



APICE plan

BARCELONA

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Maritime and port emissions mitigation
for air quality improvement



APICE Plan Barcelona

Maritime and port emissions mitigation for air quality improvement

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Foreword

The Environmental Quality General Directorate of the Catalan Government is pleased to endorse the results of the Project APICE, implemented in Barcelona by EUCC Mediterranean Centre and CSIC-IDÆA. This project has studied the Barcelona port contribution to the air quality of the metropolitan area and has put forward mitigation actions to decrease its share. Hence the APICE Plan Barcelona is fully in line with our General Directorate mission, which aims to achieve an air quality in accordance to public health requirements.

The collaboration and engagement of our institution, the Project partners and the Port Authority all along this Project has benefited us all. Thanks to APICE the Catalan Government holds data on Port emissions to a more detailed scale and so, as described in this document, on the most suitable actions to mitigate them. These measures, when lined up to those presented in the Barcelona Metropolitan Area Air Quality Improvement Action Plan 2011-2015, will allow achieving our air quality objectives.

Our General Directorate will devote all necessary efforts to implement those actions of our competence as well as to advocate others to the pertinent stakeholders. All at once we will continue supporting the Barcelona harbour as a key development hub for Catalunya. Estas medidas, junto con las recogidas en el *Pla d'actuació per a la millora de la qualitat de l'aire 2011-2015*, permitirán alcanzar los objetivos deseados de calidad del aire en el área metropolitana de Barcelona.



Isabel Hernández

Deputy General Secretary for Air Pollution Prevention and Control Environmental Quality
General Directorate
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Funding



Collaborators



Project partners



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The World Health Organisation (WHO) informs Some impacts of air quality on health

Urban outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year. Those living in middle-income countries disproportionately experience this burden.

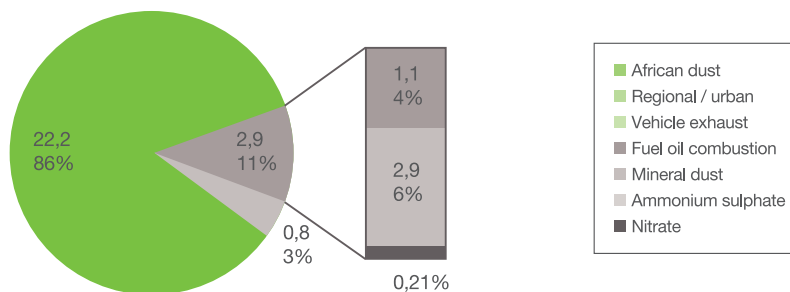
Exposure to air pollutants is largely beyond the control of individuals and requires action by public authorities at the national, regional and even international levels

The WHO Air quality guidelines represent the most widely agreed and up-to-date assessment of health effects of air pollution, recommending targets for air quality at which the health risks are significantly reduced. The Guidelines indicate that by reducing particulate matter (PM₁₀) pollution from 70 to 20 micrograms per cubic metre, we can cut air quality related deaths by around 15%.

Introduction

The Port of Barcelona is a key player in the economical development of the metropolitan area. As usual in large urban conglomerations, air quality levels are not optimal in this area and they at times exceed legal thresholds, especially with regard to particulate matter (PM₁₀) and nitrogen dioxides (NO₂). A number of administrations and stakeholders confront this problem with serious consequences on human health. Barcelona port and its associated maritime and land traffic are the source of a relevant fraction of this pollution. According to the Catalan Government, port emissions represent 23% of PM₁₀ and 16% of NO_x emissions at the area declared “air environment protection zone as to PM₁₀ and NO_x” (40 municipalities), where the Air Quality Improvement Plan 2011-2015 is being implemented.

Urban PM₁₀ BCN: 26 µg/m³



APICE studies found that 11% of particulate matter (PM₁₀) concentrations measured in the city can be attributed to port activity emissions.

The full APICE Plan Barcelona as well as all preliminary studies is available at

www.apice-project.eu



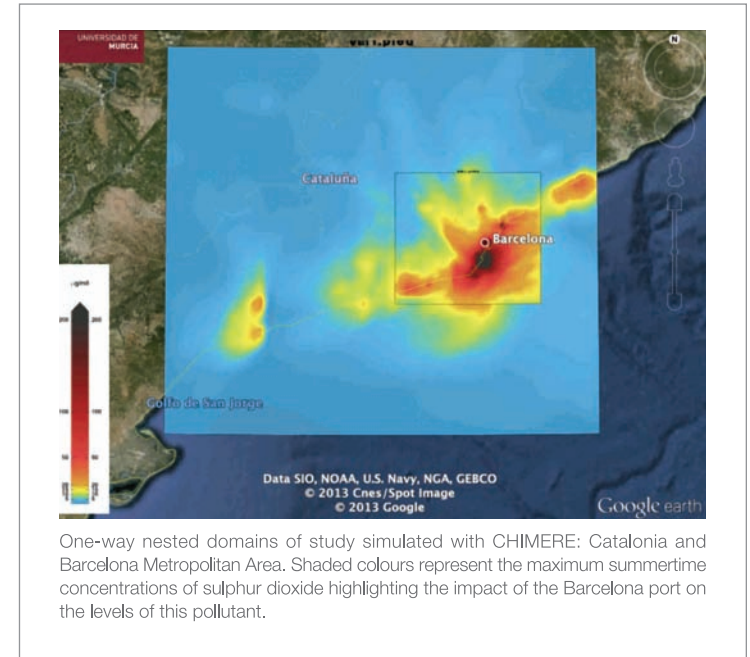
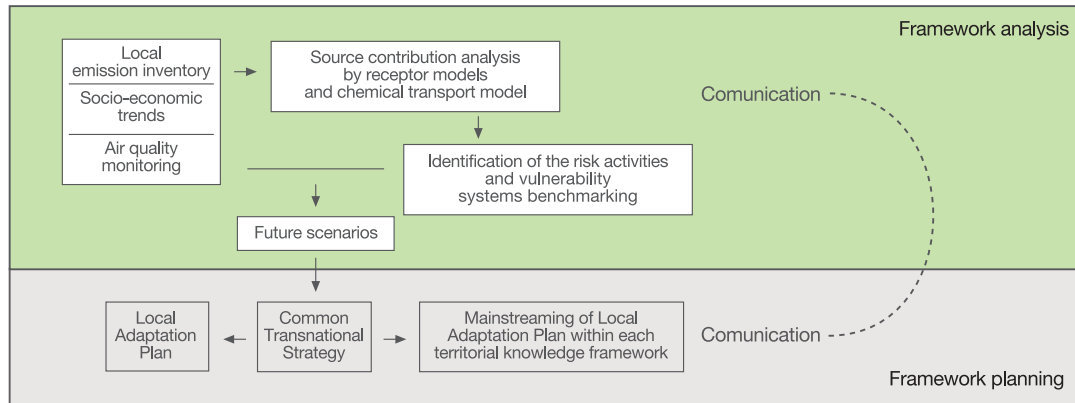
On the other hand, the APICE monitoring campaign implemented at the port indicates that the PM₁₀ levels are higher here than in the rest of the urban area. There is no such a large difference regarding NO_x, even though levels do increase in the proximity of truck traffic and ships and vessels.

