second Green Bond issued by ADIF-Alta Velocidad, have been applied most of them to the category of "Investments related to new lines and extensions of existing lines".

Likewise, a minority part of the funds has been allocated to the category "Investments related to the maintenance, upgrades and energy efficiency of the high-speed rail system". Particularly, they have been applied to the project of "Reversible Substations".

Below it appears in detail such investments, performed during the years 2017 and 2018.

Table 2.1

HIGH SPEED LINES	Executed amount 2017-2018 (thousands of euros)	Funding with Green Bond 2018 (thousands of euros)	Green Bond allocation (%)
MADRID-LEVANTE H.S.L.	187,154.38	53,144.39	8.93%
ANTEQUERA-GRANADA H.S.L.	116,598.33	42,747.46	7.18%
VALLADOLID-BURGOS-VITORIA H.S.L.	85,586.66	18,906.03	3.18%
MADRID-EXTREMADURA H.S.L.	180,941.20	75,374.12	12.66%
GALICIA H.S.L. (OLMEDO-LUBIAN-ORENSE-SANTIAGO)	612,418.49	372,508.06	62.58%
ATLANTIC AXIS (SANTIAGO - VIGO)	43,844.69	31,234.33	5.25%
TOTAL	1,226,543.75	593,914.39	99.78%

Table 2.2

ENERGY EFFICIENCY PROJECTS	Executed amount 2017-2018 (thousands of euros)	Funding with Green Bond 2018 (thousands of euros)	Green Bond allocation (%)
Reversible Substations (Alcorcón)	484.45	339.12	0.06%
Reversible Substations (Guarnizo)	398.32	278.82	0.05%
Reversible Substations (Olabeaga)	174.35	122.04	0.02%
Reversible Substations (Getafe)	471.57	330.10	0.06%
Reversible Substations (Martorell)	169.34	118.54	0.02%
Reversible Substations (Arenys de Mar)	155.70	108.99	0.02%
TOTAL	1,853.73	1,297.61	0.22%

TOTAL INVESTMENTS IN ELIGIBLE GREEN PROJECTS	1,228,397.48	595,212.00	100.00%

As a summary, in the following chart it appears the funding of the investments performed in eligible green projects in the period 2016-2018 through the funds coming from the issues of green bonds.

Table 3.1

HIGH SPEED LINES	Executed amount 2016-2018 (thousands of euros)	Funding with Green Bond 2017 (thousands of euros)	Funding with Green Bond 2018 (thousands of euros)
MADRID-LEVANTE H.S.L.	373,669.27	103,808.89	53,144.39
ANTEQUERA-GRANADA H.S.L.	182,609.31	61,704.95	42,747.46
VALLADOLID-BURGOS-VITORIA H.S.L.	128,211.71	32,792.84	18,906.03
MADRID-EXTREMADURA H.S.L.	223,297.62	62,765.02	75,374.12
GALICIA H.S.L. (OLMEDO-LUBIAN-ORENSE-SANTIAGO)	885,432.76	302,804.52	372,508.06
ATLANTIC AXIS (SANTIAGO - VIGO)	74,356.96	33,987.78	31,234.33
TOTAL	1,867,577.63	597,864.00	593,914.39

Table 3.2

ENERGY EFFICIENCY PROJECTS	Executed amount 2017-2018 (thousands of euros)	Funding with Green Bond 2017 (thousands of euros)	Funding with Green Bond 2018 (thousands of euros)
Reversible Substations (Alcorcón)	484.45	0.00	339.12
Reversible Substations (Guarnizo)	398.32	0.00	278.82
Reversible Substations (Olabeaga)	174.35	0.00	122.04
Reversible Substations (Getafe)	471.57	0.00	330.10
Reversible Substations (Martorell)	169.34	0.00	118.54
Reversible Substations (Arenys de Mar)	155.70	0.00	108.99
TOTAL	1,853.73	0.00	1,297.61

TOTAL INVESTMENTS IN ELIGIBLE GREEN PROJECTS	1,869,431.36	597,864.00	595,212.00

INDEPENDENT ASSURANCE REPORT ON THE GREEN BONDS ANNUAL REPORT 2018

To the President of ENTIDAD PÚBLICA EMPRESARIAL ADIF – ALTA VELOCIDAD.

Scope of the work

We have performed a reasonable assurance engagement on the of contents of Tables 2.1 and 2.2 of the section "Application of the Funds to Green Eligible Projects" of the Annual Green Bonds Report 2018 (hereinafter, Green Bonds Report), of ENTIDAD PÚBLICA EMPRESARIAL ADIF – ALTA VELOCIDAD, (hereinafter ADIF-AV or the Entity).

