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

Executive Report

MED ATLANTIC
ECOBONUS

Co-financed by the Connecting Europe Facility of the European Union

(191117_EN.rev)

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:	Liquefied 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 on the Functioning of the European Union
WACC:	Weighted Average Cost of Capital

ACKNOWLEDGEMENTS

The authors of this report wish to thank the institutional and private sector experts in the field of transport who, individually or on behalf of their entities, have collaborated in meetings and workshops held during the development of the Med Atlantic Ecobonus Action. Their contributions have been of great value in achieving the objectives of the study.

Likewise, the beneficiaries of the Med Atlantic Ecobonus Action acknowledge the financial support provided by the Connecting Europe Facility of the European Union and the advice of the Innovation and Networks Executive Agency during the development of the Action.

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, open 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 an example to prove the impacts of such approach.

This document has been generated as part of 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).

MAE Action is a policy study that ends with a proposal, in order to be of use to the European Commission (EC) and Member States (MS) in the ongoing debate on 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 in transport activities while securing market conditions for transport growth.

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

As an example of **regulatory measures**, EURO regulations setting industry standards for heavy goods vehicles (HGV) in environmental performance drastically reduced SOx and NOx emissions in freight mobility by road over the last decade. A similar regulatory measure has recently been approved for maritime transport regarding the sulfur content of marine fuels, to decrease down to 0.5% by 2020[3].

However, the use and scope of regulatory measures depend on the mode of transport. For instance, given the intrinsically global character of maritime

[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). 2 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.

transport, the EU usually regulates at the slower pace of the International Maritime Organization (IMO) in order to uphold a market balance, unlike inland modes.

Moving on to public support, both the EU and MS have been incentivizing sustainable mobility in many ways. This includes **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 transport greening.

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

After the **Paris Agreement**[5], decarbonization has become a top priority for the EU, to also include mobility. Greenhouse gas (GHG) emissions produce global impact and thus become a global concern, which is why it is totally reasonable for intergovernmental bodies, such as the EU, to pay special attention to this external cost factor. On 28 November 2018, the EC presented a highly ambitious strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy[6]. More recently, on 11 December 2019, the EC presented a roadmap based on this vision[7] with sustainable mobility as part of its scope.

On the other hand, **air pollution and social costs** from transport activities, such as congestion, accidents or noise, have been and are still a major concern for the EU. Mitigation of these external cost factors with great regional impact is another MS priority.

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

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

[4] Following an amendment 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.

[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.

guidelines brought a new approach to TEN-t development, changing over 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 more efficient, sustainable and integrated transport.

Part of the input for this approach to sustainable freight transport services in the current TEN-t framework came from experience in previous funding programs within the EU, 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. In hindsight, this new approach to sustainable freight transport services makes sense.

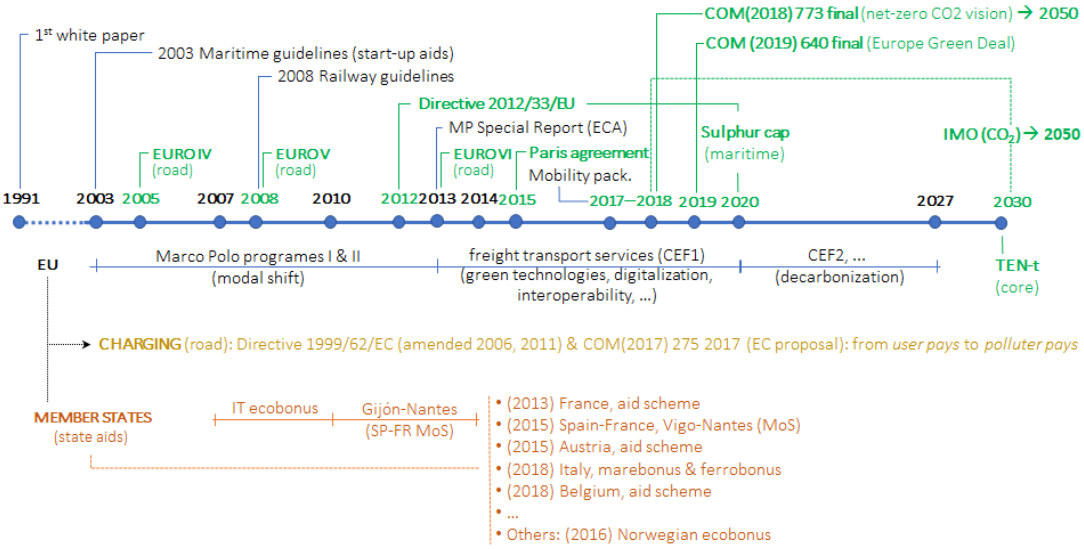

Figure 1.- Evolution chart. EU and MS support to sustainable freight transport services

A freight shift from roads has been a major policy objective in various transport White Papers issued by the EC since 1992, even with specific targets[10]. The main rationale behind this approach was to reduce road congestion and to improve the environmental transport footprint by using greener modes instead.

[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.

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

A relevant best practice was the first use of an **EU external cost calculator** to measure and monetize environmental achievements in these modal shift actions, on which to estimate EU support.

Following this approach, the EC extended its interpretation to Union compatibility rules on state aid[11] and allowed **state aid support** from MS to compensate the launching of sustainable freight transport services, subject to differences between inland and maritime transport.

At the same time, several MS have been supporting a modal shift with national budgets and incentivizing the use of rail or waterborne transport even after MP programs have ended (though not coordinated with EU support).

As a result, today's transport market is more mature than in the past, and is aware of the benefits of integration and multimodal transport solutions (the evolution of short sea shipping is a good example of this; furthermore, the network of short sea promotion centers have played a key role in this evolution). Consequently, the need to compensate market losses only, incurred by transport operators that promote a 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 in terms of air polluting factors (i.e. SOx, NOx and particulate matter (PM)).

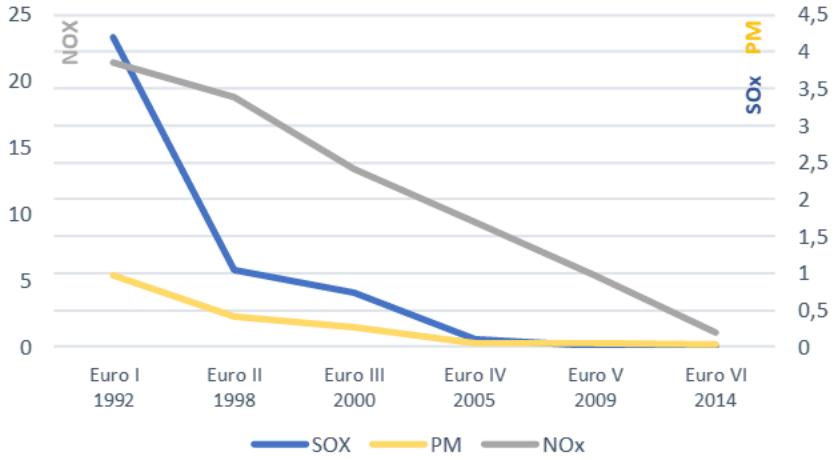

Figure 2.- Heavy goods vehicles (HGV) emissions (g/kg). Evolution (1992-2014)

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

Although rail and waterborne transport still outperform road transport in terms of social costs (i.e. congestion, accidents and noise), the gap in overall externalities between road and other modes of transport has been narrowed. Therefore, reducing road-only operations might be insufficient to improve sustainability in overall transport activity in all cases, as it certainly was in the past. This factor may require alternative transport to improve environmental performance by means of *green* actions.

The EC already took this approach in its Communication on the results of MP programs[12], recommending that further EU support on sustainable freight transport services development should *depart from pure start-up aid for modal shift* (i.e. 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 No. 3/2013, the EC insisted that **further EU support to sustainable freight transport services** would *not necessarily remain on modal shift and its targets not necessarily set according to road-shifted volumes* (despite still considering modal shift a fundamental tool to reduce external costs in the transport sector even further).

With respect to national schemes, the EC recalled the differences amongst MS in terms of geographical location, freight flows, infrastructure availability, modes used, etc. These circumstances could lead to disadvantages in the event of EU-based programs (e.g. administrative complexity, undesirable effects on market competition, etc.). This resulted in a call for a regional approach.

Furthermore, the EC insisted that EU-based programs should be justified on subsidiarity grounds, which is interpreted here as the need for MS to share responsibilities and accordingly finance and implement such programs together with the EU.

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

[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).

When it comes to EU support, the **form taken by EU contribution** is very relevant to the eco-incentive approach. Currently, CEF is mainly implementing action grants taking the form of reimbursement of the eligible costs incurred by the action. EU contribution is estimated with the co-financing principle, based on those action costs not covered by revenue (funding gap approach) and limited to maximum pre-established rates (usually between 20%-50% depending on the type of action).

According to this approach, the CEF rationale is basically to help promoters bridge the financial gap of any eligible actions. In other words, CEF will only support those actions evidencing a funding gap, to be calculated with a common reference[14].

Furthermore, under this approach, any eligible actions must be established before each call is announced and after negotiating with the CEF Committee about work program content.

This approach under the current CEF has proved to be very effective in the ongoing Multiannual Financial Framework (MFF, 2014-2020), triggering major infrastructure investments and pilot actions in clear need (almost by definition) of EU contribution for financial viability. This approach has also proved accurate for actions in early stages of deployment, when is more likely to evidence funding gaps.

Furthermore, it seems to be the proper approach to meet the conditions set out in **sector-specific rules** and EU legislation, especially those referring to infrastructure requirements for various modes of transport, such as in TEN-t guidelines, Directive on alternative fuels infrastructure[15] and Directive on the interoperability of the rail system[16]. In these cases, requirements may be easily linked to single actions to facilitate eligibility criteria defined in each work program.

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

No individual actions exist when it comes to reducing carbon emissions, air pollution and social costs.

In particular, carbon emissions and air pollution depend on the type and magnitude of energy consumption which, in turn, can be reduced through a wide variety of actions, technology and non-technology based (switching the

[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.

type of fuel, improving resource efficiency, optimizing transport and modal balance, increasing capacity, reducing speed, etc.). Ultimately, these actions change mobility patterns through better environmental behavior, but with different merits that can be measured and monetized.

However, all potential actions to reduce carbon emissions and air pollution are unlikely to find a place under the current CEF approach. Some of them do not involve technical requirements in sector-specific rules applicable to freight transport services, making it difficult to define eligible costs. Others (leaving pilot initiatives aside) may find it difficult to prove funding gaps, if for instance technology or commercial readiness for such actions is high. Yet, stimulus is required for the action's implementation, especially when the market provides cheaper (and less green) alternatives.

Nevertheless, from a transport market perspective, the goal of sustainable mobility should be to actually **reduce external costs** irrespective of the type of actions taken which, in a competitive environment, should depend on the market.

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

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

In this context, the **eco-incentive measures** proposed seek to complement the current CEF approach in order to improve overall efficiency in public support.

In particular, eco-incentive measures are conceived as a form of support not linked to action costs but to the achievement of actual socio-environmental merits attained through such actions, to be measured and monetized by reference to common sources, such as the EC's Handbook on External Costs of Transport[17].

Instead of using the funding gap to estimate EU contribution, the co-financing rate may be estimated by reference to a share in the overall merit achieved due to global factors, such as GHG.

[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

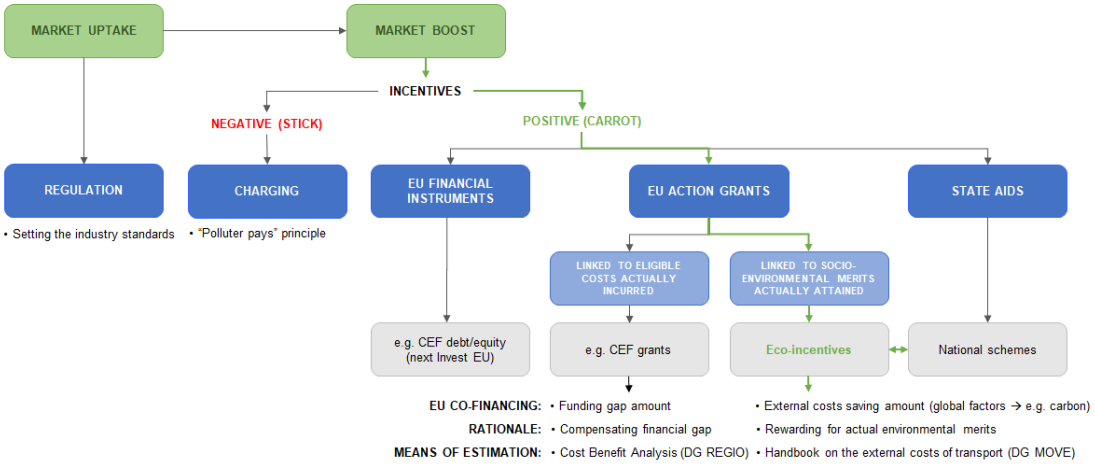

Figure 3.- Development framework for sustainable freight transport services. Setting the scene for eco-incentive measures

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

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

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

Eco-incentive measures follow this line.

C. THE MAE ACTION

Against this background, Ministries of Transport in 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 EU support to sustainable freight transport services within the EU.

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 using eco-incentive measures within the EU for 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, particularly through MoS servicing road transport in the Atlantic and West Mediterranean regions.

