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The Sustainability of Italian Ports between Energy Efficiency and Environmental Quality

In the current environmental policy framework, energy policies play a leading role in the sustainable development of our country, which has a structural deficiency in some traditional energy sources. At this stage, however, studies aimed at verifying the methods of production with renewable energies and their location seem to excel in the panorama of research, favoring the economic and infrastructural feasibility in urban contexts and in particular port contexts. The latter in particular have endured an increase in traffic represented by ever larger ships that are transporting an increasing amount of goods and people faster and faster so that the quality of life in these areas, especially the urban-port areas, has greatly decreased. Improving the environmental quality of these territories becomes a priority for a sustainable development and consequently the contribution, in a first part, will analyze this situation of the ports by placing the phase of the landing of the ships in the ports for transport as a determining variable for the purposes environmental quality. Once moored, in fact, the ships do not turn off the engines with a consequent very high local and global air polluting effect and, considering the geography of the Italian ports, some of which are large urban centers, one can understand the impact that this practice have on human activities. In the second part the contribution will study from an environmental and economic point of view two possible ways to remedy this problem: the first, consisting of the advantage deriving from the entry into force of the IMO directives aimed at the use of low sulfur diesel fuel for ships. on the other hand oblige them to turn off the engines in the port and to feed exclusively through electricity supplied by the ports, providing in advance for the arrival of the ships in having pontoons and useful and sufficient equipment to power them. The cost-benefit analysis will determine the most correct investments in terms of combating climate change and cost-effectiveness. The third part, therefore, will illustrate the possible policies to be implemented in order to achieve sustainability in urban-port areas.

La sostenibilità dei porti italiani tra efficienza energetica e qualità ambientale

Nell'attuale quadro delle politiche ambientali, le politiche energetiche assumono un ruolo di primo piano per lo sviluppo sostenibile del nostro Paese, che ha una carenza strutturale di alcune fonti energetiche tradizionali. In questo momento, peraltro, nel panorama della ricerca sembrano primeggiare gli studi diretti a verificare le modalità di produzione con energie rinnovabili e la loro localizzazione, assecondando la fattibilità economica e infrastrutturale nei contesti urbani e in particolare quelli portuali. Questi ultimi in particolare hanno sopportato un aumento di traffico rappresentato da navi sempre più grandi che trasportano in maniera sempre più veloce una quantità crescente di merci e di persone tanto che la qualità della vita in tali aree, soprattutto quelle urbano-portuali, è molto diminuita. Migliorare la qualità ambientale di questi territori diventa prioritario per una sostenibilità dello sviluppo e di conseguenza il contributo, in una prima parte, andrà ad analizzare tale situazione dei porti ponendo la fase dell'approdo delle navi nei porti per il trasporto come variabile determinante ai fini della qualità ambientale. Una volta ormeggiate, infatti, le navi non spengono i motori con un conseguente effetto inquinante aereo sia locale che globale molto elevato e, considerando la geografia dei porti italiani, alcuni tra i quali sono grandi centri urbani, si può comprendere l'impatto che tale pratica abbia sulle attività umane. Nella seconda parte il contributo studierà sotto il profilo ambientale ed economico due possibili modi per ovviare a tale problematica: la prima, consistente nel vantaggio derivante dall'entrata in vigore delle direttive IMO volte all'utilizzo del gasolio a basso contenuto di zolfo per le navi, dall'altra obbligare le stesse a spegnere i motori in porto ed ad alimentarsi esclusivamente attraverso energia elettrica fornita dai porti, provvedendo anticipatamente all'arrivo delle navi nel disporre di pontili e di attrezzature utili e sufficienti per alimentarle. L'analisi costi-benefici determinerà gli investimenti più corretti sotto il profilo di lotta al cambiamento climatico e di economicità. La terza parte è diretta a illustrare, infine, le possibili politiche da attuarsi in modo da realizzare la sostenibilità nelle aree urbano-portuali.

