TOWARDS A COMMON EU APPROACH ON ECO-INCENTIVE MEASURES FOR THE DEVELOPMENT OF SUSTAINABLE FREIGHT TRANSPORT SERVICES IN THE TEN-T

Executive Report

Prepared by:

Technical Committee of the Med Atlantic Ecobonus Action, an institutional study with the support of the Connecting Europe Facility of the European Union, and promoted by:

- Puertos del Estado, Ministerio de Fomento, España (Coordinator)
- Ministero delle Infrastrutture e dei Transporti, Italia
- Instituto da Mobilidade e dos Transportes, Portugal
- Ministère de la Transition Écologique et Solidaire, France

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GLOSSARY

AIS:	Automatic Identification System
CAPEX:	Capital Expenses
CBA:	Cost-Benefit Analysis
CEF:	Connecting Europe Facility
CNC:	Core Network Corridor
EC:	European Commission
ECA:	European Court of Auditors
EP:	European Parliament
ETS:	Emission Trading Scheme
EU:	European Union
GA:	Grant Agreement
GDP:	Gross Domestic Product
GHG:	Greenhouse Gas
HGV:	Heavy Goods Vehicle
HSFO:	High Sulfur Fuel Oil
IMO:	International Maritime Organization
IRR:	Internal Rate of Return
LNG:	Liquified Natural Gas
LSFO:	Low Sulfur Fuel Oil
MAE:	Med Atlantic Ecobonus
MEPC:	Marine Environment Protection Committee
MFF:	Multiannual Financial Framework
MGO:	Marine Gasoil
MoS:	Motorways of the Sea
MP:	Marco Polo
MS:	Member States
NPV:	Net Present Value
NSW:	National Single Window (NSW)
OPEX:	Operational Expenses
PM:	Particulate Matter
TEN-t:	Trans-European Transport Network
TFEU:	Treaty of the Functioning of the European Union
WACC:	Weighted Average Cost of Capital

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A. SCOPE

The present document describes the possible use of **eco-incentives measures** for the development of sustainable freight transport services through a common approach, opened to all modes of transport and regions in the European Union (EU) and in the context of the Trans-European Transport Network (TEN-t).

In addition, the case of Motorways of the Sea (MoS) in the West-Mediterranean and Atlantic regions is taken as example to prove the impacts of such approach.

This document has been produced within the Med Atlantic Ecobonus (MAE) Action[1], an institutional Action carried out by Spain, France, Portugal and Italy with the financial support of the EU through the Connecting Europe Facility (CEF).

The MAE Action is a policy study ending at proposal level in order to be of use to the European Commission (EC) and the Member States (MS) for the on-going debate on the further support to sustainable freight transport services in the context of the TEN-t policy.

B. SETTING THE SCENE

The objective of sustainable mobility is firmly addressed in the EU policy, pursuing the reduction of carbon emissions, air pollution and social costs from transport activities while securing market conditions for transport growth.

Especially since the first 1992 transport White Paper[2] these goals have been in the upfront of the EU and MS regulatory measures and public support for all modes of transport, with different priorities over the years depending on the actual evolution of the market and the upcoming challenges.

By way of illustration on **regulatory measures**, the EURO regulations setting the industry standards for heavy goods vehicles (HGV) on environmental performance brought a dramatic reduction of SOx and NOx emissions from freight mobility by road in the last decade. A similar regulatory measure has recently been approved for the maritime transport on the sulfur content of marine fuels, which shall be reduced to 0,5% by 2020[3].

[1] Action number: 2014-EU-TM-0544-S.

[2] The Future Development of the Common Transport Policy: A Global Approach to the Construction of a Community Framework for Sustainable Mobility (COM (92) 494 final). 2nd December 1992.

[3] Directive (EU) 2016/802 of the European Parliament and of the Council of 11 May 2016 relating to a reduction in the sulfur content of certain liquid fuels.

However, the use and the scope of regulatory measures depends on the mode of transport. As an example, given the intrinsically global character of the maritime transport the EU usually regulates at the slower pace of the International Maritime Organization (IMO) to preserve the equilibrium of the market, which is not the case for the inland modes.

Moving to public support, both the EU and MS have been incentivizing sustainable mobility in many ways. This including **charging measures**, working as negative incentives by extending the *user pays* to the *polluter pays* principle[4] (especially for road transport) as well as positive incentives, such as **EU grants**, **state aids** and, lately, specific **financial instruments** for the greening of transport.

Furthermore, the EU and MS have been setting their priorities at each time according to the market uptake and needs and the intensity of the challenges ahead.

After the **Paris Agreement**[5], decarbonization has become a top priority for the EU, in mobility as well. Greenhouse gases' (GHG) emissions produce global impacts and are a global concern, so it makes all sense that intergovernmental bodies, such as the EU, pay special attention to this external cost factor. On 28th November 2018, the EC presented its very ambitious strategic long-term vision for a prosperous, modern competitive and climate neutral economy[6]. More recently, on 11th December 2019, the EC has presented the route map following such vision[7] and including sustainable mobility in the scope.

On the other hand, **air pollution and social costs** from transport activities, such as congestion, accidents or noise, have been and remain being a major concern for the EU. And the mitigation of these external cost factors with great impacts in the regional level is a priority for MS as well.

To a certain extent, this *global* vs *local* scope of social and environmental impacts from transport activities claims for a combined approach from the EU and MS support towards its mitigation.

Currently, the CEF[8] is one of the main funding programs for EU support to sustainable freight transport services, following the TEN-t guidelines[9]. These

[4] Through the amending of Directive 1999/62/EC of the European Parliament and of the Council of 17 June 1999 on the charging of heavy goods vehicles for the use of certain infrastructures.

[5] Adopted at the Paris climate conference (COP21) in December 2015 where 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C.

[6] COM (2018) 773 final.

[7] COM (2019) 640 final on the European Green Deal.

[8] Regulation (EU) 1316/2013 of the European Parliament and of the Council of 11 December 2013 establishing the Connecting Europe Facility.

guidelines brought a new approach to the TEN-t development, departing from a list of isolated projects to a true network approach (i.e. comprehensive and core networks) and integrating the need for sustainable freight transport services as part of the network priorities (Article 32 of the TEN-t Regulation). By doing so, the guidelines not only take future infrastructure needs into account, as in the past, but also the need for projects of common interest in the field of transport services to achieve a more efficient, sustainable and integrated transport.

This approach to sustainable freight transport services in the current TEN-t framework fed partly from the experienced achieved in previous funding programs at EU level, namely **Marco Polo** (MP). In this regard, the new approach departed from pure modal shift actions (as in MP programs) and paid more attention to decarbonization, lower emissions and improved efficiency and integration of transport, mostly through technology-based measures. Looking backwards this new approach to sustainable freight transport services makes sense.

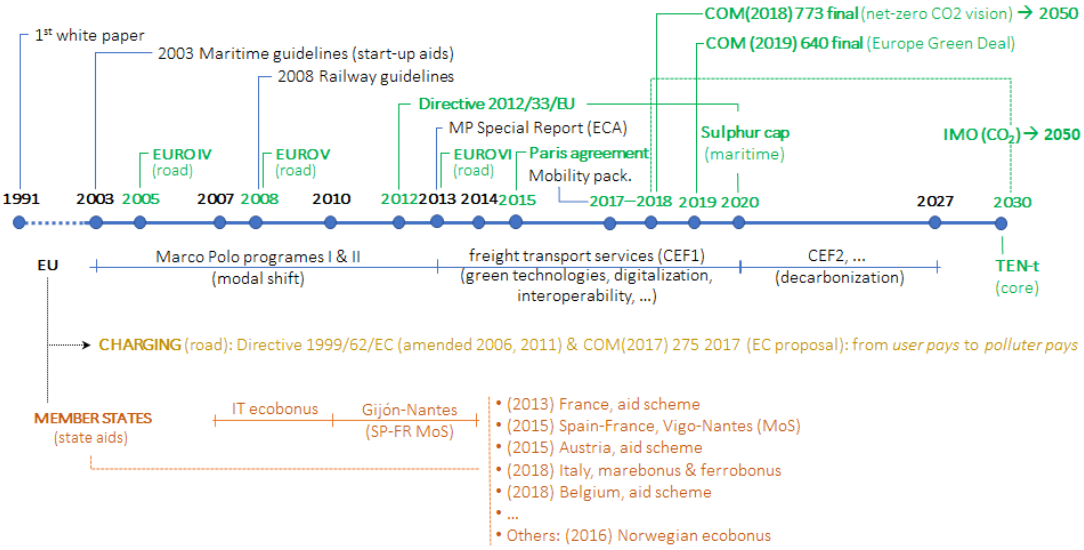

Figure 1.- Evolution chart. EU and MS support to sustainable freight transport services

Shifting freight out of the roads has been a major policy objective in the different transport White Papers issued by the EC since 1992, even with specific targets[10]. The main rationale behind this approach was to reduce road

[9] Regulation (EU) 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network.

[10] According to the White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system" (COM (2011) 144 final), 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030

congestion and to improve the environmental footprint of transport by using greener modes instead.

This was the rationale of the MP programs as well when supporting modal shift actions and assuming market failings that discouraged transport operators from setting up alternatives to road transport. Then, the main justification for the EU support was to compensate transport operators for the initial losses on new or upgraded transport services that shifted traffic from the road (i.e. start-up aids).

And it is worth mentioning as a best practice the first use of an **EU external cost calculator** to measure and monetize the environmental achievements from these modal shift actions as a basis to estimate the EU support.

Following this approach, the EC gave further interpretation to compatibility rules of the Union on state aids[11] and allowed for **state aid support** from MS to compensate for the launching of sustainable freight transport services although with differences between inland and maritime transport.

In parallel, several MS have been supporting modal shift with national budgets and incentivizing the use of rail or waterborne transport even after the termination of the MP programs. Although with no coordination with the EU support.

As a result, the transport market today is more aware and mature than in the past about the benefits of integration and multimodal transport solutions (the evolution of short sea shipping is a good example in this regard and is worth recognizing in this evolution the key role played by the network of shortsea promotion centers). Consequently, the need to compensate for just the market losses incurred by transport operators promoting modal shift is reduced and even discouraged in some cases.

On the other hand, **road transport** has dramatically reduced the level of emissions over the last decade with regards to air polluting factors (i.e. SOx, NOx and particulate matter (PM)).

And although the rail and the waterborne transport still outperform the road with regards to social costs (i.e. congestion, accidents and noise), the gap in the overall externalities account between the road and these other modes of transport has been narrowed. Therefore, just reducing road-only operations might not be enough in all cases to improve sustainability in the overall transport activity, as it certainly was in the past. This fact might require the alternative transport to improve his environmental performance by means of *green* actions.

[11] Articles 106-109 and 93-96 of the Treaty of the Functioning of the European Union.

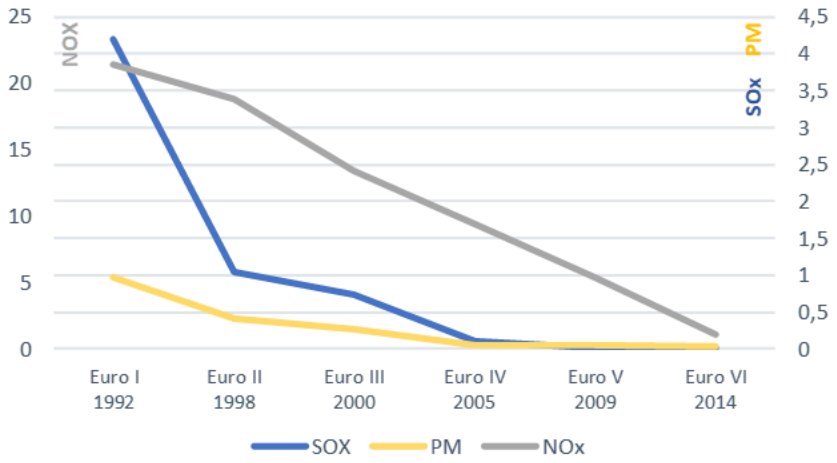

Figure 2.- Heavy goods vehicles (HGV) emissions (g/kg). Evolution (1992-2014)

The EC already took this approach after the MP programs in its Communication on the results of the MP programs[12], recommending that the EU support to the further development of sustainable freight transport services should *depart from the pure start up aid for modal shift* (i.e. to the launching of new/upgraded freight services based on pure modal shift goals)

Shortly after, in its reply[13] to the European Court of Auditors (ECA) Special Report Nº3/2013, the EC insisted that **further EU support to sustainable freight transport services** would *not necessarily remain on modal shift and its targets will not necessarily be set in respect to the volumes shifted off the road* (despite modal shift continuing to be seen as a fundamental tool to further reduction of external costs in the transport sector).

When referring to national schemes, the EC recalled on the differences between MS in terms of geographical location, freight flows, infrastructure availability, modes used, etc. These circumstances might lead to disadvantages in the event of EU based programs (e.g. administrative complexity, undesirable effects on market competition, etc.). To a certain extent, this was calling for a regional approach.

Furthermore, the EC insisted that EU-based programs should be justified on grounds of subsidiarity, which is interpreted here as the need for the MS to share responsibilities and get involved with the EU in the financing and implementation of such programs, as appropriate.

[12] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Marco Polo Programme: results and outlook (COM (2013) 278 final).

[13] Replies of the Commission to the Special Report of the European Court of Auditors "Have the Marco Polo Programmes been effective in shifting traffic off the road?" (COM (2013) 321 final).

Ultimately, further EU-based programs for sustainable freight transport services using incentive schemes is not denied, but is clearly limited to the new objectives, priorities and operational structures from TEN-T and CEF frameworks. Meaning that start up support to pure modal shift actions is unlikely to be considered as eligible (in fact, modal shift as such is not explicitly mentioned either in the TEN-t or in the CEF Regulations). Conversely, it is likely that such EU-based programs should be implemented on grounds of subsidiarity (i.e. involving MS co-responsibility) and through a common approach which is transferable to any EU region and applicable to all modes of transport.

When it comes to the EU support, the **form of the EU contribution** is very relevant to the eco-incentive approach. Currently, the CEF is mainly implementing action grants in the form of reimbursement of the eligible costs incurred by the action. The EU contribution is estimated through the co-financing principle considering the part of the action's costs that is not covered by the revenue (funding gap approach) and limited to maximum pre-established rates (typically between 20%-50% depending on the type of action).

According to this approach the rationale behind the CEF is basically helping the promoters to bridge the financial gap of the eligible actions. In other words, CEF will only give support to those actions which demonstrate a funding gap amount, to be calculated with a common reference[14].

Furthermore, with this approach the eligible actions must be established in advance of each call and after negotiation within the CEF Committee on the contents of the Work Programs.

This approach from the current CEF has proved to be very effective in the on-going Multiannual Financial Framework (MFF, 2014-2020) to trigger major investments on infrastructure and pilot actions which clearly needed (by nature) the EU contribution to reach the financial viability. For those actions in early stages of deployment this approach has proved to be the right one as well, for the same reason.

Furthermore, it seems to be the proper approach to cope with the conditions set out in **sector-specific rules** and EU legislation, especially the ones referring to infrastructure requirements for the different modes of transport, such as in the TEN-t guidelines, the Directive on alternative fuels infrastructure[15] or the Directive on the interoperability of the rail system[16], as examples. In these

[14] Guide to Cost-Benefit Analysis of Investment Projects. Economic appraisal tool for Cohesion Policy 2014-2020. European Commission (DG REGIO):

https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

[15] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure.

[16] Directive 2008/57/EC of the European parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community.

cases, the requirements can be easily linked to single actions and thus facilitate the definition of eligibility criteria in the corresponding Work Programs.

However, when coming to sustainable freight transport services, the current CEF approach might be more restrictive.

There are no single actions when it comes to reducing carbon emissions, air pollution and social costs.

In particular, carbon emissions and air pollution depend on the type and the magnitude of the energy consumption which, in turn, can be reduced through a wide variety of actions, technology and non-technology based (switching the type of fuel, improving resource efficiency, optimizing transport and modal balance, increasing capacity, reducing speed, etc.). Ultimately, these actions change the mobility patterns towards an improved environmental behavior, but with different merits that can be measured and monetized.

Yet, it is unlikely that all the possible actions reducing carbon emissions and air pollution could find a place within the current CEF approach. Some of them do not relate to technical requirements in sector-specific rules applying to freight transport services, making it difficult to define eligible costs. And leaving pilot initiatives aside, some of them might have problems to demonstrate the existence of a funding gap amount when the commercial readiness is high.

However, and from a transport market perspective, the goal of sustainable mobility should be the actual **reduction of external costs** regardless the type of actions which, in a competitive environment, should be left to the decision of the market.

Therefore, the use of action grants in the form of reimbursement of eligible costs and the application of the funding gap amount to estimate the EU support could sometimes result in a limited or ineffective approach, especially when it comes to transport services and to the acceleration of sustainable mobility patterns.

Moreover, this is particularly relevant for the next MFF (2021-2027) when decarbonization, air pollution and social costs of transport will have to meet rather difficult mitigation targets.

In this context, the **eco-incentive measures** are proposed as complementary to the current CEF approach to improve the overall efficiency of the public support.

In particular, the eco-incentive measures are conceived as a form of support not linked to the costs of the actions but to the achievement of actual socio-environmental merits attained through such actions, to be measured and

monetized with reference to common sources, such as the EC's Handbook on External Costs of Transport[17].

And instead of using the funding gap amount to estimate the EU contribution, the co-financing rate could be estimated by reference to the share of the overall merit that due to global factors, such as those responsible for GHG.

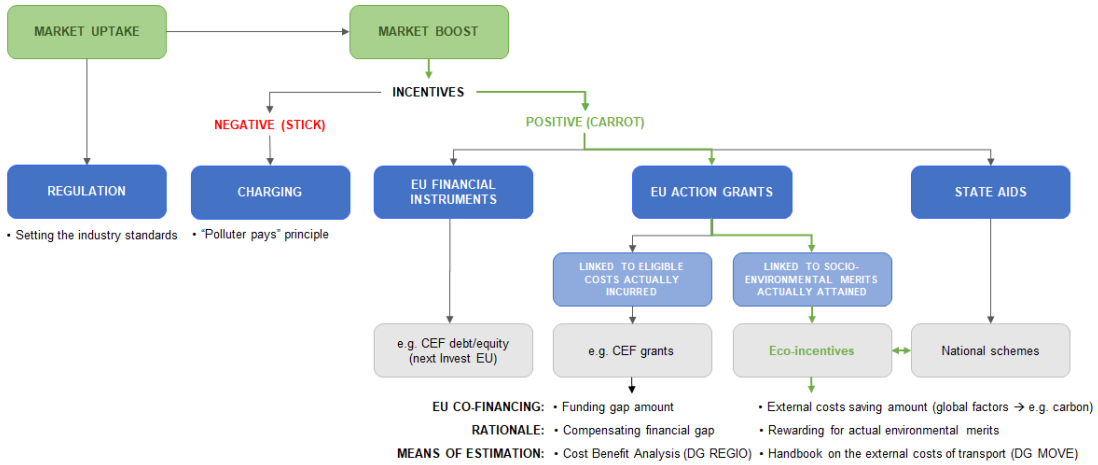

Figure 3.- Development framework for sustainable freight transport services. Setting the scene for eco-incentive measures

With this approach, transport operators would be incentivized on a level playing field towards those actions which contribute most to reduce external costs, accelerating the uptake for sustainable patterns.

The aim is not to replace the current CEF approach whatsoever, which has proved to be very effective as mentioned before. The eco-incentive approach would just extend the scope of the EU contribution in order to improve the effectiveness of the EU support in coordination with the MS.

Ultimately, the transport sector is more integrated, balanced and efficient than it was a decade ago. But new challenges are in the EU and MS agendas that worth new approaches to the debate on the public support to sustainable freight transport services targeting the reduction of external costs.

The eco-incentive measures follow this line.

[17] Handbook on the external costs of transport (2019), European Commission:
https://ec.europa.eu/transport/sites/transport/files/studies/internalisation-handbook-isbn-978-92-79-96917-1.pdf

C. THE MAE ACTION

Having regard to this background, the ministries of transport from Spain, Portugal, France and Italy launched the MAE Action. The aim was to undertake a comprehensive analysis on the potential use of eco-incentive measures as part of the EU support to the development of sustainable freight transport services at EU level.

The action is a study co-financed by the EU through the CEF, under the Motorways of the Sea priority.

As a result, the MAE Action has produced **two main outcomes**:

- A proposal on a common approach to the use of eco-incentives measures at EU level for the development of sustainable freight transport services, open to all modes of transport and EU regions.

- A complete ex-ante analysis to prove the impacts of such approach using the MoS as example. In particular, the MoS servicing the road transport in the Atlantic and West Mediterranean regions.

The study follows the **recommendations** of the EC[18] and the ECA[19] after the MP programs as a main reference to the common EU approach. Moreover, the case-study takes over previous experiences in the region from national incentive schemes, such the Italian Ecobonus. This program was implemented by the Italian administration from 2007 to 2010 and was recognized as a best practice by both the EC and the ECA. A complete review on the Italian Ecobonus experience is available for download (see APPENDIX 2).

The case-study focuses on a specific transport market segment which is on the interest of the MS involved in the MAE Action. Indeed, MoS freight services complementing road transport contribute to reduce social costs (especially congestion) at major bottlenecks such as those of the Pyrenees and the Alps in cross-border sections of the Atlantic and the Mediterranean core network corridors (CNC). Furthermore, the case-study intends to analyze the extent to which eco-incentives would be an effective measure to improve the environmental performance of the MoS services in the context of the upcoming sulfur cap on marine fuels which shall apply by 2020.

In this regard, the MAE Action follows the recitals 30 to 32 of the sulfur Directive[20]. Indeed, the EC and the MS are recommended in this Directive to provide targeted assistance, including operators, so as to minimize the risk of

[18] See notes 12, 13.

[19] Special Report Nº3/2013: Have the Marco Polo programs been effective in shifting traffic off the road. European Court of Auditors.