The current legislation and the upcoming restrictions with regard to maritime transport air emissions push for the uptake of adaption measures.

APICE- Common Mediterranean strategy and local practical Actions for the mitigation of Port, Industries and Cities Emissions – has contributed to gain knowledge with regard to port air quality and associated emissions. Various studies highlight the relevance of ports as air pollutants emission source. The present plan is based on the results of APICE studies and on a stakeholder’s engagement and agreement process. It exposes those actions identified as most relevant to abate port related air pollution in terms of feasibility and effectiveness. It further identifies the steps to follow for each of the measures at the most workable detail. The team has put emphasis on raising awareness and opening dialogue with all interested parties in order to promote the measures implementation as well as on identifying potential financial sources to this end. Thus, APICE complement the regional and state efforts to improve air quality and intends to be a useful tool applicable to those bodies responsible for air emissions and control.

Process

Emission sources identification and air pollution monitoring campaign. Setting down the plan



1 Analysis phase

A good number of studies have been implanted in order to identify the most suitable actions to be included in the plan. To this end, and with the collaboration of the Catalan Government and the Barcelona Port Authority (APB), all port activities with associated air emissions have been studied and we have grown deeper in the Barcelona port emissions inventory of 2008. This data has represented the starting point to define socio-economic trends and two future emission scenarios, one following the current trends and another adapting to the effects of the APICE and Catalan Government plans.

Emission data has allowed evaluating pollution dispersion and the source contribution through the MM5-CHIMERE model. On the other hand, the team has carried out an intensive air quality monitoring campaign at the port area and a source contribution analysis through receptor models. Stakeholders' consultations have been fundamental to identify issues and improvement opportunities. The monitoring campaign results, the pollutants dispersion model and the evaluation of criteria and actions have allowed the selection of the priority actions of the action plan.

2 Planning phase

Once priority actions have been identified and the beneficiaries have confirmed interest on their execution, they have been developed to the largest possible detail in order to offer an implementation roadmap. Firstly, the measure state of the art is introduced, explaining the conditions of the port of Barcelona regarding the measure as well as good practice examples from other areas which can provide inspiration. Next, the implementation process is documented and particularized through the identification of associated stakeholders and their role and, whereas possible, cost estimate and possible financial sources. Last, the emission abatement effect of each measure is estimated, allowing to build the APICE mitigation scenario. The plan has been reviewed by and embraces the feedback of key players as the Barcelona Port Authority, the Spanish Merchant Navy General Directorate and the Air Quality General Directorate of the Catalan Government. It is especially significant that the last has signed a support letter endorsing the results and committing to promote the plan implementation.



APICE Plan Barcelona

Maritime and port emissions mitigation for air quality improvement

//Ship and vessels activity

//Harbour craft

//Land traffic: heavy-duty vehicles

//Land traffic: locomotives

//Cargo handling equipment

//Solid bulks

//Enlargement and maintenance works

//Emissions and air quality monitoring

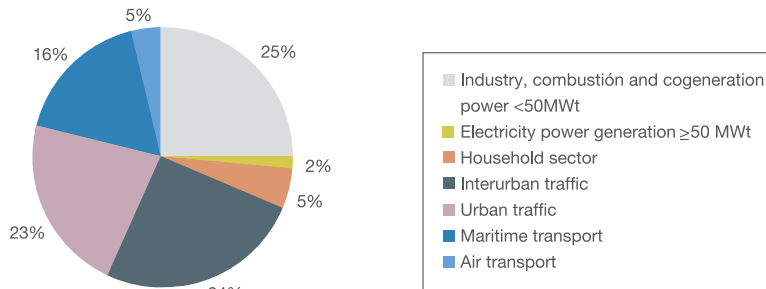
//Governance, monitoring and financing the plan

//Future emission and immission scenarios for the Barcelona Metropolitan Area

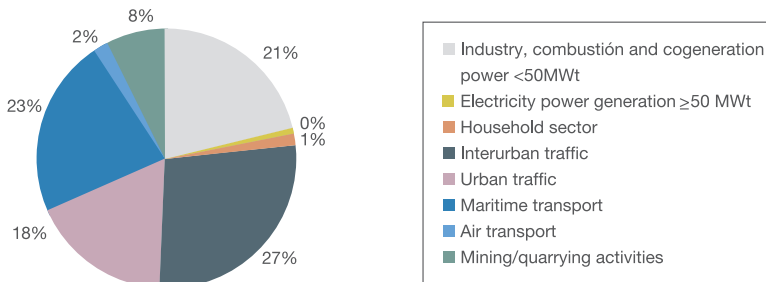
El Barcelona port and the maritime and terrestrial transport linked to it are the origin of an important share of air pollution in the metropolitan area. The Catalan Government emissions inventory of 2008, illustrated in the figure, assigns to the port 23% of PM₁₀ and 16% of NO_x emissions at the area affected by the Air Quality Improvement Plan. The project APICE has analysed those emissions derived from maritime and port traffic, identifying the sources and calculating emissions for each of them. The horizon 2015 emissions have been moreover estimated according to the current trend.

Should mitigation measures not be undertaken, NO_x emissions at the port - a critical pollutant in Barcelona- will increase. A decreasing trend is nevertheless expected for SO_x and PM₁₀ as a result of the entry into force of stricter regulations for fuel of vessels. It is important to emphasise the contribution of vessels as compared to other maritime transport and port activity sources. Following the analysis of emission sources and in view of the urgency to abate emissions, measures have been identified addressing each of the sources. The implementation of the APICE Plan would result on a 12% NO_x y PM₁₀ emission abatement as compared to the 2015 trend scenario.

