Project confinancé parle Fonds Européen de Développement Régional

Project co-finnaced by the European Regional Development Fund

APICE

WP5.5. Local Adaptation Plan
Genoa

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CHAPTER 1. INTRODUCTION

In parallel with the investigation on air quality, APICE involved in a participative process a selection of local stakeholders, with the aim of providing useful data for improving the analysis of the area, of suggesting and sharing possible development scenarios, and, finally, of using APICE tools in the local territorial planning.
In the participation process that has accomplished the whole Apice project, the Province of Genoa has involved the following stakeholders:

- Port Authority of Genoa
- Liguria Region and ARPA Liguria
- Muncipality of Genoa,
- Harbor Office of Genoa

The Genoa Port Authority has been involved since the earliest stage of the project, and this institution is officially “Observer” of the Apice Project.
The Genoa Port Authority is developing the new Port Master Plan, whose guidelines were published in July 2012. Apice is considered a good tool to support decisions in the construction of this Plan.
The Liguria Region is in charge of the Air quality plan. The in force plane is dated 2006. In this plane, the harbor is identified as air pollution source, but the measures envisaged in 2006 to mitigate this impact had necessity to be better evaluated and more supported by scientific knowledge.

The scenarios of development foreseen by Genoa Port Authority in the new port master plan, which describe the harbor towards 2020, focus on five main themes:

- Expanding the harbor entrance for hotelling the last generation ships which require maneuvering ray of 300 meters.
- Increase the linear length of the piers in TEUs Terminal, with a capacity of 12 meters deep, for hotelling post-Panamax cargo-ships.
- Expanding Terminal TEUs spaces;
- Improving the infrastructural interconnection considering also the dry port area (Catch Area), with particular reference to the new railway line over the Apennines.
- Overcoming and mitigate possible/future risk situations within the relationship City-Port.

The discussion on these five themes – proposed by Genoa Port Authority - was the starting point for the assessment of the measures, to be investigated with the APICE tools.
Since the development of the APICE project coincided with the revision of the Port Master Plan, a bottom up approach was used in the definition of the reduction target.

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The main objective of such approach was to furnish a useful indication to the decision makers (and in particular to the Port Authority, which now is in charge of the new plan) on the possible impact of the future scenarios.

As first result of the APICE project, in Genoa for the first time it was developed a modelistic tool, able to reproduce with good agreement the actual situation and to simulate development scenarios.
The actual contribution of the port activities to the air pollution in Genoa, for the first time, was evaluated in a scientific and accurate manner.
A detailed analysis of the guide lines of the port master plan with APICE model requires a deeper knowledge of concrete actions which are going to be implemented by local stakeholders, and then a further study of expected effects of such actions.
This activity exceeds the objectives of APICE; nevertheless the stakeholders involved in the process decided, in agreement with the roadmap indicated by thy APICE partnership, to simulate the following scenarios:

1. Scenario at 2020 without mitigation actions
2. Scenario at 2020 with reduction of sulfur content in fuel.
3. Scenario at 2020 with reduction of sulfur content in fuel and electrification of selected quays

The power plant actually in activity in the Genoa harbour will be definitely closed in 2017, and this fact is considered in the three scenarios. The socio-economic trends to 2020 are an uncertainty in this crisis period. Nevertheless the Genoa port is living a paradox effect, which foresees a strong development of the traffic in the next years because it was estimated a concentration of activity in big ports, like Genoa is.

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CHAPTER 2. MEASURES ANALYSIS AND IMPLEMENTATION

2.1 Selection of the actions

The selection of the actions to be evaluated with APICE model has been carried on according to the APICE methodology proposed by Veneto Region (for further details see the final publication: " Reducing atmospheric pollution in the Mediterranean Port Cities - The results of APICE project")
Starting from the 47 different actions provided by Veneto Region, in Genoa the relevance of the actions has been evaluated using the Delphi methodology. APICE team has conducted the assessment according with the indications of Genoa Port Authority and Liguria Region in occasion of the local working table ad in specific interviews.
The general ranking of these measures is provided in Table I.