[20] See note 3.

modal (back) shift from sea to land-based transport as a direct consequence of the increase in the maritime costs to complying with the lower sulfur limits for marine fuels by 2020, which could run counter to the Union's climate change objectives and increase road congestion.

Nevertheless, the MAE Action is a policy study where a possible approach is proposed. Moving to implementing actions based on this approach requires further consensus. To this end, the MAE Action ends at proposal level and **intends to the debate** on eco-incentive measures as a way to boost the development of sustainable freight transport services at EU level.

Preliminary contacts with representatives of the transport sector, the academy and the institutions have been made throughout the study that have enriched the proposal from different perspectives. To all of them, the MAE study team is very grateful. According to the methodology of the study, these contacts where conceived as part of a preliminary stage for consensus.

However, the relevant consensus should be reached through formal discussion between the MS and the EC, as appropriate. As a result of the debate, the eco-incentive schemes could eventually be considered as **projects of common interest** for the development of sustainable freight transport services in the TEN-t and be supported by the EU for the next MFF (i.e. CEF2).

D. THE COMMON EU APPROACH

The potential use of eco-incentive measures to boost the development of sustainable freight transport services is proposed under a common EU approach. The main aim of such approach is to ensure that the eco-incentive measures are designed, promoted and implemented with common principles and methodology regardless the mode of transport or the EU region which are targeted. In fact, making the analysis **transferable to any mode of transport or EU region** has been a requirement of the Grant Agreement (GA) under which the MAE Action has been developed, following the indications of the EC.

In order to identify such common principles for eco-incentive measures and how to take them into viable implementing schemes, the MAE study has been analyzing and interpreting many references. These including policy documents and legal instruments[21] setting challenges, objectives, priorities, rules and standards for freight transport over time, together with past and current experiences and best practices at EU and MS level. A list of references is included in APPENDIX 1.

Above all, the TEN-t and CEF Regulations[22], together with the EC Communications[23] and the ECA's special report[24] issued after the MP programs

[21] Regulations, Decisions, Directives, Communications, Recommendations, etc.

[22] See notes 9, 8.

have been major references to the common EU approach. The analysis of the applicable rules on state aids has taken an important part of the MAE study as well.

In addition to this review there have been direct contacts with relevant stakeholders, including transport operators, project promoters, the academy, MS, EU institutions, etc. which have enriched the analysis and the internal discussions towards the common approach. In particular, the contacts with projects promoters in northern Europe have been of great use to accommodate different sensitivities and market realities across EU which have definitively contributed to the transferability of the approach.

Finally, as a preliminary consideration, it should be stressed that the common approach to eco-incentive measures targets freight transport services, not infrastructure development. And of course, it is not limited to MoS even though the ex-ante analysis takes maritime services as example.

According to this background, granting EU support to eco-incentive measures should stick to following **common principles**.

The eco-incentive amount should be based on actual **socio-environmental merits** attained through concrete actions reducing external costs[25] from freight transport services. Moreover, the eco-incentive should only be granted upon demonstration on the achievement of such merits.

Having the socio-environmental merits at the forefront of the eco-incentive measures (translated into actual external costs savings) is an essential feature to make the approach transferable at EU level.

Indeed, transport markets are different depending on the EU region and mode of transport. The latter behave and develop in the market with different patterns, needs and priorities according to their own sectorial structure, past evolution, specific constraints and market fields. And partly because of that, the sectorial

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[23] See notes 12, 13.

[24] See note 19.

[25] Only social and environmental external costs are considered. In particular, the internalization of infrastructure costs is outside the scope of the eco-incentive measures. This issue has been largely discussed in the MAE Action. There are significant differences in this field amongst modes of transport, including different approaches as well in the means of achievements, following the *user pay* principle. By way of illustration, the maritime transport is considered to be paying for most of the port and maritime infrastructure costs. On the other hand, rail transport is clearly not paying the cost of the rail infrastructure (maintenance costs at the most). Road transport is difficult to assess. According to some sources (*), the revenues from HGV taxes and charges in the EU amounts 43 billion euro. Whereas the infrastructure external costs of HGV is estimated at 57 billion euro. In any case, beyond these differences, the fact that the eco-incentive approach is targeting socio-environmental impacts, makes it reasonable to maintain a level playfield for all modes of transport as regards social and environmental costs.

(*) CE Delft: Revenues from HGV taxes and charges in the EU 28 in 2013. Addendum to “External and infrastructure costs of HGVs in the EU28 in 2013”.

regulation for each mode of transport has his own specificities as well, even under the envelope of the Common Transport Policy.

As example, maritime transport is subject to the IMO regulation, whereas inland modes (such as rail and road transport) are basically ruled by national and European legislations, providing the EU with more capacity to develop the transport policy. The faster transition of road transport compared to maritime in terms of air pollution emission factors may respond to this fact. On the other hand, competitiveness and openness to private operators in maritime transport are not comparable to rail, which is still facing a transition in this field and calls for specific actions at EU level to overcome infrastructure bottlenecks and develop rail freight services. Also, road transport faces important challenges with regards to social costs mitigation, in particular congestion and accidents, that are a major concern of the EU and the MS, which is not the case for the rail and maritime transport.

Moreover, the transport market develops with significant differences depending on the EU region as well, even within a same mode of transport. This is partly due to the ever-increasing specialization of freight transport services following the requirements of freight logistics. Furthermore, the economic fabric of the different EU regions and the way in which transport practices and networks have developed in these regions over the years have result in different transport markets across Europe. This fact is quite evident in the maritime sector with many different markets operating at the EU and with different characteristics and needs (including deep sea, short sea, ferries, ro-ro, container ships, channel crossings, island servicing, etc.).

Finally, the evolution of the market itself introduces an additional complexity as it makes those differences variable and dynamic. As a consequence, the needs and priorities of the different transport markets can change over time as well.

In this context, a common EU approach on eco-incentive measures might combine **regional perspective**, to maximize effectiveness, with common (neutral) drivers to all transport markets across the EU, to minimize inconsistencies.

A good example to illustrate this comment could be the incentivizing of modal shift from road to maritime transport, which has been largely discussed throughout the MAE study.

With no question, modal shift is a major objective for the MS involved in the MAE study. Currently, more than 18.000 HGV per day are crossing the Pyrenees using the road sections of the Atlantic and Mediterranean CNC, growing at 3,5% per year. This fact poses a major problem on congestion, accidents and air pollution which is on the interest of the MS to mitigate by shifting part of those trucks to MoS and rail alternatives. Moreover, the evolution of the MoS market servicing alternative routes to the road transport has been

very different in the Atlantic and in the West-Mediterranean, the latter being much more developed today.

However, bringing modal shift goals to the forefront of a common EU approach on eco-incentives schemes might lead to inconsistencies. As example, modal shift from road-only to maritime-based transport might not be the goal for some regions in the northern part of the EU where trucks are already using the maritime services on a regular basis. For the MS at these northern markets, the concern might be exactly the opposite (i.e. preventing transport from a modal back shift effect if the maritime price is increased due to environmental requirements).

This fact is somehow implicit in the Communication from the EC presenting the results and outlook of the MP programs and latter reply to the ECA[26]. As already mentioned, these are seminal documents to understand the later approach to sustainable freight transport services in the TEN-t Regulation:

"The Commission acknowledges the potential advantages of programmes like Ecobonus but, at the same time, is aware that there could also be disadvantages (e.g. administrative burden and costs, sustainability, efficiency, effects on the competition etc.), especially if such programmes were to be implemented at the EU level, in all the EU Member States. The EU-based programmes have a different nature in the sense that they need to be justified on grounds of subsidiarity. They need to address problems, which cannot be addressed by the Member States themselves and achieve objectives, which are not possible to achieve at the national level. There are also significant differences between the Member States in terms of geographical location, freight flows, infrastructure availability, modes used etc."

According to the wording of the EC communications this means *"departing from the pure start up aid for modal shift"* as regards the EU support.

Conversely, using actual socio-environmental merits as eligibility criterion for eco-incentive measures and linking the value of the eco-incentive to the intensity of such merits (estimated as a reduction of external costs) would be a horizontal and neutral principle to any possible action regardless the EU region or mode of transport.

Linked to the above, the need to measure and monetize those merits by reference to a common methodology emerges as a principle of the common approach as well. In this regard, the **Handbook on External Costs of Transport** produced by the EC in 2004 for the first time and later updated represents the main reference at EU level. A very recent update of this Handbook has been published in June 2019[27]. This update entails a great

[26] See notes 12, 13.

[27] See note 17.

opportunity for the purposes of this common EU approach to eco-incentive measures.

Moreover, funding is made **conditional upon results** since the eco-incentive is granted by reference to *demonstrated* socio-environmental merits. This is an important feature of the common EU approach, following specific recommendations from the EC and the ECA after the MP programs.

In terms of the **form of the support**, the eco-incentive measures are conceived as action grants not linked to the cost of the action but to the achievement of actual socio-environmental merits. This is a different approach to the one used so far by the CEF.

Indeed, the main form of the EU contribution in the current CEF approach falls under Article 125.1.b) of the Financial Regulation[28]. That is a *reimbursement of eligible costs actually incurred* by actions which meet the requirements previously set by the CEF Committee in the work programs.

Conversely, Article 125.1.a.ii) could apply in the proposed approach to eco-incentives. That is *financing not linked to the costs of the relevant operations based on the achievement of results measured by reference to previously set milestones or through performance indicators*. In this case, the *results* to which the grant should be based would be the actual socio-environmental merit attained through the action and *measured* with the Handbook (i.e. not the incurred costs).

Eventually, the proposed approach requires for concrete actions even if the grant is not linked to the costs of such actions. In turn, this requirement contributes to **minimize deadweight loss**[29], which should be considered itself a principle of the common EU approach following the recommendations from ECA.

Moreover, with this approach the CEF Committee still has the chance to set priorities in advance of the calls for proposals regarding which type of actions should or should not be acceptable for the EU funding as part of an eco-incentive scheme. Even more, a minimum threshold could be established for the socio-environmental merit to be attained by the scheme, below which no action would be eligible.

Anyhow, since the grant is not linked to the action itself but to the amount of external costs savings that is attained, the discussion on the eligible actions could be more flexible and neutral than it is today, and ease the negotiation between MS and the EC. Furthermore, this approach would bring more flexibility for the promoters to decide on market basis the type of actions that

[28] Regulation (EU) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union.

[29] An effect occurring when funding is provided to support a beneficiary who would have made the same choice in the absence of aid (ECA Special Report nº8, 2018).

could contribute better to attain the socio-environmental merit. In other words, the common EU approach is prepared to be neutral on how the socio-environmental merit is achieved (e.g. technology agnostic), and that can be raised as a principle itself.

With regards to the calculation of the **EU co-financing**, again the approach in the current CEF might not fit well with the eco-incentive approach. As mentioned before, the maximum EU co-financing is estimated with the funding gap amount and capped with maximum rates that are established in advance in the work programs depending on the type of action and the funding priorities. This funding gap amount must be estimated through a specific cost-benefit analysis (CBA) based on common references[30]. In the case of eco-incentive schemes, where the grants are not linked to the cost of the action, estimating the co-financing by reference to the funding gap amount might lead to inconsistencies. However, following the common EU approach to eco-incentives, as described so far, the rate of the EU co-financing could be calculated by reference to a certain part of the total external cost savings which is considered to be a highest priority for the EU or even justified on grounds of subsidiarity (e.g. the reduction of carbon emissions, as they impact globally in the environment). Same way as before, the CEF Committee still has the chance to modulate this criterion in the work programs and of course to establish the maximum ceilings as is now the case.

All of the above, the eco-incentives measures would entitle a different form of EU contribution and estimation of the EU co-financing compared to the current CEF approach. Therefore, the viability of this alternative approach is subject to the assessment and validation from the responsible Unit at DG MOVE.

Following the regional perspective as part of the common EU approach, the **involvement of MS** emerges as a major principle as well. MS are in the best position to identify the needs and priorities of the different transport markets that develop in the EU regions. Therefore, MS should be the promoters of the eco-incentive schemes deciding on the targeted markets for each specific scheme in coordination with the MS involved in the same EU region.

This co-responsibility principle in the promotion of the eco-incentive schemes takes part of the recommendations of the EC after the MP programs as well. And is consequently fully aligned with the TEN-t guidelines regarding the role of the MS in the promotion of sustainable freight transport services[31].

Based on this regional approach and co-responsibility principles, MS should be responsible for the designing and implementation of the eco-inventive schemes

[30] See note 14.

[31] "Member States shall pay particular attention to projects of common interest which both provide efficient freight transport services that use the infrastructure of the comprehensive network and contribute to reducing carbon dioxide emissions and other negative environmental impacts". Article 32, Regulation (EU) 1315/2013.

provided there is an EU co-financing. Consequently, MS would be responsible for the funding request as well and, ultimately, the beneficiaries of the EU grants. On the other hand, according to the financial rules applicable to the EU budget, EU grants shall involve co-financing[32]. Consequently, MS as beneficiaries would be responsible for the scheme's financing as well. They should mobilize the financial resources covering the part of the scheme's budget that is not covered with the EU funding.

The above is nothing new at all for the MS. Many countries in the EU are implementing incentive schemes with national budgets to stimulate sustainable freight mobility (including different EU regions and modes of transport), although not based on a common EU approach and with no co-financing from the EU budget.

In this regard, the proposed approach on eco-incentive measures seeks a **combined effort** from the MS and the EU financial support based on common principles that could improve the effectiveness, the impact and even the scopes of the existing incentive programs at national level.

It can be discussed whether the common EU approach should establish the need for a joint promotion of at least two MS to be granted with the EU support. This would make sense according to the rationale behind the concept of EU added value which is usually referred to join actions amongst MS. Conversely, a single MS scheme might provide the EU with socio-environmental benefits that can be global even if the scheme is implemented in just one country (e.g. reduction of carbon emissions). In the same way, national sections of the CNC are eligible to the EU funding and are submitted by single MS under the current CEF. MAE study leaves the door open, although the case-study on MoS which is further used as example develops the multilateral approach.

But more relevant to the analysis as regards the involvement of MS is the use of national funds to which the **state aid rules would apply**.

Indeed, state aid to the transport sector is covered by the general state aid rules set in the Treaty of the Functioning of the European Union (TFEU)[33]. Moreover, the TFEU foresees sectorial rules applying in the case of inland (road, rail and inland water transport modes) and combined transport modes in Articles 93 and 96.

By contrast, no such specific Treaty rules apply to aviation or maritime transport. However, account should also be taken of the applicable EC guidelines on state aid, which compile the EC interpretation of the Treaty rules for the different modes of transport, including maritime. These guidelines constitute a piece of soft law, meaning that they have no legally binding force but still have practical and relevant effects.

[32] See note 28, Article 190.

[33] Articles 107 to 109, alongside Article 106 (2).

The MAE study has produced a separate review and analysis on the subject which is available for download (see APPENDIX 2). Particular attention has been paid to the applicable rules on maritime transport since MoS is the targeted market in the MAE case-study.

Some **horizontal aspects** emerge as a result of the analysis that are relevant to the proposed approach on eco-incentive measures.

As a general rule, any aid granted by a MS or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods is prohibited by the TFUE.

In particular, Article 107(1) develops the constitutive elements of state aids. Following this provision, it is most likely that the eco-incentive measures would be qualified as state aids since the MS are responsible for the financing. By way of example, as soon as the MS grant a financial advantage to an undertaking in a liberalized sector (which is the case for eco-incentives), the aid will be distorting competition.

On the other hand, Article 107(3) of the TFEU covers the categories of state aids which *may* be compatible with the internal market and thus *may* qualify for the EC authorization (compatibility assessment).

The most important and frequently category used for authorizing state aid is Article 107(3) c), which covers either aid granted to facilitate the development of regions or industries (sectorial aid). Furthermore, the word ‘may’ in Article 107 (3) gives the EC a significant degree of discretion in relation to this category. Indeed, in its compatibility assessment the EC should not merely take into account economic goals but also other considerations in the interest of the EU, such as the socio-environmental goals (which is the case for eco-incentives as well).

According to the analysis, to be compatible with the internal market the state aids to freight transport services must be justified on the grounds of socio-environmental impacts, implemented in a non-discriminatory way and budgeted proportionally to the goals. The common EU approach is aligned with the requirements since the eco-incentive is proportional to the socio-environmental merit and such merit is measured and monetized with common references.

Anyhow, as part of the common EU approach the eco-incentive measures should be implemented in a non-discriminatory way which, in turn, will very much depend on the specific market (regional approach).

Following the analysis, state aid compatibility is typically limited to new or upgraded services. This is aligned with the fact that the socio-environmental merit must be achieved through implementing actions as a requirement and connects with the need to minimize deadweight loss.

The fact that the aid does not impact negatively in the transport market to an extent contrary to the common interest is also a prominent requirement of the compatibility assessment. The common approach is aligned since the eco-incentive measure would be implemented exclusively on the basis of actual and demonstrated socio-environmental merits.

Finally, it could be discussed the extent to which the guidelines on environmental protection[34] could apply to the eco-incentive measures since the only objective is improving socio-environmental performance in freight mobility. MAE study has not taken the discussion any further.

Further to this sum of horizontal requirements, there are some differences in the **applicable rules** for state aids depending on the mode of transport

A relevant one has to do with the maximum duration of the aid as well as with the ability to renew it over the years. Whereas in the inland modes the aid can last for five years and be renewed without any limit, in the maritime transport the aid is limited to three years and there is no possibility for renewal[35]. The EC is aware of it and is willing to harmonize when necessary[36].

There can be many reasons for this asymmetry. For example, the concept of **start-up aid**, which is firmly addressed in the applicable rules to maritime transport. According to this concept, the aim is to compensate for the initial losses incurred by shipowners when developing maritime services shifting traffic from roads. This approach may have made sense back in 2004 to develop short sea shipping at an emerging stage of the market, following the objectives of the MP programs as well (2003-2013). However, this network has developed over the years and the market is considered to be mature, with short sea services offering alternative routes to road transport on market conditions. It has been fifteen years since the Maritime Guidelines of 2004 and now the challenge is not to develop the market but to accelerate its socio-environmental transition on a rolling basis. The concept of start-up aid can be ineffective to that aim which may need a revision of the Maritime Guidelines.

In fact, the common EU approach only targets mature markets (eco-incentives are not intended as start-up aids).

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[34] Commission Communication: Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C200/01).

[35] Commission Communication: Community guidelines on State aid to maritime transport (2004/C 13/03).

[36] "On this point, the Commission notes a discrepancy between the Maritime Guidelines and the Community guidelines on State aid for railway undertakings (OJ 2008 C 184 of 22.7.2008, p. 13) in which, for similar schemes promoting an intermodal shift from road transport to rail transport, no corresponding three-year limit is prescribed. Thus, when revising the Maritime Guidelines, the Commission will specify that under certain circumstances, State aid for short sea shipping may be declared compatible for a period of more than three years". Commission Decision of 17 July 2013 on State aid SA.33412 (12/C) (ex 11/N). Footnote nº10.

However, due to the variety of legal issues covered by the Maritime Guidelines, it is unlikely that they will be modified for this particular purpose.

On the other hand, the further guidance given by the EC on state aid complementary to EU funding for the development of MoS[37] is obsolete as well. These MoS Guidelines make reference to the former MP and TEN-t programs and should be adapted to the new CEF. This update is relevant to the common EU approach on eco-incentive schemes given the combined support that is proposed from the MS and the EU.

Moreover, having a narrower scope, MoS Guidelines would be easier to amend than the Maritime Guidelines.

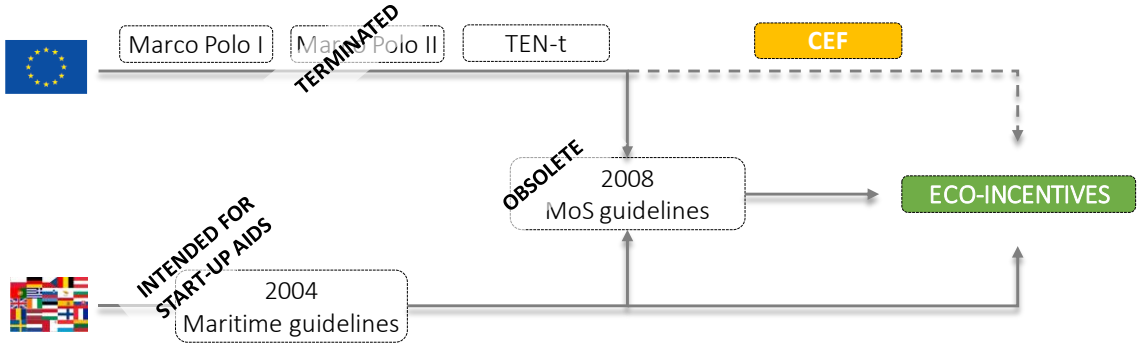

Figure 4.- Current situation on the state aid rules applicable to maritime transport.

Anyhow, the eco-incentive schemes must be compatible with the applicable rules on state aid, which is considered a principle of the common EU approach as well.

Following the recommendations of the ECA[38], **additional principles** might be part of the common approach. In particular, the scheme design should minimize the risk of fraud, minimize bureaucracy and demonstrate the performance achieved when it comes to implement the eco-incentive measures. These particular principles should be attained through the administrative, technological and operational structures of the eco-incentive schemes, at implementation.

Finally, granting EU support to eco-incentive measures should be conditional to an **ex-ante analysis** showing whether and to what extent there is an EU added value. This is a fundamental principle of the common EU approach and is firmly addressed in both the ECA and the EC recommendations for future incentive programs in the field of freight transport services.

[37] Commission Communication providing guidance on State aid complementary to Community funding for the launching of the motorways of the sea (2008/C 317/08).

[38] See note 19.

As part of the common approach, a common methodology is outlined on how the ex-ante analysis could be developed by reference to the above principles.