La sostenibilidad de los puertos italianos entre la eficiencia energética y la calidad ambiental

En el marco actual de las políticas ambientales, las políticas energéticas asumen un papel protagónico para el desarrollo sostenible de nuestro país, que presenta un déficit estructural de algunas fuentes de energía tradicionales. En este momento, sin embargo, los estudios destinados a verificar los métodos de producción con energía renovable y su ubicación parecen sobresalir en el panorama de la investigación, apoyando la viabilidad económica y de infraestructura en contextos urbanos y, en particular, portuarios. Estos últimos en particular han sufrido un aumento del tráfico representado por barcos cada vez más grandes que transportan una cantidad cada vez mayor de mercancías y personas cada vez más rápido, tanto que la calidad de vida en estas zonas, especialmente las urbano-portuarias, ha disminuido considerablemente. . . Mejorar la calidad ambiental de estos territorios se convierte en una prioridad para el desarrollo sostenible y en consecuencia la aportación, en una primera parte, analizará esta situación de los puertos situando la fase de desembarque de buques en los puertos para su transporte como variable determinante para la propósitos calidad ambiental. Una vez amarrados, de

hecho, los barcos no apagan sus motores con el consiguiente efecto de contaminación del aire local y global muy alto y, considerando la geografía de los puertos italianos, algunos de los cuales son grandes centros urbanos, es posible comprender el impacto que esta práctica tiene sobre las actividades humanas. En la segunda parte, la contribución estudiará desde un punto de vista ambiental y económico dos posibles vías para superar este problema: la primera, consistente en la ventaja derivada de la entrada en vigor de las directivas IMO dirigidas al uso de combustibles con bajo contenido de azufre gasóleo para los buques, por otra parte, para obligarlos a apagar sus motores en puerto y a alimentarse exclusivamente de la electricidad suministrada por los puertos, previendo con antelación a la llegada de los buques en tener acceso a muelles y útiles y suficientes equipos para alimentarlos. El análisis coste-beneficio determinará las inversiones más correctas en términos de lucha contra el cambio climático y rentabilidad. La tercera parte está destinada a ilustrar, finalmente, las posibles políticas a implementar para lograr la sostenibilidad en las áreas urbano-portuarias.

Keywords: *environmental quality, renewable energy, innovation in marine transport, sustainable ports, green economy*

Parole Chiave: *aree portuali e qualità ambientali, efficienza energetica, sostenibilità dei porti, green economy*

Palabras clave: *calidad ambiental, energías renovables, innovación en transporte marítimo, puertos sostenibles, economía verde*

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Nota: *Paragraph 1 is edited by Carmen Bizzarri, the others are by Matteo Crea; the conclusion are common.*

1. Pollution of Italian Ports

The geographic position of Italy is, from a strategic geo-political point of view, like a bridge linking the north shore of Africa and the south of Europe. In the current commercial scenario, the centrality of our country is crucial for sustainable economic development that can be achieved not only thanks to the infrastructure network of canals and ports, but above all thanks to the continuous innovations – the first of all that of containers – which will be fielded.

Currently the movement of goods and people flows and trade have increased considerably and the Italian port cities are facing many challenges, but the most complex and articulated one is the energy transition. The greatest difficulties currently encountered in implementing the new energy challenges can be represented by the sudden territorial extension of these cities, so much so that while on the one hand some have now become real metropolises, on the other hand many of them have lost competitiveness as they were affected by the dimensional and logistical problems deriving from the increasing size and quantity of ships, and have gradually become smaller centers, to the benefit of larger ports, especially foreign ones. In fact, in many of the Italian ports there is a port infrastructure that is often linked to 19th century designs and therefore conceived without any link to accessibility, logistics and environmental protection.