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

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

In this regard, the MAE Action follows recitals 30 to 32 of the Sulfur Directive[20]. Indeed, both the EC and MS are recommended in this Directive to provide targeted assistance, including operators, in order to minimize the risk of modal (back) shift from sea to land-based transport as a direct consequence of the increase in maritime costs due to the need to meet lower sulfur limits for marine fuels by 2020, which could be contrary to the Union's climate change objectives and increase road congestion.

Nevertheless, the MAE Action is a policy study that proposes a possible approach. A move towards implementing actions based on this approach requires further consensus. To this end, MAE Action stops at a proposal and **encourages debate** on eco-incentive measures as a way to boost sustainable freight transport services within the EU.

[18] See notes 12, 13.

[19] Special Report No. 3/2013: Have the Marco Polo programs been effective in shifting traffic off the road?. European Court of Auditors.

[20] See note 3.

Preliminary contacts with representatives in the transport sector, academics and institutions were made throughout the study, enriching the proposal from different perspectives. The MAE study team is very grateful to all of them. According to the study methodology, these contacts where conceived as part of a preliminary consensus stage.

However, consensus should be reached through formal discussion between the MS and EC, as appropriate. As a result of the debate, eco-incentive schemes could eventually be considered as **projects of common interest** for sustainable freight transport services under article 32 of the TEN-t Regulation, 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 sustainable freight transport services is proposed under a common EU approach. The main aim of such approach is to ensure that eco-incentive measures are designed, promoted and implemented with common principles and methodology regardless of the targeted mode of transport or EU region. 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 EC indications.

In order to identify such common principles for eco-incentive measures and incorporate them into viable implementing schemes, the MAE study analyzes and interprets many references, to include policy documents and legal instruments[21] setting challenges, objectives, priorities, rules and standards for freight transport over time, together with past and current experience and best practices in the EU and MS. A list of references is included in APPENDIX 1.

Particularly, TEN-t and CEF Regulations[22], together with EC Communications[23] and the ECA special report[24] issued following MP programs, have been major references in this common EU approach. An analysis of applicable rules on state aids has also played an important part in the MAE study.

In addition to this review, direct contact was made with relevant stakeholders, including transport operators, project promoters, academics, MS, EU institutions, etc., enriching this analysis and internal discussions towards a common approach. In particular, contacts with project promoters in Northern Europe have been of great use to cover various sensitivities and market

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

[22] See notes 9, 8.

[23] See notes 12, 13.

[24] See note 19.

realities across the EU, definitively contributing 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 an example.

With this background in mind, EU support to eco-incentive measures should apply the following **common principles**.

The eco-incentive amount should be based on actual **socio-environmental merits** attained through concrete actions reducing external costs[25] in freight transport services. Moreover, the eco-incentive should only be granted when such merits are confirmed as achieved.

The placement of socio-environmental merits at the forefront of eco-incentive measures (translated into actual external costs savings) is essential to make the approach transferable within the EU.

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 for this reason, the sectorial regulation for each mode of transport has its own specificities too, even under the umbrella of the Common Transport Policy.

As an 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 legislation, allowing the EU to develop its transport policy. The foregoing may be due to the faster transition of road transport when compared to maritime transport in terms of air pollution emission factors. On the other hand, maritime transport competitiveness and openness to private operators are not comparable to rail, which is still undergoing a transition and requires specific EU actions to overcome infrastructure bottlenecks and develop rail freight services. Also, road transport faces important challenges with respect to

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

mitigated social costs (congestion and accidents in particular), representing a major concern for the EU and MS, which is not the case of rail and maritime transport.

Moreover, the transport market develops differently depending on the EU region, even within the 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 various EU regions and the way in which transport practices and networks have developed in these regions over the years have resulted in different transport markets across Europe. This is very evident in the maritime sector, where many different markets operate in the EU with different characteristics and needs (including deep sea, short sea, ferries, ro-ro, container ships, channel crossings, island servicing, etc.).

Finally, market performance itself introduces additional complexity by making these differences variable and dynamic. As a consequence, needs and priorities in various transport markets may also change over time.

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

A good example of the foregoing would be incentivizing a modal shift from road to maritime transport, which has been extensively discussed throughout the MAE study.

There is no question that 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 Atlantic and Mediterranean CNC road sections, at a growth rate of 3,5% per year. This raises a major congestion issue, as well as accidents and air pollution, which the MS seek to mitigate by shifting part of those trucks to MoS and rail alternatives. Moreover, performance in the MoS market servicing alternative routes to road transport has greatly differed in the Atlantic and West Mediterranean, which is currently much more developed.

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

This is somehow implicit in the EC Communication presenting the results and outlook of the MP programs and subsequent reply to the ECA[26]. As already

[26] See notes 12, 13.

mentioned, these seminal documents explain the later approach to sustainable freight transport services taken by 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 Communication, this means *"departing from the pure start-up aid for modal shift"* as regards EU support.

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

Further to the foregoing, the need to measure and monetize those merits by reference to a common methodology has become another common approach principle. In this regard, the **Handbook on External Costs of Transport,** first issued by the EC in 2004 and later updated, is the main reference at EU level. A very recent update of this Handbook was published in June 2019[27]. This update represents a great opportunity for the purposes of this common EU approach to eco-incentive measures.

Moreover, funding is **conditioned to results** since the eco-incentive is granted depending on *demonstrated* socio-environmental merits. This important feature of the common EU approach follows specific recommendations from the EC and ECA after the MP programs.

As regards the **form taken by this support**, eco-incentive measures are conceived as grants not linked to action cost 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 taken by EU contribution under the current CEF approach is covered by Article 125.1.b) of the Financial Regulation[28], i.e. a

[27] See note 17.

[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.

reimbursement of eligible costs actually incurred by actions which meet the requirements previously set by the CEF Committee in work programs.

Conversely, Article 125.1.a.ii) could apply under the proposed approach to eco-incentives, i.e. *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 would be linked would be the actual socio-environmental merit attained through the action and *monetized* with the Handbook (i.e. not incurred costs).

Eventually, the approach proposed demands concrete actions even if the grant is not linked to the costs of such actions. In turn, this requirement helps **minimize deadweight loss**[29], which in itself constitutes a principle of the common EU approach following ECA recommendations.

Moreover, with this approach, the CEF Committee still has the chance to set priorities and requirements in the work programs before calls are announced, for instance regarding which type of actions are or not eligible for EU funding as part of an eco-incentive scheme. A minimum threshold could even be established for the socio-environmental merit attainable by the scheme, below which no action would be eligible.

In any case, since the grant is not linked to the action itself but to the total external costs savings attained, discussion on eligible actions could be more flexible and neutral than it is today, facilitating negotiations between MS and the EC. Furthermore, this approach would allow more room for promoters to decide on the type of actions that could best help attain the socio-environmental merit on a market basis. In other words, the common EU approach may be potentially **neutral on how socio-environmental merit is achieved** (e.g. technology-agnostic), constituting a principle in itself.

As regards calculation of **EU co-financing**, the approach under current CEF may once again not fit into the eco-incentive approach. As already mentioned, maximum EU co-financing is estimated with the funding gap and capped at pre-established maximum rates in the work programs depending on type of action and funding priorities. This funding gap must be estimated through a specific cost-benefit analysis (CBA) based on common references[30]. In the case of eco-incentive schemes, where grants are not linked to action cost, estimating the co-financing by reference to the funding gap may lead to inconsistencies. However, following the common EU approach to eco-incentives, as described so far, the EU co-financing rate could be calculated by reference to part of the total external cost savings considered to be a high priority for the EU or, even, justified on subsidiarity grounds (e.g. reduction in carbon emissions, as they

[29] The effect of funding a beneficiary who would have made the same choice in the absence of aid (ECA Special Report No. 8, 2018).

[30] See note 14.

globally impact the environment). In the same way as before, the CEF Committee still has the chance to modulate this criterion in the work programs and, certainly, to establish maximum ceilings (as is the case now).

Further to the foregoing, eco-incentives measures would warrant a different form of EU contribution and estimated EU co-financing when compared to the current CEF approach. Therefore, the feasibility of this alternative approach will depend on DG MOVE's assessment and validation.

Following a regional perspective as part of the common EU approach, **MS involvement** has become another major principle. MS are in the best position to identify the needs and priorities of various transport markets in EU regions. This is why MS should promote eco-incentive schemes deciding on each targeted market, individually or together with other MS operating in the same EU region (depending on the scope of the scheme).

This co-responsibility principle in the promotion of eco-incentive schemes also applies part of the EC recommendations following MP programs. It is therefore fully aligned with TEN-t guidelines on MS role in promoting sustainable freight transport services[31].

Based on this regional approach and co-responsibility principle, MS should be in charge of designing and implementing eco-incentive schemes, provided that there is EU co-financing. Consequently, MS would be responsible for the funding request and ultimately the beneficiaries of the EU grants. On the other hand, according to EU budget financial rules, EU grants require co-financing[32]. Consequently, beneficiary MS would also be responsible for the scheme's financing. They need to mobilize financial resources covering any part of the scheme's budget that is not EU funded.

This does not come as a surprise for MS. Many EU countries are implementing incentive schemes with national budgets to stimulate sustainable freight mobility (including different EU regions and modes of transport), albeit not based on a common EU approach and not co-financed under the EU budget.

The proposed approach on eco-incentive measures thus seeks a **combined effort** from MS and EU financial support based on common principles to increase effectiveness, impact and even the scope of existing national incentive programs.

An argumentative issue is whether a common EU approach should require the joint promotion of at least two MS receiving EU support. This would make sense according to the rationale behind the concept of EU added value, which usually

[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.

[32] See note 28, Article 190.

involves joint action amongst MS. On the other hand, a single MS scheme may provide the EU with socio-environmental benefits of a global scope even if the scheme is implemented in just one country (e.g. reduction of carbon emissions). Likewise, national sections of the CNC are eligible for EU funding and apply as a single MS under the current CEF. The MAE study leaves this possibility open, although the MoS case-study further used as example applies a multilateral approach.

A more relevant issue when analyzing MS involvement is the use of national funds subject to **state aid rules**.

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

On the other hand, no such specific Treaty rules apply to aviation or maritime transport. However, applicable EC guidelines on state aid should be taken into account, which compile EC interpretation of Treaty rules for various modes of transport, including maritime. These guidelines constitute soft law, meaning that they are not legally binding but still have practical and relevant effects.

The MAE study has separately reviewed and analyzed the matter, which is available for download (see APPENDIX 2). Particular attention has been paid to applicable rules on maritime transport since MoS is the targeted market in the MAE case-study.

Some **horizontal aspects** have been identified in this analysis that are relevant to the proposed approach on eco-incentive measures.

As a general rule, the TFEU forbids any aid whatsoever granted by MS or through State resources that distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods.

In particular, Article 107(1) develops the constitutive components of state aid, according to which it is likely that eco-incentive measures would be classified as state aid since the MS are in charge of the financing. As an example, as soon as the MS grant an undertaking a financial advantage in a liberalized sector (the case of eco-incentives), such aid would be distorting competition.

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

The most important category usually used to authorize state aid is Article 107(3) c), which covers aid granted for regional or industrial development (sectorial aid). Furthermore, the word ‘may’ in Article 107 (3) gives the EC a significant

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

margin of discretion in this category. Indeed, in its compatibility assessment, the EC should not only take economic goals into account but also other considerations in the EU's interest, such as socio-environmental goals (also the case of eco-incentives).

According to this analysis, state aid for freight transport services must be justified by socio-environmental impact reasons in order to be compatible with the internal market, implemented in a non-discriminatory way and budgeted in proportion to its goals. The common EU approach is aligned with these requirements since the eco-incentive is proportional to the socio-environmental merit, which is measured and monetized with common references.

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

Following this analysis, state aid compatibility is usually limited to new or upgraded services. This is in line with the proposed approach on eco-incentive measures since the socio-environmental merit must be achieved through required implemented actions based on the need to minimize deadweight loss.

The fact that aid does not negatively impact the transport market to the detriment of the common interest is also a priority compatibility assessment requirement. The common approach is consistent with this, since the eco-incentive measure would be only implemented exclusively based on actual and demonstrated socio-environmental merits.

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

Based on these overall horizontal requirements, **applicable rules** may change for state aid depending on the mode of transport.

A relevant difference has to do with maximum aid duration as well as its potential renewal over the years. Whereas in inland modes aid may last for five years and be renewed on an unlimited basis, in maritime transport aid is limited to three years and a renewal is not possible[35]. The EC is aware of this and is willing to harmonize when necessary[36].

[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

There are many reasons for this asymmetry, one of which is the concept of **start-up aid**, firmly addressed to maritime transport in applicable rules. According to this concept, the aim is to compensate initial losses incurred by shipowners in maritime services to shift traffic from roads. This approach may have made sense back in 2004, for short sea shipping at an emerging market stage following MP programs objectives (2003-2013). However, this network has developed over the years and the market is now mature, with short sea services offering alternative routes to road transport in market conditions. Fifteen years have passed since the 2004 Maritime Guidelines; now the challenge is not market development but accelerating its socio-environmental transition on a rolling basis. The concept of start-up aid may be irrelevant for this aim, requiring an update of Maritime Guidelines.

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

However, due to the variety of legal issues covered by Maritime Guidelines, they are unlikely to change for this particular reason.