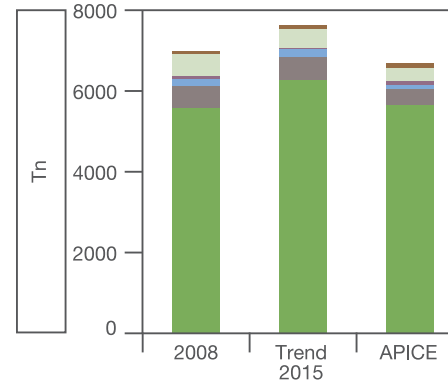
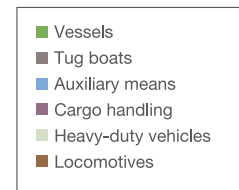
NO_x emissions within Barcelona metropolitan area



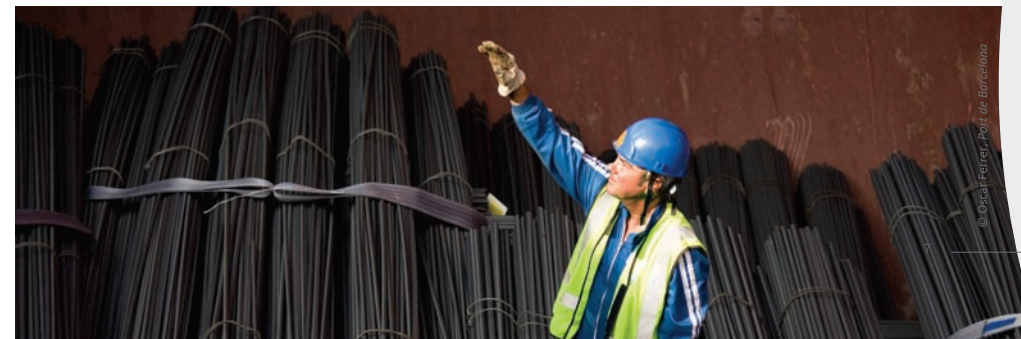
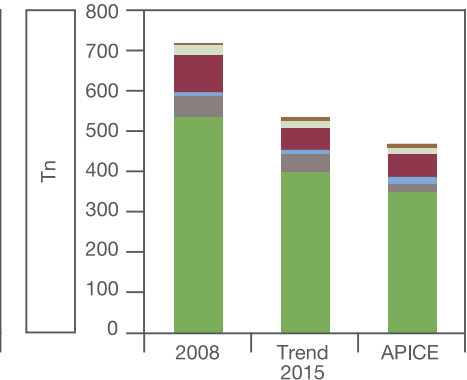
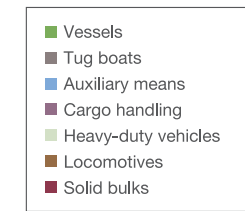
NO_x emissions within Barcelona metropolitan area



NO_x emission sources



PM₁₀ emission sources



1 //Ship and vessels activity

International ship emissions thresholds are set by the International Maritime Organization (IMO). The European Union establishes further requirements for vessels within its ports. While SO_x emissions are controlled through fuel sulphur

content, NO_x emissions are ruled according to the ships construction year. In order to fulfil these requirements, vessels will have to change the type of fuel or adapt their engines.

1.1 LNG promotion as fuel for vessels

According to reports of the DNV classification society, LNG is currently an interesting fuel for maritime traffic commercially and offers reductions of around 25% CO_2 , full elimination of SO_x and nearly 90% of NO_x . However, there are still barriers to overcome in order to facilitate LNG being a widely use fuel. APICE proposes to work in three aspects:

Development of normative framework for ships propelled by LNG

Nowadays, there is not international non national regulations for the use of LNG in vessels other than ships that transport gas, which is a barrier for introducing this fuel. However, international rules are being developed (IGF code and ISO TC 67/WG 10). At national level, the Merchant Navy General Directorate should play an important role to promote LNG within IMO framework.

Implementation of infrastructure and logistic for LNG supply

Setting up a basic infrastructure, as a pilot project, is necessary to use LNG in the Mediterranean and to foster this fuel like it has been done in North Europe. Considering current commercial relations, it would be convenient to dedicate this pilot project in West Mediterranean to Short Sea Shipping.



Ports that could make part of this network are: Valencia, Barcelona, Palma de Mallorca, Marseilles-Fos, Bastia, Genoa, Livorno, Civitavecchia and Olbia.

Networking to promote LNG in maritime transport

ELNG development as maritime fuel is complex from the normative and logistics side. It is necessary to work co-ordinately and in network. Hence, at Spanish level, the Asociación de Ingenieros Navales y Oceánicos de España (AINE) has set up a working Group (PAT-20) to address mainly LNG legal and technical aspects. Furthermore, several companies and entities are setting up an Association to promote natural gas in the transport sector.

This measure aims at creating and making operational this Association to foster the use of natural gas in vessels and ports, at normative, logistics and supply levels. The Port of Barcelona and Catalan Government could also take part in this group to provide local knowledge and implement infrastructures.



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1.2 On board air emissions inspections

Both national and regional plans to improve air quality consider on board air emissions controls for ships. European regulations regarding the sulphur content in fuel and conventional inspections seem to have a positive impact on reducing SO_x emissions. However, in the case of NO_x emissions, current inspections may not have effect since they do not depend on the sulphur content.

The state and regional authorities responsible for air quality should expose the need for this measure to the Merchant Navy General Directorate, and once there is an agreement to enhance emissions control, an inspection protocol should be developed for exhausted gases and admissible emission values. It would be also necessary to provide the maritime authorities with the necessary tools for measurement, or delegate this task to other accredited institutions.