Accessibility, in fact, for many of them has become a very important and decisive criterion for expanding both commercial and above all infrastructural potential. If it has often been believed in the past that the infrastructural dimension is one of the main criteria for accessibility, today a port needs tools that make infrastructure mobility inclusive and integral in its geographical-territorial dimension, reducing and facilitating the physical distance between users and required services/resources. If we accept accessibility as the «greater or lesser possibility of a node – point of entry and exit of a region and thanks to its easy use, as an access door connected or interconnected with others, it gives a high hierarchical rank to all territorial context – of being reached by other nodes of the graph, of that geometrical figure able to synthesize a network and to measure, through specific indexes or other methods, the connectivity, the quality of the connections» it becomes clear that the relationship between port and land goes far beyond what has always been supported, that is, that size is the main characteristic of a contemporary and competitive port. To this, if we add that «a graph is perfectly connected and accessible when all vertices are linked together» (Morelli, 2013, p. 327), we realize that the port should be that vertex of the graph capable of synthesizing visually the connections and accessibility of a network, also measuring the qualitative elements or the configuration of the network itself. It is evident that especially in ports, accessibility is a prerequisite,

but often in contrast or in apparent contrast with the geo-physical formation of ports, especially of some of the main Italian ports – see Genoa and Naples, for example, and not only – where the construction of a transport or communication network, although hoped for and in theory planned, has not yet been fully implemented with catastrophic consequences from both an economic and an environmental impact point of view. For these reasons the impact of transport on land use has been discussed in numerous geographic studies (i.e., Hansen, 1959; Banister, 1995; Wegener and Furst, 1999; Geurs and van Wee, 2004). Thanks to the transport means of a region and the networks connected to it, a territory and a port city realize the relationships and interconnections with the outside to create that territorial system capable of satisfying the demands and needs of the economic activities related to the port system itself. It therefore makes urgent a new planning of infrastructures that can guarantee maximum efficiency in transport, sorting and internal shipment, and not least environmental sustainability. Cities such as Genoa, Venice, Trieste, Taranto, Naples, Palermo and Catania, just to mention a few examples, can no longer be considered immune from applying profound internal changes such as to guarantee public health of their citizens, especially when it comes to atmospheric and acoustic pollution.

As regards to air pollution, in particular, naval activity has a very strong impact on the port ecosystem as it involves the release of extremely polluting agents, directly in the midst of urban centers, such as carbon monoxide and dioxide (CO, CO2), sulfur oxide (SOx), nitrogen oxide (NOx) and particulate matter of various sizes (PM10, PM2.5), due to the combustion of high sulfur content diesel, also called HFO (Heavy Fuel Oil), or one waste refining oil, which has a maximum content of 3.5% m/m except for ferries and cruise ships whose limit is 1.5% m/m.

In this regard, a great stimulus for innovation will be given starting from January 1, 2020, with the introduction of new limits on the use of fuels with high sulfur content also in the Mediterranean basin introduced by the IMO (International Marine Organization), the United Nations agency in charge of navigation safety and the prevention of atmospheric and marine pollution, the application of which will entail the obligation to use only LSDO low sulfur fuel (Low Sulfur Diesel Oil) respecting a limit of 0, 5% m/m.

Despite this limit, which for Italian ports is still a target to be reached with difficulty, in many port cities of the world – the Baltic Sea area; the North Sea area; the North American area (which covers coastal areas off the United States and Canada); and the Caribbean Sea area of the United States (around Puerto Rico and the US Virgin Islands) – the value of the four SOx-ECA p is reduced to just 0.1% m/m.

The reduction of the environmental impact and the relative improvement of the air quality must not be considered as a simple application of norms, above all for Italy, but it must be inserted in a wider framework of enhancement of port cities, as they often enclose a cultural heritage of great depth, so much so that in some of these there are priceless World Heritage Sites that need to be protected from aggression and from the greed of progress at any cost.

Furthermore, the reduction of the atmospheric pollution limit of ports, although important, is absolutely not sufficient to preserve the port ecosystem as only some of the polluting agents are subject to this legislation, but there is no serious and integrated intervention so as to improve air quality in all port areas. A truly radical transformation, which could benefit the entire port area in terms of environmental quality, could be derived from the introduction of new regulations and technological innovations in the cruise area that today, thanks to its high level of traffic, is one of the more polluting activities in terms of weather. This activity has a profound effect on Italian ports, with Italy being one of the most sought-after destinations globally with a market that will touch 11.5 million passengers in 2019 and numbering among the 10 ports most widely used by cruise ships in the world. In this regard, it should be noted that the environmental impact deriving from the stationing of cruise ships is extremely significant since it normally occurs in the center of ports and, consequently, in the center of inhabited areas and, if we consider that in 2018 there were 4641 «Touch ship», with an average stationary time of one day each, the result being that about 140 tons of CO2 have been released into the atmosphere per day.