On the other hand, further EC guidance on state aid in addition to EU funding for MoS[37] development is also obsolete. These MoS Guidelines refer to former MP and TEN-t programs and should be adapted to the new CEF. This update affects the common EU approach on eco-incentive schemes due to the combined MS and EU support proposed.

Moreover, MoS Guidelines would be easier to amend than Maritime Guidelines as their scope is more reduced.

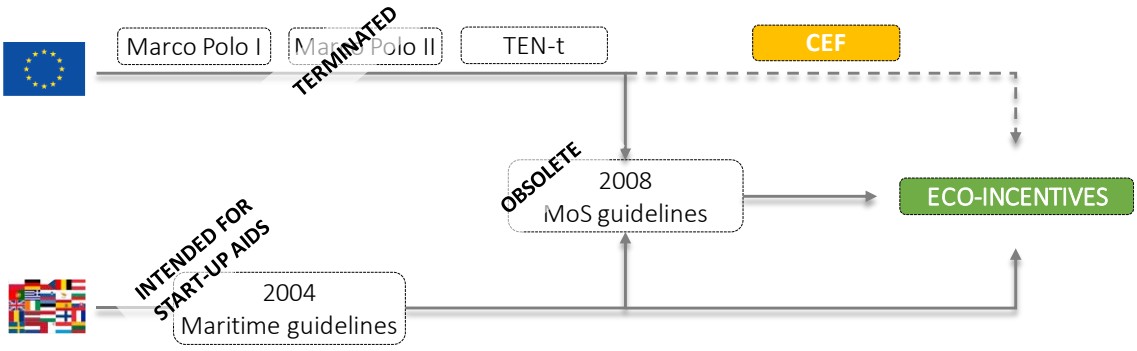

Figure 4.- Current situation on the state aid rules applicable to maritime transport.

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 no. 10.

[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).

In any case, eco-incentive schemes should be compatible with applicable rules on state aid, another principle of the common EU approach.

Following the ECA[38] recommendations, **additional principles** may be included in the common approach. In particular, the schemes' outline should minimize the risk of fraud, reduce bureaucracy and prove achieved performance when implementing eco-incentive measures. These particular principles should be attained through administrative, technological and operational structures in eco-incentive schemes, at the implementation stage.

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

As part of the common approach, a common methodology is outlined on how to complete this ex-ante analysis by reference to the foregoing principles.

Following these principles, MS promote eco-incentive measures and receive EU co-financing. That is to say MS should be in charge of preparing the scheme proposal and applying for EU funding, following the operational structures of the funding program.

An ex-ante analysis would be the proposal's cornerstone, including the scope and design of the scheme and a full **impact assessment**.

The following main proposals apply to the schemes' scope and design:

- The **targeted market** where the eco-incentive scheme will apply, including any mode of transport, market segment or EU region. Following the regional approach, the MS involved are in charge of coordinating and prioritizing possible targets as promoters aware of each EU region's needs,

- The **goals** for which the scheme is promoted. Following the foregoing principles, this goal should involve actions to improve socio-environmental performance in freight transport services.

- The **socio-environmental merit** incentivized. This is important, not only to achieve the scheme's goals but also to ensure that the eco-incentive measure is implemented in a non-discriminatory way.

On the other hand, an ex-ante analysis is basically a simulation that will operate in the targeted market. It uses relevant tools to estimate socio-environmental

[38] See note 19.

merit, is able to complete a sensitivity analysis and generate the necessary outcome to assess goal achievement.

Moreover, an ex-ante analysis should provide enough background on the ground regulations, administrative and technological aspects inherent to the scheme's scope and design. The foregoing is relevant to assess the risk of fraud, level of bureaucracy, compatibility with state aid rules or the ability to monitor and demonstrate achieved performance, as examples. Ultimately, this ex-ante analysis must prove that the eco-incentive scheme is compatible with common EU approach principles.

Following the foregoing sequence, the diagram below illustrates a possible common methodology for an ex-ante analysis.

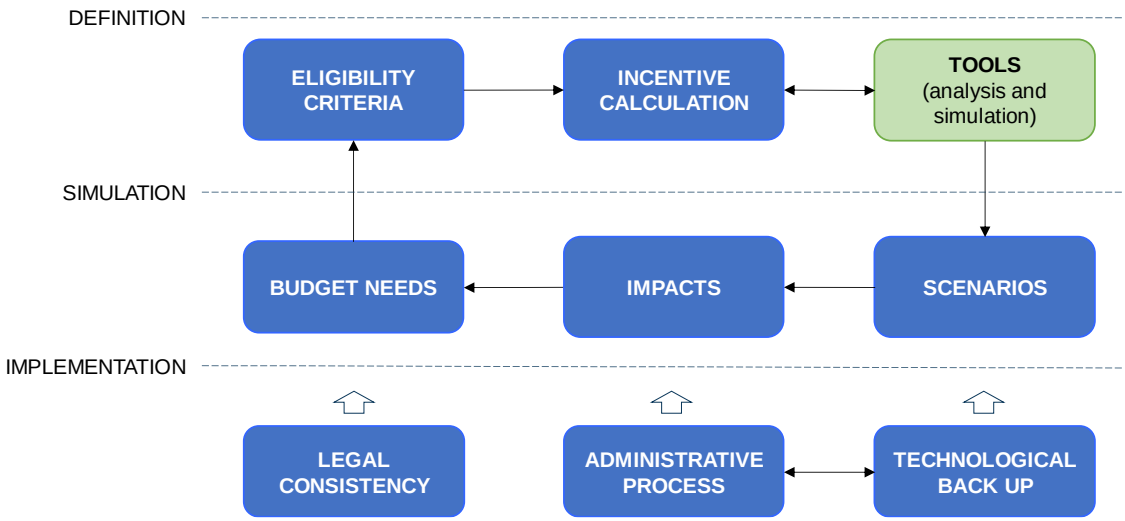

Figure 5.- Ex-ante analysis. Common methodology. MAE approach

Eligibility criteria should first of all be proposed. This essential feature, having a regional impact, should be decided and agreed by the MS involved (regional approach). To a certain extent, eligibility criteria transform the scheme's scope and design into actual requirements. Among other issues, they should be consistent with the targeted market, enable the scheme's goals, identify beneficiaries and include an eligibility period.

Along with eligibility criteria, an ex-ante analysis should generate **relevant professional tools** to estimate and simulate the impacts of the eco-incentive measure in different scenarios. These tools must produce outcomes for comprehensive scheme performance assessment (effects on demand, external costs savings, budget needs, etc.). This is why tools should be designed *ad hoc* for the scheme's scope and design, based on common references, relevant methodologies, best practices, updated information, reasonable assumptions, etc.

The following minimum tools should be considered as part of an ex-ante analysis of any eco-incentive scheme:

- **External cost calculator,** specifically designed to measure and monetize socio-environmental merit based on common references (essentially the EC's Handbook on External Costs of Transport).

- Detailed **market analysis and simulation** tool, according to EC and ECA recommendations following MP programs, to estimate the effects of the eco-incentive measure on the targeted market (including demand) as well as resulting socio-environmental impacts for each external cost factor[39] when used together with the external cost calculator.

- **Financial assessment** tool to estimate the extent to which the eco-incentive measure is able to achieve the scheme's goals, from a market perspective.

Since the goal of the scheme is to reduce external costs through green actions stimulated through the eco-incentive measure, it is of the utmost importance for the external cost calculator to be ready to measure and monetize such actions.

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

At this point, we should specifically refer to the importance of calculating external costs for sustainable freight transport services at EU level.

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

Moreover, there is virtually no other way to incentivize a socio-environmental merit unless the merit itself is measured and monetize. This is why it is not possible to exclude the external cost calculator from the eco-incentive approach.

On the other hand, calculator effectiveness depends on data quality, accuracy and representativeness and the assumptions made regarding measurable reality. For the purposes of a common EU approach, consensus based on common references such as the Handbook is of utmost importance, particularly

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

when it comes to monetizing the various causes of local and global impacts in different EU regions.

This is a major challenge given that transport technologies are constantly evolving and different existing methodologies on the monetization of environmental and social costs. The MP calculator together with the first Handbook on External Costs of Transport (2008) thus represented a unique step towards a harmonized approach on transport external costs calculation at EU level that should be undisputedly recognized.

In any case, upon completion of the MP programs, the EC stopped granting aid based on the external cost calculator, although the Handbook (later updated in 2014) continued as a common reference in the CBA (currently requested by CEF to assess proposal impacts).

Nevertheless, the need to measure and monetize external transport costs cannot be overlooked when it comes to eco-incentive measures as a potential move forward towards EU support on sustainable freight transport services.

As has been the case in the past, this poses a major challenge due to the consensus required. However, now seems to be a good time for such **consensus on external costs valuation**, when there is great socio-environmental concern in political agendas and with the recently published update of the EC Handbook (June 2019)[40].

In this context, the proposed approach to eco-incentive measures offers an excellent opportunity for the EC and MS to build up the consensus required on external costs valuation following implemented eco-incentive schemes and based on a regional approach (i.e. different EU regions have varying values for emission and social factors)

Indeed, a regional approach would facilitate a consensus when it comes to monetization, allowing the MS supporting the scheme to agree on values dependent on local conditions (e.g. congestion, SOx emissions, etc.).

On the other hand, consensus required at EU level would be limited to global values, shared by all EU regions (i.e. GHG). Furthermore, this *local* vs *global* scope of socio-environmental merits attained with eco-incentive measures would be consistent with co-financing by the EU based on an actual reduction in GHG external costs, as mentioned before.

Based on the eligibility criteria defined and developed tools, an ex-ante analysis should propose **relevant scenarios** for simulation. Here, scenarios must be consistent with tool design (and *vice versa*), which means that tools must be prepared to simulate scenario variables. Otherwise, this simulation will not be possible or relevant.

[40] See note 17.

Scenarios should be designed to generate relevant outcomes, as appropriate. They should at least separately provide maximum budget needs (total eco-incentive given in the eligible period) and total external costs savings for each external cost factor (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, net profit of the eco-incentive scheme should exclude baseline scenario effects (e.g. external cost savings due to new environmental regulations entering into force).

The foregoing is able to complete a full simulation, returning the relevant assessment outcomes. As a rule of thumb, the total eco-incentive given must remain below total external cost savings. Otherwise, impact assessment must be presumed negative. In this case, the eco-incentive could be lowered (e.g. by granting just a percentage) and the simulation exercise recalculated. On the other hand, if the budget remains below external cost savings but the eco-incentive scheme goal is not achieved (e.g. if it is considered that the eco-incentive does not trigger the necessary actions to attain the socio-environmental merit), the impact assessment would also be presumed negative. In such case, the budget may be raised (i.e. with higher eco-incentives). By altering eligibility criteria, it is possible to increase or restrict both the impacts and budget needs. Also, by increasing or reducing eco-incentive scheme duration, it is possible to increase or reduce budget needs. Ultimately, an ex-ante analysis is an iterative process.

Finally, and besides the simulation exercise, an ex-ante analysis should also check compliance with the underlying 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 an example, to prove the impacts of the common EU approach as described: the MAE case-study.

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

As mentioned, the goal should target a reduction in 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 their eco-incentive scheme:

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

This particular market segment is of interest to these four national administrations. Indeed, this constantly evolving market generates an annual average of approximately 200,000 HGV. Traffic is highly sensitive to maritime prices 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 road haulers, which in turn produce higher emissions. Moreover, shipowners have been using smaller vessels to secure viable utilization rates. Finally, fleet design in this market has applied classic marine fuels in vessels to minimize costs and offer competitive prices to road haulers (a scenario that has changed by 2020 with the sulfur cap). As a result, environmental performance of the maritime leg is not optimized in this market. Conversely, road has significantly reduced emissions over time (especially air pollution) as a direct consequence of HGV environmental performance transitioning from the EURO III to EURO VI standard (i.e. a *regulation merit*). All of the foregoing means that the targeted market is suitable for improving environmental performance in the maritime leg and reducing social costs.

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

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

The **merit to be incentivized** are savings in external costs in freight units using the improved MoS as opposed to the road-only alternative. Following the Italian Ecobonus approach, which is recognized as best practice by the EC and ECA, the eco-incentive would be granted to maritime service users. In other words, the eco-incentive would only apply if maritime operators implement green

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

[42] See note 3.

actions in maritime services and a socio-environmental benefit is confirmed if road haulers use such services.

With this scope and design, it will be demonstrated through an ex-ante analysis that maritime operators strictly complying with the Sulfur Directive will not be entitled to eco-incentives. Therefore, the eco-incentive scheme proposed would only be effective for green actions in MoS services beyond the scope of environmental regulations, in force by 2020 (i.e. minimizing the deadweight loss of public support).

F. EX-ANTE ANALYSIS

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

In order to assess maximum budget needs, the case-study simulates a scenario where all MoS implement a **green action** consisting of switching their fuel to liquefied natural gas (LNG). The choice of LNG is solely based on the assumption that this option will generate the greatest environmental merit today. Thus, the green scenario will return the maximum eco-incentive possible and allow an estimation of 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 where MoS strictly comply with the sulfur cap regulation applicable by 2020[43]. The baseline scenario also generates environmental benefits, not explained by the eco-incentive measure but as a ***regulation merit***.

The eco-incentive will amount to the same value as the incentivized merit. Consequently, eco-incentive value will equal external costs savings attained by freight units when using 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**, developed *ad hoc* for the case-study. Consequently, the eco-incentive is proportional to savings and will never be higher than the socio-environmental benefit attained with the scheme, by definition.