Following these principles, MS are the promoters of the eco-incentive measures and the beneficiaries of the EU co-financing. Therefore, MS should be responsible for the preparation of the scheme proposal and for the EU funding request following the operational structures of the funding program.

The ex-ante analysis would be the fundamental part of the proposal, including the scheme's scope and design and the complete **impact assessment**.

On the scheme scope and design, the following basic elements should be proposed:

- The **targeted market**, where the eco-incentive scheme will perform, including any mode of transport, market segment or EU region. Following the regional approach, it is on the MS involved to coordinate and prioritize among the possible targets since they are promoters and the ones that better know the needs in the corresponding EU region.

- The **goals**, for which the scheme is promoted. Following the above principles, this goal should comprise implementing actions improving the socio-environmental performance of freight transport services.

- The **socio-environmental merit** which is incentivized. This is an important feature design not only to reach the goals of the scheme but to secure implementation of the eco-incentive measure in a non-discriminatory way as well.

On the other hand, the ex-ante analysis is basically a simulation exercise that will perform for the targeted market, using relevant tools to estimate the merit, prepared for sensitivity analysis and returning the necessary outcomes to assess the achievement of the goals.

Moreover, the ex-ante analysis should provide with enough background on the legal basis, administrative and technological aspects that are specific to the scheme's scope and design. These are relevant elements to assess the risk of fraud, the level of bureaucracy, the compatibility with the state aid rules or the ability to monitor and demonstrate the performance achieved, as examples. Ultimately, the ex-ante analysis must prove compatibility of the eco-incentive scheme with the principles of the common EU approach.

Following the sequence above, the next figure illustrates a possible common methodology for the ex-ante analysis.

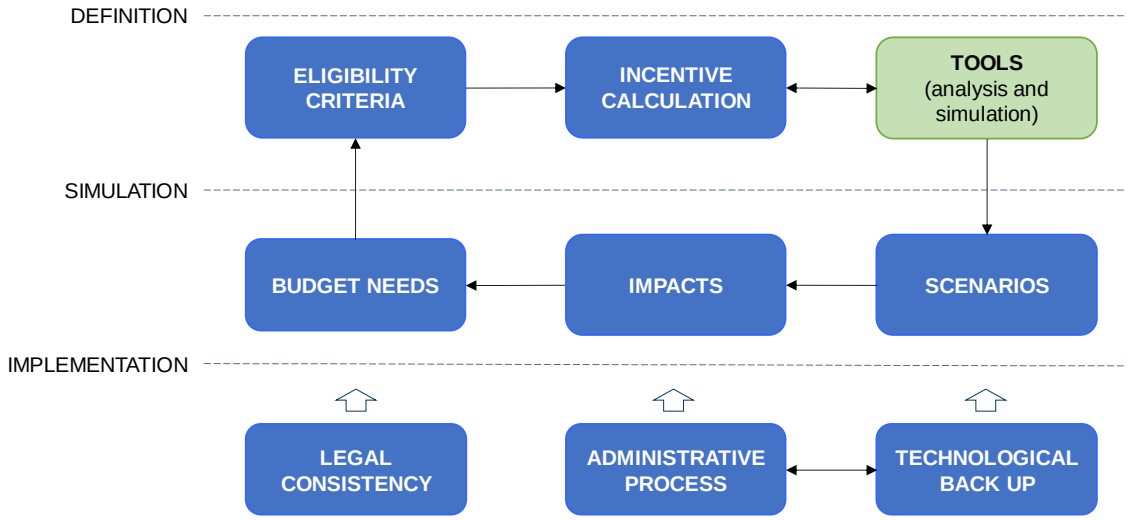

Figure 5.- Ex-ante analysis. Common methodology. MAE approach

In the first place, the **eligibility criteria** should be proposed. This a main feature to be decided and agreed by the MS involved with relevant impacts on the regional level that will be better addressed at MS level (regional approach). To some extent, the eligibility criteria translate the scheme's scope and design into actual requirements. Among other issues, they should be consistent with the targeted market, allow for the goals of the scheme, identify the beneficiaries and include the eligible period.

Next to the eligibility criteria, the ex-ante analysis should produce **relevant and rigorous tools** to the estimation and simulation of the impacts of the eco-incentive measure in different scenarios. The tools must provide with the necessary outcomes for the comprehensive assessment of the scheme's performance (effects on demand, external costs savings, budget needs, etc.). Therefore, the tools should be designed *ad hoc* for the scheme's scope and design and based on common references, relevant methodologies, best practices, updated information, reasonable assumptions, etc.

At least the following tools should be considered as part of the ex-ante analysis of any eco-incentive scheme:

- An **external cost calculator,** specifically designed to measure and monetize the socio-environmental merit based on common references, with the EC's Handbook on External Costs of Transport as the main one.

- A detailed **market analysis and simulation** tool, according to the recommendations from the EC and the ECA after the MP programs, to estimate the effects of the eco-incentive measure on the targeted market (including demand) as well as the resulting socio-environmental impacts per

external cost factor[39] when used in combination with the external cost calculator.

- A **financial assessment** tool to estimate the extent to which the eco-incentive measure is relevant to the achievement of the goals of the scheme, from a market perspective.

Since the goal of the scheme is reducing external costs by means of green actions stimulated through the eco-incentive measure, it is of outmost importance that the external cost calculator is prepared to measure and monetized such actions.

At least, the calculator should consider the following external cost factors: carbon emissions, air pollution (NOx, SOx and PM separately) and social costs (congestion, accidents and noise separately as well). By reference to these common factors, the calculator will be prepared to estimate global and local impacts, which in turn can be used to estimate the amount of the EU contribution over the total scheme's budget.

At this point, it is worth making a specific reference to the importance of calculating external costs when it comes to supporting the development of sustainable freight transport services at EU level.

The common EU approach, as proposed by the MAE study, differs significantly from the MP approach. However, as recognized by the EC, the external cost calculator used in the MP programs was considered at that time an exceptional instrument to evaluate projects.

Moreover, there is virtually no other means of incentivizing a socio-environmental merit if it is not measuring and monetizing the merit itself. In this regard missing the external cost calculator is not an option.

On the other hand, the effectiveness of the calculator depends on the quality, accuracy and representativeness of the data and the assumptions made with respect to the reality being measured. And for the purposes of a common EU approach, consensus based on common references such as the Handbook is of outmost importance. Particularly when it comes to monetize the different factors that produce local and global impacts in the different EU regions.

This is a major challenge considering the constant evolution in transport technologies and the different existing methodologies on the monetization of environmental and social costs. In this regard, the MP calculator together with the first Handbook on External Costs of Transport (2008), represented a unique exercise towards a harmonized approach on transport external costs calculation at EU level that should be recognized beyond discrepancies.

[39] Main factors: CO_2 equivalent, SO_x, NO_x, particulate matter, congestion, accidents and noise.

Anyhow, with the finalization of the MP programs, the EC stopped granting aid based on the external cost calculator, although the Handbook (later updated in 2014) remained as a common reference to be used in the CBA that are currently requested in the CEF to assess the impacts of the proposals.

Nevertheless, the need to measure and monetize external costs of transport cannot be ignored when it comes to eco-incentives measures as a potential way forward to the EU support on sustainable freight transport services.

This poses a major challenge, as in the past, due to the required consensus. Although today seems a good time for such **consensus on external costs valuation**, in a context of great socio-environmental concern at the forefront of the political agendas and the recent publication of a new update of the EC's Handbook (June 2019)[40].

In this context, the proposed approach to eco-incentives measures brings to the EC and to the MS an excellent opportunity to build the required consensus on external costs valuation following the implementation of the eco-inventive schemes and based on a regional approach (i.e. different EU regions having different values for certain emission and social factors)

Indeed, the regional approach would facilitate consensus when it comes to monetize, allowing for the MS supporting the scheme to agree on those values that depend on local conditions (e.g. congestion, SOx emissions, etc.). Conversely, the consensus required at EU level would be limited to the global values, those that must be the same for any EU region (i.e. GHG). Furthermore, this *local* vs *global* scope of the socio-environmental merits attained with the eco-incentive measure would be consistent with an EU co-financing based on the actual reduction of external costs related to GHG, as mentioned before.

Following the definition of the eligibility criteria and the developing of the tools, the ex-ante analysis should propose the **relevant scenarios** for the simulation exercise. In this regard, the scenarios must be consistent with the tool's design (and *vice versa*). It means that the tools must be prepared to simulate the variables considered in the scenarios. Otherwise the simulation will not be possible or relevant.

The scenarios should be designed to allow for the relevant outcomes, as appropriate. At least they should return the maximum budget needs (total eco-incentive given in the eligible period) and the total external costs savings by each of the external cost factors, separately (GHG, air pollution and social costs).

Furthermore, the baseline scenario (i.e. no eco-incentive measure scenario) must also be simulated and compared. In this regard, the net benefits of the eco-incentive scheme should exclude the effects from the baseline scenario

[40] See note 17.

(e.g. external costs savings due to new environmental regulation entering into force).

All of the above allows for a complete simulation returning the relevant outcomes for the assessment. As a rule of the thumb, the total eco-incentive given must remain below the total external costs savings. Otherwise the impact assessment must be considered as negative. In this case, the eco-incentive could be lowered (e.g. by granting just a percentage) and the simulation exercise recalculated. Conversely, if the budget remains below the external cost savings but the goal of the eco-incentive scheme is not achieved (e.g. if it is considered that the eco-incentive does not trigger the actions needed to attain the socio-environmental merit), then the impact assessment would have to be considered negative as well. In this case, the budget might be raised (i.e. with higher eco-incentives). By altering the eligibility criteria, it is possible to increase or restrict the impacts and budget needs as well. Also, by increasing or reducing the duration of the eco-incentive scheme it is possible to increase or reduce the budget needs. Ultimately, the ex-ante analysis is an iterative process.

Finally, and besides the simulation exercise, the ex-ante analysis should also check the compliance with the backing principles of the common EU approach, as a general rule.

E. THE MAE CASE-STUDY

A complete ex-ante analysis has been carried out taking a specific market segment as example to prove the impacts of the common EU approach, as described. This is called the MAE case-study.

Following the common EU approach, MS can get involved and coordinate to target specific transport markets of their interest, decide on the goal they want to address with the eco-incentive measure and establish which merit and how it will be incentivized accordingly.

As mentioned, the goal should target the reduction on external costs of freight transport services through concrete actions.

In particular, the MS involved in the MAE case-study (Portugal, Spain, France and Italy) agreed on the following scope and design for the eco-incentive scheme:

The **targeted market** would be the MoS ferry and ro-ro segment servicing alternative routes to the road transport in the West Mediterranean and Atlantic regions.

This particular market segment is on the interest of the four national administrations. Indeed, such market is currently performing with around 200.000 HGV per year on average. This traffic is very sensitive to the maritime price since there is an alternative route by road. On the other hand, vessels in

this market usually sail at higher speeds to secure frequencies that are attractive to the road haulers, which in turn produce higher emissions. Moreover, shipowners have been using smaller vessels to secure viable utilization rates. Finally, fleet designs in this market have been considering classic marine fuels on their vessels to minimize costs and offer competitive prices to the road haulers (a scenario changing by 2020 with the sulfur cap). As a result, the environmental performance of the maritime leg is not optimized in this market. Conversely, road has significantly reduced emissions over time (specially air pollution) as a direct consequence of the transition in HGV environmental performance from EURO III to EURO VI standard (i.e. a *regulation merit*). All of the above makes the targeted market well suited to the goals of improving the environmental performance of the maritime leg and reducing social costs.

Furthermore, the targeted market is considered to be mature, with existing MoS currently operating in both seas. Therefore, the eco-incentive measure is not intended as a start-up aid to develop the market but to improve its socio-environmental performance.

The main **goal** of the eco-incentive scheme is the improvement of the environmental performance of the maritime leg through specific actions incurring costs[41] to the shipowners (green actions), while reducing social costs from road transport. These goals follow the recommendations made in the sulfur Directive[42] by the European Parliament (EP) and the Council to the MS and the EC. In particular, the need to provide targeted assistance to the operators in order to minimize the risk of modal (back) shift from sea to road transport.

The **merit to be incentivized** is the external costs saving from freight units using the improved MoS compared to the road-only alternative. Following the Italian Ecobonus approach, which is recognized as a best practice by the EC and the ECA, the eco-incentive would be granted to the users of the maritime services. In other words, the eco-incentive would only apply if maritime operators implement green actions in the maritime services and the socio-environmental benefit is proved with the use of such services by road haulers.

With this scope and design, it will be demonstrated through the ex-ante analysis that those maritime operators going for a strict compliance with the sulfur Directive will not deserve relevant eco-incentives. Therefore, the eco-incentive scheme as proposed would only be effective for green actions in the MoS

[41] It has been largely discussed whether they should be investment costs only or consider operating costs as well. In the end, as far as a green action is concern, the difference between both types of costs will depend on the market and should not be critical to the eligibility provided the shipowner is incurring additional costs. By way of illustration, a new LNG vessel could entail an investment or an operating cost depending on the shipowner's decision (whether the vessel is owned or charted).

[42] See note 3.

services going beyond the environmental regulation, as applicable by 2020 (i.e. minimizing deadweight loss of the public support).

F. THE EX-ANTE ANALYSIS

Having regard to the scope and design of the proposed scheme, the ex-ante analysis is carried out for the MAE case-study following the guidelines of the common EU approach. This chapter describes the process of the ex-ante analysis and the main outcomes, these including the methodological approach, the eligibility criteria, the simulation tools, the scenarios, the budget needs and the impacts of the eco-incentive measure, together with the main assumptions taken throughout the process.

In order to assess the maximum budget needs, the case-study simulates a scenario in which all MoS implement a **green action** consisting of switching to liquified natural gas (LNG) as fuel. The choice of LNG is based exclusively on the assumption that this option would bring the largest environmental merit from today's perspective. Thus, the green scenario will return the maximum eco-incentive possible and allow the estimation of the maximum budget needs, which is an objective of the ex-ante analysis. Nevertheless, the final assessment will compare this green scenario with a baseline scenario consisting of the MoS strict compliance with the sulfur cap regulation entering into force by 2020[43]. The baseline scenario will bring environmental benefits as well which cannot be credited to the eco-incentive measure but to a ***regulation merit***.

The eco-incentive will amount the same value of the merit which is incentivized. Consequently, the value of the eco-incentive will be equal to the external costs savings attained by freight units when using the greener MoS instead of the road-only alternative.

These savings (per freight unit and per MoS) are measured and monetized with the **external cost calculator tool** which is developed *ad hoc* for the case-study. Consequently, the eco-incentive is proportional to the savings and will never be higher than the socio-environmental benefit that is attained with the scheme, by definition.

Next, a **transport modelling tool** has been calibrated *ad hoc* for the case-study to simulate the effects of the eco-incentive measure in the targeted market, in the green and baseline scenarios.

The modelling tool will return the total eco-incentive given (i.e. budget needs), the effects on demand (i.e. modal shift and modal back shift effects) and the total external costs savings due to both the green actions and the modal (back) shift effects.

[43] See note 3.

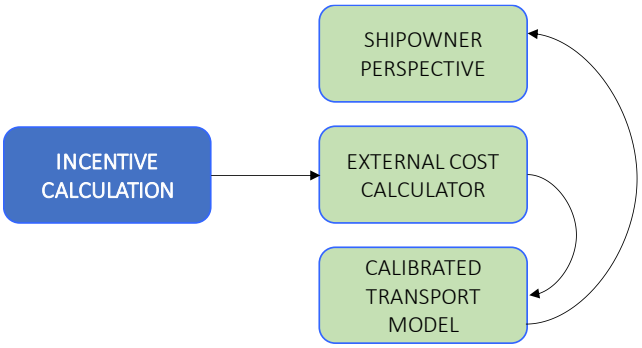

Figure 6.- Incentive calculation and market simulation tools (MAE case-study)

A third tool, called the **shipowners' perspective tool**, will estimate the additional incomes to shipowners (resulting from the effects in demand) and will assess the extent to which these additional incomes received by the shipowners contribute to the business case of the investments needed for the green actions (LNG in the MAE case-study).

As a result, the ex-ante analysis will provide all the relevant information for the complete assessment on the impacts of the eco-incentive scheme.

Besides the impact assessment, a reference is made to the legal, administrative and technological aspects of the scheme design that should be considered in the event of a possible implementation.

Eligibility criteria

The eligibility criteria are an essential feature of the scheme design and have great influence in the ex-ante analysis. They particularize the scope on the regional level and allow for the full compliance with the common EU approach through specific requirements. As an example, altering the scope would have a great influence in the budget needs.

It has to be emphasized that the eligibility criteria, as proposed for the MAE case-study, do not relate to any institutional action already committed by the promoters of the study and must be taken **as example** at this stage. In fact, these eligibility criteria might be revised (enlarged or restricted) should this example is moved to an implementing action in the future.

According to the scope and design of the eco-incentive scheme the following eligibility criteria are proposed (all criteria should be considered together):

- Only maritime services consisting in international lines with no more than 2 stops or one enroute call.

- Direct beneficiaries shall be the users of the maritime services upon proof of boarding and proof of purchase (i.e. provided by the transport operator and the shipowner). By users it is meant the purchasers of the maritime ticket. Users will also be responsible for the proof of the boarding event.
- Lines shall go from / to a port of the implementing MS to / from another EU port or between ports of the implementing MS.
- Domestic services are not eligible in the example.
- Only maritime services having a door-to-door road alternative in operation are eligible (i.e. no pure channel crossing lines).
- Only ro-ro, ro-pax or con-ro vessels are eligible (for ro-pax and con-ro, only freight on ro-ro units is eligible).
- Regular services with a minimum frequency of 1 departure per week by a dedicated vessel (i.e. no seasonal services).
- Services consisting of new or upgraded lines producing external costs savings per transported unit compared to the road-only alternative. Such merit shall be demonstrated and monetized using the scheme's external cost calculator tool and incur direct costs to the shipowners by means of green actions improving the environmental performance of the maritime service.
- Only accompanied or non-accompanied trips of rolling cargo, intended as freight that can be loaded and unloaded autonomously on the vessel (i.e. no cranes used), may be considered eligible. New cars would be considered eligible given they are loaded on trucks.
- Direct beneficiaries shall commit to a minimum number of trips (100 trips a year).
- Maritime services shall be open to all users under the same conditions and in a non-discriminatory way.
- Only services using vessels complying with 2020 sulfur cap (or its equivalent with abatement technologies) are considered eligible.

Furthermore, the **maximum duration** of the eco-incentive measure is set at 5 years, from 2020 to 2024. This eligibility period is agreed to be compatible with the applicable rules on state aids in combination with EU funding.

As mentioned, these eligibility criteria delimitate the targeted market where the eco-incentive measure will be implemented. And it should be noticed that this exercise allows for a common regional approach among the MS involved in the definition of such criteria. It is not new the interest for the road and the maritime transport to perform multimodal solutions. Indeed, the MS involved in the MAE

case-study have been promoting such goal with national budgets, although with different approaches. In this regard, the common EU approach allows for a coordinated effort at the regional level which might increase the impact of the public support, including the EU funding as appropriate.

Anyhow, the eligibility criteria should meet the backing principles of the common EU approach as described above. By way of illustration, some comments are included below.

The criteria establish that only HGV using the maritime services will benefit from the eco-incentive. This is a **demand approach**, also used in the former Italian Ecobonus program, which allows for non-discrimination at implementation (same rules apply to all MoS and users). Shipowners should keep proving the commercial competitiveness of the maritime services on a market playing field (frequencies, prices, etc.) but with the best environmental behavior stimulated through level playing conditions.

Moreover, the demand approach brings additional benefits. It allows for the goal of reducing social costs, stimulating new transport patterns in the road sector (i.e. using the MoS services instead of the road-only alternative) and preventing from modal back shift effects. In turn, it improves the utilization rates of the MoS, inducing an optimization in freight transport. Finally, it facilitates the compatibility assessment on state aid rules since the approach has been already validated by the EC with the occasion of the Italian Ecobonus program.

The criteria set the main goal of the scheme as well, which is the improvement of the environmental performance of the MoS through green actions incurring direct costs to the shipowners. The need to incur costs is brought to the case-study as a way of reducing deadweight as much as possible, but mainly to fulfill the conditions of the existing rules on state aids to maritime transport[44] which limit the compatibility to new or upgraded services.

In any case, the eligibility criteria do not predetermine or favors any type of green action, leaving the decision to the shipowners on a market basis. Further on, the external cost calculator will cover the possible actions to be decided by the shipowners according to current practices that are observed in the market (technology or not technology based, such as increasing capacity or reducing the speed[45] of the vessels). Anyhow, the strict compliance with the sulfur directive is considered as a baseline scenario (i.e. switching to low sulfur conventional fuels) in which no eco-incentive will be granted.

[44] See note 35.

[45] Reducing speed should be considered a green action since it reduces fuel consumption (and thus emissions). But according to the scheme design it would only be eligible if it incurs costs to the shipowner. This could be the case if the shipowner is forced to add an additional vessel to the MoS to keep the frequencies of the maritime service. In this event, the shipowner would incur additional costs. However, it would also increase the overall fuel consumption of the line. In the end, the external cost calculator should estimate the net savings, if any.

Eligibility is limited to international routes, contributing with the case-study to increase the EU added value.

The eligibility criteria ensure that funding is conditional upon results since the eco-incentive is paid upon proof of boarding.

External cost calculator

As mentioned, the external cost calculator is a prominent feature in the overall approach to eco-incentive measures. When it comes to grants based on actual socio-environmental merits missing an external cost calculator tool is not an option.

Thus, following the common EU approach an external cost calculator has been developed *ad hoc* for the MAE case-study. The calculator has been designed to measure and monetize external costs in the targeted market (i.e. performing road and maritime transport) and to estimate the socio-environmental merits that should be incentivized according to the scheme design (i.e. the value eco-incentive).