In fact, the most harmful issue is the lack of an integrated vision and a collective control room that puts a serious and structured attention on the problem in order to draft national guidelines on the transition to be implemented and which adopts methods, without leaving the burden solely on private individuals, but collectivize expenses that would bring positive externalities to the entire community.

This issue is totally understood by the EU, which has a clear picture of the focal points that are needed for a «revolution» of the port infra-

Figure 1. Heatmap of SOX emissions from cruise ships in 2017, T&E
Source: Transport & Environment, 2017

Tab. 1. Stakeholder's roles in investment decisions by type of port infrastructure

Type of port infrastructure	Common stakeholders roles in investment decisions
maritime access	Generally decided by port managing body or government or in partnership
Basic port infrastructure	Generally a port managing body investment decision
Equipment and superstructure	Generally private terminal operator decision under the landlord model and a port managing body investment decision in case of a service port model
Infrastructure for smooth transport flows within the port	Generally a port managing body investment decision
Energy-related infrastructure such as infrastructure for exchange of energy	Investment decision of utility infrastructure provider or in the port managing body or in partnership
Rail transport connection from port to main (TEN-T) line	Generally a rail infrastructure manager decision, in some cases in partnership with port managing body
Road transport connection from port to main (TEN-1) highway	Generally a road infrastructure manager decision, in some cases in partnership with port managing body
Inland waterway transport connection from port to main (TEN-T) line	Generally a waterway infrastructure manager decision, in some cases in partnership with port managing body
ICT/digital infrastructure for efficient port hinterland operations	Generally a part managing body investment decision
Intermodal/multimodal terminals in the port area And/or dry port outside the port area	When in the port area, generally a port managing body investment decision, but when outside the port (as in case of a dry port) generally a government entity from that jurisdiction decides
Infrastructure for reducing environmental footprint of port and shipping operations	Generally a port managing body investment decision
Sites for port-related logistic and manufacturing activities in the port area	Generally a port managing body investment decision

Source: the infrastructure investment needs and financing challenge of European ports

structure but considering the complexity and the utilization of those ports, any kind of operation requires a very good level of coordination for minimizing any form of hardship.

The European Union (EU) is highly dependent on seaports, both for trade with the rest of the world and for trade between Member States. 74% of imported and exported goods (in tons) and 37% of intra-EU transport flows make use of seaports[1].

In addition to freight transport, about 400 million passengers embark and disembark in EU ports every year[2], and ports also attract increasing volumes of cruise ships and passengers (more than 6 million passengers yearly embark on a cruise in Europe), which creates a positive impact on the tourism sector.

Ports not only accommodate freight and passengers, but they are also quite often the site of energy nodes and clusters of industrial logistics and also tourism/leisure activities. For instance, ports are energy hubs for conventional and renewable energies. Thus, ports will have to play a major role in decarbonizing the economy, beyond the port area and operations, by offering alternative energy solutions. Ports generate employment for about 470.000 people directly and help sustain 3 million jobs, for instance in warehousing or export-oriented manufacturing[3]. Ports also contribute to territorial cohesion: in regions with a weak economic basis, efficient seaports can be a catalyst for the development of the region.

As outlined in «Ports: an engine for growth», the communication from the European Commission, ports are critical for a competitive European economy; efficient ports are needed to accommodate economic growth[4]. These facts underline the importance of ports for the overall economy and are reflected in the EU classification of ports as critical infrastructure[5].

This is not an infrastructure improvement but is a new way of thinking all the port mobility, which is clearly unsustainable and not oriented to a lean management, which could reduce costs and create environmental benefits.