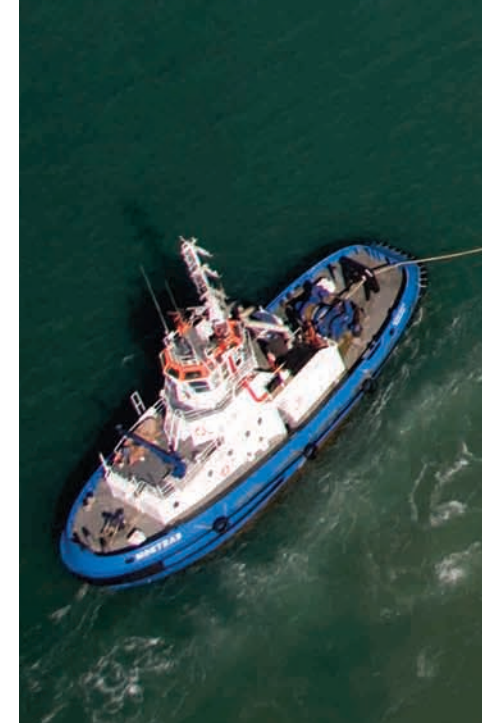
1.3 Cold-ironing

Currently there are some ports worldwide where it is possible to supply electricity to ships while at berth, thus avoiding local emissions.

Taking advantage of the potential of natural gas, it is proposed to deepen the ongoing study on the construction of floating platforms / barges equipped with natural gas generators that could produce electricity and supply it directly to cruise ships. It would also be necessary to study the possibility of deploying these generators on land, even on tugs. Another alternative which is being studied is direct natural gas supply by pipeline from land to auxiliary ship engines.

2 //Harbour craft

Harbour craft consists of tug boats and other vessels that perform various tasks such as cleaning of floating debris, bunkering, etc. Regarding air emissions, the main contribution corresponds to the activity of the tug boats.



2.1 Optimizing tug boats working time

The APB sets the time that tugs must operate for towing vessels entering and leaving the port. At present, the maximum response time is 25 minutes, but tug boats are often much earlier due to early notice, and therefore release emissions longer than necessary.

The measure proposes to renegotiate the time of availability of tugs. For this, the APB should judge the adequacy and agree to modify the requirements, always ensuring the service quality and safety.



2.2 LNG as fuel for tug boats

Currently the Barcelona harbour tug boats have diesel engines and use fuel containing less than 0.1% sulphur, as required by law. All of them are certified IMO NO_x and are relatively new. However, in the long term, it is appropriate to think about replacing the type of fuel and/or other retrofitting technologies.

The measure consists in incorporating, converting or replacing current fleet units by tug boats powered by LNG. To this aim, a pilot project on a tug boat should be implemented to show the feasibility of this solution, with collaboration between different stakeholders.

Promoters of the project could be one of the towing companies and a gas supply company. The APB could facilitate procedures and regulations on safety, together with the Merchant Navy General Directorate. The Government could also participate in the pilot project through the Catalan Energy Institute (ICAEN).

3 //Land traffic: heavy-duty vehicles

According to APB data, around 4.500 trucks have daily access to the port, most of them in regular manner and being diesel powered. In 2008, 32,687,121 tons of goods were transported by truck, corresponding to 98.3% of goods (the rest by train or pipeline).

3.1 Trucks conversion to CNG and LNG

Taking advantage of the potential of natural gas in the port, CNG and LNG can be seen as future fuels with much lower generation of air emissions. The market already offers tractor models for these fuels.

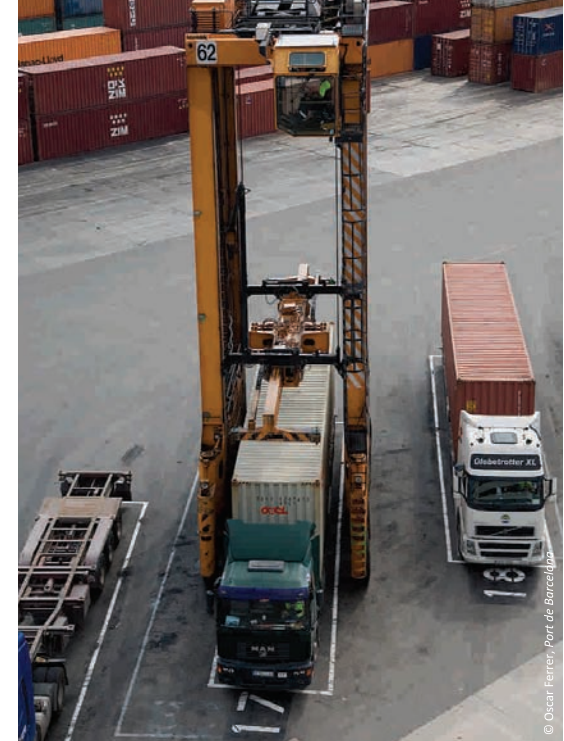
The measure would lie in implementing a pilot program to which some companies could subscribe to replace their diesel engines to dual. To do this, support of natural gas supply companies and the administration should be made available, as there are financial incentive programs for the purchase of environmentally friendly vehicles.



3.2 Efficient driving in port

Currently there are agreements signed between entities such as the Logistics Activities Zone (ZAL), Port of Barcelona and Catalunya Barcelona Centre Logistics Association (BCL), Catalan Energy Institute (ICAEN) and Royal Automobile Club of Catalunya (RACC) on energy efficiency in transport and efficient driving, which can reduce fuel use by about 12%.

The ZAL will explain and train on energy efficiency and efficient driving to the fleets operating in the port, both own brands as freelancers. It will explore the possibilities of microcredits to finance investments to benefit independent carriers. The ZAL will organize workshops to promote this initiative. It is intended to cover the entire fleet of trucks through CBL, including that in charge of containers. The implementation of this measure may be accompanied by the explanation of the eventual introduction of the CNG program in trucks, described in the previous measure.



3.3 Wheel washing systems

According to the results of the APICE air quality monitoring campaign, vials, together with works, are a major source of contribution to particulate pollution. This is because of the passage of vehicles resulting in re-suspension of already deposited particles. The Port of Barcelona has a sweeper-vacuum cleaners system to mitigate this problem.

According to the report *Studies of Mitigation and Corrective Measures of air emissions caused by port activities* by HADA project, two options are proposed: washing system with rollers or wheels-pass system. Another alternative would be gravel beds as the Catalan government propose for quarrying activities.

4 // Land traffic: locomotives

The Port of Barcelona has devoted great efforts to the development of the railway as land transportation option in the port, motivated by economic, strategic and environmental issues, particularly with the implementation of the Railway Master Plan of the Port of Barcelona. The image shows the new port rail system.