In particular, the specific aspects that we have confirmed about the aforementioned information are the following:

- That the net funds received by the Entity for the issuance of the Green Bonds, made on April 23, 2018, coincides with the net funds stated in the Green Bonds Report.
- That the typology of the projects in which the investments have been materialized, stated in the Green Bonds Report, corresponds to one of the two categories of "eligible green projects" indicated in the Entity's Green Bond Framework.
- That the investment made in the eligible green projects, stated in the Green Bonds Report, is greater than the net funds received from the Green Bonds issue, made on April 23, 2018.

Inherent limitations

Our assurance work has not included the evaluation of the risks of material misstatements due to fraud or error, nor the evaluation of the control environment, nor of the internal control implemented by the Entity for the adequate preparation and presentation of the information included in the Green Bonds Report.

Responsibility of ADIF-AV's Management

The preparation of the Green Bond Annual Report and its contents are the responsibility of ADIF-AV's Management, which is also responsible for establishing, implementing and maintaining the internal control and management systems where information is obtained.

Our responsibilities

Our responsibility is to issue an independent assurance report, based on work performed in accordance with the provisions of ISAE 3000 "Assurance Engagements Other Than Audits or Reviews of Historical Financial Information" issued by the International Auditing and Assurance Standards Board (IAASB) from the International Federation of Accountants (IFAC) for a reasonable level of assurance.

This standard requires planning and applying procedures to obtain sufficient evidence to reduce the risk of the assignment to an acceptably low level, according to the circumstances thereof, as a basis for expressing a conclusion.

For the purpose of this report, we have asked Management and the units of ADIF-AV which have participated in the preparation of ADIF-AV's Green Bond Annual Report various questions and we have applied certain procedures including, in general and amongst others, the following procedures:

- Obtaining and reading of the Green Bonds Report issued by the Entity.
- Meetings with ADIF-AV's staff and management at a corporate level and at the level of its business of the Green Bonds projects, to ascertain the nature of the projects financed by Green Bonds and the correct allocation of the funds.
- Verify the cash receipts, in the bank account of the Entity, of the net funds received for the issuance of Green Bonds, made by the Entity on April 23, 2018, by reviewing the corresponding bank statements.
- Confirm that the typology of the projects in which the investments stated in the Green Bonds Report have materialized corresponds to one of the two categories of "eligible green projects" indicated in the Entity's Green Bond Framework.
- We have confirmed whether the investment made in the eligible green projects, stated in the Green Bonds Report, is greater than the net funds received from the Green Bonds issue made on April 23, 2018, by reviewing the main corresponding supporting documentation of the investment.
- Confirm, where appropriate, that the amount of funds obtained from the issuance of Green Bonds not applied to the investment of "eligible green projects" are invested in a responsible manner, in bank deposits, cash or equivalents, as indicated in the Framework of Green Bonds of the Entity.
- Obtaining and reading of the "Second opinion on ADIF-Alta Velocidad's Green Bond Framework", issued by an independent expert.

We consider that the evidence which we have obtained provides an adequate basis for our conclusions, drawing attention to what is indicated in the section on inherent limitations.

Our independence and quality control

We have complied with the independence and other ethical requirements of the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants (IESBA), which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behavior

Our firm applies International Standard on Quality Control 1 (NICC 1) and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

Conclusion

In our opinion, based on the procedures performed, we conclude that:

1) The net funds that ADIF-AV has received for the issuance of Green Bonds, made on April 23, 2018, coincides with the net funds stated in the Green Bonds Report.

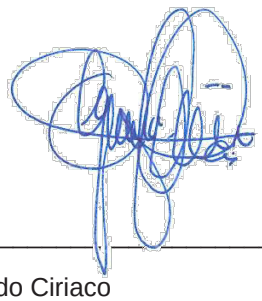
2) The typology of the projects in which the investments have materialized, stated in the Green Bonds Report, corresponds to one of the two categories of "eligible green projects" indicated in the Entity's Green Bond Framework.

3) The investment made in the eligible green projects, stated in the Green Bonds Report, is greater than the net funds received from the Green Bonds issue, made on April 23, 2018.

Other matters

This work does not constitute an audit of accounts nor is it subject to the regulations governing the audit activity in force in Spain, and therefore we do not express an audit opinion in the terms provided in the aforementioned regulations.

PKF ATTEST Servicios Empresariales, S.L.



Alfredo Ciriaco

April 5, 2019

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