To that aim, an exhaustive analysis has been carried out, including past and existing calculators, technical, statistical and scientific reports, publications and articles, EU projects, emission trading schemes, etc. and different perspectives, including academia, transport administrations, consultancy, financial institutions, etc. Ultimately, the MAE study has analyzed and confronted many references which are listed in APPENDIX 1.

Above all, an in-depth analysis of the MP calculator and the EC's Handbook on External Costs of Transport has been carried out (both 2008 and 2014 editions)[46].

Based on the common approach, the MAE calculator could be a piece of a future EU calculator, bringing consensus when it comes to measure and monetize external costs in the EU regions and modes of transport involved in the case-study. Following a similar approach, other calculators addressing different market segments and EU regions could be developed by MS consensus towards this common EU calculator.

The tool is set up in excel format for easy use and understanding, including all the supporting tables. In addition, a separate deliverable has been produced describing the designing process and use of the MAE calculator. Everything is available for download (see APPENDIX 2).

[46] At the time of the elaboration of this report the 2019 update of the Handbook was not available yet.

Also due to the lack of information and harmonized references, the MAE calculator is based on several assumptions. These assumptions are explained as well in the separate deliverable just mentioned above.

Finally, the external cost calculator is designed using the 2014[47] version of the EC's Handbook on External Costs of Transport as a main reference. As indicated, the latest version (June 2019) was not available at the time of elaboration.

A brief description of the main features of this tool is summarized below.

As mentioned, the calculator is designed *ad hoc* to estimate external costs in the targeted market and the specific merit to be incentivized, according the proposed scheme. Therefore, it estimates and compares the incurred external costs by HGV when using the MoS and the road-only alternative.

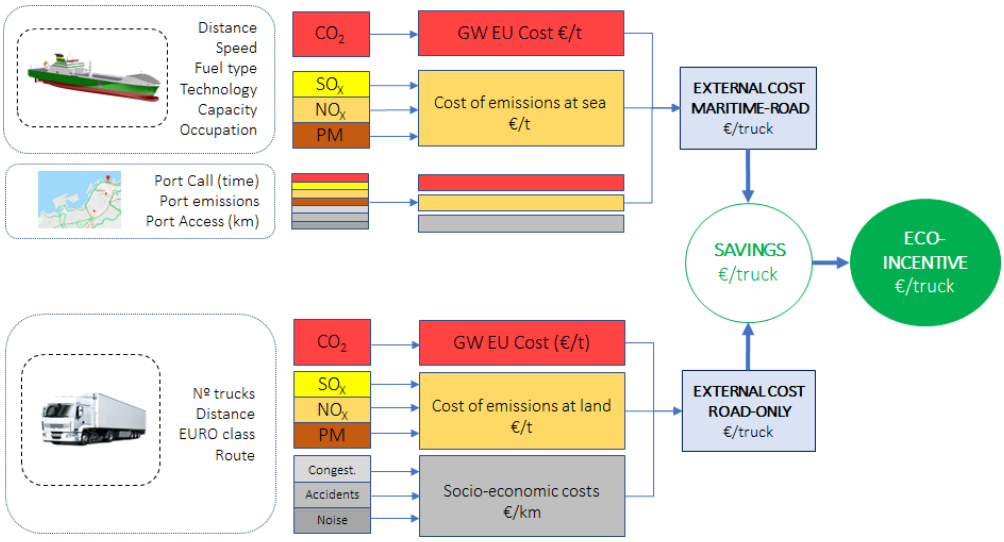

Figure 7.- External cost calculator. Eco-incentive calculation. MAE case-study

On the **maritime leg**, the MAE calculator considers the specific vessel's size and technology, operating profile and socio-environmental impacts at port call and port access. The external costs that are measured in both the road-only and the MoS alternative include CO_2, SOx, NOx and PM emissions. In addition, the road-only alternative is also measured with social factors (congestion, accidents and noise), assuming that MoS impacts are null or no significant when it comes to social costs.

Unlike the MP calculator, which used an average value for all type of vessels, the MAE calculator is prepared to measure the actual socio-environmental impacts of each line, case by case, considering specific vessels' technologies,

[47] Monetary values have been brought to 2016 using consumer price index.

characteristics and operational behavior. Therefore, the calculator is ready to simulate the effects from the most usual green actions (technology and not technology based) to be taken by the shipowners in order to improve the environmental performance of the maritime leg, which is the main goal of the scheme.

On the other hand, the **road performance** is calculated on average, based on the mix of the truck fleet operating the routes. This translates into 62% of the fleet with EURO VI specs by 2020.

The tool also estimates on average the external costs incurred by both the boarding trucks in the access to and from the port and the vessels at **port access and port call**, respectively. These externalities run counter the socio-environmental merit of the maritime service and are significant when ports are close to urban areas, which usually happens to be the case. In turn, shipowners adopting port emission reduction technologies in their vessels (e.g. batteries, cold ironing, etc.) will be reducing the overall impact of their MoS. Of course, that merit will also be measured and monetized through the calculator.

By definition, the calculator will only account for external costs incurred by freight units. Therefore, for ferries or ro-pax vessels where freight capacity is combined with private vehicles, vessel's emissions shall be allocated to freight and passengers separately. To do so, the MAE calculator estimates the number of **trucks equivalent**, which represents for each vessel the actual trucks plus the private vehicles converted into virtual trucks or trucks equivalent using average utilization rates for the vessel capacity. For new vehicles, not eligible to the case-study as well, a similar calculation is performed.

In addition to the values that are implemented by default, the MAE calculator allows for **direct entries** in case the user wants to simulate specific data (e.g. engine specifications or operational profile of the vessels) and estimate specific navigation and port environmental performances.

By way of illustration, the following figure shows one of the output charts of the MAE calculator in a theoretical example called 'Parallel 2020'. In this example the maritime service runs parallel to the road-only alternative (i.e. no geographical advantage compared to the road) with a 3.000 lane meter ro-ro vessel at 70% occupancy, resulting in 140 trucks per trip. The vessel sails at 19 knots using marine gasoil (MGO) compliant with the 0,5% sulfur cap or LNG. As mentioned, 62% of the truck fleet is EURO VI (the estimated share by 2020). The results show no environmental merit when using MGO, with the external costs incurred per unit being 44,7 € higher in the MoS compared to the road-only alternative. Conversely when using LNG the situation is reversed and yields a positive 51,9 € external costs saving per unit on the MoS alternative. All CO_2, SOx, NOx and PM are reduced when using LNG, also at port (with the auxiliary engines running on LNG as well).

So, in the 'Parallel 2020' example, and according to the scheme design, switching to LNG would grant a positive eco-incentive of 51,9 € per truck to the MoS users.

Assessing the effects of the eco-incentive measure in the targeted market, including whether such effects would bring the business case for the shipowners to incur the costs of the green actions are the goals of the following tools.

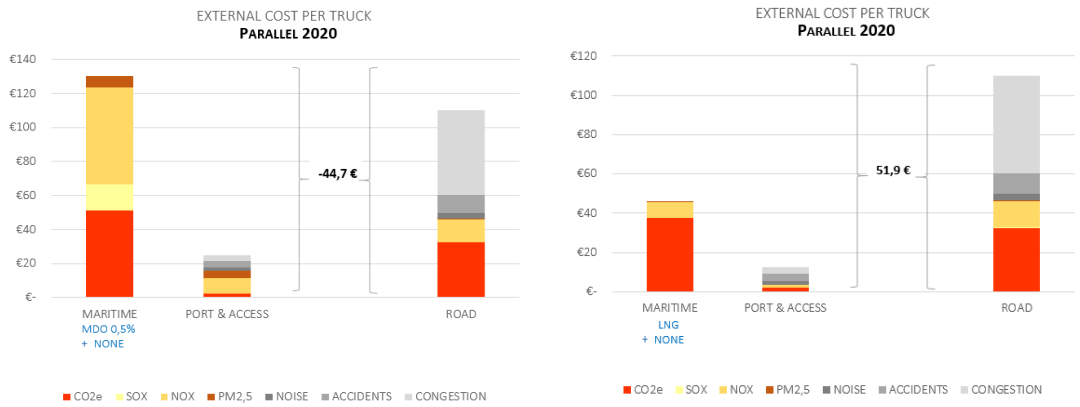

Figure 8.- MAE external cost calculator (MGO -left-, vs LNG -right-). Parallel 2020.

Transport modelling tool

Following the requirements of the common EU approach, a complete transport modelling tool has been calibrated *ad hoc* for the targeted market. This tool, together with the external cost calculator, allows for the market analysis and the impact assessment on the effects of the eco-incentive measure.

The modelling tool intends to replicate the actual performance of the targeted market by using advanced modelling methods. Moreover, it is designed for sensitivity analysis on the relevant variables, such as the transport price or the frequency of the maritime services.

The goodness of the calibration is considered to have been satisfactory despite the lack of data available, which is the main limitation for this kind of modelling tools. As a result, the tool is valid and ready for simulation.

It should be noted that MAE Action, as initially proposed to the CEF call, included a specific task to update the Pyrenees and the Alps transport observatories, supported by the French, Italian and Spanish administrations. The aim was to secure the statistical data needed for the calibration exercise in the modelling tool. On the award of the Action, the financing was cut due to oversubscription and this budget line decayed. Nevertheless, a calibration has

been completed, as mentioned, without prejudice to the possibility of improving in the future when new statistical data are available.

On the other hand, the MoS market shows different patterns in the West Mediterranean region compared to the Atlantic region, including different market shares and different densities in the maritime network.

Therefore, two models have been calibrated, one for each market, following the same **methodological approach**.

A thorough report has been elaborated explaining in detail the designing and calibration process for both models, including the market analysis for the West Mediterranean and the Atlantic regions. This report is available for download together with the tool in excel format (see APPENDIX 2).

The main features of the modelling exercise are summarized below.

The methodology for the design and calibration of the models in each region uses the classic **four-step transport modelling** approach. In a typical *micro* approach, it implies the calibration of four stepped models, with the following scopes: (i) Global mobility model, (ii) Spatial distribution model, (iii) Modal choice model and (iv) Route assignment model (e.g. modelling the maritime choice between MoS).

However, due to the lack of data and the fact the available data came from different sources (leading to information which is not harmonized), an aggregated *macro* approach was taken. In the *macro* approach each available data is assumed to be representative of a group of individual travels. The statistical errors from this assumption are not very high. Finally, in the aggregated approach the spatial distribution model is integrated with the global mobility model.

The influential area and the geographical zoning for the spatial distribution considered in the mobility model are shown in the next figure.

It comprises 20 zones in the south of the Pyrenees (15 in Spain and 5 in Portugal) and 21 zones in the north (8 in France, 6 in Italy, 3 in Germany, plus Belgium, the Netherlands, Austria and UK as a whole). Therefore, 420 origin-destiny (O-D) pairs are considered initially. However, 26 of them have no actual traffic in the sample and have been discarded to avoid statistical issues.

On the other hand, only general cargo has been considered. Typically, bulks have different transport patterns and are not in the scope of the targeted market.

The explanatory variable used in the **mobility model** is the Gross Domestic Product (GDP) of each zone. It is commonly accepted and confirmed by statistical data that freight mobility (general cargo in particular) between two different zones increases or decreases accordingly to the evolution of the GDPs of both zones.

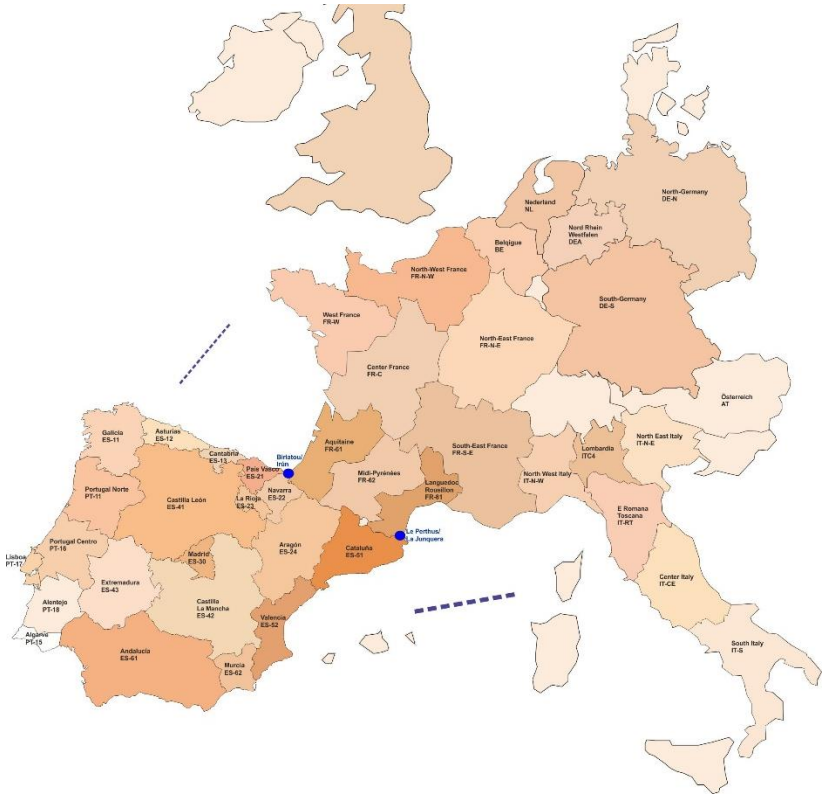

Figure 9.- Mobility model. Influential area and zoning. MAE case-study

As an example, the figure below shows the evolution of the growth rates for both the total GDP and freight mobility in the area of analysis. The result is well known; freight mobility grows in the same way as GDP but with a higher rate. This pattern is what the mobility model replicates per each O-D pair.

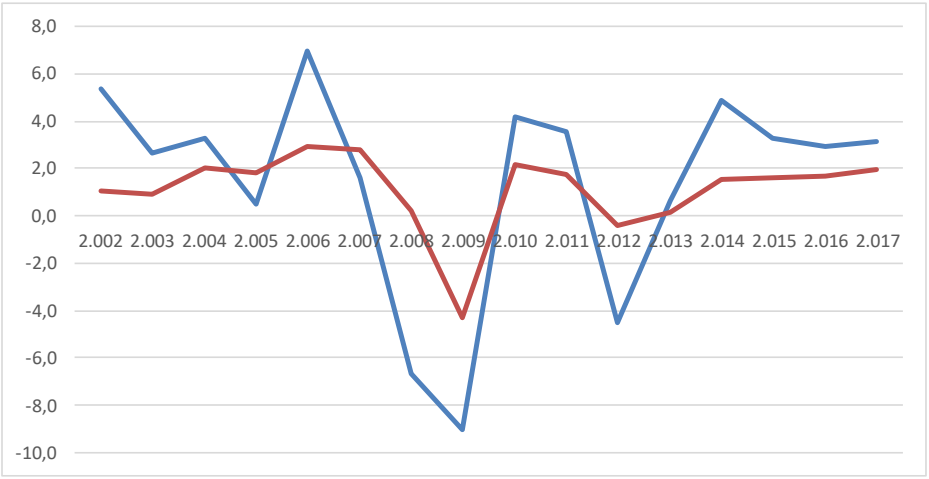

Figure 10.- Total freight mobility (in blue) and GDP (in red) growth rates evolution in the influential area

The next step in the modelling exercise, as described, is the **modal choice model**. This model explains the modal balance per each O-D pair between the two transport alternatives considered under the case-study (i.e. HGV using the road-only alternative and HGV using the MoS, including road sections as well).

The model uses two basic explanatory variables to replicate demand's behavior when deciding among the two options. On the one hand, the average **price** of the door to door transport in each alternative, including the maritime price when using the MoS option. On the other hand, the **frequency** of the maritime services, affecting exclusively to the MoS option.

The model formulation in both the West Mediterranean and the Atlantic regions is a **binary logit**, which is a commonly accepted approach for modal choice modelling.

The following sources of statistical data have been used in the calibration. For the road-only, the very extensive Transyt survey campaigns carried out in 2004 and 2010 by the Spanish and French Governments as part of the statistical observatory of the Pyrenees. For the MoS, the sources are more limited. In the West Mediterranean, the only available sources including quantitative data come from EU projects[48]. In addition, the analysis of the Italian Ecobonus experience that has been mentioned above provided some useful information. Finally, direct information from transport operators, ports, etc. has been used as well. As for the Atlantic, the only available data for the maritime leg come from a survey campaign to the users of the Gijon-Nantes MoS, performed during 2010 and 2011.

Beyond these limitations, the results of the calibration are acceptable (statistically speaking) in both the Atlantic and the West Mediterranean markets. Therefore, the binary logit models give the possibility to replicate the actual shares as well as to simulate new shares by altering the explanatory variables (i.e. transport prices and frequencies).

As an example, the next figure represents in both the Atlantic and the West-Mediterranean markets the variations in the modal share between the road-only and the maritime-road (MoS) options referred to variations in the differences of price. As shown in the figure, the maritime services in the Atlantic need higher efforts in price to get the same share as in the West Mediterranean. This result is consistent with reality, with a MoS network in the Atlantic that is not as developed as in the West Mediterranean and needs to cover higher distances to be competitive in price compared to the road-only alternative.

[48] (2006-EU-93016-S) West Med Corridors; (2005-EU-90609-S) Western Europe Sea Transport & Motorways of the Sea (WEST-MOS).

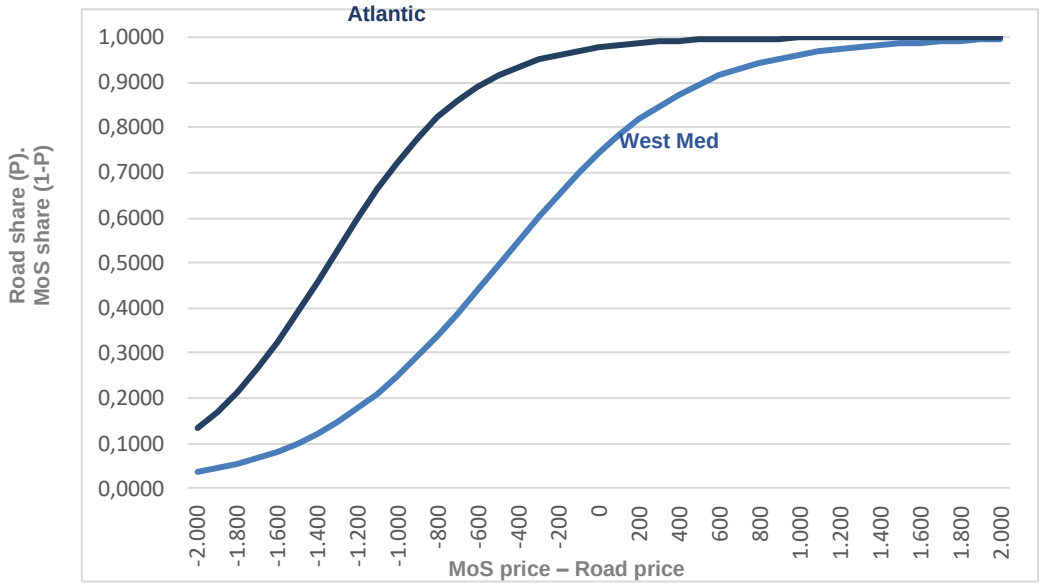

Figure 11.- Road/MoS sharing (%) vs price gap (€). Atlantic and West Mediterranean

Another interesting outcome from the calibrated models has to do with the values of demand elasticity to price for the maritime services in each area (Atlantic and West Mediterranean), as shown in the next figure:

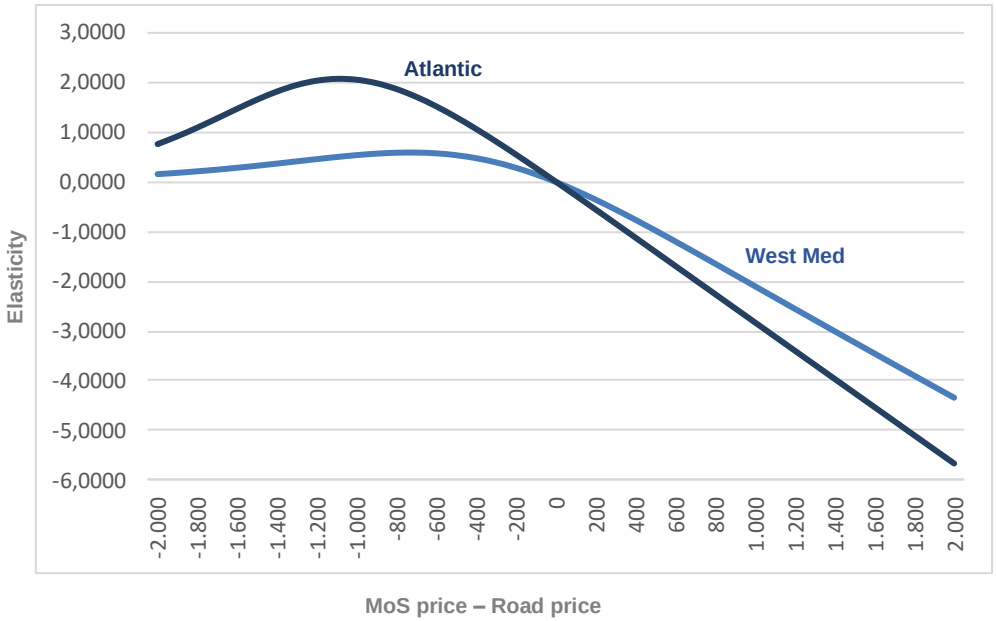

Figure 12.- Elasticity of the Road/MoS sharing to price gap. Atlantic and West Mediterranean

An immediate outcome of the calibrated models is that MoS in the Atlantic are much more **sensitive to price** than in the West-Mediterranean. This is relevant to the case of eco-incentives, as this higher elasticity will also bring higher shifts in the Atlantic for the same value of the eco-incentive.

Finally, the last step for the complete transport modelling tool is the design and calibration of the **route assignment model**. This particular model intends to replicate the share of the maritime option between the different MoS considered, per O-D pair. A complete description of the designing and calibration of this model is included in the specific report which has been mentioned above. Some of the main features are described below.