Next, a **transport modeling 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.

[43] See note 3.

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

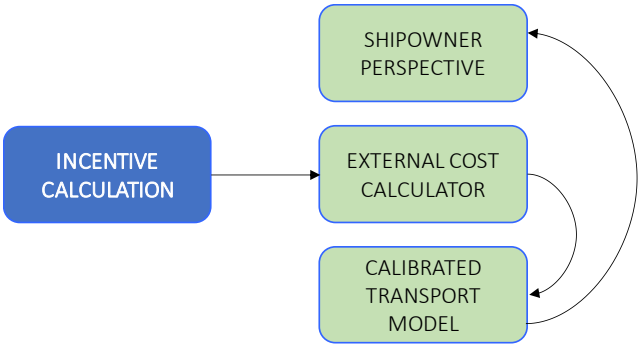

Figure 6.- Incentive calculation and market simulation tools (MAE case-study)

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

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

Besides the impact assessment, the analysis will refer to the legal, administrative and technological aspects of the scheme design that should be considered in the event of possible implementation.

Eligibility criteria

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

We should highlight that eligibility criteria, proposed for the MAE case-study, do not relate to any institutional action already taken by study promoters and must be taken **as an example** at this stage. In fact, these eligibility criteria may be revised (extended or restricted) if this example is eventually implemented in the future.

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

- Maritime services consisting only of international lines with no more than 2 stops or one enroute call.
- Maritime service users are the direct beneficiaries upon proof of boarding and purchase (i.e. provided by the transport operator and shipowner). *Users* refers here to purchasers of the maritime ticket. Users will also be responsible for providing proof of the boarding event.
- Lines shall go from / to a port of implementing MS to / from another EU port or between ports of implementing MS.
- Domestic services are not eligible here.
- Only maritime services with an operating door-to-door road alternative 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 departing at least once a week with a full-time vessel (i.e. no seasonal services).
- Services consisting of new or upgraded lines generating external cost savings per transported unit when compared to the road-only alternative. Such merit shall be demonstrated and monetized using the scheme's external cost calculator tool, generating direct costs for shipowners through green actions improving environmental performance in maritime service.
- Only accompanied or non-accompanied trips of rolling cargo, intended as freight that can be independently loaded and unloaded on the vessel (i.e. no cranes used), may be eligible. New cars would be considered eligible given that 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 the 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 confirmed as compatible with applicable rules on state aids in combination with EU funding.

As already mentioned, these eligibility criteria define the targeted market where the eco-incentive measure will be implemented. The foregoing allows a common regional approach among the MS involved in defining such criteria.

The interest held by road and maritime transport in multimodal solutions is not new. Indeed, the MS involved in the MAE case-study have been promoting such goal with national budgets, although with different approaches. In this regard, a common EU approach enables joint effort at a regional level that may increase the impact of public support, accordingly including EU funding.

In any case, eligibility criteria should meet the underlying principles of the common EU approach described above. By way of illustration, some comments are included below.

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

Moreover, the demand approach brings additional benefits. It enables a reduction in social costs, stimulating new transport patterns in the road sector (i.e. using MoS services instead of the road-only alternative) and preventing modal back shift effects. In turn, it improves MoS utilization rates, inducing optimization in freight transport. Finally, it facilitates a compatibility assessment on state aid rules since the approach is already validated by the EC as part of the Italian Ecobonus program.

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

In any case, eligibility criteria do not predetermine or favor any type of green action, leaving the decision to shipowners based on the market. Later, the external cost calculator will cover possible actions to be decided by shipowners according to current market practices (technology or not technology based, such as increasing capacity or reducing vessel speed[45]). In any case, strict compliance with the Sulfur Directive is used as a baseline scenario (i.e. switching to low sulfur conventional fuels) where no eco-incentive is granted.

[44] See note 35.

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

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

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

External cost calculator

As already mentioned, the external cost calculator is a prominent feature of the overall approach to eco-incentive measures. For grants based on actual socio-environmental merits, an external cost calculator tool is essential.

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. road and maritime transport) and to estimate socio-environmental merits that should be incentivized according to the scheme design (i.e. eco-incentive value).

To achieve this, an exhaustive analysis has been carried out, including past and existing calculators, technical, statistic and scientific reports, publications and articles, EU projects, emission trading schemes, etc. and different perspectives, including academics, transport administrations, consultancy, financial institutions, etc. Ultimately, the MAE study has analyzed and tackled the many references listed in APPENDIX 1.

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

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

The tool is an Excel spreadsheet, for easy use and understanding, including all the supporting tables. In addition, there is a separate deliverable to describe the design process and use of the MAE calculator. Everything is available for download (see APPENDIX 2).

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 mentioned above.

[46] At the preparation of this report, the 2019 update of the Handbook was not available.

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

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 incentivized, under the proposed scheme. Therefore, it estimates and compares external costs incurred by HGV when using MoS and the road-only alternative.

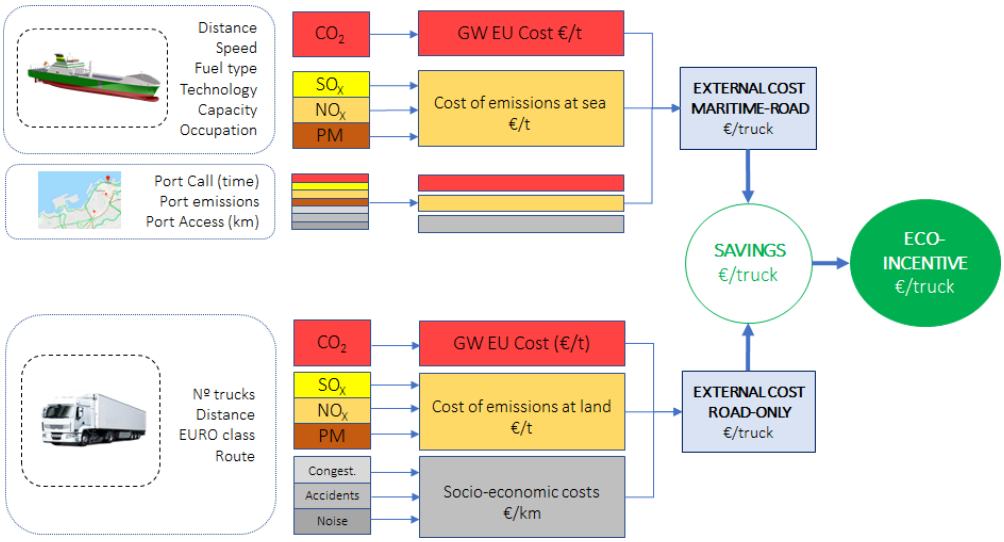

Figure 7.- External cost calculator. Eco-incentive calculation. MAE case-study

In 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. External costs measured in both road-only and MoS alternatives include CO_2, SOx, NOx and PM emissions. In addition, the road-only alternative also measures social factors (congestion, accidents and noise), assuming that MoS impacts are nil or not 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 able to measure actual socio-environmental impacts in each line, case by case, considering each specific vessel's technologies, characteristics and operational behavior. Therefore, the calculator is ready to simulate effects of standard green actions (technology and not technology based) taken by shipowners in order to improve environmental performance in the maritime leg, which is the main goal of the scheme.

[47] Monetary values at 2016 using the consumer price index.

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

The tool also estimates average external costs incurred by both boarding trucks to and from the port and vessels at **port access and port call**, respectively. These externalities run counter to the socio-environmental merit of the maritime service and are significant when ports are close to urban areas, which is usually the case. In turn, shipowners adopting port emission reduction technologies in their vessels (e.g. batteries, cold ironing, etc.) will reduce the overall impact of their MoS. Such merit should also be logically measured and monetized with 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, the vessel's emissions shall be allocated to freight and passengers separately. To do this, the MAE calculator estimates the number of **equivalent trucks**, representing for each vessel the actual trucks plus private vehicles converted into virtual trucks or equivalent trucks using average utilization rates for vessel capacity. For new vehicles, which are also ineligible for the case-study, a similar calculation is performed.

In addition to the values that are implemented by default, the MAE calculator allows **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 performance.

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 above, 62% of the truck fleet is EURO VI (the estimated share by 2020). The results show no environmental merit when using MGO, and the external costs incurred per unit are 44.7 € higher in the MoS when compared to the road-only alternative. Conversely, when using LNG the situation is reversed and yields a positive savings of 51.9 € in external costs per unit in the MoS alternative. All CO_2, SOx, NOx and PM are reduced when using LNG, also at port (when auxiliary engines are also LNG-run).

Therefore, in the 'Parallel 2020' example and according to the scheme design, switching to LNG would generate a positive eco-incentive of 51.9 € per truck to MoS users.

To assess the effects of the eco-incentive measure in the targeted market, including whether such effects would allow the business case to generate costs for shipowners related to green actions, are the goals of the following tools.

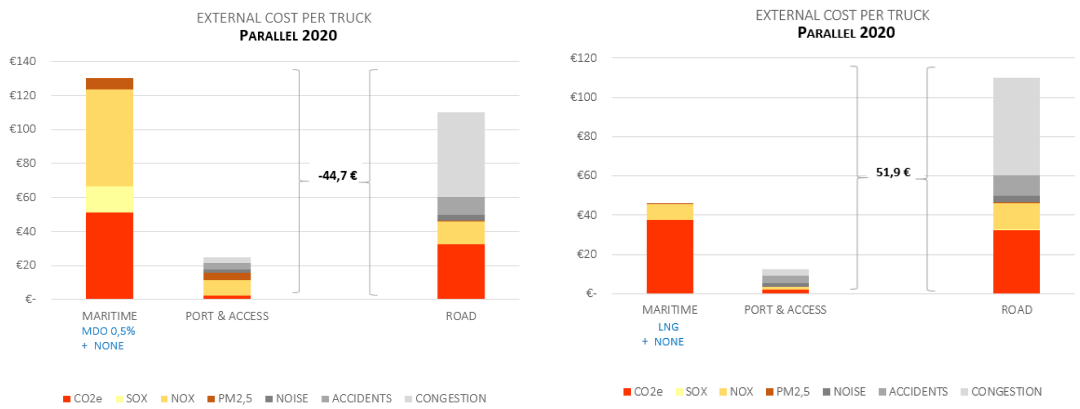

Figure 8.- MAE external cost calculator (MGO -left-, vs LNG -right-). Parallel 2020.

Transport modeling tool

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

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

Calibration is considered satisfactory despite the lack of available data, which is the main limitation in this kind of modeling tool. As a result, the tool is valid and ready for simulation.

It should be noted that MAE Action, as initially proposed when participating in the CEF call, included a specific task to update Pyrenees and Alps transport observatories, supported by the French, Italian and Spanish administrations. The aim was to secure the statistics needed to calibrate the modeling tool. When the Action was awarded, financing was cut due to oversubscription and this budget line was removed. Nevertheless, calibration was completed, as mentioned, without prejudice to the possibility of a future improvement when new statistics 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 maritime network density.

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

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

The main features of the modeling exercise are summarized below.

Methodology to design and calibrate the models in each region uses the classic **four-step transport modeling** approach. In a typical *micro* approach, this involves calibrating four-step models, with the following scopes: (i) Global mobility model, (ii) Spatial distribution model, (iii) Modal choice model, and (iv) Route assignment model (e.g. modeling the maritime choice amongst MoS).

However, due to insufficient data and the fact that available data are from different sources (resulting in unharmonized information), an aggregated *macro* approach was taken. In this *macro* approach, each available data is presumed representative of a group of individual travels. Few statistic errors arise from this assumption. Finally, in the aggregated approach, the spatial distribution model is integrated into the global mobility model.

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

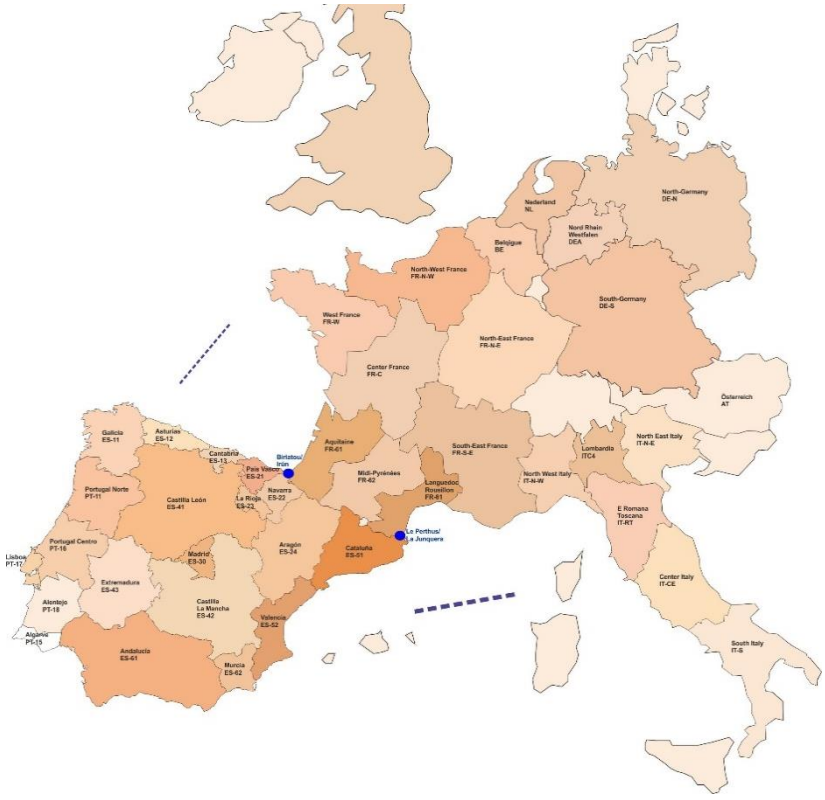

Figure 9.- Mobility model. Influential area and zoning. MAE case-study

It comprises 20 zones in 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 initially considered. However, 26 of these have no actual traffic in the sample and have been ruled out to avoid statistical issues.