2. Opportunities analysis for improving the environmental quality of Ports

It is undeniable that the IMO 2020 introduction will have a significant impact on the global maritime sector starting from the second half of 2019 due to the adaptation of most of the port refueling infrastructures and the need to carry out the «washing» of all tanks currently used to contain fuel with a high sulfur content, but these disadvantages will be largely offset by environmental benefits.

Italy, having an experience of many years both in the shipbuilding and energy sectors, has the characteristics to act as a leader of a transition that is not only energy, but is also environmental and geographical, finally managing to heal the rift between the world maritime production and the beauties that historic centers possess.

To accomplish this step, the full application of the IMO legislation is only a first and feeble step, as to achieve a real transition, interventions are needed both on the whole port chain, both of goods and passengers and, to date, there are two main vectors that can easily replace diesel: methane, in its compressed forms (CNG) and liquefied (LNG) and electricity.

As far as CO2 emissions are concerned, based on the data provided by ISPRA, it is clear that the most sustainable solution is undoubtedly that relating to the total electrification of each port quay in our country, as the balanced energy mix in national production saves 544g of CO2 per KWh not produced from fossil sources. This value does not take into consideration that the additional capacity generated is produced from renewable sources.

Starting from these analysis, from a first analysis based on own elaborations on these bases, it can be seen how, for each electric MWh produced on board a boat with an average thermal efficiency (35%), the abolition of the HFO does not involve a significant reduction of CO2, as with the use of LSDO alone or with the new Scrubber, this value will drop by only 4% and this percentage represents the need to find alternative solutions, especially if compared with the use of CNG (compressed CNG and LNG) and electricity, which would bring about a reduction of approximately 18% and 32% respectively.

At present, there are significant critical issues regarding the purely economic aspect, which is very unfavorable, compared to a possible switch from Diesel Oil to other forms of power supply to the boats, once moored and which allows a tangible advantage to the owners in extinguishing the engines.

In fact, according to the same assessment used, it shows that the production cost of one MWh of electricity to power the auxiliary units of a boat stationed in port, without the necessary incentives and applying ARERA market prices, is decidedly lower ~~if~~ when keeping the diesel engine on also using a low sulfur fuel.

Tab. 2. Kg of CO2 per MWh

	HFO	LSDO	LNG	Electricity
KG CO2 per MWh	795	761	648	544
CO2 reduction Vs HFO		-4,27%	-18,50%	-31,58%