The design of the model follows the same approach as in the modal choice model and is based in a logit formulation as well.

The main explanatory variables used to replicate the shares between maritime lines are the sea rates (maritime price), the frequency and the distance between the centroid of each zone and the call ports of the maritime service.

As for the **maritime prices**, which play a significant role in the model, the information is taken from different sources, including direct queries to maritime operators. However, real prices are always subject to a lack of transparency. Differences in prices between accompanied and non-accompanied units have been considered, when available, by using averages depending on the actual performance of the line. As an estimate, maritime prices are giving unitary prices for the maritime leg (including port dues) that are below 1 € per unit-km. Moreover, as part of the market analysis it has been observed that it is possible to run a line in market conditions with competitive prices compared to the road-only alternative with vessels occupancies over 50%. Nevertheless, this is considered a minimum threshold. In fact, the eco-incentive calculation will later use the value of 70% occupancy on average as a reference.

The **lines** that have been considered for the calibration are the following:

West Mediterranean:

- Barcelona-Genoa
- Barcelona-Civitavecchia
- Barcelona-Livorno/Savona
- Valencia-Salerno
- Valencia-Livorno/Savona

Atlantic:

- Bilbao/Santander-Zeebrugge/Amsterdam/Rotterdam
- Bilbao/Santander-Reino Unido
- Gijón-Nantes
- Vigo-Nantes
- Leixoes-Zeebrugge/Amsterdam/Rotterdam
- Lisboa/Setúbal/Sines-Zeebrugge/Amsterdam/Rotterdam

Some of these lines do not exist at this time. Some of them existed in the past. However, it is considered that they could reasonably operate in the targeted market as of 2020.

Finally, as a result of the 4 steps modelling exercise the complete modelling transport tool is calibrated.

As mentioned, the goodness of the calibration is considered acceptable under statistical parameters. By way of illustration the following tables compare the observed and the estimated values in both the West Mediterranean and the Atlantic regions.

YEAR	TOTAL	ROAD-ONLY	MOS	LINE 1 BCN-GEN	LINE 2 BCN-CIV	LINE 3 BCN-LIV	LINE 4 VAL-SAL	LINE 5 VAL-LIV
2008	**8.931**	**5.757**	**3.174**	1.113	875	488	524	174
2009			**2.687**	468	1.090	493	394	243
2010	**8.318**	**5.631**	**2.687**	341	1.189	451	445	262
2011			**3.290**	437	1.126	636	425	666
2012			**2.771**	181	1.010	506	364	710
2013			**2.805**	67	1.189	395	398	756
2014			**3.266**	29	1.281	473	541	943
2015			**3.840**	69	1.350	780	635	1.006
2016			**3.410**	30	1.282	662	600	836
2017			**3.711**	32	1.384	715	660	920

Table 1.1.- Traffic demand. Observed values. West-Mediterranean. 2008-2017 (x 1000 tones)

YEAR	TOTAL	ROAD-ONLY	MOS	LINE 1 BCN-GEN	LINE 2 BCN-CIV	LINE 3 BCN-LIV	LINE 4 VAL-SAL	LINE 5 VAL-LIV
2008	**8.978**	**5.796**	**3.182**	1.125	815	496	415	331
2009	**8.095**	**5.425**	**2.670**	604	990	521	308	247
2010	**8.318**	**5.388**	**2.930**	410	1.276	621	338	285
2011	**8.297**	**5.079**	**3.218**	474	1.154	853	269	468
2012	**7.812**	**5.134**	**2.678**	214	1.146	535	273	511
2013	**7.601**	**4.875**	**2.726**	74	1.104	576	371	600
2014	**7.794**	**4.456**	**3.338**	86	1.345	660	501	747
2015	**8.116**	**4.261**	**3.855**	83	1.540	706	658	868
2016	**8.492**	**4.806**	**3.686**	83	1.371	705	657	869
2017	**8.917**	**5.085**	**3.833**	84	1.456	715	704	873

Table 1.2.- Traffic demand. Estimated values. West-Mediterranean. 2008-2017 (x 1000 tones)

YEAR	TOTAL	ROAD-ONLY	MOS	LINE 1 BIL/SAN-ZE/AM/RO	LINE 2 BIL/SAN-UK	LINE 3 GIJON-NANTES	LINE 4 VIGO-NANTES	LINE 5 LEIXOES-ZE/AM/RO	LINE 6 LIS/SET/SIN-ZE/AM/RO
2004			**317**	106	115		96		
2005			**349**	113	128		108		
2006			**378**	119	136		122		
2007			**676**	362	176		138		
2008			**903**	460	287		156		
2009			**1.120**	674	295		151		
2010	**32.594**	**30.946**	**1.648**	933	519	34	162		
2011			**1.317**	420	447	299	151		
2012			**1.233**	335	458	288	153		
2013			**1.227**	281	441	297	169	39	
2014			**1.264**	245	500	170	166	184	
2015			**1.088**	109	488		266	225	
2016			**1.255**	113	558		313	271	
2017			**1.502**	258	587		336	321	

Table 2.1.- Traffic demand. Observed values. Atlantic. 2004-2017 (x 1000 tones)

YEAR	TOTAL	ROAD-ONLY	MOS	LINE 1 BIL/SAN-ZE/AM/RO	LINE 2 BIL/SAN-UK	LINE 3 GIJON-NANTES	LINE 4 VIGO-NANTES	LINE 5 LEIXOES-ZE/AM/RO	LINE 6 LIS/SET/SIN-ZE/AM/RO
2004	28.037	27.708	328	114	138		76		
2005	29.395	29.029	366	124	150		91		
2006	31.339	30.927	412	154	151		107		
2007	33.513	32.942	571	338	145		88		
2008	34.021	33.235	786	474	196		116		
2009	31.445	30.458	987	645	217		124		
2010	32.369	30.687	1.682	967	511	26	177		
2011	32.795	31.460	1.334	483	483	241	128		
2012	31.869	30.524	1.344	272	565	315	193		
2013	31.550	30.315	1.235	218	503	288	173	54	
2014	32.481	31.281	1.200	205	488	131	202	173	
2015	33.966	32.937	1.030	142	458		236	194	
2016	35.563	34.401	1.162	176	530		247	209	
2017	37.361	35.859	1.503	299	646		312	245	

Table 2.2.- Traffic demand. Estimated values. Atlantic. 2004-2017 (x 1000 tones)

The figures are quite similar in both markets. Moreover, it should be noticed on the West Mediterranean that the model is replicating quite well the observed values in the period 2008-2010, thus including the effects from both the Italian Ecobonus program and the financial crisis. This final consideration underscores the quality of the calibration.

Consequently, the calibrated tool is ready to simulate future scenarios including those operating eco-incentives measures and returning for each scenario the effects on demand and the external costs in each of the alternatives (MoS and road-only) when used in combination with the external cost calculator.

As mentioned, the tool is set up in excel format, including all the supporting tables, and is available for download together with the specific report including the market analysis and the detailed explanation on the designing and calibration exercise for both the Atlantic and West Mediterranean models.

Ultimately, this tool is considered an important contribution from the MAE Action, of interest for the market studies developed in the Mediterranean and Atlantic CNC work programs and MoS Detailed Implementation Plan (DIP).

Shipowners' perspective tool

According to the scheme design, the eco-incentive is granted directly to the users of the maritime services (i.e. demand approach). However, the main goal of the eco-incentive measure is to trigger the improvement of the environmental performance of the MoS by means of green actions. These actions, incurring costs according to the eligibility criteria, should be implemented by the shipowners, although they are not the direct beneficiaries of the grants.

On the other hand, the modelling tool will show the extent to which these eco-incentives provide the MoS with additional demand which in turn will indirectly provide the shipowners with additional incomes.

Then, the ex-ante analysis should assess whether these additional incomes are financially attractive for the shipowners to incur the costs of the green actions on a market basis. This particular **financial assessment** is performed through the shipowners' perspective tool.

Basically, this tool allows for the simulation of the cashflows and relevant financial indicators that shipowners would possibly consider when facing the investment decision of the green action (i.e. switching to LNG in the case-study).

The methodological approach follows a very practical vision, playing only with the relevant concepts of a typical operating account in a shipping line. Moreover, it just simulates the main financial outputs that are usually considered to assess decisions in the business environment.

In addition, the tool makes it possible to assess compatibility with the applicable state aid rules. In this regard, it should be noted that the Maritime and MoS Guidelines[49] would apply to shipowners as indirect beneficiaries following the EC interpretation in its Decision on the one-year extension of the Italian

[49] See notes 35, 37.

Ecobonus program[50]. Shipowners should therefore meet the requirements laid down in those guidelines. In particular, the amount of aid over the operational costs of the maritime service, which can be estimated through the shipowners' perspective tool.

The shipowners' perspective tool is set up in excel format for easy use and understanding, as well as the other tools. The excel file is available for download together with a technical report including a short description on the tool's design and functioning and practical examples (see APPENDIX 2).

As in the other tools, the main features and assumptions taken for the designing of this particular tool are summarized below.

As mentioned, the shipowners' perspective tool intends to replicate the basic structure of a standard operating account of a shipping line.

Following the previous design of the ex-ante analysis, it should be noted that the tool has only been calibrated for the same green action in all MoS, consisting of new LNG vessels (i.e. green scenario)[51].

On the other hand, it is assumed that the investment decision on a new LNG vessel (i.e. green scenario) would be taken against an investment decision on a new vessel running with conventional low sulfur fuel to be compliant with the sulfur cap regulation by 2020 (i.e. baseline scenario).

Both scenarios (green and baseline) are described below in this report.

In other words, investing in a new vessel is considered to be a **market decision** and for that reason it is not in the scope of the eco-incentive scheme. Conversely, the green action has to do with the additional investment that will bring a greener performance of the vessel, which is the goal of the eco-incentive measure. Somehow this is the same approach followed by the CEF when funding innovation and new technologies (only the innovative part of the investment is considered as eligible). Anyhow, this assumption isolates the ex-ante analysis from market issues that should not be in the scope of the eco-incentive measure, following the common EU approach.

Consequently, as regards expenses, whether capital (CAPEX) or operational (OPEX), the shipowners' perspective tool reflects the relative effects between the green and baseline scenarios.

[50] Commission Decision of 17 July 2013 on State aid SA.33412 (C/2012, ex N/2011) which Italy is planning to implement for the development of logistics chains and the upgrading of intermodality.

[51] An additional calibration is available in APPENDIX 3 as example, simulating the case of green actions consisting on a scrubber combined with a selective catalytic reduction system (SCR).

On the other hand, the tool compares the situations with and without eco-incentive in order to assess the ability of the eco-incentive measure to trigger the green actions (which is precisely the purpose of the tool).

In the situation with eco-incentive, the shipowners benefit from **additional incomes** due to the additional demand which is incentivized. Based on the additional demand, which is provided by the modelling tool, the additional incomes are estimated with the net sea rates (i.e. net contribution to the vessel, excluding port costs paid by freight units).

Whereas in the situation without eco-incentive, there are no additional incomes.

Following this approach to the tool design, some additional features are mentioned below.

To estimate the operational costs, some basic data are needed for each MoS (see table below). These parameters set the operating profile of each line and are key to estimate the fuel consumption. In turn, the fuel consumption is the main fact behind the difference between the green and the baseline scenario as regards operational costs. On top of the operating profile, the fuel price is also an essential input.

PARAMETER	DESCRIPTION
Nautical miles	• Distance from port of origin to port of destination
Lane Meters	• Freight capacity of the vessel
Vessel average speed	• Average operational speed of the vessel in the service
Vessel power (kW)	• Total main engine (propulsion) power
Number of vessels	• Number of vessels servicing the line
Departures (sailings)	• Total annual departures (from both ends, for all participating vessels)
Fuel type / consumption	• Total annual fuel consumption (tones)

Table 3.- MoS operating profile. Main parameters. Shipowners' perspective tool

As regards capital costs, the additional investment between a new LNG vessel and a conventional vessel is estimated, as previously mentioned. To that aim, accredited references have been considered. On the financial perspective, the rate of interest and the residual value of the investment have been used in the calculation. In this regard, the tool allows for direct entries on specific values for the weighted average cost of capital (WACC) and the residual value of the investment, depending on its lifetime.

For the estimation of the additional incomes in the situation with eco-incentive a total duration of 5 years is considered, according to the eligible period. Although, the tool is prepared to simulate different durations as well.

Finally, the tool will return the following **outputs** for the additional investment on the green action: (i) the net present value (NPV), (ii) the internal rate of return (IRR) and (iii) the payback (i.e. the number of years required to pay the investment). Having regard to these outputs in the situations with and without eco-incentive, the tool provides the relevant information for the assessment (i.e. the ability of the eco-incentive to trigger the green action).

On top of these outcomes, the tool also provides two **additional ratios**.

By one hand, the amount of the indirect incomes to shipowners over the operational costs for each MoS. This indicator makes it possible to assess the compatibility of the state aids, following the applicable rules. Indeed, the maritime rules would apply to shipowners as indirect beneficiaries, as previously mentioned. According to these rules, the amount of the state aid per line should remain below 30% of the operational costs of the line (or below 35% when combined with EU funding). In the strict sense, the aid per line should be assimilated to the additional incomes received by the shipowners. Anyhow, even if the total amount of state aid is considered instead of the additional incomes the assessment proves to be relevant (e.g. in the Atlantic region the amount of the additional incomes to shipowners is even higher than the state aid).

Finally, the tool estimates the amount of the indirect incomes over the additional investment incurred with the green actions in each MoS. This indicator can be assimilated to a sort of co-financing rate that the shipowner could expect for the green action. Thus, giving a better understanding of the financial attractiveness that the eco-incentive measure would bring to the shipowner compared to other possible means of financing (i.e. the co-financing rates in the current CEF).

Simulation scenarios

The tools have been developed *ad hoc* for the case-study and are conceived, designed and calibrated to simulate the effects of the eco-incentive measure in the targeted market. As a result, they allow for the assessment on how much the eco-incentive measure would contribute to the goals of the proposed scheme (i.e. improving the environmental performance of the MoS services while reducing social costs from road transport).

Following the regional perspective of the proposed common EU approach, other scopes and scheme designs at EU level should develop their relevant tools allowing for the simulation exercise, which is the main purpose of the ex-ante analysis.

As in any simulation exercise, the ex-ante analysis should include the definition of scenarios. The selection of scenarios should respond to the needs of the assessment, including those aspects which are critical to the viability of the eco-incentive measure (e.g. allowing the estimation of the maximum budget needs).

Moreover, the scenarios with and without eco-incentive measure should be compared, the latter being the baseline scenario.

In addition, the simulation exercise requires that the definition of the scenarios depends on the same variables that have been considered when designing the tools.

Following this approach, two scenarios are considered and compared in the MAE case-study, both as of 2020:

- A **baseline scenario**, with all MoS behaving conservatively and switching from high sulfur fuel oil (HSFO) to marine gasoil (MGO) or low sulfur fuel oil (LSFO)[52] to comply with the IMO 0,5% sulfur cap. The environmental merit is very limited, and no eco-incentive is given to the users. On the other hand, the higher cost of the fuel leads to an average 12% increase in sea rates that is applied to all users from day one (estimated for all lines as a 50% fuel price increase x 24% weight of fuel over the total costs of the line). As a result, a modal back shift effect will happen.
- A **green scenario**, with all lines switching to LNG vessels from day one. Sea rates are maintained. The environmental merit is the highest possible, including at ports (auxiliary engines also running on LNG), and all users receive the maximum eco-incentive, leading to a modal shift effect.

Furthermore, the following **assumptions** apply to the simulation exercise:

- The choice of LNG is based exclusively on the assumption that this option would bring the largest environmental merit from today's perspective. Thus, the green scenario will return the maximum eco-incentive possible and allow the estimation of the maximum budget needs, which is an objective of the *ex-ante* analysis.
- The lines that are considered for simulation as part of the targeted market are the same that were considered for the calibration of the transport modelling tool. Therefore, no new lines are considered as a result of the eco-incentive measure, not in particular in the green scenario. As mentioned, the aim of the eco-incentive is not to develop the market, as it was for start-up aids in the past, but to improve its socio-environmental performance on a rolling basis (i.e. the targeted market is now considered mature).
- In the event of capacity constraints, it is assumed that the maritime service will adapt to demand by increasing the frequency (when frequency is 3

[52] The price of the LSFO is likely to be slightly lower than that of the MGO in the near future. However, the only reference available to date is for the MGO. Therefore, this will be the price that will be used in the simulation.

departures per week or below) or the capacity of the vessels (when frequency is over 3 departures per week).

- The duration of the eco-incentive scheme is 5 years, from 2020 to 2024, as previously mentioned.
- Global mobility grows according to the available official GDP projections per each zone, and a 2% annual as a default.
- An average occupancy rate of 70% for the vessels is assumed in order to measure the socio-environmental merit and calculate the eco-incentive.
- Transport prices and external costs are presented in constant values of 2016.
- Road transport is mostly EURO VI in 2020, starting with an average external cost ratio of 0,11 €/v-km in 2020 and reaching the level of 0,10 €/v-km as of 2024, based on the assumptions of the external cost calculator.

Simulation and results

Once the eligibility criteria, the tools and the scenarios have been established, it is possible to carry out a simulation exercise for the targeted market, including both West Mediterranean and Atlantic regions.

First, featuring each MoS in order to estimate the socio-environmental merit per line in the green scenario (i.e. all switching to LNG). Then, the corresponding eco-incentive per MoS is calculated using the **MAE calculator**.

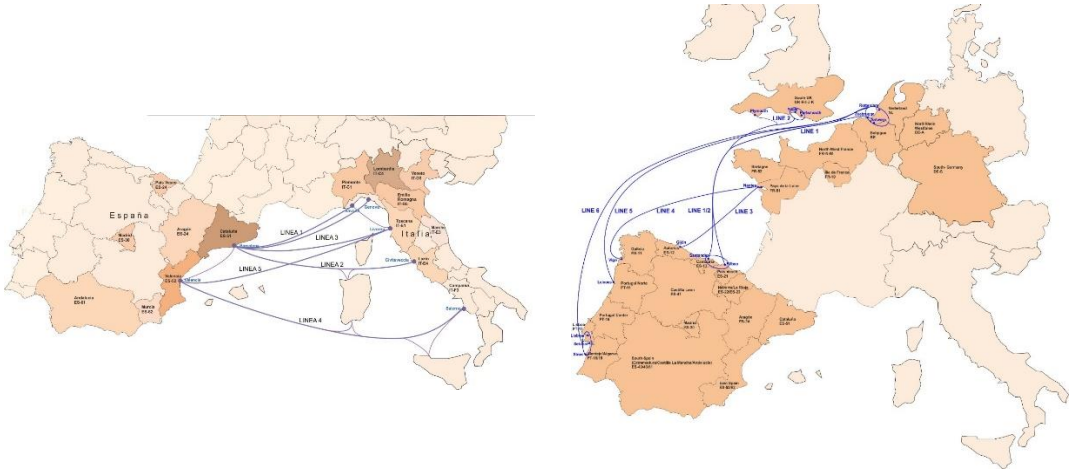

Figure 13.- MoS considered for simulation. West Mediterranean and Atlantic regions.

The main data needed to estimate the socio-environmental merit per line are summarized in the next tables and described below.

The sea distance and the road distance in nautical miles (NM) and kilometers (KM). The lower the maritime distance is compared to the road distance, the better the socio-environmental merit will be. This is a kind of *geographical merit* (GEO) that influences the overall socio-environmental merit of the line. As shown in the tables, this factor is between 65% and 75% in the West Mediterranean, whereas for the Atlantic it ranges from 55% to 114%.

The type and the capacity of the vessels in lane meters (LM), the number of vessels (#V) and the average shares for passenger (PAX) and new vehicles (VEH) are key parameters to the estimation of the socio-environmental merit per freight unit. As described in the eligibility criteria, only trucks (TRUCKS) are eligible and only their share over the total external costs of the vessel shall be estimated. To do so, passengers and new vehicles are converted into trucks equivalent (TRUCKSe) that can be added to the actual trucks. This way, the total emissions of the vessel can be estimated per truck equivalent, allowing for the later calculation of the fair share due to the real trucks.

Finally, the average speed of the vessels needs to be considered, which has a great influence on the environmental performance of the line.

The tables below show the values which have been considered for the simulation, based on available data for the existing MoS and estimations for the rest. Anyhow, the external cost calculator tool allows direct data entry in case it is necessary. In this event, the tool would recalculate the socio-environmental merit of the line and the corresponding eco-incentive per unit.

ROUTE	VESSEL	#V	NM	KM	GEO	LM	PAX	VEH	OCC LM	SPEED	TRUCKS	TRUCKSe
Barcelona-Civitavechia	CRUISE X	2	439	1.298	65%	3.050	400	50	70%	24	142	191
Barcelona-Livorno	EUROCARGO ALEXANDRIA	2	382	1.053	70%	3.810	0	0	70%	18	178	178
Barcelona-Genoa	FANTASTIC/MAJESTIC	1	347	885	75%	2.250	100	12	70%	19	105	117
Valencia-Salerno	EUROCARGO SALERNO	2	710	1.939	70%	3.810	0	0	70%	18	178	178
Valencia-Livorno	EUROCARGO VALENCIA	2	534	1.374	75%	2.550	0	0	70%	18	119	119

Table 4.1.- MoS considered for simulation in the WESTMED. Estimated performance of the lines.

ROUTE	VESSEL	#V	NM	KM	GEO	LM	PAX	VEH	OCC LM	SPEED	TRUCKS	TRUCKSe
Bilbao-Zeebrugge	RORO	2	675	1.139	114%	2.300			70%	19	107	107
Santander Portsmouth	FERRY	1	537	1.135	91%	1.780	300		70%	19	83	113
Gijon-Nantes	VISENTINI	1	271	951	55%	2.110	200	50	70%	19	98	127
Vigo-Nantes	SUARVIGO	2	475	1.344	68%	1.542		250	70%	18	72	114
Leixoes Zeebrugge	RORO	3	844	1.866	87%	3.050			70%	14	142	142
Lisbon Zeebrugge	RORO	1	1020	2.099	93%	2.300			70%	15	107	107

Table 4.2.- MoS considered for simulation in the ATLANTIC. Estimated performance of the lines.