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

The explanatory variable used in the **mobility model** is each zone's Gross Domestic Product (GDP). It is commonly accepted and statistically confirmed that freight mobility (general cargo in particular) between two different zones increases or decreases according to GDP evolution in both zones.

As an example, the figure below shows growth rate evolution for both total GDP and freight mobility in the analyzed area. The result is obvious: freight mobility grows in the same way as GDP but at a higher rate. This pattern is what the mobility model replicates for each O-D pair.

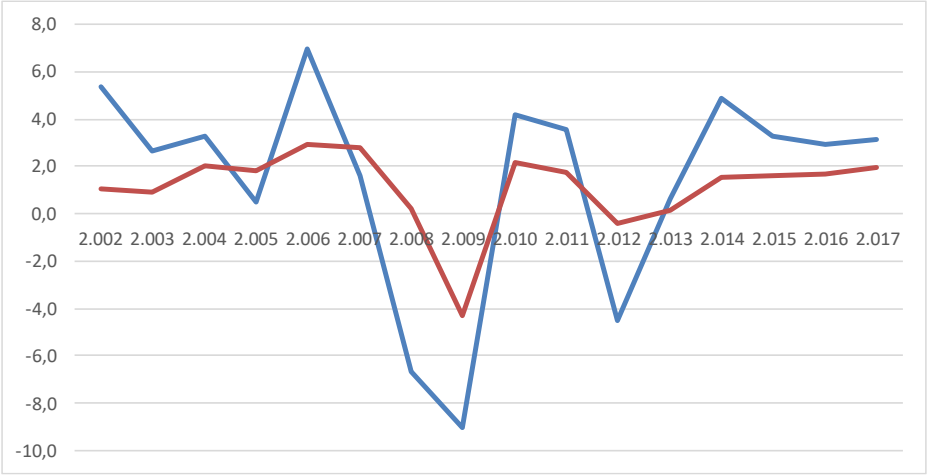

Figure 10.- Total freight mobility (in blue) and GDP (in red) growth rate evolution in the area of influence

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

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

The model formulated for both the West Mediterranean and Atlantic regions is a **binary logit**, a commonly accepted approach for modal choice modeling.

The following statistic sources have been used for calibration. For road-only, extensive Transyt survey campaigns carried out in 2004 and 2010 by the Spanish and French Governments as part of their statistical observatory of the Pyrenees. For MoS, sources are more limited. In the West Mediterranean, the only available sources of quantitative data are taken from EU projects[48]. In addition, an analysis of the Italian Ecobonus experience mentioned above provides some useful information. Finally, direct information from transport operators, ports, etc. has also been used. As for the Atlantic, the only available data for the maritime leg derives from a Gijón-Nantes MoS user survey, completed during 2010 and 2011.

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

As an example, the next figure shows for both the Atlantic and West Mediterranean markets modal share variations between the road-only and maritime-road (MoS) options, based on price differences. As shown in the figure, maritime services in the Atlantic need greater price effort to achieve the same share as the West Mediterranean. This result is consistent with reality, as the Atlantic MoS network is not as developed as in the West Mediterranean and needs to cover longer distances in order to be price-competitive when 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).

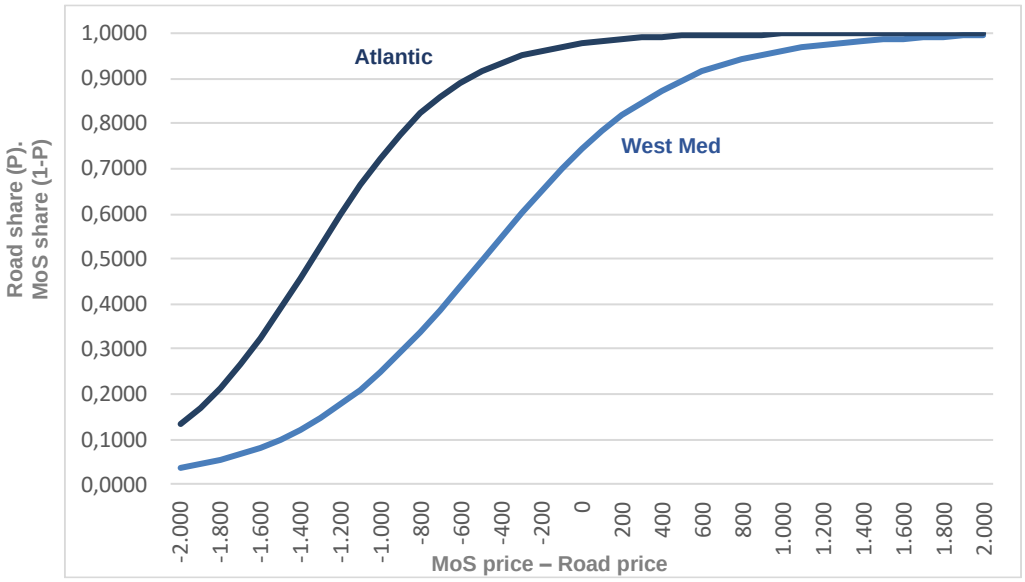

Figure 11.- Road/MoS sharing (%) vs price gap (€). Atlantic and West Mediterranean

Another interesting result of the calibrated models is related to demand elasticity to price values for each area's maritime services (Atlantic and West Mediterranean), as shown in the next figure:

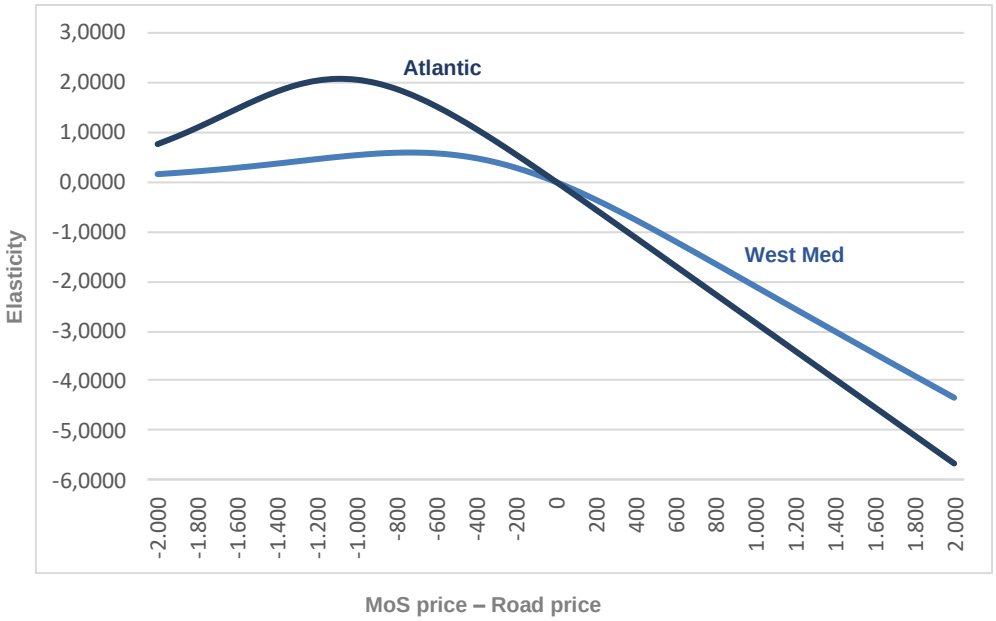

Figure 12.- Elasticity of the Road/MoS sharing to price gap. Atlantic and West Mediterranean

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

Finally, the last step for the complete transport modeling tool is **route assignment model** design and calibration. This particular model intends to replicate the share of the maritime option between the various MoS considered, for each O-D pair. The aforementioned specific report includes a full description of the model's design and calibration. Some of its main features are described below.

The model's design follows the same approach as the modal choice model and is also based on a logit formulation.

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

As for **maritime prices**, which play a significant role in the model, information is taken from various sources, including direct consultations to maritime operators. However, real prices always suffer from a lack of transparency. Price differences between accompanied and non-accompanied units have been considered, if available, using average amounts depending on actual line performance. As an estimate, maritime prices result in unit prices for the maritime leg (including port dues) that are below 1 € per unit-km. Moreover, the market analysis has observed that it is possible to run a line in competitive price market conditions when compared to the road-only alternative with more than 50% vessel occupancy. Nevertheless, this is considered a minimum threshold. In fact, the eco-incentive calculation later uses 70% occupancy on average as a reference.

The following **lines** were considered for calibration:

West Mediterranean:

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

Atlantic:

- Bilbao/Santander-Zeebrugge/Amsterdam/Rotterdam
- Bilbao/Santander-United Kingdom
- Gijón-Nantes
- Vigo-Nantes
- Leixoes-Zeebrugge/Amsterdam/Rotterdam
- Lisboa/Setúbal/Sines-Zeebrugge/Amsterdam/Rotterdam

Some of these lines do not currently exist, whilst some existed in the past. However, they are expected to reasonably operate in the targeted market as of 2020.

Finally, as a result of the 4-step modeling exercise, the complete modeling transport tool is calibrated.

As already mentioned, calibration is considered acceptable under statistic parameters. By way of illustration, the following tables compare observed and estimated values in both the West Mediterranean and 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 tons)

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 tons)

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 tons)

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, of interest in the West Mediterranean is that the model adequately replicates the values observed in the period 2008-2010, thus including the effects of both the Italian Ecobonus program and the financial crisis. This final consideration underscores calibration quality.

Consequently, the calibrated tool is ready to simulate future scenarios with operating eco-incentive measures, generating for each scenario effects on

demand and external costs in each alternative (MoS and road-only) when used in combination with the external cost calculator.

As already mentioned, the tool is an excel spreadsheet with all supporting tables, and is available for download together with the specific report (including the market analysis and details of the design and calibration of both the Atlantic and West Mediterranean models).

Ultimately, this tool constitutes a valuable contribution from the MAE Action, of interest for market studies 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 directly granted to maritime service users (i.e. demand approach). However, the main goal of the eco-incentive measure is to help improve MoS environmental performance through green actions. These actions, incurring costs according to eligibility criteria, should be implemented by shipowners, even though they do not directly benefit from the grants.

On the other hand, the modeling tool will show the extent to which these eco-incentives generate additional MoS demand which, in turn, will indirectly generate extra income for the shipowners.

Next, the ex-ante analysis should assess whether this additional income is financially attractive for shipowners to incur green action costs on a market basis. This particular **financial assessment** is completed with the shipowners' perspective tool.

Basically, this tool simulates cashflows and relevant financial indicators that shipowners may consider when deciding to invest in green action (i.e. switching to LNG in the case-study).

The methodological approach is very practical, exclusively based on the relevant concepts of a standard shipping line operating account. Moreover, it only simulates the main financial outputs usually considered to assess business decisions.

In addition, the tool is able to assess compatibility with applicable state aid rules. In this regard, please note that Maritime and MoS Guidelines[49] would apply to shipowners as indirect beneficiaries following the EC's interpretation in its Decision on the one-year extension of the Italian Ecobonus program[50]. Shipowners should therefore meet the requirements laid down in those

[49] See notes 35, 37.

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

guidelines, to particularly include the amount of aid over maritime service operational costs estimated through the shipowners' perspective tool.

The shipowners' perspective tool is provided as an excel spreadsheet for easy use and understanding, like the other tools. The excel file is available for download together with a technical report including a brief description of the tool's design and functioning and practical examples (see APPENDIX 2).

As in the other tools, the main features and assumptions followed to design this particular tool are summarized below.

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

Following the previous design of the ex-ante analysis, 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 presumed that an investment decision on a new LNG vessel (i.e. green scenario) would prevail over an investment decision on a new vessel running with conventional low sulfur fuel, in order to be compliant with the Sulfur Cap Regulation by 2020 (i.e. baseline scenario).

Both scenarios (green and baseline) are described below.

In other words, investing in a new vessel is considered to be a **market decision** and is therefore not within the scope of the eco-incentive scheme. Instead, green action involves an additional investment for greener vessel performance, which is the goal of the eco-incentive measure. This is almost the same approach followed by the CEF when funding innovation and new technologies (the investment's innovative part only is considered eligible). In any case, this assumption isolates the ex-ante analysis from market issues that should not fall within the scope of the eco-incentive measure, following the common EU approach.

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

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

In an eco-incentive situation, shipowners benefit from **additional income** due to additional incentivized demand. Based on additional demand, provided by the

[51] An additional calibration is available in APPENDIX 2 as an example, simulating the case of green actions consisting of a scrubber combined with a selective catalytic reduction system (SCR).

modeling tool, additional income is estimated with net sea rates (i.e. net vessel contribution, excluding port costs paid by freight units).

On the other hand, in a non-eco-incentive situation, there is no additional income.

This approach to tool design involves some additional features mentioned below.