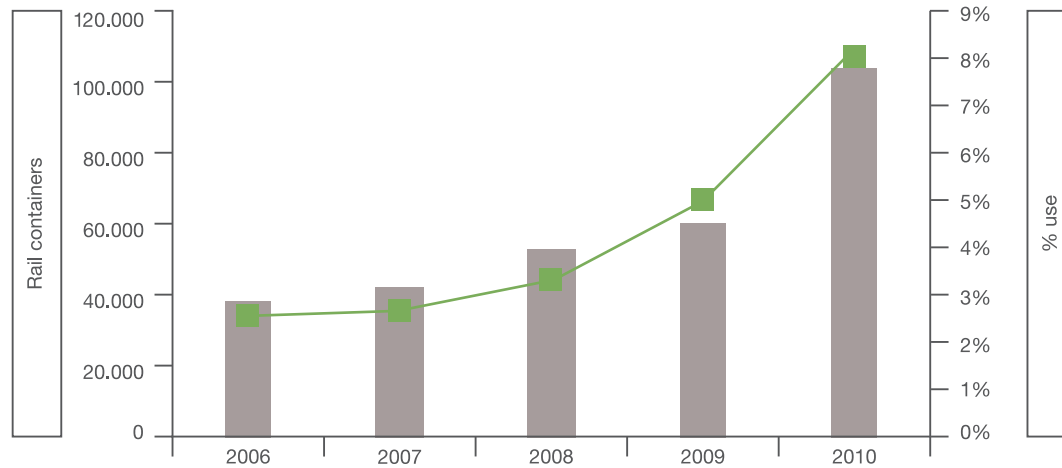
4.1 Increased market share

Rail has been gaining ground to road in recent years, and it is expected to continue increasing in the future. In addition to the built infrastructure and operational improvements, there is a key area for increased market share: the commercial part. It is about gaining more customers using this transport. The Port of Barcelona, through its Commercial Department, works continuously on these aspects. A remarkable strategy to increase rail's share is the application of a rate policy that favours rail (APB applied the maximum benefits allowed by law).

The measure lies in strengthening commercial missions to gain more customers using rail instead of road, taking advantage of the extensive network and existing commercial offer.



Evolution rail use at Port of Barcelona 2006-2010. Containers

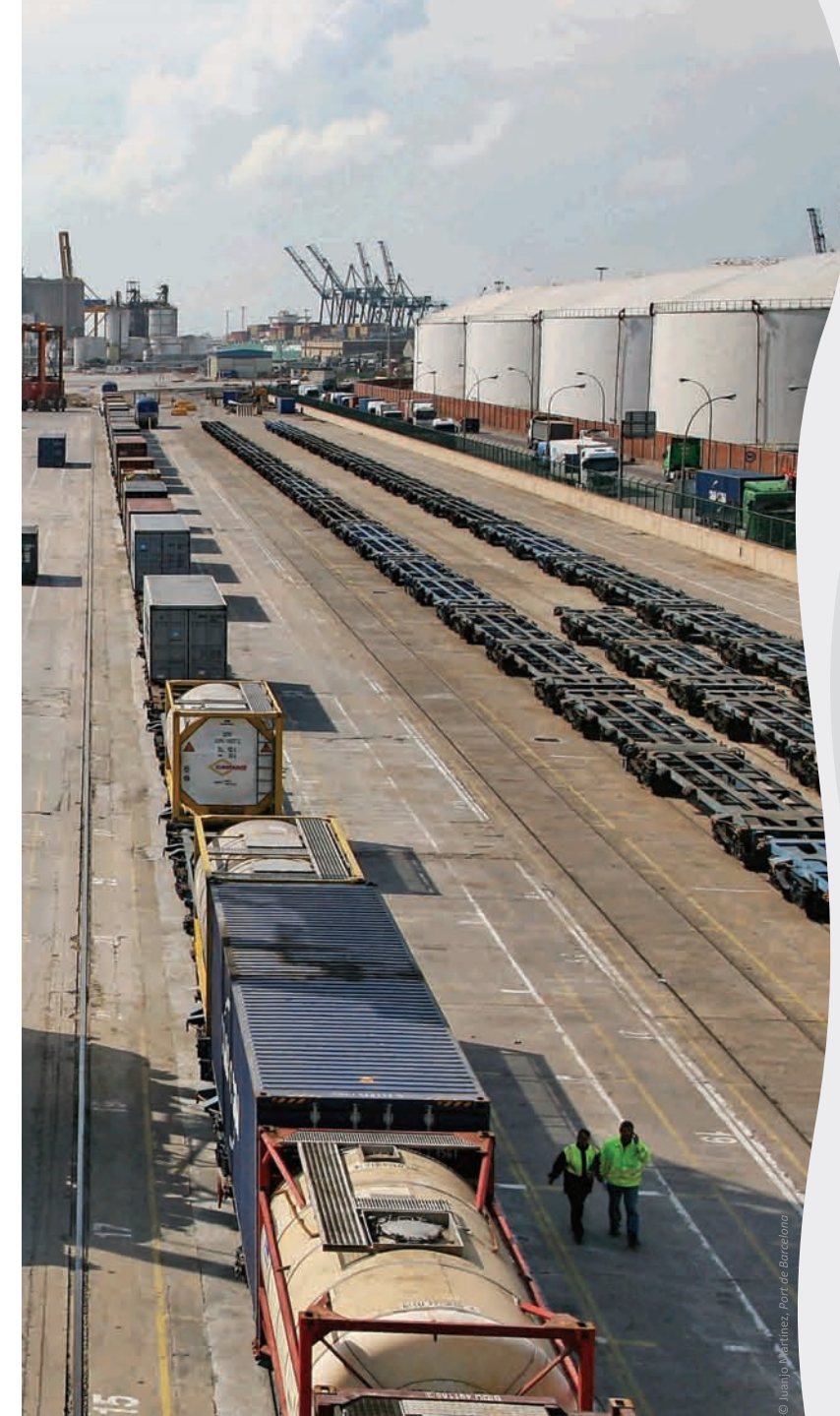


Goods transported by rail have increased considerably, particularly in the case of containers

4.2 Locomotives powered with natural gas

The locomotives operating in the port are diesel, although most of them are electrified once they are outside the harbour at Can Tunis station.