With each MoS featured as described, the socio-environmental merit per line and per freight unit is estimated in the green scenario using the MAE calculator (all vessels running with LNG). This merit is considered to be the maximum eco-incentive that could be granted to each HGV in each MoS, as mentioned before.

The following figure shows the results per MoS from higher to lower values of the **eco-incentive per unit**. The color of each bar represents the speed of the vessels, from the highest to the lowest, being the speed one of the most influential parameters in the vessels' environmental performance.

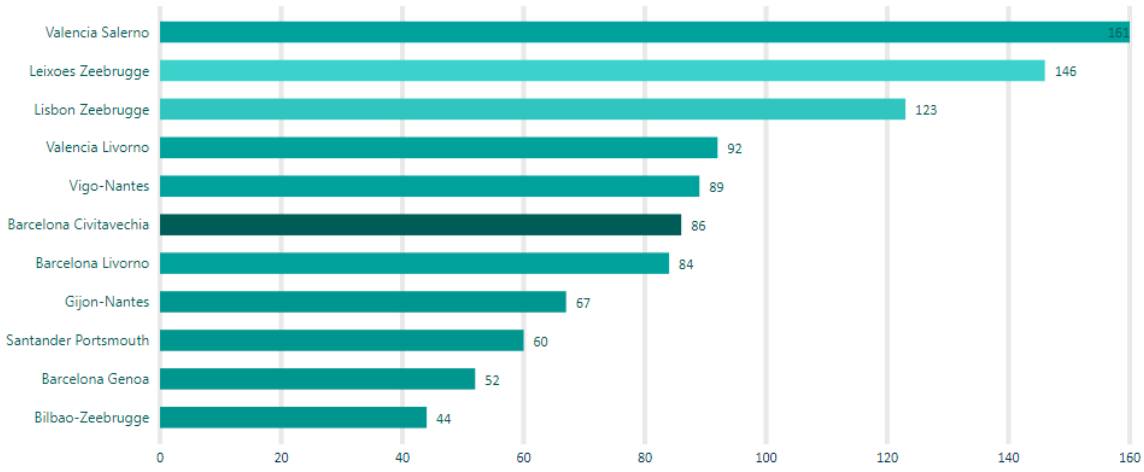

Figure 14.- Eco-incentive per line (€/unit). Green scenario (LNG). The darkest color means higher speed of the vessel according to the estimated performance of the line

The differences between the estimated values of the eco-incentives per MoS are mainly due to the following reasons: the maritime distance (i.e. greater distances produce higher savings) together with the GEO factor (i.e. the maritime shortcut compared to the road-only alternative); the vessels' capacity (i.e. higher capacity means higher efficiency per unit); and the vessels' average speed (i.e. higher speed means higher emission levels).

Consequently, the greatest merit is for the Valencia-Salerno MoS, which sails the largest maritime distance in its market, with a 30% distance saving compared to the road-only alternative, and it is operated by the largest vessel (3.810 lane meters) at 18 knots. On the bottom of the table, the Bilbao-Zeebrugge (discontinued some years ago) suffers from the GEO factor as the route must round the Brest Peninsula, sailing higher distances than the road-only alternative.

These are the unitary values of the eco-incentive that would be granted to the users of each MoS in the green scenario (i.e. shipowners implementing LNG vessels in all the lines).

From the users' perspective, the effect of the eco-incentive can be simulated as a discount in the sea rate. Such assimilation is made only for simulation purposes since the green scenario, as described, is assuming that the sea rates remain unaltered.

Following that reasoning, the next table presents the values of the eco-incentive per MoS as a percentage of the actual sea-rates.

Line	Region	Eco-incentive (€/unit)	Discount (%)
Valencia Salerno	West Med	161	23
Leixoes Zeebrugge	Atlantic	146	12
Lisbon Zeebrugge	Atlantic	123	10
Valencia Livorno	West Med	92	13
Vigo-Nantes	Atlantic	89	12
Barcelona Civitavechia	West Med	86	12
Barcelona Livorno	West Med	84	12
Gijon-Nantes	Atlantic	67	11
Santander Portsmouth	Atlantic	60	7
Barcelona Genoa	West Med	52	10
Bilbao-Zeebrugge	Atlantic	44	4

Table 5.- Eco-incentive per MoS and estimated discount over the actual sea-rates. Green scenario

These values of the eco-incentive, which are different for each MoS, will be implemented in the calibrated transport modelling tool as lower maritime prices. Being the maritime price one of the explanatory variables in both the modal choice and route assignment models, as previously described, the modelling tool will return the effects on demand. In particular, the new traffic volumes per year in the road-only alternative and in each of the MoS considered.

Conversely, the baseline scenario entails an increase in the sea rate due to the use of a more expensive fuel, also with effects in demand (i.e. modal back shift from MoS to road-only alternative).

As previously mentioned, the simulation performs in a way that the two scenarios (baseline and green) are compared. Therefore, the effects on the targeted market that are due to the eco-incentive measure are actually the relative effects between the two scenarios.

In particular, the modelling tool will return the following outcomes:

- The **effects on demand**, including the new traffic shares for the road-only and MoS alternatives. Demand is measured in number of units, using an average ratio of tones per unit based on observed values. This ratio, as

observed, is slightly higher in the MoS compared to the road-only alternative (i.e. an average 17 ton/unit compared to 19 ton/unit in the Atlantic region and 21 ton/unit in the West Mediterranean region). This fact demonstrates a greater optimization in truck loads from road transport operators that are using regular maritime services as part of his logistics. In turn, it proves how multimodal transport with more mature logistics brings higher transport efficiency contributing to sustainability in freight mobility. In the baseline scenario the tool simulates maritime price increases leading to modal back shift effects.

- The total **external cost savings**. By total it is meant not only the savings coming from the greener performance of the MoS, which is the goal of the eco-incentive measure, but also the additional savings coming from the modal shift effect as a consequence of the scheme design. The results will demonstrate that the main savings are not coming from modal shift, as a significant share of the road transport is performing with EURO VI. Nevertheless, modal shift happens and will contribute to reducing social costs which is a goal of the scheme as well.

- Another relevant effect for the purposes of the ex-ante analysis is the total amount of eco-incentives that is mobilized with the scheme. This amount represents the total revenues of the users of the MoS which in turn amount the total **budget needs** of the eco-incentive scheme. Moreover, with all lines running on LNG from day one the green scenario would return the *maximum* budget needs (assuming LNG is the greenest alternative from todays' perspective). This is a very important outcome of the assessment to be compared with the available budget.

Finally, the shipowners' perspective tool will estimate the additional incomes that the eco-incentive measure would indirectly bring to the shipowners through the additional demand. As previously mentioned, such tool will be used to assess the extent to which these additional incomes are attractive enough for the shipowners to incur the additional costs of the green action (i.e. the additional investment for LNG vessels).

Following the previous considerations, the results of the simulation are described below for both the West Mediterranean and the Atlantic regions. The results are presented for the complete 5 years period (2020-2024).

West Mediterranean

In the **green scenario**, all the users of the maritime services would receive an eco-incentive ranging from 161 €/unit to 52 €/unit depending on the MoS. The reasons for these differences between lines have already been explained.

Then, the values of the eco-incentive per MoS are simulated in the modelling tool as discounts over the sea rates.

ALTERNATIVE 1 GREENER (LNG)										
Price incentive (%)						10	12	12	23	13
Ext. Saving (%)						82	82	85	85	85
	Total	Road	MoS	Ports	LINES	BCN-GEN	BCN-CIV	BCN-LIV	VAL-SAL	VAL-LIV
Units (x1000)	-25	-129			104	1	33	17	32	22
Externalities (x1000€)	290.430	18.466	271.964	-8.336	280.300	29.274	113.304	34.309	57.907	45.506
Direct Benefit (x1000€)	98.324									
Indirect Benefit (x1000€)	58.892					343	19.131	9.035	17.770	12.614

Table 6.- Simulation of the green scenario. All lines switching to LNG and all users receiving the maximum eco-incentive. Aggregated effects for the period 2020-2024. West Med.

Following the main goal of the eco-incentive scheme, the green actions in the maritime leg lead to a significant improvement in the environmental performance of the MoS, which brings an external cost saving of 272 M€.

Moreover, as a result of the eco-incentive freight operators are attracted to the MoS resulting in 129.000 trucks shifted off the roads in the five-year period. This effect brings an additional 18,5 M€ external cost saving resulting in an overall 290,4 M€ saving in the targeted market. This figure includes the external costs incurred by the shifted trucks when accessing ports through urban areas, following to the design of the external cost calculator.

The cost of the action is 98,3 M€ which become direct revenues to the road operators, whereas shipowners receive additional incomes of 58,9 M€ for the additional trucks shifted to the MoS.

In the **baseline scenario**, all vessels are switched to low sulfur conventional fuels to comply with the 0,5% sulfur cap from 2020 onwards. As a result, there is also an improvement in the environmental performance of the MoS which brings a total external cost saving of 148,5 M€, much lower than in the green scenario. This could be by the way a good estimation of the expected savings in the targeted market due to the implementation of the sulfur Directive (i.e. the *regulation merit*).

ALTERNATIVE 2 CONSERVATIVE (MGO)										
Price incentive (%)						-12	-12	-12	-12	-12
Ext. Saving (%)						38	38	46	46	46
	Total	Road	MoS	Ports	LINES	BCN-GEN	BCN-CIV	BCN-LIV	VAL-SAL	VAL-LIV
Units (x1000)	20	111			-91	-2	-38	-17	-11	-23
Externalities (x1000€)	132.716	-15.725	148.441	6.851	141.590	13.596	52.622	18.777	31.691	24.904
Direct Benefit (x1000€)	-67.572									
Indirect Benefit (x1000€)	- 51.313					- 691	- 22.231	- 9.340	- 5.999	- 13.051

Table 7.- Simulation of the baseline scenario. All lines switching to low sulfur fuels to comply with 2020 cap and increasing by 12% their sea rates. No eco-incentive is given to the users. Aggregated effects for the period 2020-2024. West Med.

However due to the higher cost of such fuels, the lines have to increase their sea rates by 12% over the current prices, leading to a modal back shift effect measured at 91.000 units off the MoS. These units are converted into 111.000 additional trucks back on the road due to the observed lower average net loads of the units using the road-only alternative, as explained before. This modal back shift effect leads to an increase in the external costs measured at 15,7 M€. As a result, the overall external cost savings in the baseline scenario is 132,7 M€.

No eco-incentive is given to any user in this scenario. Conversely, due to the increase of the sea rate, the users that remain at the MoS internalize an increase of 67,6 M€ in their costs. Moreover, shipowners would have to internalize a financial loss of 51,3 M€ due to the (back) shifted units.

As mentioned above, the **actual merit** of the eco-incentive measure should be assessed by difference between the effects in the green and baseline scenarios.

DIFFERENCES

	Total	Road	MoS	Ports	LINES	BCN-GEN	BCN-CIV	BCN-LIV	VAL-SAL	VAL-LIV
Units (x1000)	-45	-240			195	3	71	34	42	44
Externalities (x1000€)	157.714	34.191	123.523	-15.187	138.710	15.679	60.682	15.532	26.216	20.601
Direct Benefit (x1000€)	165.897									
Indirect Beneft (x1000€)	110.205					1.033	41.362	18.376	23.770	25.664

Table 8.- Relative effects comparing the green scenario and the baseline scenario. West Med.

Both scenarios induce **external cost savings** in the targeted market. The baseline scenario due to a *regulation merit* and the green scenario due to the eco-incentive measure. Therefore, the fair contribution to sustainability from the eco-incentive scheme should be the difference between the external cost savings in each of the two scenarios. This difference is measured at 157,7 M€, of which 123,5 M€ come directly from the improvements on the environmental performance of the MoS whereas 34,2 M€ are credited to the modal shift and modal back shift effects in the green and baseline scenarios respectively (i.e. similar effects with opposite signs).

This 34,2 M€ also mean 240.000 trucks off the roads during the five-year period under analysis leading to a net reduction in social costs, which is also a goal of the eco-incentive scheme together with the greener performance of the MoS.

As a result, road congestion would be reduced at some of the main bottlenecks in the Mediterranean CNC, such as the cross-border sections of the Pyrenees and the Alps. Thus, proving how incentivizing sustainable freight transport services can contribute to the priorities of the CNC, complementing the infrastructural measures (i.e. investments).

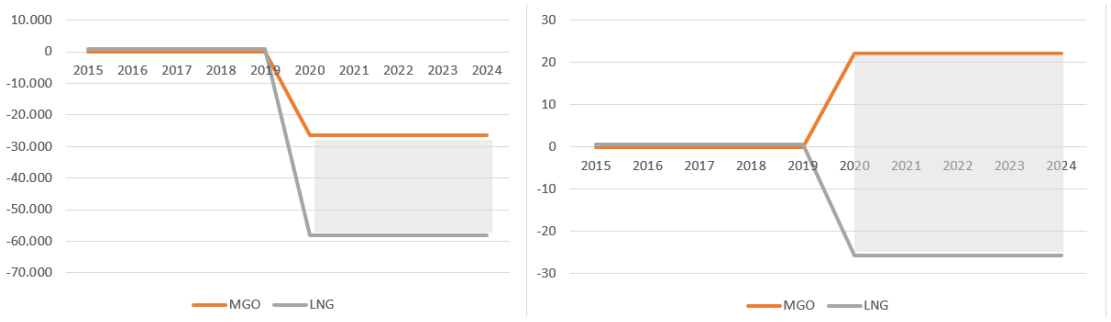

Figure 15.- Relative impacts on total external cost savings (left) and modal shift (right) comparing the green and the baseline scenarios. Costs (€ x 1000). Volumes (units x1000). West Med.

To estimate the **benefits to the users** of the maritime services two opposite effects shall be considered again. In the green scenario, all users will be given the eco-incentive. In the baseline scenario, all users will see an increase of 12% in the maritime price. Adding both effects with opposite signs the net benefits to the users as a result of the eco-incentive scheme would reach 165,9 M€.

The same happens with the net **benefits to the shipowners**, having two effects with opposite signs in each scenario (i.e. the additional incomes in the green scenario and the potential losses in the baseline scenario) leading to a total 110,2 M€. However, only the 58,9 M€ of additional incomes got by shipowners in the green scenario will be considered to assess the weight of the eco-incentive scheme in the shipowner's decision to develop the green action.

Finally, the **total cost** of the eco-incentive measure, granting all these effects, would be of 98,3 M€.

In terms of **market share**, with no action taken, the growth in road-only transport would reach a cumulated 29% at the end of the five-year period, including both global mobility growth (based on GDPs) and modal back shift from MoS. The market share for the MoS would drop from 31% to 26%. Conversely, with the eco-incentive measure the growth in road-only transport would be reduced to 15% and the MoS share would increase to a 33% in the targeted market.

The slight difference between the total mobility in the scenarios with and without eco-incentive is due to the observed lower average net loads of the freight units using the road-only alternative, as already mentioned.

Finally, the additional incomes to the shipowners allow for the **financial assessment** on the shipowners' willingness to invest in the green action as a result of the eco-incentive measure. To that end, the shipowners' perspective tool has been calibrated for each MoS as explained above in this document,

taking the additional incomes on one hand and the additional CAPEX and OPEX on the other.

	CURRENT 15-19				WITH ECO-INCENTIVE ALL LNG 20-24				WITHOUT ECO-INCENTIVE 20-24			
	TOTAL	ROAD	MoS	share	TOTAL	ROAD	MoS	share	TOTAL	ROAD	MoS	share
WEST MED	496	344	152	31%	595	397	198	33%	604	445	160	26%
Increase over current					20%	15%	30%	3%	22%	29%	5%	-4%

Table 9.- 'Road only' and MoS volumes (units x 1000) and shares (%). Observed (2015-2019) and Simulated values for the baseline scenario and the green scenario (2020-2024). Annual average values. West Med.

The following considerations apply to the assessment.

The additional incomes are calculated as net contributions to the vessel from the additional freight units in the green scenario, using the specific sea rates of each MoS. With that purpose, the port costs to be paid by freight units have been excluded from the sea rates.

The additional CAPEX is estimated as the difference between the investment costs of an LNG and a conventional vessel (green and baseline scenario respectively) and considering the number of vessels operating the line.

The estimation is made by reference to updated publications from DNV-GL (e.g. the incremental investment for a LNG fueled vessel could range from 600 €/kw to 840 €/kw)[53].

	BCN-GEN	BCN-CIV	BCN-LIV	VAL-SAL	VAL-LIV
	Barcelona Genoa	Barcelona Civitavechia	Barcelona Livorno	Valencia Salerno	Valencia Livorno
Line details	West-Mediterranean	West-Mediterranean	West-Mediterranean	West-Mediterranean	West-Mediterranean
Fuel saving per trip	9.311 €	19.812 €	9.334 €	22.876 €	17.384 €
Induced modal shift	1 K units	33 K units	17 K units	32 K units	22 K units
Unit net contribution	400 €	580 €	540 €	560 €	580 €
Indirect benefits	342.549 €	19.130.713 €	9.035.129 €	17.770.427 €	12.613.527 €
Unit investment	23.362.069 €	29.913.793 €	15.172.414 €	18.103.448 €	18.103.448 €
Incremental LNG inv.	23.362.069 €	59.827.586 €	30.344.828 €	36.206.897 €	36.206.897 €
cost of LNG Kw	667 €	598 €	702 €	754 €	754 €
Annual fuel saving	2.904.954 €	12.362.770 €	2.912.153 €	7.137.159 €	5.423.849 €
Additional incomes/investment	1%	32%	30%	49%	35%
Additional incomes/operation	1%	8%	7%	13%	13%
WITH... ECO-INCENTIVE: NPV	6.240.147 €	79.797.641 €	6.301.793 €	49.755.647 €	28.498.696 €
IRR	11%	25%	11%	26%	19%
Payback	14 years	5 years	14 years	6 years	7 years
NO... ECO-INCENTIVE: NPV	5.712.920 €	64.441.166 €	-1.198.004 €	35.571.241 €	18.247.189 €
IRR	11%	20%	7%	19%	14%
Payback	14 years	7 years	NEVER	7 years	9 years

Table 10.- Contribution of the eco-incentive measure to the financial result of the green action in the West Med (per line).

[53] Alternative Fuels Insight, DNV-GL (2018)

The fuel costs, at the time of the calibration exercise, is measured at 643 €/ton for the low sulfur conventional fuel (i.e. MGO[54]) whereas the LNG fuel is set at 472 €/ton based on an assumption of 25 €/MWh for the molecule and a 5 €/MWh for the bunker logistics.

The operational profile of the vessels in each line (speed, distance and frequency) remains unaltered and is taken or estimated from real operations.

The WACC is simulated at 8% and the residual value of the investment at 5%, based on common values.

Following these considerations, the shipowners' perspective tool will compare the financial impact of the additional LNG investment in the cases with and without eco-incentive.

The relevant **outcomes** for the MoS in the West Mediterranean are summarized below.

The main contribution of the eco-incentive scheme to the shipowners' perspective is as a catalyst of the investment decision. Through the additional incomes, shipowners would see their paybacks reduced and the returns of their investments significantly increased (50% on average).

Only in one case the financial impact of the green action would clearly demonstrate a funding gap amount in the situation without eco-incentive.

On the other hand, the additional incomes of the shipowners over the total operational costs of the maritime services remain in all cases far below the 30%. This would be compatible with both the Maritime and MoS Guidelines on state aid rules to maritime transport, even if the total amount of state aid is considered for the assessment instead of the additional incomes.

Moreover, the additional incomes over the additional investment needs range from 32% to 49%[55]. From the shipowners' perspective these percentages could be considered as if they were co-financing rates higher than the typical 20-30% rates in the current CEF. To a certain extent, the scheme design improves the leverage effect of the public funding.

Finally, the fact that the eco-incentive measure is contributing, by definition, to minimize the risk of demand, makes reasonable thinking that this eco-incentive scheme could grant the shipowners with better access to EU financial instruments for the development of the green actions. This would contribute to a sort of virtuous circle where shipowners could improve their financial conditions

[54] See note 52.

[55] The Genoa-Barcelona line is not considered in this analysis. Most of the route is not eligible (Tangier-Genoa) leading to results that are not consistent.

and the EU increase the use of financial instruments to improve in turn the leverage effect of the EU support.

Atlantic

Following the same approach with than in the West Mediterranean, the results for the simulation in the Atlantic are presented below.

In the **green scenario**, all the users of the maritime services would receive an eco-incentive ranging from 146 €/unit to 44 €/unit depending on the MoS. The reasons for these differences between lines have already been explained. Then, the values of the eco-incentive per MoS are simulated in the modelling tool as discounts over the sea rates.

ALTERNATIVE 1												
GREENER (LNG)						Price incentive (%)	4	7	11	12	12	10
						Ext. Saving (%)	76	76	76	76	77	70
	Total	Road	MoS	Ports	LINES	BIL/SAN-ZE/	BIL/SAN-UK	GIJON-NANTES	VIGO-NANTES	LEIXOES-ZE/	LIS/SET/SIN-ZE/	
Units (x1000)	-19	-157			138	10	22	18	22	43	23	
Externalities (x1000€)	226.726	30.685	196.042	-13.475	209.517	40.973	62.481	18.824	38.845	34.910	13.484	
Direct Benefit (x1000€)	49.813											
Indirect Benefit (x1000€)	105.275					7.839	13.693	8.204	11.272	37.574	26.692	

Table 11.- Simulation of the green scenario. All lines switching to LNG and all users receiving the maximum eco-incentive. Aggregated effects for the period 2020-2024. Atlantic.