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

PARAMETER	DESCRIPTION
Nautical miles	• Distance from port of origin to port of destination
Lane Meters	• Vessel freight capacity
Average vessel speed	• Average operational speed of the vessel in 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 (tons)

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. For this, accredited references have been considered. In financial terms, the interest rate and residual investment value have been used in these calculations. The tool allows direct entries on specific values for the weighted average cost of capital (WACC) and residual investment value, depending on its lifetime.

When estimating additional income in an eco-incentive situation, a total duration of 5 years is considered, according to the eligible period. However, the tool is also able to simulate different durations.

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

Apart from these outcomes, the tool also provides two **additional ratios**.

On the one hand, the amount of indirect shipowner income over operational costs for each MoS. This indicator is able to assess state aid compatibility, following applicable rules. Indeed, maritime rules would apply to shipowners as indirect beneficiaries, as previously mentioned. According to these rules, the amount of state aid per line should remain below 30% of the line's operational costs (or below 35% when combined with EU funding). Strictly speaking, aid per line should be treated the same way as additional shipowner income. In any case, even if the total amount of state aid is considered instead of additional income, the assessment is still relevant (e.g. in the Atlantic region the amount of the additional shipowner income is even higher than state aid).

Finally, the tool estimates total indirect income over the additional investment incurred with green actions in each MoS. This indicator may be treated as a co-financing rate that the shipowner could expect from the green action, highlighting the financial attractiveness of the eco-incentive measure for the shipowner over other possible means of financing (i.e. co-financing rates in the current CEF).

Simulation scenarios

Ad hoc tools have been developed 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 assess how much the eco-incentive measure would contribute to the goals of the proposed scheme (i.e. improving environmental performance in MoS services whilst reducing social costs in road transport).

Following the regional perspective of the proposed common EU approach, other scopes and scheme designs at EU level should develop their own simulation tools, the main purpose of an ex-ante analysis.

As in any simulation, an ex-ante analysis should include a scenario definition. Scenarios should be selected according to assessment needs, including aspects which are critical to the eco-incentive measure's feasibility (e.g. estimating maximum budget needs).

Moreover, scenarios with and without an eco-incentive measure should be compared (the latter is the baseline scenario).

In addition, simulation requires that a scenario definition depend on the same variables considered in tool design.

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

- A **baseline scenario**, where all MoS behave conservatively and switch 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. Environmental merit is very limited, and no eco-incentive is given to users. On the other hand, the higher fuel cost 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 total line costs). This results in a modal back shift effect.

- A **green scenario**, with all lines switching to LNG vessels from day one. Sea rates are maintained. Environmental merit is the highest possible, including 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:

- The choice of LNG is exclusively based on the assumption that this option generates the greatest environmental merit from today's perspective. Thus, the green scenario will return the maximum eco-incentive possible and estimate maximum budget needs, one of the goals of an ex-ante analysis.
- The lines considered for simulation as part of the targeted market are the same ones considered to calibrate the transport modeling tool. No new lines are therefore considered as a result of the eco-incentive measure, particularly in the green scenario. As already mentioned, the aim of the eco-incentive is not market development, as was the case of past start-up aid, but to improve 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 vessel frequency (maximum of 3 departures per week) or capacity (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 available official GDP forecasts for each zone, with a default growth rate of 2%/year.
- An average vessel occupancy rate of 70% is presumed in order to measure socio-environmental merit and calculate the eco-incentive.
- Transport prices and external costs are in constant values for 2016.
- Road transport is mostly EURO VI in 2020, starting with an average external cost ratio of 0.11 €/truck-km in 2020 and reaching 0.10 €/truck-km as of 2024, based on external cost calculator assumptions.

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

Simulation and results

Once the eligibility criteria, tools and scenarios have been established, the targeted market may be simulated for both the West Mediterranean and Atlantic regions.

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

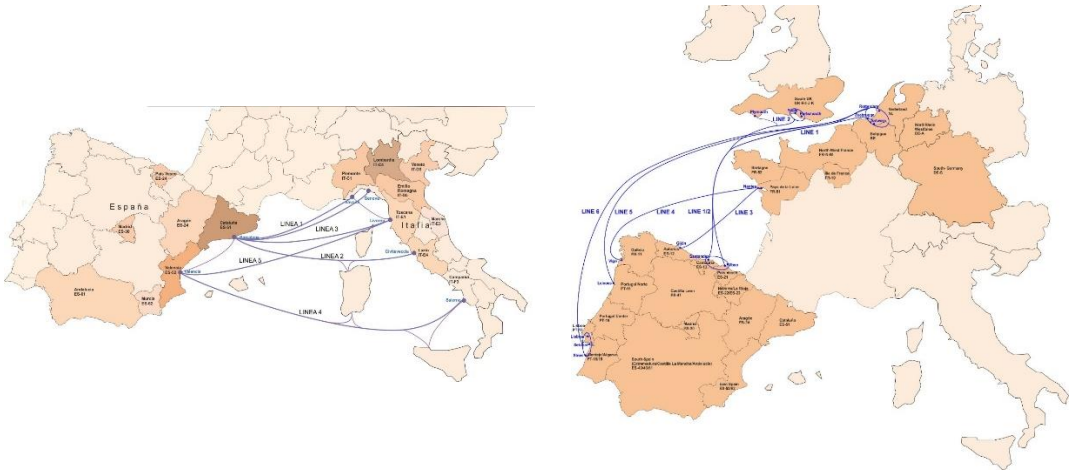

Figure 13.- MoS considered for simulation. West Mediterranean and Atlantic regions.

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

Sea distance and road distance in nautical miles (NM) and kilometers (KM). The lower the maritime distance over the road distance, the better the socio-environmental merit, as a kind of *geographical merit* (GEO) that influences the line's overall socio-environmental merit. 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%.

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

Finally, average vessel speed needs to be considered, with a great influence on environmental line performance.

The tables below show the values considered for our simulation, based on available data for existing MoS and estimates for the rest. In any case, the external cost calculator tool is able to include direct data if necessary. In this case, the tool would recalculate the line's socio-environmental merit and each 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 line performance.

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 line performance.

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

The following figure shows results per MoS from higher to lower values of the **eco-incentive per unit**. Bar color represents vessel speed, from the highest to the lowest (speed is one of the most influential parameters in environmental vessel performance).

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

Consequently, the greatest merit is achieved in the Valencia-Salerno MoS, which sails the longest maritime distance in the market, a 30% savings distance compared to the road-only alternative, and is operated by the largest vessel (3,810 lane meters) at 18 knots. At the bottom of the table, the Bilbao-

Zeebrugge (discontinued some years ago) suffers under the GEO factor as the route needs to circumvent the Brest Peninsula, sailing longer distances than the road-only alternative.

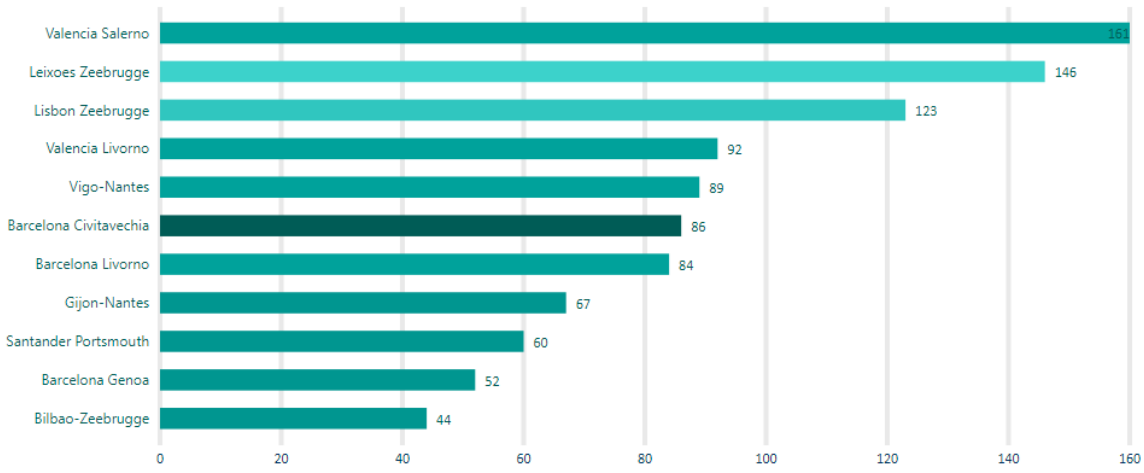

Figure 14.- Eco-incentive per line (€/unit). Green scenario (LNG). The darkest color is the highest vessel speed according to estimated line performance

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

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

Further to this reasoning, the next table presents eco-incentive values for each MoS as a percentage of 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
Gijón-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 actual sea rates. Green scenario

Eco-incentive values, which differ for each MoS, are implemented in the calibrated **transport modeling tool** as lower maritime prices. With the maritime price acting as one of the explanatory variables in both the modal choice and route assignment models, as previously described, the modeling tool will return effects on demand, to particularly include new traffic volumes per year in the road-only alternative and in each MoS considered.

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

As previously mentioned, simulation is able to compare both (baseline and green) scenarios, which is why effects on the targeted market due to the eco-incentive measure are actually the relative effects between the two scenarios.

In particular, the modeling tool will generate the following outcomes:

- **Effects on demand**, including new traffic shares for road-only and MoS alternatives. Demand is measured in number of units, using an average ratio of tons per unit based on observed values. This observed ratio is slightly higher in the MoS when 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 greater optimization in truck loads from road transport operators that are using regular maritime services as part of their logistics. In turn, it proves how multimodal transport with more mature logistics results in greater transport efficiency, contributing to sustainability in freight mobility. In the baseline scenario, the tool simulates maritime price increases leading to modal back shift effects.

- Total **external cost savings**. Total refers not only to savings generated by greener MoS performance, main goal of the eco-incentive measure, but also additional savings generated by the modal shift effect as a consequence of scheme design. The results will demonstrate that most savings are not a result of modal shift, given that a significant share of road transport is performing under EURO VI. In any case, modal shift does occur and will help reduce social costs, another one of the scheme's goals.

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

Finally, the **shipowners' perspective tool** will estimate additional income indirectly generated by the eco-incentive measure for shipowners through additional demand. As previously mentioned, such tool will be used to assess the extent to which this additional income is sufficiently attractive for shipowners to incur additional costs on green actions (i.e. additional investment for LNG vessels).

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

West Mediterranean

In the **green scenario**, all maritime service users receive an eco-incentive ranging from 161 €/unit to 52 €/unit depending on the MoS. The reasons for these differences per line have already been explained. Next, eco-incentive values are simulated for each MoS in the modeling tool, as discounts over sea rates.

ALTERNATIVE 1 GREENER (LNG)						Price incentive (%) Ext. Saving (%)				
						10 82	12 82	12 85	23 85	13 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, green actions in the maritime leg lead to a significant improvement in environmental MoS performance, generating external cost savings of 272 M€.

Moreover, as a result of the eco-incentive, freight operators are attracted to the MoS and 129,000 trucks are eventually shifted off the roads in the five-year period. This effect brings an additional 18.5 M€ external cost savings resulting in overall savings of 290.4 M€ in the targeted market. This figure includes external costs incurred by shifted trucks when accessing ports through urban areas, following the design of the external cost calculator.

The action cost is 98.3 M€ as direct revenues for road operators, whereas shipowners receive extra income of 58.9 M€ for 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 environmental MoS performance, generating total external cost savings of 148.5 M€, which is much lower than in the green scenario. This could be a way to adequately estimate expected savings in the targeted market due to the implementation of the Sulfur Directive (i.e. *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 Beneft (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 their sea rates by 12%. No eco-incentive is given to users. Aggregated effects for the period 2020-2024. West Med.

However due to the higher cost of such fuels, lines have to increase their sea rates by 12% over 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 lower average net loads observed in units using the road-only alternative, as explained before. This modal back shift effect leads to an increase in external costs of 15.7 M€. As a result, overall external cost savings in the baseline scenario total 132.7 M€.

No eco-incentive is given to any user in this scenario. On the other hand, due to the increased sea rate, users remaining at the MoS internalize a 67.6 M€ cost increase. Moreover, shipowners would have to internalize a financial loss of 51.3 M€ due to (back) shifted units.

As mentioned above, the **actual merit** of the eco-incentive measure should be assessed according to the difference between green and baseline scenario effects.

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 and baseline scenarios. West Med.

Both scenarios encourage **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, fair contribution to sustainability under the eco-incentive scheme would be the difference between external cost savings in each of these two scenarios. This difference totals 157.7 M€, of which 123.5 M€ is a direct result of improved environmental performance in the MoS whereas 34.2 M€ are accounted for by modal and modal back shift effects in green and baseline scenarios respectively (i.e. similar effects with opposite signs).

This figure of 34.2 M€ also means that 240,000 trucks are off the roads during the five-year period under analysis, leading to a net reduction in social costs, another goal of the eco-incentive scheme together with greener MoS performance.

As a result, road congestion would be alleviated at some of the main bottlenecks in the Mediterranean CNC, such as .cross-border sections in the Pyrenees and Alps, which proves that incentivizing sustainable freight transport services can contribute to CNC priorities by complementing infrastructure measures (i.e. investments).