Description of the action	Final ranking		Sub-ranking		
	Ranking	Total evaluation	6 criteria	3 criteria	1 criteria
Hotelling - Shore power	1	**324,08**	1	1	1
Displacement of port activities	2	**281,47**	2	2	1
Air emissions inspection on board	3	**238,69**	6	6	2
Communication strategy	4	**236,24**	3	5	2
Alternative fuel (LNG)	5	**226,63**	5	3	2
Manouvering - Change in fuel while manouvering	6	**224,12**	7	9	4
Mode switching - Alternative fuels (CNG, LNG, hybrid)	7	**219,96**	4	5	4
Data Sharing: Inventoring Emissions and Monitoring concentrations	8	**213,07**	7	7	4
Monitoring and control (protocol or agreement between stakeholders, etc)	9	**212,24**	8	8	4

Table I: General ranking of the measures with assessment

From this evaluation, the local stakeholders selected as the most important actions for improving air quality in Genoa:

- ✓ the on-shore power supply during the hotelling phase
- ✓ the displacement of port activities,
- ✓ the inspection on board of air emissions
- ✓ the communication strategy.

The action ***Hotelling – shore power*** reaches the first ranking as it combines a high emission reduction with good technical feasibility and adaptation capacity to the actual piers organization in Genoa. The ***Displacement of port activities*** action gets a high total because of the definition of new governance and development plans as the PRP (Port Authority Development Plan). The ***Air emissions inspection on board*** reaches an high ranking position even if not the best position, because of the necessity to control the high traffic within Genoa Port. The ***Communication strategy*** represent a key action for Genoa Port Authority because of the international role of the Port within Mediterranean Sea as well as in the APICE project.

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2.2 The present situation in Genoa

The present situation in terms of pollutant concentration in the city of Genoa is represented in figure 1, where PM2,5 hourly concentrations in summer 2011 is represented.
This is the output of the APICE model, which reproduces the present situation in Genoa.
It is important to underline that the pollutants concentrations estimated in 2011 with APICE model are in good agreement with the values measured during the monitoring campaign held in Genoa in the period February – October 2011.
The projections and effect of the measures considered in the APICE scenarios is represented as a relative difference with respect to these reference values.

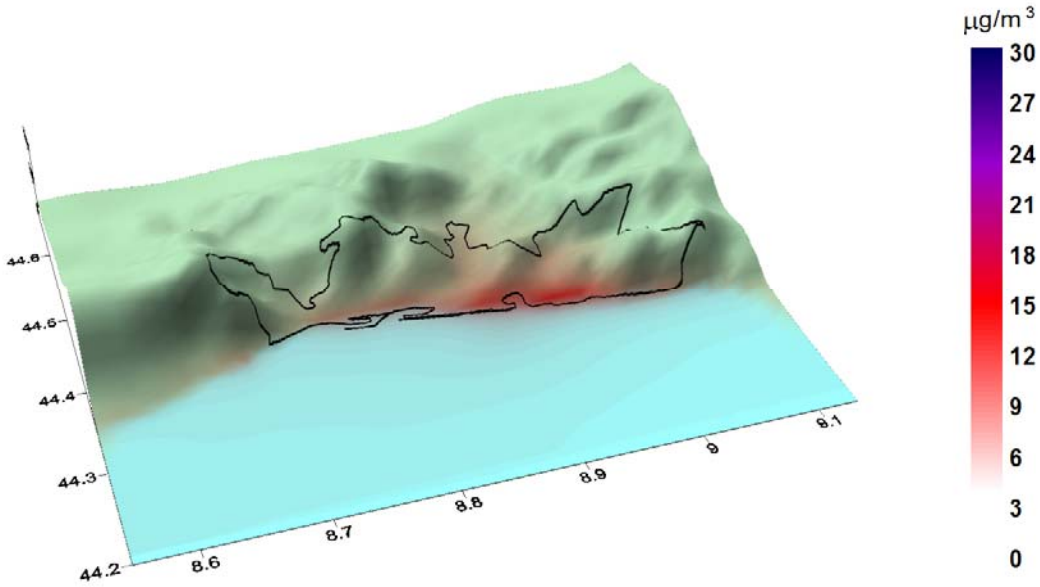

Figure 1 – PM2,5 hourly concentrations in summer 2011 in the city of Genoa

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2.3 Scenario at 2020 without mitigation actions (Scenario n. 1)

The first scenario considered with APICE model is based on the projection of the emissions inventory to year 2020, in the absence of mitigation actions.

The emission values at 2020 are calculated on the basis of the analysis of the ENEA project GAINS-Italy (http://gains-it.bologna.enea.it/gains/IT/index.login). According to this projection, there is an overall reduction in the concentration of PM2.5 in the atmosphere, due to a general reduction of all production activities, while an increase is expected for the emissions related to the maritime sector.