While there are different options regarding emission reduction technologies and alternative fuel, APICE goes for the introduction of natural gas locomotives operating within the port as tractors, either by substitution or conversion. The use of natural gas as an alternative to diesel fuel can be applied to the existing fleet of locomotives with a cost-benefit relatively effective. NO_x emissions can be reduced by up to 78%. An advantage of the dual fuel technology is to have flexibility to operate fully with diesel if no natural gas available. The cost of replacing a diesel locomotive engine for dual engine diesel or natural gas is between 300,000 and 600,000 €



5 //Cargo handling equipment

Regarding this emission sector, APICE focuses on three container terminals: TCB, Prince of Spain Dock and Prat Dock (the two latter operated by TERCAT), where the largest number of cargo handling equipment is found. TCB has invested in the installation of catalytic converters in some machines. Most of the activity is done by machinery which has been improved and the oldest only come into operation at peaks of work. Regarding Prat Dock of TERCAT, it should be noted that it is semi-automated and much of its equipment is powered by electricity and will progressively assume the Prince of Spain Dock activity.

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5.1 Equipment substitution/conversion to natural gas

Replacing diesel with natural gas versions equipment can significantly reduce emissions, up to 50-80% and 90-95% NO_x and particulate matter respectively. However, it can be very expensive. While some engines would meet some minimum requirements for their conversion or adaptation to natural gas, others may be fully replaced.

The measure would consist in replacing or converting TCB equipment, fully or partially depending on possibilities, in an analogous manner to measure on tug boats powered natural.

5.2 Other abatement emissions strategies (technology, fuel and operations)

Regarding measures to improve equipment by reducing emissions through chemical and physical processes that change the composition of the exhaust gases, it is worth mentioning: particulate filters, partial particulate filters, diesel oxidation catalyst, NO_x catalyst, catalytic reduction and selective catalyst for NO_x absorption. As for fuel options, other alternatives are: diesel emulsions, biodiesel, Fischer-Tropsch diesel and E-diesel. Concerning operational measures, it would be interesting to introduce an idle reduction program, which also saves costs to companies. These programs have been successfully introduced in the ports of New York and New Jersey, among others.

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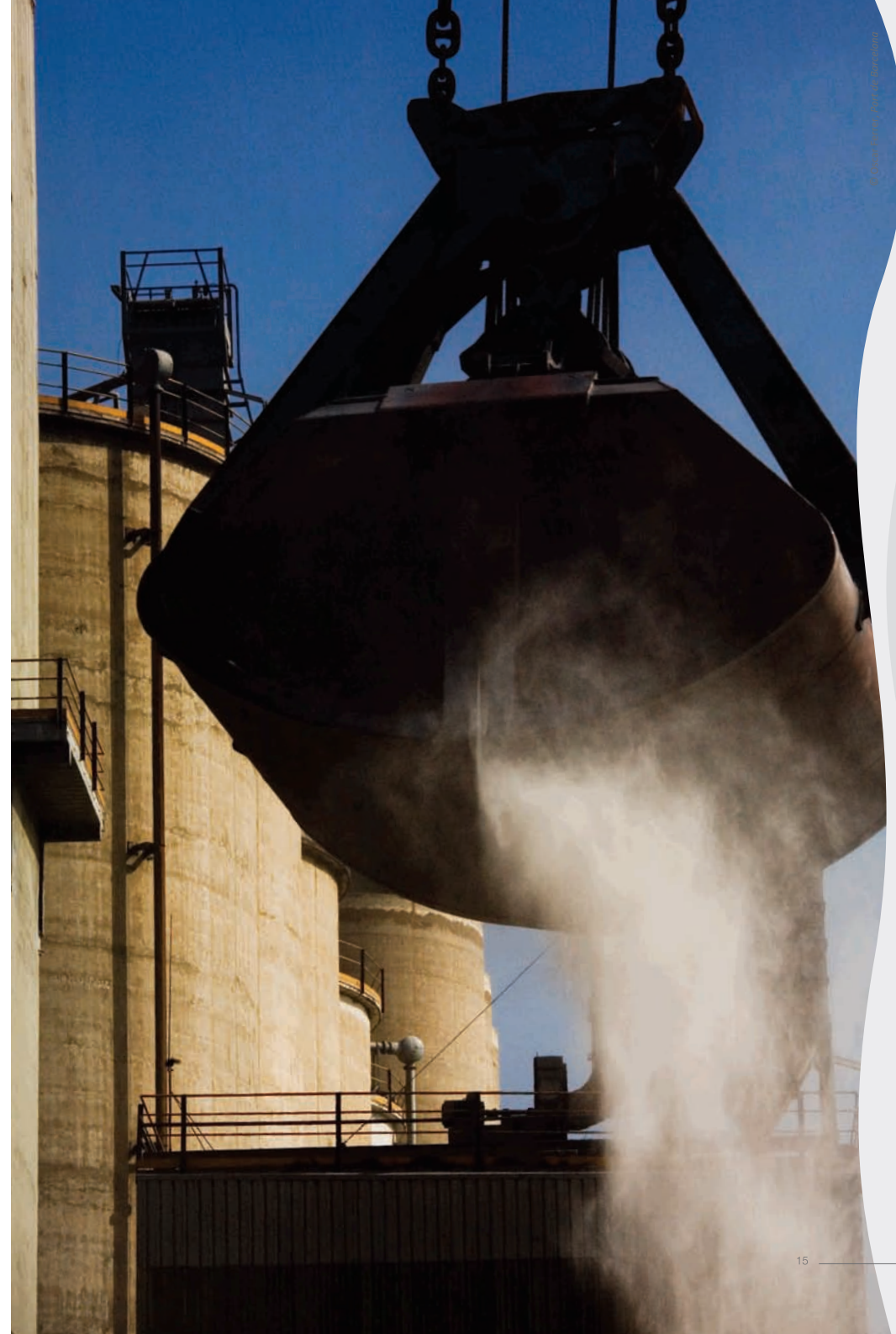


6 //Solid bulks

6.1 Best practices implementation as developed by Ports of the State

The Port of Barcelona has introduced significant improvements in handling solid bulks, which are going to be governed by a port ordinance, and according to the previous air quality plan of the Catalan Government. Furthermore, it is planned to consider the transfer of the bulk terminal to another area of the port, although there is still no roadmap for action.