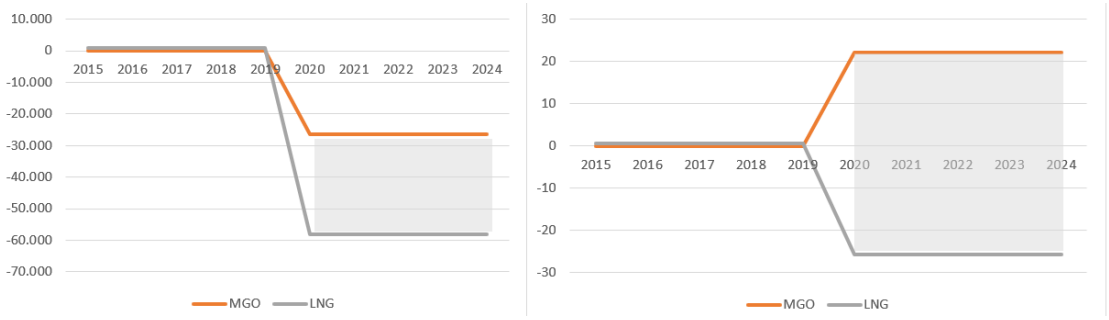

Figure 15.- Relative impacts on total external cost savings (left) and modal shift (right) comparing the green and the baseline scenarios. Costs (€ x 1000). Volumes (units x1000). West Med.

In order to estimate maritime service **user benefits,** two opposite effects shall be reconsidered. In the green scenario, all users will be given the eco-incentive. In the baseline scenario, all users will be subject to a 12% increase in the maritime price. If both effects with opposite signs are added, net user benefits as a result of the eco-incentive scheme would reach 165.9 M€.

The same applies to net **shipowner benefits**, with two effects of opposing signs in each scenario (i.e. additional income in the green scenario and potential losses in the baseline scenario), totaling 110.2 M€. However, only 58.9 M€ in additional income obtained by shipowners in the green scenario will be used to assess the weight of the eco-incentive scheme in the shipowner's decision to launch a green action.

Finally, the **total cost** of the eco-incentive measure, based on all these effects, would be 98.3 M€.

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

The slight difference in total mobility in scenarios with and without eco-incentive is due to a lower average of net load observed in 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
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.

Finally, additional shipowner income allows a **financial assessment** of shipowner 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, taking additional income on the one hand and additional CAPEX and OPEX on the other.

The following considerations apply to the assessment.

Additional income is calculated as net vessel contribution from additional freight units in the green scenario, using specific sea rates in each MoS. For this purpose, port costs payable by freight units have been excluded from the sea rates.

Additional CAPEX is estimated as the difference between the LNG and conventional vessel investment costs (green and baseline scenario respectively), based on the number of vessels operating the line.

This estimate is based on updated DNV-GL publications (e.g. incremental investment for an LNG-fueled vessel could range from 600 €/kw to 840 €/kw)[53].

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

	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 financial results in green action in the West Med (per line).

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

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

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

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

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

The main contribution of the eco-incentive scheme to the shipowners' perspective is to trigger an investment decision. Through additional income, shipowners may require less paybacks and receive a significantly greater return on investment (over 30% increase on average).

Only in one case has the green action's financial impact clearly demonstrated a funding gap in the situation with no eco-incentive.

On the other hand, additional shipowner income over total operational costs in maritime services in all cases remain way below 30%. This would be compatible with both the Maritime and MoS Guidelines on state aid rules for maritime

[54] See note 52.

transport, even if the total amount of state aid is considered in the assessment instead of additional income.

Moreover, extra income over additional investment needs ranges from 32% to 49%[55]. From a shipowner's perspective, percentages could be presumed to be co-financing higher rates than standard 20-30% rates in the current CEF. To a certain extent, scheme design improves the leveraging of public funding.

Finally, the fact that the eco-incentive measure is in itself helping minimize the risk of demand makes it reasonable to think that this eco-incentive scheme may grant shipowners better access to EU financial instruments for the launching of green actions. The effect would be like a full circle, where shipowners improve their financial conditions, the use of EU financial instruments is increased and, ultimately, the leverage effect of EU support is improved.

Atlantic

Following the same approach as in the West Mediterranean, simulation results in the Atlantic are presented below.

In the **green scenario**, all maritime service users receive an eco-incentive ranging from 146 €/unit to 44 €/unit depending on the MoS. The reasons for these differences per line have already been explained. Next, eco-incentive values for each MoS are simulated in the modeling tool as discounts over 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, green actions in the maritime leg significantly improve MoS environmental performance, generating external cost savings of 196.0 M€.

Moreover, thanks to the eco-incentive, freight operators are attracted to the MoS and 157,000 trucks are ultimately shifted off the roads in the five-year period. This effect brings an additional 30.7 M€ external cost savings,

[55] The Genoa-Barcelona line is not considered in this analysis. As most of the route is not eligible (Tangier-Genoa), results could be inconsistent.

representing overall savings of 226.7 M€ in the targeted market. This figure includes external costs incurred by shifted trucks when accessing ports through urban areas, following external cost calculator design.

The action cost is 49.8 M€, as direct revenues for road operators, whereas shipowners receive additional income of 105.3 M€ for 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 MoS environmental performance, generating external cost savings of 100.8 M€, which is much lower than in the green scenario. As previously mentioned, this could act as an adequate estimate of expected savings in the targeted market due to implementation of the Sulfur Directive (i.e. *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 their sea rates by 12%. No eco-incentive is given to the users. Aggregated effects for the period 2020-2024. Atlantic.

However due to higher fuel cost, lines must increase their sea rates by 12% over current prices, leading to a modal back shift effect calculated as 133,000 units off the MoS. These units are converted into 152,000 additional trucks back on the road due to lower average net load observed in units using the road-only alternative, as explained before. This modal back shift effect causes an increase in external costs of 29.0 M€. As a result, overall external cost savings in the baseline scenario are 71.7 M€.

No eco-incentive is given to any user in this scenario. Conversely, due to higher sea rates, users remaining at the MoS internalize a cost increase of 56.9 M€. Moreover, shipowners need to internalize a 120.5 M€ financial loss due to (back) shifted units.

As mentioned above, the **actual merit** of the eco-incentive measure should be assessed as the difference between 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 encourage 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 sustainability contribution under the eco-incentive scheme would be the difference between external cost savings in each of the two scenarios. This difference is calculated as 155.0 M€, of which 95.3 M€ are a direct consequence of improved MoS environmental performance whereas 59.7 M€ are accounted for as the modal and modal back shift effects in green and baseline scenarios respectively (i.e. similar effects with opposite signs).

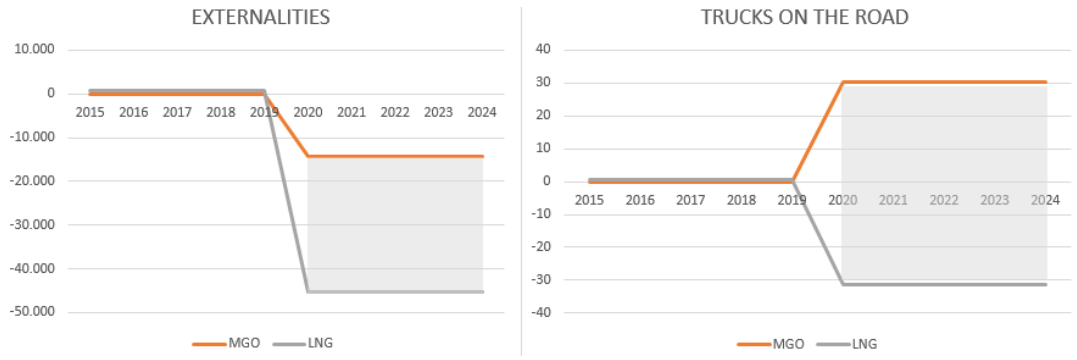

Figure 16.- Relative impacts on total external cost savings (left) and modal shift (right) comparing the green and the baseline scenarios. Costs (€ x 1000). Volumes (units x1000). Atlantic.

The 59.7 M€ figures also represents 309,000 trucks off the roads during the five-year period under analysis, leading to a net reduction in social costs, another goal of the eco-incentive scheme together with greener MoS performance.

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

In order to estimate maritime service **user benefits,** two opposite effects are reconsidered. In the green scenario, all users are given the eco-incentive. In the baseline scenario, all users will be subject to a 12% increase in the maritime

price. When both effects with opposite signs are added, net benefits to users as a result of the eco-incentive scheme total 106.7 M€.

The same applies to net **shipowner benefits**, with two effects of opposite signs in each scenario (i.e. additional income in the green scenario and potential losses in the baseline scenario), totaling 225.8 M€. However, only 105.3 M€ in additional income obtained by shipowners in the green scenario will be considered to assess the weight of the eco-incentive scheme in the shipowner's decision to launch a green action.

Finally, the measure's **total cost**, based on all these effects, would be 49.8 M€.

In **market share** terms, with no action taken, aggregate growth in road-only transport would reach 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 MoS would remain at its current 3%. Conversely, with the eco-incentive measure, growth in road-only transport would be reduced to 18% and the MoS share would increase to 5% in the targeted market.

The slight difference between total mobility in scenarios with and without incentive is due to lower average net load observed in 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, estimated additional income for shipowners allow a **financial assessment** of the eco-incentive scheme from a shipowner's perspective.

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

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

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

		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 financial results of the green action in the Atlantic (per line).

The main contribution of the eco-incentive scheme to shipowners is, again, to trigger an investment decision. Through additional income, shipowners are required fewer paybacks and receive a significant increase in return on their investment (with IRR occasionally exceeding 20%).

Only in a few cases has the financial impact of green action clearly demonstrated a funding gap in the situation without an eco-incentive.

Moreover, please note particularly for the Atlantic market that additional shipowner income exceeds total revenues of road operators (in the West Mediterranean market the ratio is about 60%). This leverage effect is due to greater demand elasticity in the Atlantic when compared to the West Mediterranean as a result of calibrated models.

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

On the other hand, extra income over additional investment needs generates values that mostly exceed 50%. As mentioned before, these values may be interpreted by shipowners as higher co-financing rates when compared to standard 20-30% rates in the current CEF.

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

Aggregate results

The **main aggregate results** are summarized below for both the West Mediterranean and Atlantic regions, over the entire 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 financial investment conditions. Indeed, the eco-incentive scheme may generate additional income of 164.2 M€ for shipowners in order to trigger investment decisions in market conditions covering 343.0 M€ in green actions.

As a result, **overall external cost savings of 312.7 M€** would be attained, of which 218.8 M€ are directly generated by improved environmental performance in the MoS, as the main goal of the scheme design. In addition, 93.9 M€ would be saved from another **550,000 HGV secured off the roads**, reducing social costs in the targeted market.

According to the MAE calculator[56], 27.9 M€ of the total 312.7 M€ in external cost savings are a consequence of a net decrease of 820,000 tons in CO_2 equivalent[57], representing 27% of all estimated carbon emissions in the targeted market.

The cost of the public funding measure would be **148.1 M€** (i.e. total eco-incentives granted to MoS users during the five-year period). This would represent the **total budget** mobilized by the MS involved in the eco-incentive scheme, provided that there is EU co-financing, according to the common EU approach.

[56] The MAE calculator is based on the 2014 version of the EC Handbook on External Costs of Transport (see note 46) except for carbon pricing, which uses 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 by 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 economic appraisals of investment projects (below 50 €/ton CO_2 equivalent in the period 2020-2025).

[57] Calculated with 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.

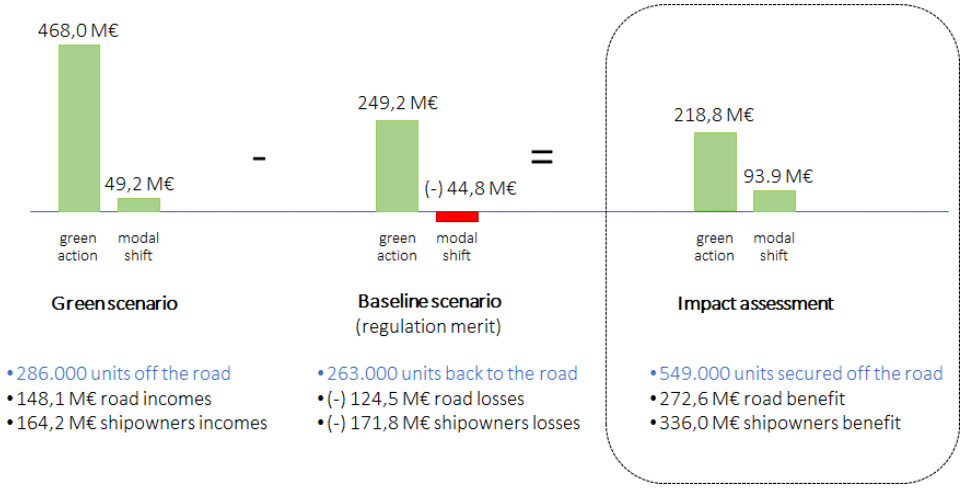

Figure 17.- Main effects of the eco-incentive measure. West Med and Atlantic.

Following this approach, EU co-financing could be based on the eco-incentive measure's actual contribution to decarbonization whereas a reduction in air pollution and social costs savings could be allocated to MS budgets. In this case, EU contribution to the scheme would be 27.9 M€ of 148.1 M€, leading to a **co-financing rate of 19%**[58] that is under the maximum rate for sustainable freight transport services in the current CEF.