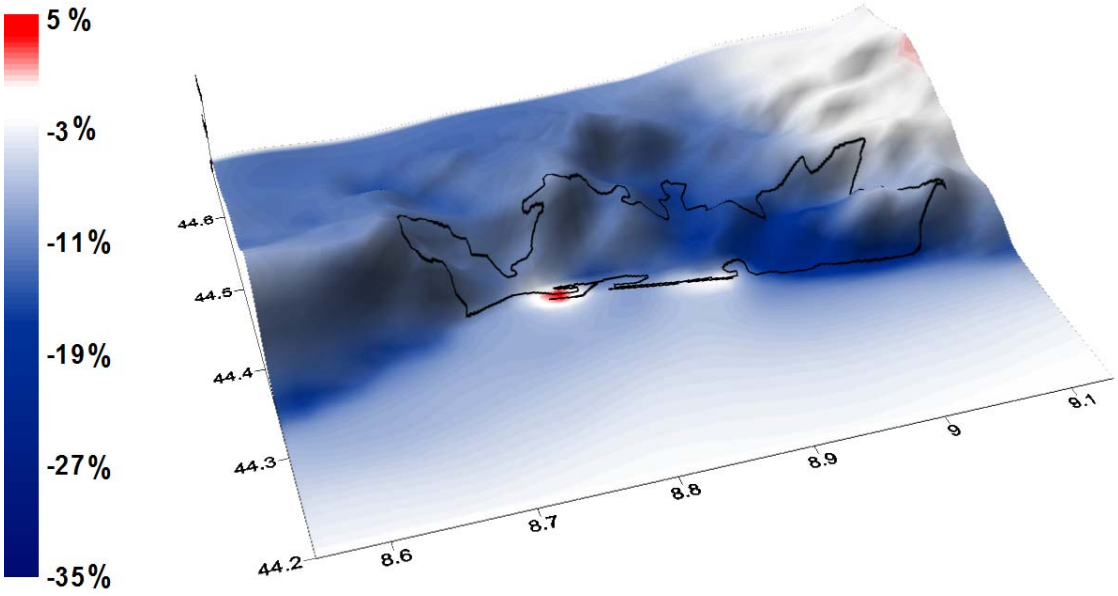

Figure 2: PM2,5 relative emissions in 2020 without mitigation actions

	Scenario I : 2020 emission					
	NO_x	**VOC**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2,5}$**
Emission change (%) with respect to actual inventory	7,9	13,0	0,0	13,0	12,0	12,0

Table 2

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2.4 Scenarios at 2020 with reduction of sulfur content in fuels (Scenario n. 2)

The second scenario considered with APICE model is based on the projection of the emissions to 2020 (like in scenario 2.1) , considering the regulatory limit imposed for the content of S in the fuels used by vessels.

For the sake of clarity, it is useful to underline that in 2008, the IMO adopted a resolution to amend the Marpol Protocol. This amendment - which came into force in July 2010 - introduces limits on the sulfur content for the marine fuel as follows:

- ✓ in the SECA: 1.00% from July 2010 and 0.10% from January 2015.
- ✓ in sea areas outside the SECA: 3.50% from January 2012, 0.50% from January 2020.

The simulation of the effect of such new regulatory limits required a series of assumptions which where shared with the APICE partners. In particular, it was assumed – based on literature data - that the reduction of sulfur in fuels causes a 20 % decrease in PM2.5 emission.