This measure embraces the implementation of the *Best Practice Guidelines for Handling Solid Bulks developed by Ports of the State* under the HADA project, through the new port ordinance, both for existing and new docks.



7 // Enlargement and maintenance works

The port of Barcelona has recently completed a major extension regarding surface and installations. Associated works have had a notable effect on the emission of particles due to the movement of sand and truck traffic, as evidenced by the air sampling campaign conducted by APICE. However, it should be noted that corrective actions have been taken as the zone watering. In addition to these works, the port area often undertakes other works, whether maintenance or minor extensions, and thus associated emissions should be controlled.

7.1 Works emissions control

As described in the 2011-2015 plan to improve the air quality of the Catalan Government for the case of municipalities, it would be desirable to restrict the operations of the port works in environmental pollution episodes. The Generalitat would warn about these episodes to the Port Authority, which in turn would do so to the companies responsible for execution of the work.



8 //Emissions and air quality monitoring

Generalitat de Catalunya is the body responsible for the assessment of air quality in Catalonia through the Air Pollution Monitoring and Forecast Network. In addition, through its Technical Office for Air Quality Improvement Plans, conducts periodic emission inventories as the basis of their plans. The 2007-2010 plan established a tracking system by which the Port Authority of Barcelona reported annually on progress on measures affecting the port. Moreover, the Port of Barcelona has its own network of air quality monitoring and issue annual reports. Finally, it is to note that several port companies (such as tugs and container terminals) perform comprehensive monitoring of its operations and energy efficiency as part of their quality systems, and thus becoming a valuable resource for inventories.

8.1 Regular update of emissions inventories

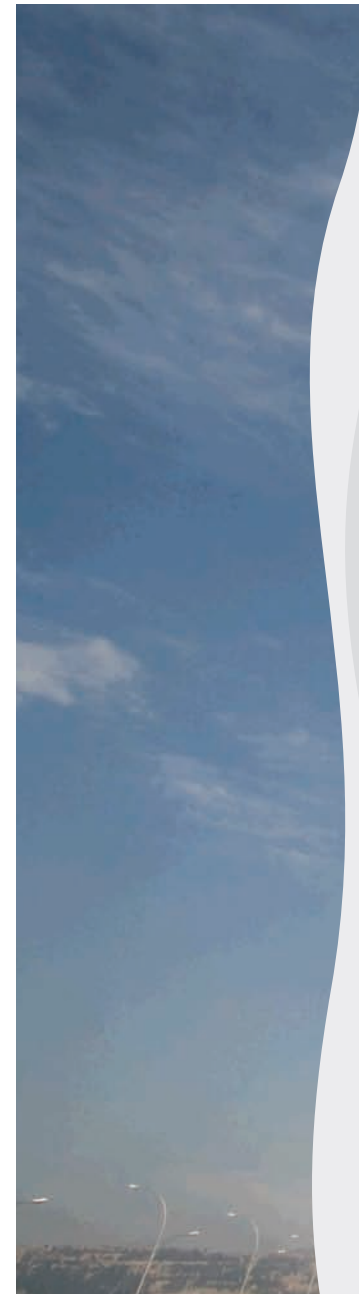
As for the 2011-2015 plan, the Technical Office for Air Quality Improvement Plans is responsible for conducting, with data provided by the APB, the emissions inventory of the port focusing on vessel traffic, particularly in the phase of manoeuvring and berthing. The APICE project, working closely with the Port Authority and the Technical Office, has expanded the inventory to include other sources related to maritime traffic.

Given the position of the Port Authority and its accessibility to data, it is the most appropriate institution to conduct such inventories. APICE project offers the worksheet used for inventory of 2008, which could provide a basis for future inventories. In addition, the sheet includes the two scenarios considered so this tool can still be used. Emission inventories should be updated while the Catalan Government updates other emission sectors for their air quality plan, avoiding a duplication of efforts.

8.2 Air quality modelling

APICE has developed an air quality assessment system through the air dispersion model MM5-CHIMERE. Modelling activities have been conducted not only for the emissions scenario 2008, but also for the trend 2015 and mitigation scenario resulting from APICE plan implementation. Thus, it helps verifying the impact of the proposed measures on immission levels, for example regarding pollutants exceedances.

APICE makes available to the Catalan Government and the Port Authority the emission data used for modelling and mapping generated. These data may be used free of charge for future modelling that any of the two entities may perform.



8.3 Air quality monitoring

The Port of Barcelona has an air quality monitoring network in place. Continuous air monitoring has been crucial for the identification of emission sources associated with these substances, and to take appropriate measures to mitigate adverse effects.

The control of air pollution in the port of Barcelona should continue and APICE proposes restructuring the monitoring network in the light of the analysis of the sampling campaign, advising, for instance, the maintenance of two well-instrumented sites (particles, NO_x, SO₂ y COVs).

8.4 Collaboration structure on air emissions

The Generalitat de Catalunya and the APB are two key players in the control and monitoring of emissions and air quality in the port. Besides its regular collaboration, the APICE project has organized meetings with both entities in the form of "working tables", which have served to work together and validate preliminary results.

APICE proposes as a measure to formalize these working tables as a follow-up tool and a body in which to agree on the necessary actions to control and monitor port emissions. The structure should be composed of at least the Industrial Security and Environment Department of the APB and the Technical Office for Air Quality Improvement Plans of the Generalitat. It is advised that other departments of these organizations attend meetings due to multi-sectoral aspects of air quality. In these meetings, which could be annual, progress on the abatement measures would be presented and the plan would be adapted when necessary.



9 //Governance, monitoring and financing the plan

APICE Plan was developed in a spirit of consensus between the project partners and stakeholders, especially the APB and the Generalitat de Catalunya. These two institutions are responsible for its implementation and follow-up. The Generalitat may integrate these measures into their plans to improve air quality. The APB, through its various departments and regulations, may promote or perform some actions as described in the preceding chapters. APICE partners in Barcelona, EUCC Mediterranean Centre CSIC - ID/EA could contribute in the manner they deem most appropriate.

For measures concerning companies operating in the port, "Best Environmental Practices" conventions with the APB can be a good source of funding. When such agreements are set, companies are entitled to bonuses as described in Article 19 of Law 48/2003 of 26 November on financial regulation and the provision of services of general interest ports, as amended by Law 33/2010 of 5 August.