Following the main goal of the eco-incentive scheme, the green actions in the maritime leg lead to a significant improvement in the environmental performance of the MoS, which brings an external cost saving of 196,0 M€.

Moreover, thanks to the eco-incentive freight operators are attracted to the MoS resulting in 157.000 trucks shifted off the roads in the five-year period. This effect brings an additional 30,7 M€ external cost saving resulting in an overall 226,7 M€ saving in the targeted market. This figure includes the external costs incurred by the shifted trucks when accessing ports through urban areas, following the design of the external cost calculator.

The cost of the action is 49,8 M€ which become direct revenues to the road operators, whereas shipowners receive additional incomes of 105,3 M€ for the additional trucks shifted to the MoS.

In the **baseline scenario**, all vessels are switched to low sulfur conventional fuels to comply with the 0,5% sulfur cap from 2020 onwards. As a result, there is also an improvement in the environmental performance of the MoS which brings an external cost saving of 100,8 M€, much lower than in the green scenario. As previously mentioned, this could be a good estimation of the expected savings in the targeted market due to the implementation of the sulfur Directive (i.e. the *regulation merit*).

ALTERNATIVE 2 CONSERVATIVE (MGO)											
	Price incentive (%)	-12	-12	-12	-12	-12	-12				
	Ext. Saving (%)	32	32	32	32	34	27				
	Total	**Road**	**MoS**	**Ports**	**LINES**	**BIL/SAN-ZE/**	**BIL/SAN-UK**	**GIJON-NANTES**	**VIGO-NANTES**	**LEIXOES-ZE/**	**LIS/SET/SIN-ZE/**
Units (x1000)	19	152			-133	-24	-31	-17	-16	-29	-17
Externalities (x1000€)	71.743	-29.033	100.776	13.066	87.710	17.051	26.002	7.834	16.166	15.453	5.203
Direct Benefit (x1000€)	-56.863										
Indirect Beneft (x1000€)	-120.543					- 21.318	- 22.961	- 9.268	- 10.614	- 31.922	- 24.460

Table 12.- Simulation of the baseline scenario. All lines switching to low sulfur fuels to comply with 2020 cap and increasing by 12% their sea rates. No eco-incentive is given to the users. Aggregated effects for the period 2020-2024. Atlantic.

However due to the higher cost of such fuels, the lines have to increase their sea rates by 12% over the current prices, leading to a modal back shift effect measured at 133.000 units off the MoS. These units are converted into 152.000 additional trucks back on the road due to the observed lower average net loads of the units using the road-only alternative, as explained before. This modal back shift effect leads to an increase in the external costs measured at 29,0 M€. As a result, the overall external cost savings in the baseline scenario is 71,7 M€.

No eco-incentive is given to any user in this scenario. Conversely, due to the increase of the sea rate, the users that remain at the MoS internalize an increase of 56,9 M€ in their costs. Moreover, shipowners would have to internalize a financial loss of 120,5 M€ due to the (back) shifted units.

As mentioned above, the **actual merit** of the eco-incentive measure should be assessed by difference between the effects in the green and baseline scenarios.

DIFFERENCES											
	Total	**Road**	**MoS**	**Ports**	**LINES**	**BIL/SAN-ZE/**	**BIL/SAN-UK**	**GIJON-NANTES**	**VIGO-NANTES**	**LEIXOES-ZE/**	**LIS/SET/SIN-ZE/**
Units (x1000)	-37	-309			272	34	53	35	38	71	40
Externalities (x1000€)	154.983	59.718	95.266	-26.541	121.807	23.922	36.479	10.990	22.679	19.457	8.280
Direct Benefit (x1000€)	106.676										
Indirect Beneft (x1000€)	225.817					29.157	36.653	17.473	21.886	69.496	51.153

Table 13.- Relative effects comparing the green scenario and the baseline scenario. Atlantic.

Both scenarios induce external cost savings in the targeted market. The baseline scenario due to a *regulation merit* and the green scenario due to the eco-incentive measure. Therefore, the fair contribution to sustainability from the eco-incentive scheme should be the difference between the external cost savings in each of the two scenarios. This difference is measured at 155,0 M€, of which 95,3 M€ come directly from the improvements on the environmental performance of the MoS whereas 59,7 M€ are credited to the modal shift and

modal back shift effects in the green and baseline scenarios respectively (i.e. similar effects with opposite signs).

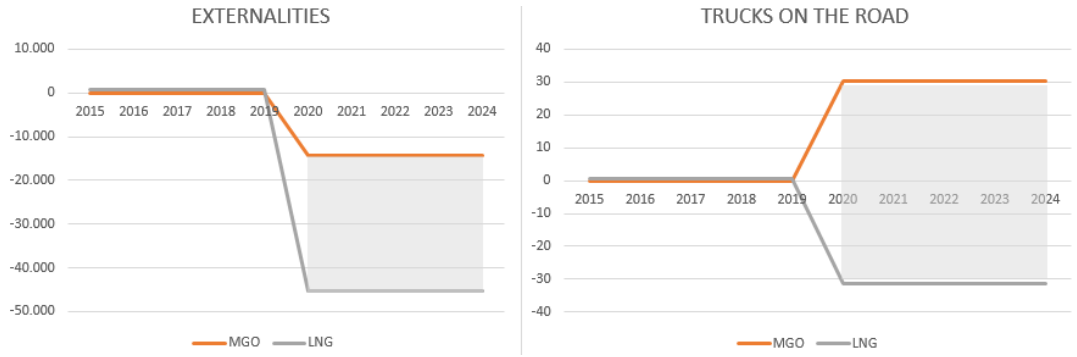

Figure 16.- Relative impacts on total external cost savings (left) and modal shift (right) comparing the green and the baseline scenarios. Costs (€ x 1000). Volumes (units x1000). Atlantic.

This 59,7 M€ also mean 309.000 trucks off the roads during the five-year period under analysis leading to a net reduction in social costs, which is also a goal of the eco-incentive scheme together with the greener performance of the MoS.

As a result, road congestion would be reduced at one of the main bottlenecks in the Atlantic CNC, such as the cross-border section of the Pyrenees. Thus, proving how incentivizing sustainable freight transport services can contribute to the priorities of the CNC, complementing the infrastructural measures (i.e. investments).

To estimate the **benefits to the users** of the maritime services two opposite effects shall be considered again. In the green scenario, all users will be given the eco-incentive. In the baseline scenario, all users will see an increase of 12% in the maritime price. Adding both effects with opposite signs the net benefits to the users as a result of the eco-incentive scheme would reach 106,7 M€.

The same happens with the net **benefits to the shipowners**, having two effects with opposite signs in each scenario (i.e. the additional incomes in the green scenario and the potential losses in the baseline scenario) leading to a total 225,8 M€. However, only the 105,3 M€ of additional incomes got by shipowners in the green scenario will be considered to assess the weight of the eco-incentive scheme in the shipowner's decision to develop the green action.

Finally, the **total cost** of the measure, granting all these effects, would be of 49,8 M€.

In terms of **market share**, with no action taken, the growth in road-only transport would reach a cumulated 21% at the end of the five-year period, including both global mobility growth (based on GDPs) and modal back shift from MoS. The market share for the MoS would remain in the current 3%.

Conversely, with the eco-incentive measure the growth in road-only transport would be reduced to 18% and the MoS share would increase to a 5% in the targeted market.

The slight difference between the total mobility in the scenarios with and without incentive is due to the observed lower average net loads of the freight units using the road-only alternative, as already mentioned.

	CURRENT 15-19				WITH ECO-INCENTIVE ALL LNG 20-24				WITHOUT ECO-INCENTIVE 20-24			
	TOTAL	ROAD	MoS	share	TOTAL	ROAD	MoS	share	TOTAL	ROAD	MoS	share
ATLANTIC	2.218	2.146	73	3%	2.676	2.538	138	5%	2.684	2.600	83	3%
Increase over current					21%	18%	89%	2%	21%	21%	14%	0%

Table 14.- 'Road only' and MoS volumes (units x 1000) and shares (%). Observed (2015-2019) and Simulated values for the baseline scenario and the green scenario (2020-2024). Annual average values. Atlantic.

As in the case of the West Mediterranean, the estimated additional incomes of the shipowners allow for the **financial assessment** on the eco-incentive scheme from the shipowners' perspective.

	BIO-ZBR	SAN-PMT	GIJ-NAN	VGO-NAN	LEX-ZBR	LIS-ZBR
	Bilbao-Zeebrugge	Santander Portsmouth	Gijon-Nantes	Vigo-Nantes	Leixoes Zeebrugge	Lisbon Zeebrugge
Line details	Atlantic	Atlantic	Atlantic	Atlantic	Atlantic	Atlantic
Fuel saving per trip	16.188 €	12.960 €	7.372 €	11.509 €	17.129 €	20.642 €
Induced modal shift	10 K units	22 K units	18 K units	22 K units	43 K units	23 K units
Unit net contribution	765 €	612 €	446 €	509 €	883 €	1.172 €
Indirect benefits	7.838.936 €	13.692.791 €	8.204.422 €	11.271.814 €	37.574.383 €	26.692.211 €
Unit investment	18.103.448 €	26.315.789 €	15.172.414 €	15.172.414 €	18.103.448 €	18.103.448 €
Incremental LNG inv.	36.206.897 €	26.315.789 €	15.172.414 €	30.344.828 €	54.310.345 €	18.103.448 €
cost of LNG Kw	754 €	658 €	702 €	843 €	724 €	724 €
Annual fuel saving	5.050.652 €	2.021.721 €	2.300.087 €	5.386.389 €	5.344.146 €	2.146.794 €
Additional incomes/investment	22%	52%	54%	37%	69%	147%
Additional incomes/operation	5%	23%	14%	15%	19%	30%
WITH... ECO-INCENTIVE: NPV	20.956.322 €	5.123.801 €	14.522.347 €	32.852.529 €	29.565.724 €	24.753.280 €
IRR	16%	11%	22%	22%	17%	34%
Payback	9 years	13 years	5 years	5 years	6 years	3 years
NO... ECO-INCENTIVE: NPV	14.444.700 €	-6.074.107 €	7.944.104 €	23.778.924 €	-643.537 €	3.583.278 €
IRR	13%	5%	14%	17%	8%	10%
Payback	12 years	NEVER	10 years	8 years	NEVER	14 years

Table 15.- Contribution of the eco-incentive measure to the financial result of the green action in the Atlantic (per line).

The same considerations that were described for the West Mediterranean apply to the assessment in the Atlantic.

Following these considerations, the shipowners' perspective tool will compare the financial impact of the additional LNG investment in the cases with and without eco-incentive.

The relevant **outcomes** for the MoS in the Atlantic are summarized below.

The main contribution of the eco-incentive scheme to the shipowners is again as a catalyst of the investment decision. Through the additional incomes, shipowners would see their paybacks reduced and the returns of their investments significantly increased (with the IRR placed above 20% in some cases).

Only in few cases the financial impact of the green action would clearly demonstrate a funding gap amount in the situation without eco-incentive

Moreover, it should be noticed for the particular case of the Atlantic market that the additional incomes of the shipowners are higher than the total revenues of the road operators (in the West Mediterranean market the ratio is about 60%). This leverage effect is due to the higher demand elasticity in the Atlantic compared to the West Mediterranean resulting from the calibrated models.

In all cases, the additional incomes over the operational costs of the maritime services comply with the 30% limit as set in the Maritime Guidelines on state aid to maritime transport, which might be up to 35% according to the MoS Guidelines since the state aid is combined with EU funding.

On the other hand, the additional incomes over the additional investment needs return values that are placed over 50% in most cases. As mentioned before, these values could be interpreted by shipowners as higher co-financing rates compared to the typical 20-30% rates in the current CEF.

Finally, the same consideration that was made for the West Mediterranean applies now to the Atlantic regarding the contribution of the eco-incentive scheme to the further development of EU financial instruments.

Aggregate results

The **main results** are summarized below in aggregate for both the West Mediterranean and the Atlantic regions in the complete five-year period.

PERIOD 20-24							
	ECO-INCENTIVE (a)	GREEN ACTIONS (b)	EXT. SAVINGS (c)	IND. INCOMES (d)	Effect 1: b/a	Effect 2: c/a	Effect 3: d/a
WEST MED	98.324	162.586	157.714	58.892	1,7	1,6	0,6
ATLANTIC	49.813	180.000	154.983	105.275	3,6	3,1	2,1
TOTAL	148.137	342.586	312.697	164.167	2,3	2,1	1,1

Table 16.- Main outcomes of the eco-incentive measure (€ x 1000). West Med and Atlantic.

As a main outcome, the eco-incentive scheme proves its ability to trigger green actions in the maritime leg by clearly improving the financial conditions for the investments. Indeed, the eco-incentive scheme would bring additional incomes of 164,2 M€ for the shipowners to trigger in market conditions investment decisions of 343,0 M€ on green actions.

As a result, an overall **312,7 M€ external cost savings** would be attained, of which 218,8 M€ would come directly from the improvements in the environmental performance of the MoS, which is the main goal of the scheme design. In addition, 93,9 M€ would be saved from additional **550.000 HGV secured off the roads**, reducing social costs in the targeted market.

According to the MAE calculator[56], 27,9 M€ out of the total 312,7 M€ of external cost savings are due to a net reduction of 820.000 tons of CO_2 equivalent[57] which represents a 27% of the estimated carbon emissions in the targeted market.

The cost of the measure for the public funding would be of **148,1 M€** (i.e. the total amount of eco-incentives granted to the MoS users during the five-year period). This would be the **total budget** to be mobilized by the MS involved in the eco-inventive scheme provided there is an EU co-financing, according to the common EU approach.

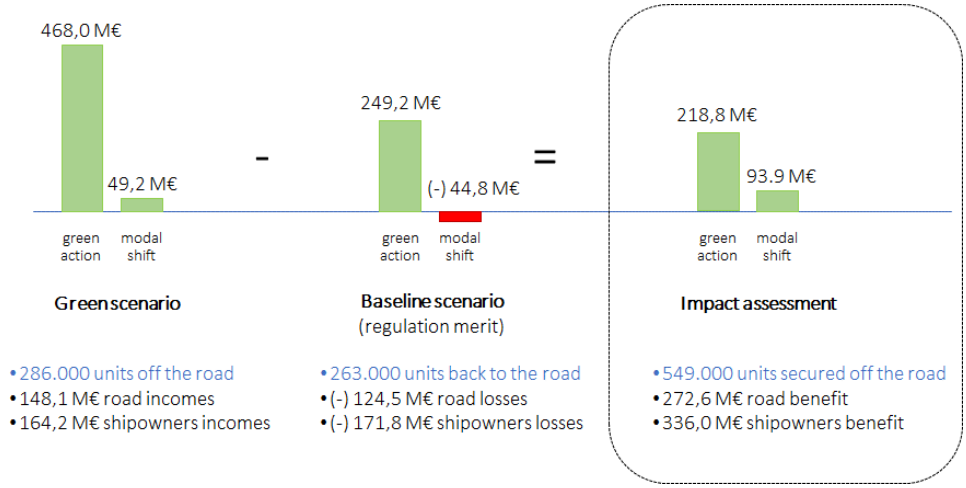

Figure 17.- Main effects of the eco-incentive measure. West Med and Atlantic.

Following such approach, the EU co-financing could be based on the actual contribution of the eco-incentive measure to decarbonization whereas the

[56] The MAE calculator is referred to the 2014 version of the EC's Handbook on External Costs of Transport (see note 46) except for carbon pricing, which takes the reference from the first version of the manual (2008), resulting in an estimated value of 34 €/ton CO_2 equivalent for the MAE case-study. This value would have been around 100 €/ton CO_2 equivalent if estimated with reference to the 2014 or 2019 version of the Handbook, which was considered too high. In fact, 34 €/ton CO_2 equivalent comes closer to the central values that the European Investment Bank is considering for the economic appraisals of investment projects (below 50 €/ton CO_2 equivalent in the period 2020-2025).

[57] Calculated with the CO2 emission factors for MGO and LNG as set in the EC Delegated Regulation (EU) 2016/2071 of 22 September 2016, amending Regulation (EU) 2015/757 of the European Parliament and of the Council as regards the methods for monitoring carbon dioxide emissions and the rules for monitoring other relevant information.

contribution to air pollution and social costs savings could be allocated to the MS budgets. In this event, the EU contribution to the scheme would be of 27,9 M€ out of 148,1 M€, leading to a **co-financing rate of 19%**[58] which is below the maximum rate for sustainable freight transport services in the current CEF.

From the EU funding perspective, the 27,9 M€ would entail an 8% of the 343,0 M€ on green investments, which is a much lower contribution than the typical co-financing rates for LNG deployment in the current CEF (e.g. 20-30 %).

This is possible due to the involvement of MS, which is not the case for green actions in the current CEF approach. Indeed, at national level MS support is directed through national schemes which develop out of the CEF and typically with no coordination between them. Conversely, the combination of the EU and MS support yielding to 148,1 M€ would bring to the shipowners a co-financing rate of 41% for the 343,0 M€ of green investments, which is significantly higher than the current rates they could receive through the CEF. Ultimately, the eco-incentive scheme would grant better funding conditions to shipowners although through indirect sources (through additional demand).

In aggregate, with 148,1 M€ of eco-incentives, shipowners would indirectly benefit from 164,2 M€ of additional incomes, triggering 343,0 M€ investments on green actions leading to a total 312,7 M€ of external costs savings in the targeted market. This leverage effect due to the scheme design (demand approach) proves to be positive and higher in the Atlantic, due to a higher elasticity to demand in that market which is explained through the modelling tool. This is interpreted with the meaning of higher potential for MoS develop in the Atlantic.

Anyhow, the external costs savings are mainly due to the improvements on the environmental performance of the maritime leg. In addition, there is a reduction of social costs due to 550.000 HGV secured off the roads. Therefore, the two goals of the eco-incentive scheme goals are achieved.

On the legal aspects, the intensity of the public support compared to the operational costs of the maritime services would be compliant with the applicable state aid rules. And despite the need for some amendments in these rules, as mentioned above in this document, the duration of 5 years would be compatible with the state aid in combination with the EU funding.

Last but not least, the demand approach would minimize by definition the risk of demand in the financial assessment of the green investment project. As a result, the shipowners could be granted with better access to financial instruments (private and public).

[58] Should carbon pricing be estimated with reference to the 2014 or 2019 version of the Handbook (see note 56) this percentage would increase significantly. Nevertheless, the EU contribution could be limited to a maximum co-financing rate, in the same way as it happens with the funding gap amount in the current CEF approach.

All of the above considered, the impact assessment brings a positive result.

Finally, according to the assessment with the shipowners' perspective tool, the green actions hardly demonstrate the existence of a funding gap amount. Although, the eco-incentive scheme would clearly improve the financial conditions for such actions, thus stimulating the investment decision to be taken by the shipowners.

This outcome reflects the potential role of the eco-incentive measures when the current approach[59] is not effective in stimulating for the actions that could most contribute to improving the socio-environmental performance of freight transport services.

With the current approach, most of the LNG investments would not be eligible to the EU funding. Indeed, the additional investments required by LNG vessels could be covered with the additional revenues from lower bunkering prices or higher energy efficiency compared to conventional fuels. The technological risks for these LNG investments have been minimized partly thanks to the EU support on innovation and new technologies. Moreover, the fact that having LNG refueling points will be mandatory for ports in the TEN-t core network[60] minimizes the financial risks of the LNG investments for shipowners as well.

On the other hand, LNG is not the only alternative for the shipowners to comply with the environmental regulation (in particular, the sulfur cap by 2020). Indeed, there are other alternatives that are compatible with such regulation, with investments costing much less than LNG. Though, when it comes to maritime transport LNG is from today's perspective the investment decision that can bring the most environmental benefits to the EU.

Therefore, and according to the setting at the beginning of this document, the use of eco-incentives would stimulate for those actions available at each point in time that could bring the highest socio-environmental benefits to the EU and the MS on market basis, regardless the existence of a funding gap amount.

Legal, Administrative and Technological considerations

According to the common approach, the ex-ante analysis should also provide with enough background on the legal basis and the administrative and technological aspects of the scheme design. Thus, allowing for the complete assessment. These matters are relevant for the scheme viability as well, specially at implementation.

[59] Action grants in the form of reimbursement of eligible costs using the funding gap principle to estimate the amount of the EU support.

[60] According to the provisions of the alternative fuels Directive (see note 15).

On the legal issues, some elements have already been discussed in previous chapters concerning the state aid rules. As mentioned, a complete review and analysis on this subject has been carried out in the context of the MAE Action (see APPENDIX 2).

In particular for the MAE case-study, the following considerations apply.

It is likely that the MS contribution to the scheme budget would be qualified as **state aid** since the eco-incentive measure is granting an economic benefit to road operators that they would not have obtained in the absence of such contribution[61]. However, as the state aid is exclusively aimed at achieving socio-environmental merits, the EC *may* likely consider such aid to be compatible with the internal market[62].

Moreover, the scheme design follows a similar approach to the one used in the Italian Ecobonus program on how the eco-incentive measure is implemented (i.e. a demand approach where the eco-incentive is granted to the users of the MoS). In doing so, the state aid would be implemented in a non-discriminatory way and not adversely affecting the targeted market to an extent contrary to the common interest. Indeed, the aid granted in the Italian Ecobonus program was qualified by the EC as compatible with the internal market within the meaning of the TFEU[63]. Later on, the EC came to consider the shipowners as beneficiaries of the state aid as well[64].

As a result, the state aid in the MAE case-study should meet the requirements of the **Maritime Guidelines**[65] which develop the EC interpretation of the general rules as applicable to the maritime transport.

The 2004 guidelines are currently in force and allow for state aid to short sea shipping provided such aid fulfil certain conditions:

- Not exceeding three years in duration
- To maritime services connecting ports situated in the territory of the MS.
- Allowing for freight cargo by road to be carried out wholly or partly by sea
- With a pre-established environmental impact
- Concerning only new routes or the upgrading of services on an existing one
- To cover up to 30 % of the operational costs of the maritime service.
- Granted with transparent criteria and applied in a non-discriminatory way to shipowners

[61] Article 107 (1) TFEU.