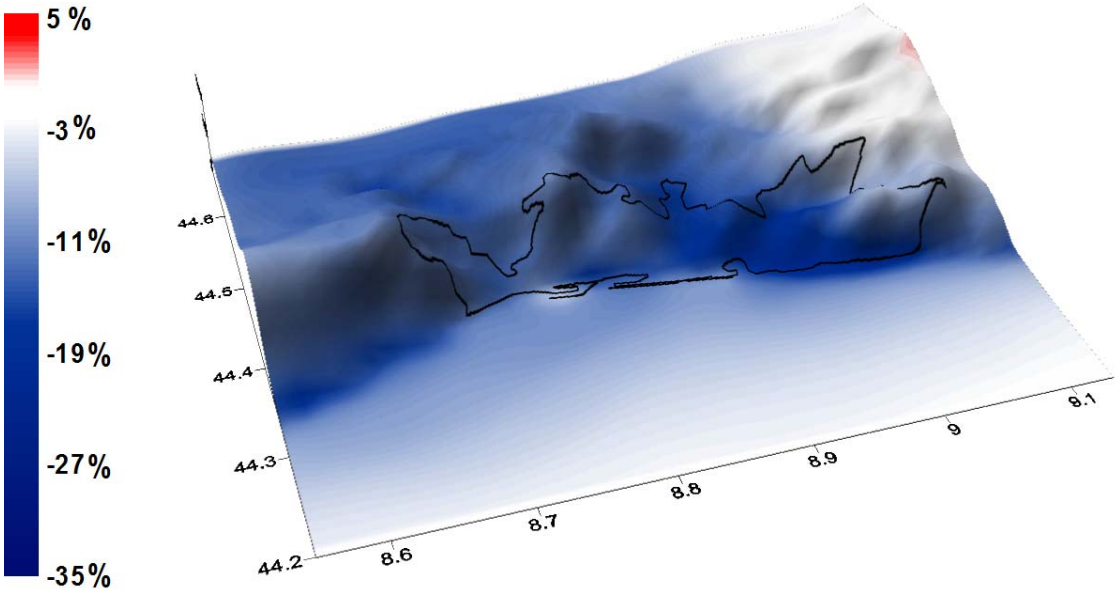

Figure 3: PM2,5 relative emissions in 2020 with Sulfur reduction in fuels

	Scenario II : 2020 emission + S% reduction in fuels					
Emission change (%) with respect to actual inventory	**NO_x**	**VOC**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2,5}$**
	7,9	**13,0**	**0,0**	**-43,5**	**-9,0**	**-10,4**

Table 3

Stakeholders: Genoa Port Authority, Harbour Office, Genoa Terminal Passengers, Ship Owners.

Advantages/Benefits: high impact on whole urban area of Genoa, with drastic reduction of particulate matter and SO2 derived fro port activities.

Uncertainties/Barriers/Bottlenecks/Disadvantages: level of control on the S level in fuels, availability of the fuel.

Implementation (Voluntary/regulatory action; Economic sources; etc): Regulatory action (EU directive)

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2.5 Scenarios at 2020 with electrification of VTE and Ferries Terminal (Scenario n. 3)

The third scenario considered with APICE model is based on Scenario n. 2 with the electrification.

As reported in the following scheme, the contribution of VTE and Ferries Terminal emissions to total harbor emissions is around 10%, while the abatement of the emission in the area close to the electrified quays is very high (till 80%).