Source: Own elaboration on IEA data

Tab. 3. Cost of each MWh

	HFO	LSDO	LNG	Electric energy
€/MWh	€ 103,18	€ 135,12	€ 212,89	€ 150,00

Source: Own elaboration on IEA data

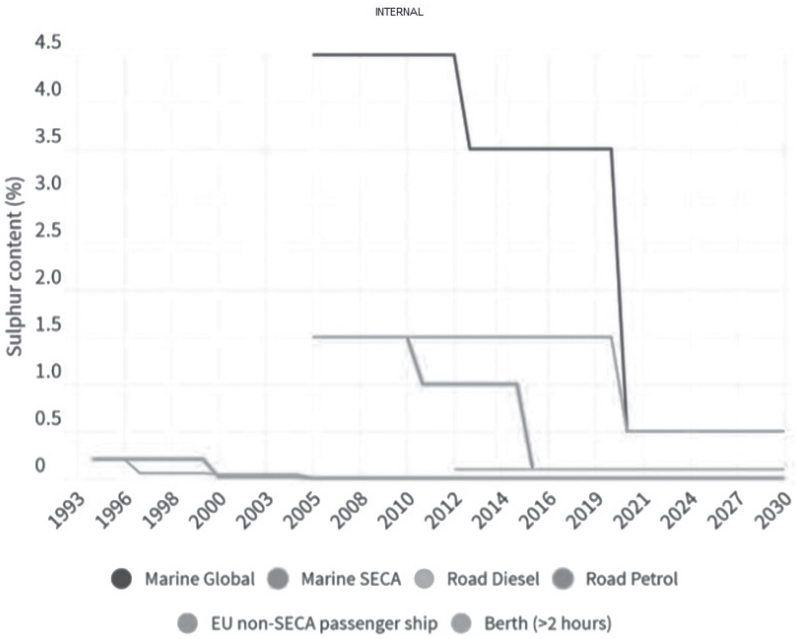

Figure 2. EU Sulphur standards for marine and road fuels
Source: EU commission

Bear in mind that these values only refer to the operating costs to be borne by ship-owners for quay supply and do not take into account all those fixed costs that should be incurred for the conversion of units to run on LNG or the installation of special electric cabins and related cabling up to the boats, as they assert to the logistic chain and would be considered as sunk costs.

3. Structural proposals for the reduction of pollution in Italian ports

Following the analysis carried out, it results that, at present, all actions aimed at reducing the environmental impact of port navigation, with the exception of the regulations in force, are delegated to the sensitivity of private shipping companies, which, on their own social responsibility, take charge of innovative projects and solutions.

In fact, they have tried to develop solutions by trying to collaborate with electricity suppliers and port authorities in an extremely independent way compared to the mere economic necessity, since, to date, the cost of replacing fossil fuel with electricity, in addition to recharging infrastructure, did not guarantee such profit margins as to justify the various operations.

Therefore, it is clear that this situation is absolutely not acceptable in an integrated view of an environmental problem that produces negative externalities for the population residing in port areas.

As the externalities in question are clearly defined as not only detrimental to the collective well-being, but also degrading to the surround-

ing territories, a joint intervention between public and private actors is necessary, led by a single national organization jointly directed by the Ministry of the Environment and by Ministry of Infrastructure and Transport which, in collaboration with the individual Port Authorities, identify a National Port Decarbonization Plan within what has already been defined as a «Save Sea Decree» whose details are expected shortly.

The energy transition is part of the Port Revolution, because the way to move into a sustainable port require structural financial framework and long-term vision on priorities will allow ports to submit more well-prepared and high-quality projects. On the one hand, the early announcement of call priorities will provide ports with sufficient time to prepare eligible projects that are solid and contribute to reaching the priorities set forward in the most efficient way.

On the other hand, a more balanced distribution of funds over all seven years of the financing period will accommodate more high-quality proposals. Whereas ESPO acknowledges the Commission's frontloading method, a more balanced distribution of the budget during the funding period would better fit with the (dynamic) nature of project generation and the complexity of project development and maturity.

Thus, a more equal distribution of funds over time is likely to lead to a higher impact of the available funding.

The EU air quality standards need to be in line with WHO's recommendations (so far they are below it). The revision of the NEC directive has to include Black Carbon and ambitious emission reduction goals. The benefits of taking action far outweigh the costs in every policy scenario put forward by the Commission, yet the Commission's proposal is far from ambitious. Air pollution has high health, economic and environmental costs.

To reduce these to a minimum within what is technically feasible would cost €51bn/yr but the health benefits would range between €58-207bn/yr. Instead, the Commission has proposed a scenario that would achieve only limited benefits by 2030 at marginal costs (EEB).

Regarding ships, the EU member states must take domestic action and push action in the IMO to cut ship emissions: - Designate all European seas as Emission Control Areas (sulphur and nitrogen oxides) - Improved emissions monitoring and compliance control, severe penalties for non-compliance - Emission standards for PN and UFP - Emission charges - Emission standards or charges to cut NOx from existing ships - Obligatory slow steaming - Develop and adopt an EU marine fuels quality directive.

There are some concrete option like cold ironing, which provides ships with electricity at berth thus they can shut down their engines. For OPS it is not necessary to build a supplementary power plant, they can be affiliated to regional grid. After many years of negotiations, an international standard for cold ironing was adopted in 2012, making it more attractive for ports and ship owners to invest. Still, the energy management is crucial but difficult when running OPS.

The power for OPS must be produced by renewable energies; otherwise the air pollution is just shifted to the location of the power plant. In comparison to on site production there has to be recognized a transport los in energy additionally. EU in 2011 permitted a reduced tax rate for electricity, which is directly provided to vessels at berth. This legislation is contemporaneously implemented in Germany, Sweden and other EU countries.