[62] Article 107 (3) TFEU.

[63] Commission Decision of 20 April 2005 on State Aid. Case N 496/2003 -Italy- Aid for the development of logistics chains and the upgrading of intermodality.

[64] Commission Decision of 17 July 2013 on State Aid. SA.33412 (12/C) (ex 11/N). Modification of the Italian Ecobonus scheme through a one-year extension.

[65] See note 35.

- With the maritime service being commercially viable after the three years period

Later on, the **MoS Guidelines**[66] introduced the possibility for an extension in the maximum duration and intensity of the state aid when combined with the EU funding. In particular, up to five years and 35% of the operational costs, respectively (the latter by reference to the total MS and EU amounts).

All of the above conditions are fulfilled with the scheme design in the case-study, and particularly through the eligibility criteria which have been set out previously.

However, it is quite clear that the Maritime Guidelines are conceived to the purposes of **start-up aids** to compensate the initial losses on new or upgraded maritime services (i.e. to develop new markets). This is no longer the aim of the eco-incentive measures, as described above, but of stimulating mature markets for the green transition on a rolling basis. This may be subject for a debate, as previously discussed. Anyhow, the conditions are fulfilled for the MAE case-study.

Moreover, the **MoS Guidelines** refer to the MP and former TEN-t programs. Therefore, they are completely obsolete. They should be accommodated to the current CEF standards as mentioned above in this document.

Moving on to the **administrative and technological aspects**, a preliminary analysis has been carried out on a possible scheme implementing process, including also legal concerns with regards to this process. This analysis is available for download (see APPENDIX 2).

These aspects are of outmost importance to the effectiveness and further viability of the scheme since they are the implementing pipeline of the eco-incentive measure. In turn, this pipeline becomes critical to comply with some of the principles of the common EU approach, such as the need to minimize the risk of fraud and additional bureaucracy, the need to demonstrate the performance achieved and the need to adequately address the consistency with the operational structures of the EU funding program to which the scheme is submitted (e.g. CEF).

Furthermore, a good design of the procedures affecting the beneficiaries including both the road operators and the shipowners (direct and indirect beneficiaries respectively), such as the timings, the data needs, the payment process, the supporting technologies, etc. is essential for the eco-incentive scheme to be effective in a market environment.

[66] See note 37.

The analysis makes use of the experienced achieved in the Italian Ecobonus program, which was the first to implement the demand approach, addressing MoS market through the users of the maritime services. However, the scheme design in the MAE case-study is different from the Italian Ecobonus in many ways (e.g. including the improvement of the environmental performance of the MoS as a requirement). Thus, introducing the need for different procedures, particularly for shipowners. Nevertheless, it keeps directing the eco-incentive through demand which entails similar procedures as regard the users.

It should be noted that the analysis is only a **preliminary approach** to some of the key aspects that should be further developed in the event of a real implementing action, including:

- The entities involved.
- The relevant procedures, such as the timings, registration, boarding events collection, route monitoring, payments, etc.
- The backing technologies, such as the system architecture, compatibilities with national single windows (NSW) and common EU emissions' information systems[67]), transactional files, databases, reporting, etc.
- Some legal aspects on the binding contracts with the beneficiaries, the use of official databases (such as the NSW and THETIS) or the limitations from data protection regulations.

Moreover, in order to assess the compatibility of the scheme with the operational structures of the EU funding program, this preliminary analysis takes the CEF as example.

Some of these aspects are briefly described below.

The implementing process of the eco-incentive scheme could be outlined in two main separates diagrams, as shown in the next figure. By one hand, the procedures that need to be completed to secure the funding (both EU and MS wise). And on the other hand, once the funding is secured, the processes involving the implementing of the eco-incentive measure itself.

On the first hand, the procedure to the awarding of the EU funding would be the usual one in the current CEF. To that extent, the work programs should first incorporate the eco-incentives schemes as eligible actions, following the proposed common approach at EU level. As for the MS funding, the procedure implies the approval on the national budgets as well as the compatibility assessment on state aid rules, which has been previously discussed. As mentioned, it is assumed that the maximum duration and intensities of the state

[67] Such as the THETIS-MRV (in the context of Regulation (EU) 2015/757 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport) and THETIS-S (to be used for the monitoring of the sulfur Directive).

aids are updated to the CEF standards (e.g. 5 years and 20% for sustainable transport services).

Following the common approach and according to the operational structures of the CEF funding mechanism (as example), the MS involved would be responsible for the elaboration and submission of the proposals in the relevant calls, as appropriate. In case of award they would be the beneficiaries of the EU grants and responsible for the implementation of the eco-incentive scheme, involving the state aids as well.

Since both assessments on the possible award of the EU support and the compatibility with the state aid rules are linked and both lay on the EC (although in different DGs) an internal coordination should be established to streamline the overall assessment process.

Only if the complete assessment is positive and the proposal is awarded the budget will be available for the eco-incentive measure. Then, the scheme can be implemented.

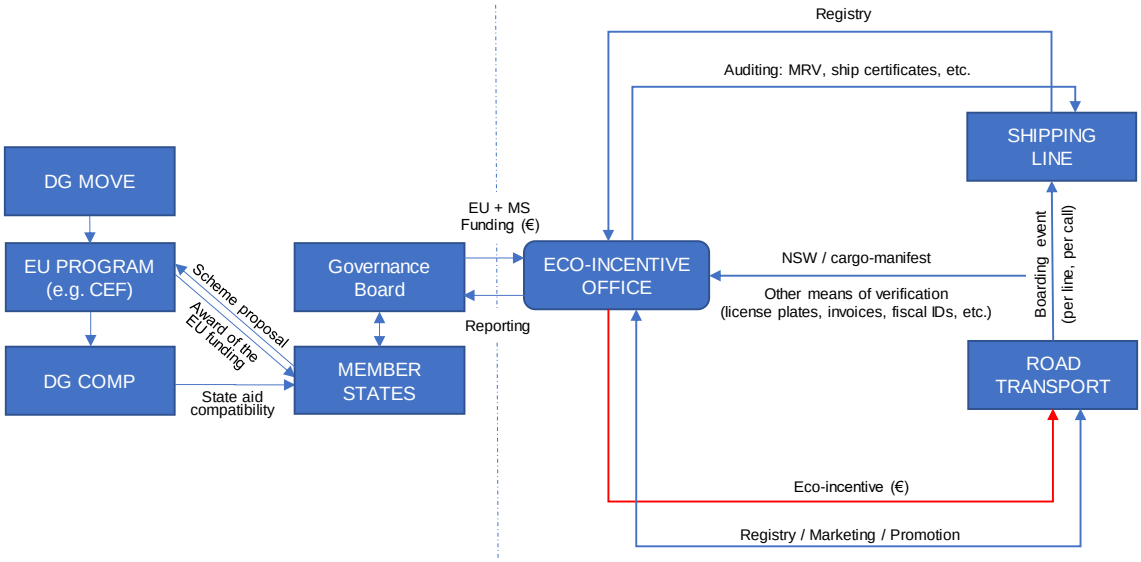

Figure 18.- Possible implementing chart for the eco-incentive scheme. MAE case-study

One major issue at implementation is how beneficiaries can join and benefit from the eco-incentive scheme. To that extent, a ***dual-call*** **mechanism** approach is proposed for the MAE case-study. The first call would be addressed to the shipowners whereas the second one would be addressed to the actual and potential users of the maritime services.

With the first call, shipowners would register in a managing platform and submit the MoS which are candidate to benefit from the scheme. At that moment, they

shall produce evidence of the green actions that have been taken to improve the environmental performance of such MoS, according to the eligibility criteria.

Only the lines that are running at the time of the call would have the possibility to register. New lines starting after the launching of the call would have to wait for the next call to register. The calls for shipowners are proposed on an annual basis within the eligible period (five years according to the eligibility criteria).

At registration, the shipowners will have to provide all the information needed to allow the MS for the assessment, including the estimation of the socio-environmental merit using the external cost calculator, as described. The assessment should also include the full compliance with the scheme's eligibility criteria. As a result of the assessment, a list will be published with the MoS where the eco-incentive could be granted, including the unitary values of such eco-incentives (per freight unit and MoS). The publication will serve as an announcement to the current and potential users of these MoS (i.e. road operators). On a yearly basis, following each call for the shipowners, an updated list of eligible MoS will be published.

After the publication of the first list, the second call will be launched for the users, who are ultimately the direct beneficiaries.

With this call, the road operators who comply with the eligibility criteria should register in the managing platform as a requirement to the eco-incentive request. Later on, at the time of such request, road operators shall produce evidence of the boarding events based on formal declarations. Otherwise no eco-incentive will be granted. Unlike the call for shipowners, and in order to minimize additional bureaucracy, this call for the road operators could possibly remain open for the complete five-year period of the eco-incentive scheme.

Another relevant issue is the **boarding event**. In fact, according to the scheme design, proving the boarding event is the most critical process to the approval of the payment of the eco-incentive. In turn, it is also very relevant to reduce potential risks of fraud. However, this process should not prevent road operators or shipowners from joining to or benefiting from the eco-incentive scheme because of excessive bureaucracy. Following these considerations, this process in particular could be addressed with the combination of three main sources of information:

- The declarations from the users, where all data related to the boarding event should be included.
- The invoices issued by the shipowners
- The cargo manifest declared through the NSW.

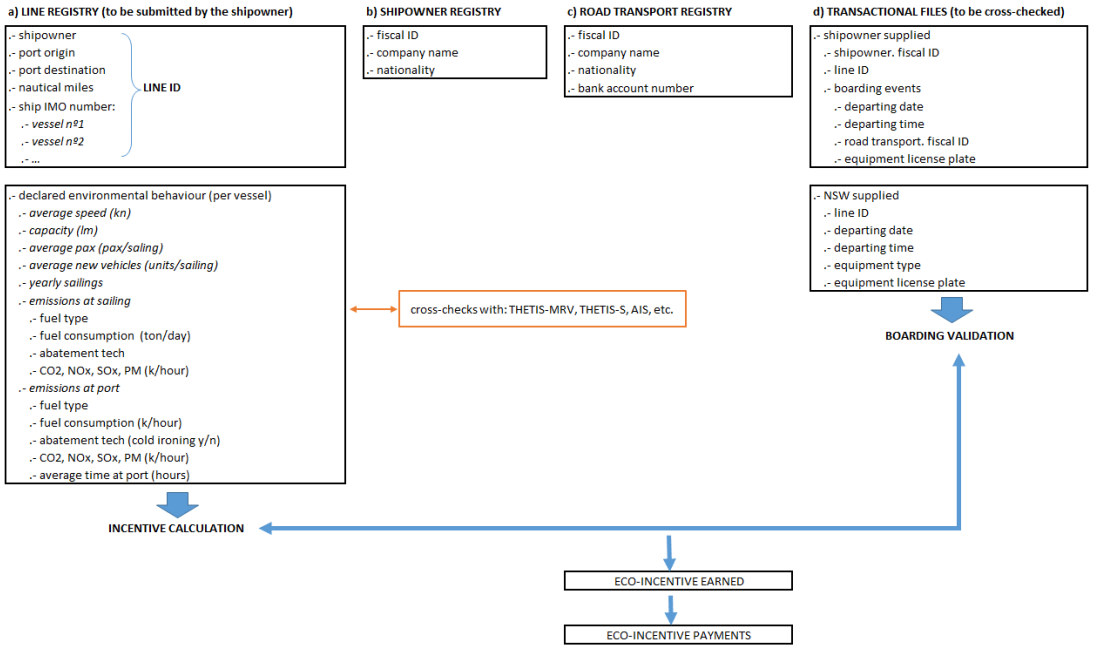

Figure 19.- Possible data request at registration and transactional files. MAE study case

The boarding event could be verified with the cross-check of the information included in these documents (e.g. type of equipment, license plate numbers, fiscal ID of the user, boarding date and time, etc.)

Some investigation has been made for this mean of verification and some issues have been identified that should be solved if moving to an implementing action. By way of illustration, registering license plates in the cargo manifests is not mandatory, according to the current NSW regulation. However, it is possible to include it on a voluntary basis. Moreover, MS could address this particular aspect to the work in progress for the further development of the European single window. Anyhow, this mean of verification for the boarding events is considered to be valid at this preliminary stage.

Finally, another critical check concerns to the maritime services. MoS actual environmental performances should be monitored in order to control possible deviations from the original values that were used to calculate the eco-incentive amount. In the event of significant deviations, the eco-incentive should be re-calculated. Therefore, shipowners could be asked to provide the specific information allowing for these checks at any time. Moreover, a cross-check with accredited sources of information could be considered, such as THETIS or the Automatic Identification System (AIS).

In summary, the preliminary investigation that has been produced returns a positive assessment on the legal, administrative and technological aspects of the scheme design at implementation. Further analysis should be made on certain aspects if moving to a real implementing action. However, the scheme design proves to be compatible at this stage of the analysis.

G. FINAL CONSIDERATIONS AND MOVING FORWARD

The MAE Action ends at proposal level and is intended to the debate. Moving to real implementing actions based on the proposed approach requires broad consensus.

Preliminary contacts have been established with relevant private and institutional stakeholders in the course of the study, with two main objectives.

First, to get a better understanding of the concerns, needs and priorities from different actors with regards to the goal of sustainability in freight mobility in a context of extraordinary challenges in this field for all modes of transport.

Secondly, to get a better knowledge of the operational structures and specific technical, legal and economic fields where these actors play, representing the specific frameworks within which they should develop and reach these challenges.

Further to these contacts, the MAE team had the opportunity to verify in all the meetings a common willingness and active sense of responsibility which makes the case for coordinated efforts under the development framework of sustainable mobility. Yet, the sector-specific priorities and constraints still undermine this great potential and call for new approaches and mechanisms to trigger it.

By way of illustration, there is an overall consensus on the need to mitigate greenhouse gas (GHG) emissions of transport that extends to both public and private stakeholders. On the one hand, and beyond the on-going debate on the inclusion of the transport sector in the EU Emission Trading Scheme (ETS), many transport operators are already considering the carbon footprint as part of their commercial activities. To some extent it appears that the sector is already internalizing that transport will eventually be included in such ETS, as it accounts for more than 20% of the total GHG emissions in the EU. On the other hand, public institutions are committed to public support for actions that reduce carbon emissions in transport. However, in many cases the support is granted only if the action demonstrates the existence of a funding gap amount, with such grants not being calculated on the grounds of the actual merits attained with the action (i.e. in terms of carbon reduction) but based only on financial considerations.

Conversely, this approach from transport operators with regards to decarbonization changes when it comes to the reduction of air pollution or social costs (e.g. congestion). This is probably due to the local nature of these impacts, which makes it more difficult to internalize them through ETS schemes when it comes to monetizing such impacts.

In these cases, transport operators do not feel stimulated and tend to accommodate their practices to a strict compliance with the sector-specific regulations setting the environmental standards for each mode of transport. In doing so, they seek not to jeopardize the commercial viability and competitiveness of their transport activities in the market.

However, reducing air pollution and social costs are key goals of sustainable mobility. Moreover, these factors are of great concern to MS, precisely because of the local nature of their effects.

Above all, it should be noted that both GHG and air pollution from transport activities are proportional to energy consumption. Moreover, certain modes of transport have not yet developed the necessary technology or reach the commercial readiness on this technology to implement a full mitigation of all emission factors. This calls for common approaches that can improve the effectiveness of public support, combining the action of the EU and the MS to stimulate for the greenest solutions that exists at any given time, including both global and local levels of impact.

The **common EU approach** on eco-incentive measures, as proposed, falls under this objective.

The main contribution to the debate concerns the possibility of stimulating sustainable freight transport services through action grants based on the achievement of actual socio-environmental merits. The specific actions attaining such merits would be proposed by the transport market.

This approach is presuming a transport market which is mature and able to improve its socio-environmental performance in market conditions.

In this context, the eco-incentive measures would play a neutral role in the market (from the perspective of internal costs) as they would only be granted on the basis of actual external cost savings. In addition, by being proportional to the amount of such savings, the eco-incentive measures would stimulate for those actions that could contribute most to reduce carbon emissions, air pollution and social costs. Conversely, the approach is not to compensate for market losses (e.g. start-up aids) or to reimburse the funding gap amount of certain investment projects (i.e. the current CEF approach).

When estimating the EU contribution to the eco-incentive measures, the approach allows EU support to focus on those impacts that benefit all EU citizens (e.g. decarbonization), conveniently measured and monetized through common references, notably the EC's Handbook on External Costs of Transport.

Thereby, the eco-incentive measures would extend the scope of the current CEF approach, where only actions proving the existence of a funding gap amount are granted with the EU support. This has proved to be a good approach for infrastructure investments as well as for pilot actions in the field of

innovation and new technologies. However, it might not be as effective when it comes to trigger actions with great socio-environmental benefits but with null or low funding gap amount. Such actions would make the case for the eco-incentive measures. In other words, when there are multiple alternatives in the market that are compliant with the binding regulations and can be adopted by the stakeholders with almost no funding gap amount, there is no clear mechanism available to grant positive incentives that make the market decide for those actions that can achieve the greatest socio-environmental merits.

In addition, the involvement of the MS as promoters of the eco-incentive schemes allows for regional approach within the common EU approach. Thereby, as MS are responsible for the scheme design, the eco-incentives measures will better address the regional specifics and priorities of the transport market where the scheme is to be implemented.

Moreover, when it comes to monetizing external costs, this regional approach will ease consensus among the MS involved regarding the value of the local factors, leaving to the EU level the consensus on the value of the global ones.

It should be noted that MS have been promoting incentive schemes with national budgets for many years. Provided that these national schemes could accommodate the principles of the common approach and thus benefit from the EU support, such programs might improve their impact and effectiveness.

Finally, it seems the right time for new approaches on the debate that could increase the effectiveness of the EU and MS support to sustainable freight transport services.

On 28th November 2018, the EC presented its very ambitious strategic long-term vision for a prosperous, modern competitive and climate neutral economy[68]. A net-zero GHG emissions is envisioned for the EU by 2050, in line with the also very challenging objective of the Paris Agreement to keep the global temperature increase to well below 2°C and pursue efforts to keep it to 1.5°C. Transport is targeted in the pathway to this transition, being responsible for around a quarter of GHG emissions in the EU. All transport modes will therefore have to contribute jointly to decarbonization, including freight transport. The EC does not hide its preference for electrification to underpin such transition, although it recognizes that it will not be the only option for all modes of transport based on today's technologies. In this regard, the EC extends the scope of the strategy to other possible ways to contribute to decarbonization, including new or improved alternative fuels, improved efficiency, behavioral changes by companies reducing or internalizing external costs, etc. Moreover, reducing air pollution, congestion, accidents and noise in

[68] A Clean Planet for All. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank on a European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM(2018) 773 final).

combination with this transition to decarbonization is also mentioned in the strategy when it comes to the local impacts of transport, especially in urban areas.

On 13th April 2018, by Resolution of the Marine Environment Protection Committee (MEPC), the IMO adopted the initial strategy on reduction of GHG emissions from ships[69]. This initial strategy is also mentioned by the EC in its long-term vision, recognizing the intrinsically global dimension of maritime transport and the need for coordination with the IMO in relation to this mode of transport. The IMO initial strategy is very ambitious as well, although not as much as the EC's net-zero GHG emissions target, proposed for 2050. In this case, the IMO vision is to phase GHG emissions out from international shipping as soon as possible, but within this century. However, the IMO initial strategy sets certain levels of ambition such as the reduction of the total annual GHG emissions by at least 50% by 2050 compared to 2008, or the reduction of CO_2 emissions per transport work by at least 40% by 2030, pursuing efforts towards 70% by 2050, both compared to 2008. Based on today's technologies maritime transport will have to face extraordinary efforts to meet these levels of ambition. However, it is interesting to underline this reference to carbon intensity (i.e. CO_2 emissions per transport work) which calls again to transport efficiency as a means to move towards decarbonization, not necessarily based on technology (e.g. increasing the capacity of the vessels, optimizing cargo, reducing speed, etc.).

On 6th June 2018 the EC launched the legislative process for the revision of the Connecting Europe Facility for the MFF 2021-2027 (CEF2), with the adoption of a first proposal for a Regulation of the European Parliament and the Council[70]. Partial provisional agreements have been reached in the Interinstitutional negotiations (Trilogue). Although the process is not yet concluded at the time of preparation of this report, and the remaining issues will have to be agreed at second-reading with the new Parliament, the latest proposal does not seem incompatible with the possible consideration of eco-incentive measures in future work programs. Likewise, the upcoming revision of the TEN-t guidelines will bring an opportunity to the debate on the potential role of eco-incentive schemes as projects of common interest for the sustainable freight transport services under **article 32 of the TEN-t Regulation[71]**.

Finally, on June 2019 the EC has published the new update of the Handbook on the external costs of transport[72], which is the main common reference to measure and monetize external costs at EU level and consequently a

[69] Resolution MEPC.304(72).

[70] Proposal for a Regulation of the European Parliament and of the Council establishing the Connecting Europe Facility (COM (2018) 438 final).

[71] Start of the legislative process for the revision of Regulation (EU) 1315/2013 planned for 2020.

[72] See note 17.

fundamental pillar of the common EU approach on eco-incentive measures, as proposed.

In this context of ambitious challenges and review of the development frameworks, it seems the time to debate how to accelerate the development of sustainable freight transport services over the coming years.

This proposal on eco-incentive measures intends to be of use of the EC and the MS in such a debate.

The executive summary and the technical annexes of this report, including the specific tools that have been developed for the MAE case-study, are available at www.mae-project.eu.

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I. APPENDIX 2 – MAE technical annexes

Available at www.mae-project.eu

- The Italian Ecobonus experience
- Review and analysis on state aids' legal framework
- Administrative and Technological aspects

- MAE tools:
  - External cost calculator
  - Calibrated transport model
  - Shipowners' perspective

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