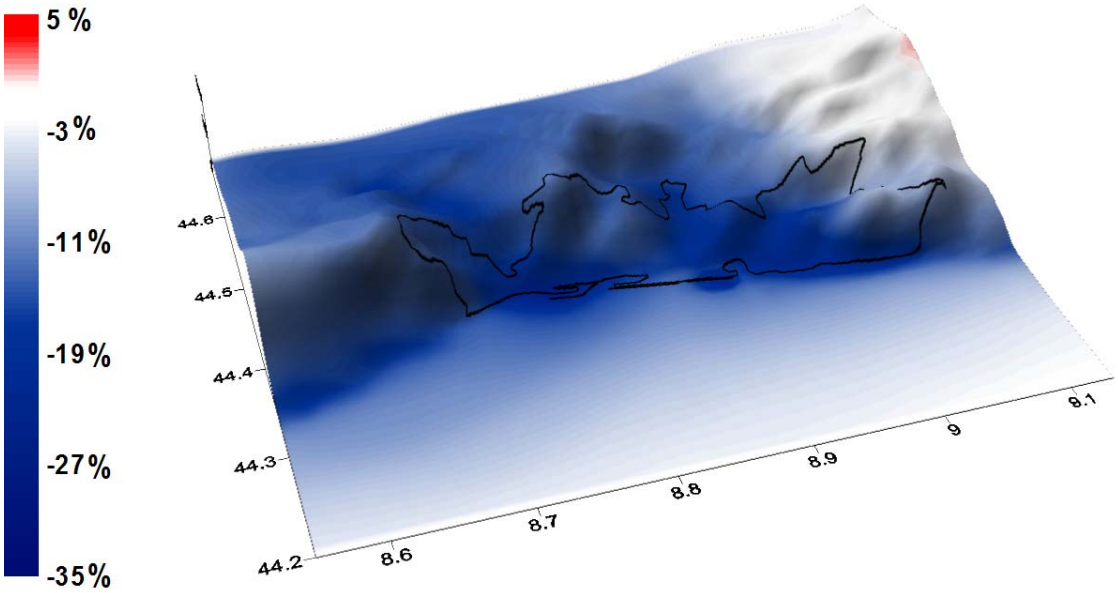

Figure 3

	Scenario II : 2020 emissions + S% reduction in fuels + cold ironing (VTE and Ferries Terminal)					
	NO_x	**VOC**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2,5}$**
Emission change (%) with respect to actual inventory	**-38**	**-34**	**-35**	**-35**	**-35**	**-35**

Table 3

Stakeholders: Genoa Port Authority, Genoa Terminal Passengers, Ship Owners.
Advantages/Benefits: very high mitigation at local level. Contemporary mitigation of noise from harbour.
Uncertainties/Barriers/Bottlenecks/Disadvantages: Economic impact.
Implementation (Voluntary/regulatory action; Economic sources; etc): Voluntary action.

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2.4 Development of infrastructural network

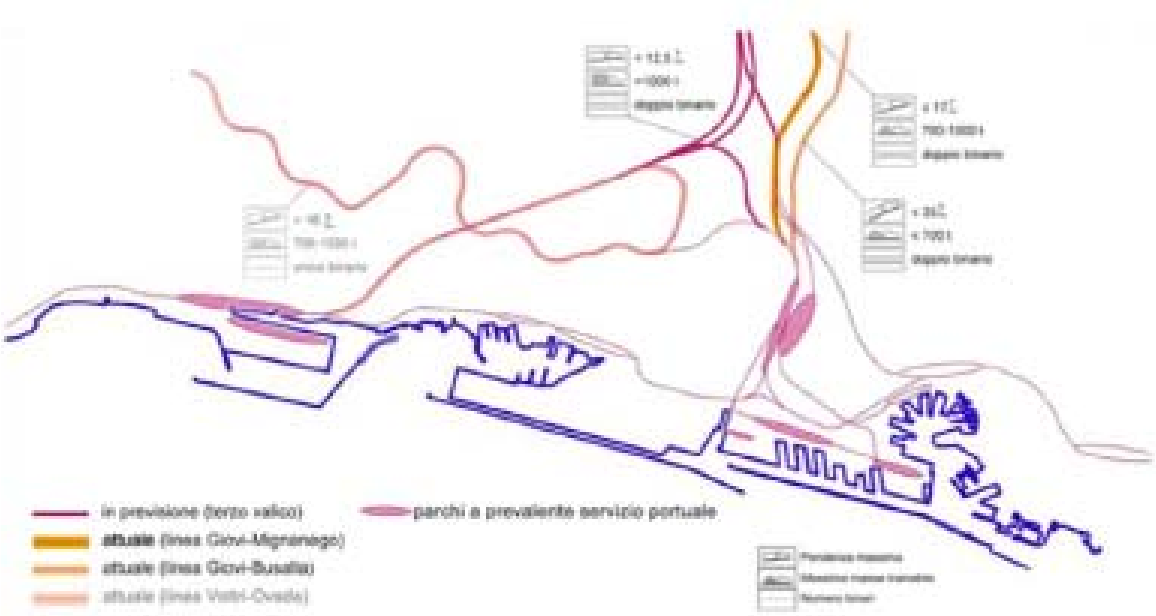
APICE project has also considered the future development of the infrastructural network, surrounding not only the port but also Genoa metropolitan area, considering both short, medium and long-term solutions.

In the year 2012 the two strategic infrastructure both for the Port of Genoa and for the entire national economy will begin:

- Third railway connection along the main North-South route
- New highway by-pass in Genoa territory along the East-West route

These interventions include the creation of more than 70% of galleries leading to the production of several million cubic meters of spoils for which it is necessary to find out the place of final allocation.
In the absence of this operation, the fulfilment of the infrastructural renovation program could not be realized.
At the same time the expansion of some terminals is foreseen in the port development plan.

The fallout of these infrastructures has not been evaluated in the context of APICE, since traffic studies necessary for the evaluation of these actions are not yet available.



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2.5 Shipyard delocalization

A high impact proposal developed within APICE project in Genoa, deals with the reorganization of some Port risk activities (such as the shipyards) also for promoting urban regeneration of historical city center and connect the old harbour area (redesigned in 1992 by Renzo Piano) with the Expò to the west.