Regarding energy and fuel measures, gas suppliers companies could finance the conversion or replacement of some units as pilot projects. In addition, ICAEN could participate in such actions. In any case, the port companies should be involved in these efforts which in the medium and long term would have positive effects in operational expenditures.

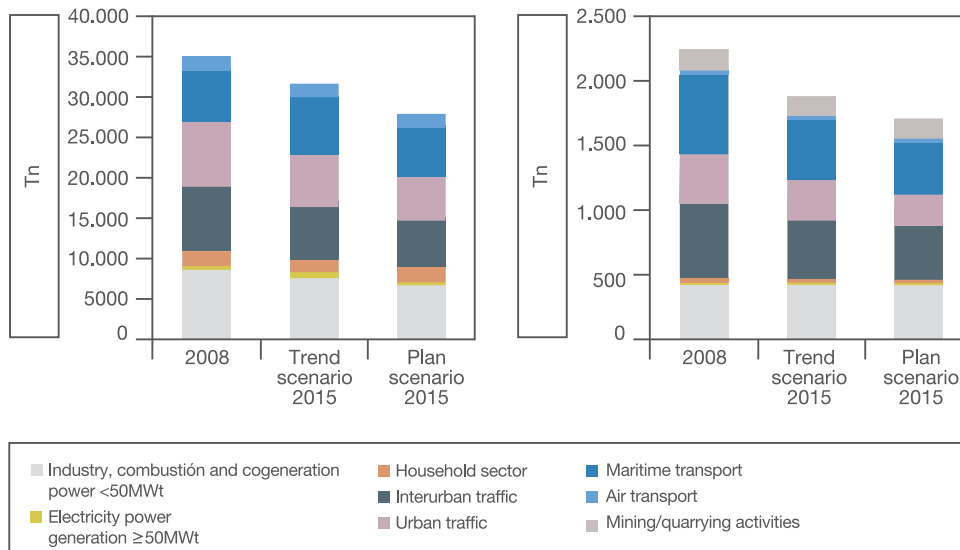
Finally, it is important to highlight the availability of European funding sources to implement some actions. For example, the APB has already mobilized over a million euro to improve the port's internal rail network through TEN-T, among other projects. The case of LNG seems best suited for such funding.



10 // Future emission and immission scenarios for the Barcelona Metropolitan Area

APICE project has followed the same approach as the Generalitat de Catalunya on the emissions evolution. As evidenced in the plan, APICE has assessed emission sources derived from shipping and port activity, while the Generalitat estimates the overall emission sources, including power generation, heating, land transportation, extractive activities, etc.

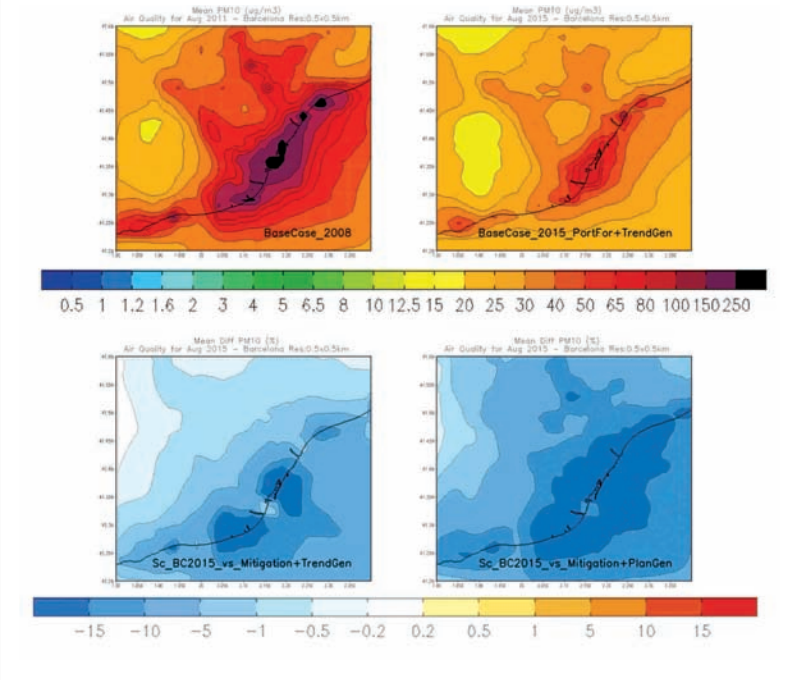
It is interesting to combine both assessments and note how APICE can contribute to the Government's efforts to reduce total emissions of the area affected by the air quality improvement plan. Thus, the shipping emissions estimated by the Government have been tuned with APICE studies, adding port emission sources and adjusting the baseline scenario and mitigation plan. The figures show the different emission sources with APICE contribution regarding fine-tuned sources of shipping and port.



As a result, considering all sectors, the plans implementation scenario (both Generalitat and APICE) reflects reductions of 12% and 9% of NO_x and PM₁₀ respectively, compared to the trend scenario. Concerning the emissions reduction between 2008 and plans implementation, the reduction is for both substances 18%.

Modelling air pollution and future evolution in different scenarios

Top-left map shows PM₁₀ concentrations (µg/m³) in August 2008. Top-right, concentrations are shown for the trend scenario 2015, where a slight decrease of concentrations is perceived. Bottom maps show two mitigation scenarios where difference with respect to scenario 2015 is shown in percentage. On the left, reductions achieved by APICE are shown, while on the right, the combination of joint Generalitat and APICE plans effect is displayed.



Conclusiones



The implementation of the European project APICE has allowed consensus building while formulating a plan for the abatement of those air emissions linked to the port of Barcelona and negatively affecting air quality at the metropolitan area. It can be said that the strength of this project has been the collaboration not just among the APICE scientific and planning team but with the stakeholders in charge of port and maritime activities and air quality. The plan does not compromise by any means the growth of the port of Barcelona; on the opposite, it regards it as a key development hub and aims to support it on the field of environmental excellence and social compromise.

Following the scientific studies and the plan formulation the time has come to implement the agreed measures. Stakeholders' engagement is crucial to succeed on air emissions abatement. Thus, the Catalan Government and the Port Authority play a major role in view of their competence on regulation. They can go further and encourage port and maritime enterprises to enhance their environmental management in ways that revert as financial savings in their operations. As regards financing, one of the challenges for implementation, the APICE Plan foresees existing sources which can be accessed by the affected group of actors.

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