And, in this respect, there are some examples: The Port of Stockholm, which was represented at the workshop in Hamburg, had their first OPS up and running already in 1985. The Antwerp Port Authority supplies all its 21 tugs boats with OPS and has the 1st OPS installation for ocean going vessels in Europe installed. The PoLA, PoLB and Port of Oakland equipped several container – and cruise berth with OPS (in the US called «Alternative Maritime Power» (AMP). Gothenburg, Antwerp, Rotterdam, Lübeck and Oslo already run OPS systems for Ferry and Cargo ships. In Hamburg the first OPS for cruise ships is planned to start operation at Cruise Terminal Altona in February 2015. The Ports of Amsterdam, Antwerp, Gothenburg and Hamburg have launched a working group within WPCI to foster and coordinate OPS.

Additionally, detailed formal feedback should be provided directly to the applicants in case of rejected project proposals, in order to ensure that the ports can use the information to improve future applications. This will also avoid repetitive failures which are a loss of time and money both for the applicant and the evaluator (the European Commission and INEA).

The funding gap should be the main criterion to define the level of co-financing. The reduction of the requested funding does not support the methodology of closing the funding gap. Projects, which receive only a partial amount of the requested funding, risk to be no longer viable due to the remaining (smaller) funding gap. In order to in-

crease the efficiency of the funding and to enable the execution of the selected projects, the initially requested amount should not be reduced for accepted projects, unless the reduction is based on a shared new understanding of the funding gap.

4. Conclusions

The research has set itself the objective of exploring the possible effects on the port ecosystem of the introduction of new technologies for the application of alternative fuels on large ships and will certainly require economic and geographical analysis.

It is hoped that a project of this magnitude will promote a strategy that can be a forerunner for other Mediterranean realities and that will act as a guide for a closer relationship between shipping companies and individual port authorities.

In this regard, it is urgent to understand how, in order to reduce negative externalities, a socialization of the costs of this transition is necessary, not only placing the burden on private companies for a public health problem, also in consideration of the fact that this operation would involve investments with a positive repercussion on employment with a high multiplier directly on the territory.

Specifically, in order to support the choices made by the shipping companies, three incentive lines could be identified in order to support the companies that replace the diesel with LNG or that use-electrified docks: *a)* reduction of mooring rights by port authorities according to the amount of CO2 saved and reimbursed to them by a national fund. Most forms of energy efficiency also reduce air pollution. When less fuel is burnt, fewer emissions are set free. Further, if electric energy is managed in an intelligent way, it is possible to restore parts of the energy for example while lowering heavy charges; *b)* reduction, up to and including zeroing, of system charges related to electricity costs or the introduction of a special discounted rate by electricity suppliers by reimbursing the difference compared to the PUN through a special fund or the introduction of a specific item in the bill to be agreed with the ARERA; *c)* hyper-amortization of the costs of reconversion of the quays and extension of the «thermal account» also for all the activities of energy efficiency of the boats that involve a significant reduction such as to limit the size of the recharging infrastructure.

At present, attempts have been made to capture the issues relating to port pollution by providing a general overview and general solutions that require further studies. The monitoring of this process is a clear necessity as it shows how Italian ports are not negatively impacted by pollution and this phenomenon is increasingly leading to a geographical impoverishment of places of very high cultural and social value.

For this reason, as highlighted, it is debated that the first action to be taken is a careful analysis of the phenomenon from a national point of view in order to implement coherent strategies.

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Note

[1] European Commission, 2018, see *https://ec.europa.eu/transport/modes/maritime/news/2016-06-27-ports_en* (last access: 13.XI.2020).
[2] Eurostat, 2018, see *http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=mar_mp_aa_cph&lang=en* (last access: 3.X.2020).
[3] European Commission (2014).
[4] European Commission (2013).
[5] EU directive 2008/114/EC, see *https://ec.europa.eu/energy/en/topics/infrastructure/protection-critical-infrastructure* (last access: 13.X.2020).