The aim of this proposal was clearly to study not only a mitigation strategy related to the old city tissues, but also to overcome the shipyards localization, defining an urban design operative approach to rethink entirely the western city waterfront.

At the same time, creating a cluster of shipyards activities concentrated in the eastern part of Genoa Port, would give strength to the already planned extension of Fincantieri areas, as preliminary economic conditions to realize the the new railway lines (Terzo Valico) along the north / south main route. It should be noted, in fact, that its realization depends directly on the possibility of relocating in that area (in order to create new piers) the huge amount of spoils derived from tunnel excavations process trough the Apennines mountains.

The idea of relocating the whole activities actually in the shipyard area in a new position of less impact to be realized within new expansions of Fincantieri area in Sestri Ponente is a project that will be evaluated in the new Port Master Plan.

This hypothesis in addition to eliminate all the existing conflicts between the port and the city, strengthen even more the node of the future shipyards activities and, because of this, the absolute necessity of providing better connections and new infrastructures to confirm the emerging and strategic role of this part of Genoa harbour.

The delocalization of shipyard area was considered and discussed with the stakeholders, but no simulation was possible within the time of APICE project.

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2.7 Communication activities in Genoa Port Center

Although the scientific content of APICE is particularly high, the outputs of the project are interesting not only for institutional stakeholders - for which APICE is a useful tool to support decision - but also for the general public, which is directly involved in the socio-economic and environmental impacts associated with port activities.

In this context, the Province of Genoa promotes the development of a specific communication tool devoted to the general public to disseminate the results of APICE, which represents in a user friendly way the scenarios evaluated in APICE (present situation, future situation with an without mitigation actions).

The natural seat for this communication activities is the "Genoa Port Center", which is a a connection point of the port with the city.

Following the Port Center Model, a section of the Genoa Port Center is devoted to the environmental sustainability in the Port of Genoa, with particular emphasis on innovative solutions to reduce emissions of pollutants, emission of climate-altering gases, noise pollution and on the exploitation of renewable energy (in agreement with the Port Authority Environmental Energy Plan, a project of the Port of Genoa, which involves the use of renewable energy sources and promoting energy efficiency in the port).

To disseminate the fundamental concept that respect for the environment and quality of life are the challenges that the port of Genoa will face in the future, in the Green Port section the following exhibit are currently present:

- ✓ *Exhibit dedicated to the electrification of the docks* - A special installation shows the virtuous cycle of energy adopted in the port of Genoa,
- ✓ *A film* illustrates the activities and the ecological services provided in port areas.

The area dedicate to APICE will be implemented in the near future with a new multimedia station, supported by a Microsoft Surface that will contain the results derived from the analysis carried out by the APICE project.

The goal of the exhibit is to provide a laboratory that allows visitors to explore the environmental impact data by manipulating a model of the port of Genoa, which allows both a tour of the current state, and the evolution of the sector plans. Touch, in real time, the consequences of certain choices helps to understand the complexity of the problem.

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CHAPTER 3. MAINSTREAMING FOR GENOA - CONCLUSION

The first result of the APICE project, is the development of a modelistic tool for air quality in the city of Genoa.
Within APICE project, it was explored the application of the model to a set of scenarios, shared with the local stakeholders. APICE model was demonstrated to be a suitable tool for predict the effects of a selection of measures.
The effect of the Sulfur reduction in fuel is a very effective measure in reducing impact of the port activity on the city.
The electrification of VTE and Ferry Terminal has mainly a local effect in the abatement of the emissions from port activity.
The new infrastructural network in Genoa and the delocalization of shipyard area were considered but no simulation was possible within the time of APICE project.
In addition, local stakeholders are interested in the future integration of the environmental effects studied with APICE within the other existing local plans.
The **Genoa Port Authority**, which followed from the very beginning the work of the scientific partners involved in APICE, remarks that the simulation tool developed within the project can be really useful, even in the immediate future, in order to measure and compare the different air quality levels and other environmental aspects on urban areas.
In this framework, it's significant that Province of Genoa and the Department of Physics are defining a first draft of voluntary agreement with Genoa Port Authority about the capitalization process of APICE project in order to consolidate and support the future development of the simulation tool for the Environmental Assessment of the Genoa Port Plan.

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