From an EU funding perspective, 27.9 M€ would entail 8% of 343.0 M€ on green investments, a much lower contribution than standard co-financing rates for LNG deployment in the current CEF (e.g. 20-30 %).

This is possible due to MS involvement, which is not the case of green actions under the current CEF approach. Indeed, at national level, MS support is directed through national schemes that are usually developed outside the CEF and are not interrelated. Conversely, a combination of EU and MS support generating 148.1 M€ would provide shipowners with a co-financing rate of 41% for 343.0 M€ in green investments, which is significantly higher than the current rates received through the CEF. Ultimately, the eco-incentive scheme would offer better funding terms to shipowners, albeit indirectly (through additional demand).

In aggregate, with total eco-incentives of 148.1 M€, shipowners would indirectly benefit from additional income of 164.2 M€, triggering a 343.0 M€ investment in green actions and totaling 312.7 M€ in external cost savings in the targeted market. This leveraging under the scheme design (demand approach) proves to

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

be positive and higher in the Atlantic, due to higher demand elasticity in this market, explained through the modeling tool. We may interpret this as greater potential for MoS development in the Atlantic.

In any case, external cost savings are mainly due to improved environmental performance in the maritime leg. In addition, there is a reduction in social costs due to 550,000 HGV secured off the roads, which is why both goals of the eco-incentive scheme are achieved.

In legal terms, the degree of public support in comparison to maritime service operational costs would be compliant with applicable state aid rules. And considering that these rules need to be amended, as mentioned above, it is presumed that the 5-year period would be compatible with state aid in combination with EU funding.

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

Considering all of the above, the impact assessment has positive results.

Finally, when assessed with the shipowners' perspective tool, green actions hardly indicate any funding gap. However, the eco-incentive scheme would clearly improve the financial conditions of such actions, thus stimulating a shipowner's investment decision.

This outcome reflects the potential role of eco-incentive measures when the current approach[59] is not able to stimulate actions that could most help improve the socio-environmental performance of freight transport services.

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

On the other hand, LNG is not the only alternative available to shipowners in order to comply with the environmental regulation (to particularly include the sulfur cap by 2020). Indeed, other alternatives exist that are compatible with such regulation, involving investments way below LNG costs. However, when it

[59] Action grants taking the form of reimbursable eligible costs using the funding gap principle to estimate EU support.

[60] According to the provisions of the Alternative Fuels Directive (see note 15).

comes to maritime transport, LNG is currently the investment decision generating the most environmental benefits to the EU.

Therefore and according to the background described at the beginning of this document, eco-incentives could stimulate actions available at each moment in time generating the greatest socio-environmental benefits to the EU and MS in market terms, regardless of the size of the funding gap.

Legal, Administrative and Technological considerations

According to the common approach, an ex-ante analysis should also provide enough legal, administrative and technological background on the scheme to enable a full assessment. These matters also are relevant for the scheme's feasibility, particularly at the implementation stage.

In legal matters, some items have already been discussed in previous chapters on state aid rules. As already mentioned, a complete review and analysis was completed in relation to the MAE Action (see APPENDIX 2).

The following particular considerations apply to the MAE case-study.

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

Moreover, the scheme design follows a similar approach to the one used in the Italian Ecobonus program regarding implementation of the eco-incentive measure (i.e. a demand approach where the eco-incentive is granted to MoS users). State aid would consequently be implemented in a non-discriminatory way without adversely affecting the targeted market 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 eventually considered shipowners as state aid beneficiaries too[64].

[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.

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

The 2004 guidelines are currently in force and enable state aid for short sea shipping provided that certain conditions are met:

- Maximum duration of three years
- Granted to maritime services connecting ports within MS territory.
- Freight cargo by road is able to be carried by sea, in whole or in part.
- With a pre-established environmental impact.
- Only new routes involved, or an upgraded existing service.
- Covering up to 30% of maritime service operational costs.
- Granted with transparent criteria and applied to shipowners in a non-discriminatory way.
- Commercial feasibility of the maritime service after three years.

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

All of the above conditions are met by the scheme design of the case-study, particularly through the aforementioned eligibility criteria.

However, it is quite clear that Maritime Guidelines are conceived for **start-up aid** to set off initial losses in new or upgraded maritime services (i.e. to develop new markets). This is no longer the aim of eco-incentive measures, as described above, which is now to stimulate mature markets for a green transition on a rolling basis. This may be the subject of debate, as previously discussed. In any case, these conditions are fulfilled for the MAE case-study.

Moreover, as **MoS Guidelines** refer to MP and former TEN-t programs they are completely obsolete and need to be accommodated to current CEF standards as mentioned above.

As regards **administrative and technological issues**, a preliminary analysis has been carried out on a possible scheme implementing process, to also include its legal concerns, which is available for download (see APPENDIX 2).

These aspects are of the utmost importance to the scheme's effectiveness and further viability since they are the implementing pipeline of the eco-incentive measure. In turn, this pipeline becomes critical for compliance with some principles of the common EU approach, such as the need to minimize the risk of

[65] See note 35.

[66] See note 37.

fraud and additional bureaucracy, the need to demonstrate achieved performance and to adequately ensure consistency with the operational structures of the EU funding program to which the scheme is subject (e.g. CEF).

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

The analysis uses the experienced gathered in the Italian Ecobonus program, which was the first to implement the demand approach, addressing the MoS market through maritime service users. However, the scheme design in the MAE case-study differs from the Italian Ecobonus in many ways (e.g. including improved environmental performance of MoS as a requirement), requiring various procedures, particularly for shipowners. Nevertheless, it still directs the eco-incentive through demand with similar user procedures.

Please note that the analysis is only a **preliminary approach** to some key aspects that should be developed further if an action is actually implemented, including:

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

Moreover, in order to assess the scheme's compatibility with operational structures in 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 may be outlined in two separate diagrams, as shown in the next figure: the procedures that need to be completed in order to secure funding (both EU and MS), and, once funding is secured, the implementation process of the eco-incentive measure itself.

[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 (for the monitoring of the Sulfur Directive).

On the one hand, the procedure to award EU funding would be the usual one used in the current CEF. Accordingly, work programs should first incorporate eco-incentive schemes as eligible actions, following the proposed common approach at EU level. As for MS funding, the procedure requires the approval of national budgets and a compatibility assessment on state aid rules, as previously discussed. As mentioned, it is presumed that the maximum duration and intensity of state aid are updated to 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 an example), the MS involved would be responsible for preparing and submitting proposals in the relevant calls, as appropriate. When awarded, they would benefit from EU grants and would be in charge of implementing the eco-incentive scheme (to also cover state aid).

Since both assessments on the possible award of EU support and compatibility with state aid rules are interrelated and both depend on the EC (albeit in different DGs), internal coordination is necessary to streamline the overall assessment process.

The budget will only be available for the eco-incentive measure if the full assessment is positive and the proposal is awarded, for implementation of the scheme.

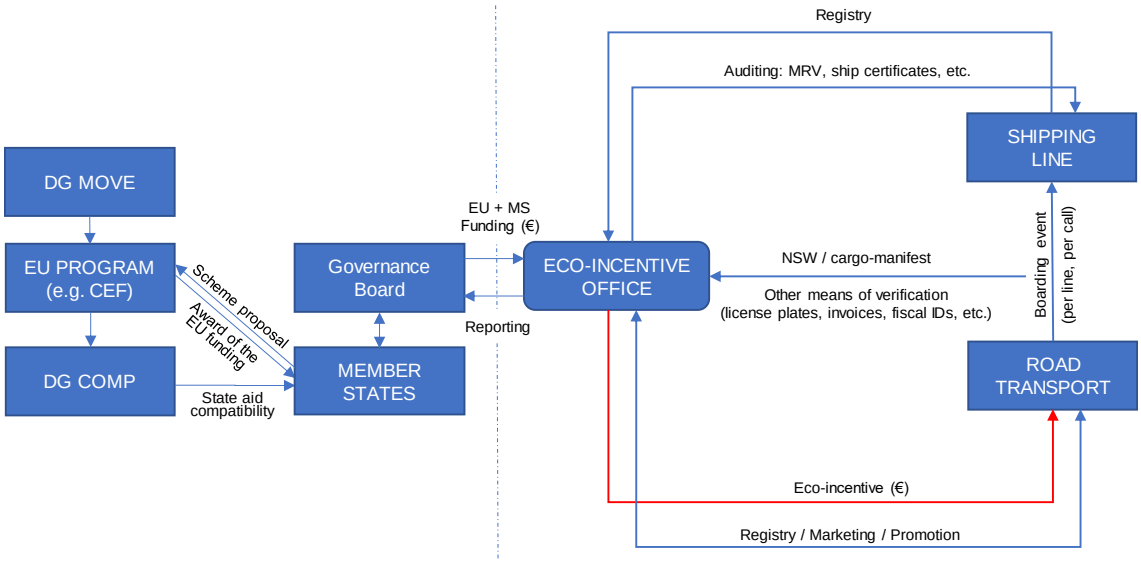

Figure 18.- Possible implementation chart for the eco-incentive scheme. MAE case-study

A major implementation issue is how beneficiaries may join and benefit from the eco-incentive scheme. Accordingly, a ***dual-call* mechanism** is proposed for the MAE case-study. The first call would be addressed to shipowners whereas the second one would be addressed to actual and potential maritime service users.

With the first call, shipowners would enroll in a management platform and submit MoS entitled to benefit from the scheme. At the time, evidence must be provided of the green actions taken to improve MoS environmental performance according to the eligibility criteria.

Only the lines that are running at the time of the call would be able to enroll. New lines starting after the call is announced would have to wait for the next call to enroll. Shipowner calls are announced each year within the eligible period (five years according to the eligibility criteria).

When enrolling, shipowners must provide all the information needed for MS assessment, including the estimated socio-environmental merit using the external cost calculator described. The assessment must also include fully comply with the scheme's eligibility criteria. As a result of the assessment, a list would be published of MoS where the eco-incentive may be granted, including eco-incentive unit values (per freight unit and MoS). This publication would serve as an announcement for current and potential MoS users (i.e. road operators). On a yearly basis, following each shipowner call, an updated list of eligible MoS would be published.

After the first list is published, a second call would be announced to users, the ultimate direct beneficiaries.

With this call, any user that meet the eligibility criteria should enroll in the management platform as a requirement for an eco-incentive application. Later on, at the application date, users must provide evidence of boarding events with formal declarations as, otherwise, no eco-incentive will be granted. Unlike the shipowner call and in order to reduce any extra bureaucracy, this user call may remain open for the entire 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 requirement for approval of eco-incentive payment. In turn, it also helps reduce the potential risk of fraud. However, this process should not prevent users or shipowners from joining or benefiting from the eco-incentive scheme because of excessive bureaucracy. Based on these considerations, this particular process could combine three main sources of information:

- User declarations, including all boarding event data.
- Shipowner invoices
- Cargo manifest declared through the NSW.

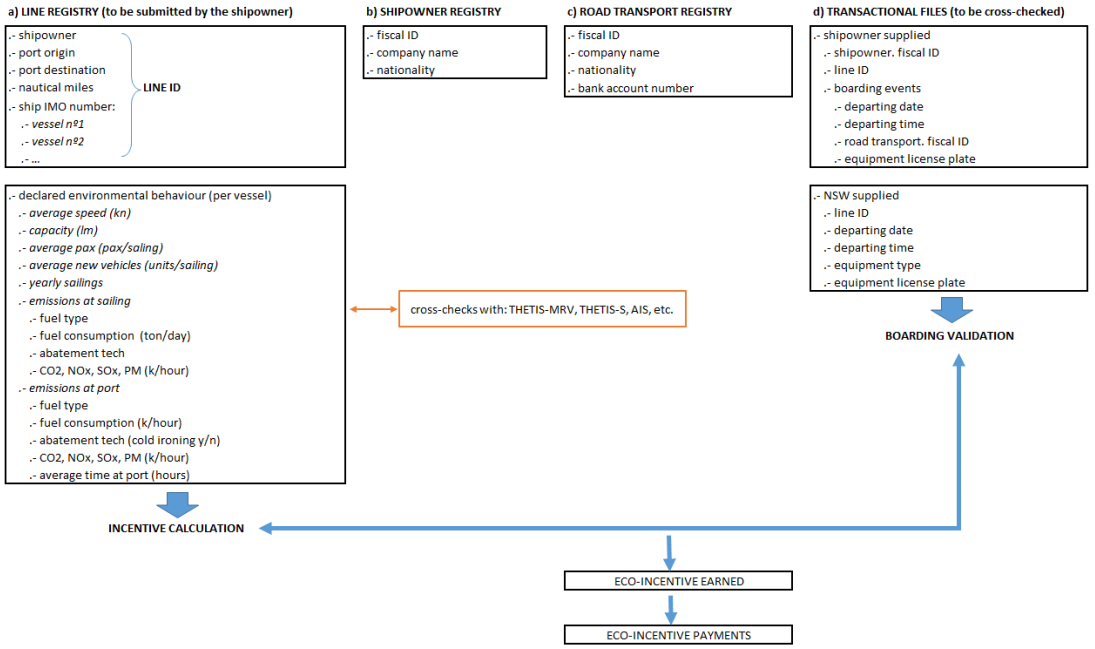

Figure 19.- Possible data request upon enrolment and transactional files. MAE case-study.

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

This means of verification has been researched and some issues identified that should be solved upon implementation. By way of illustration, registering license plates in the cargo manifests is not mandatory according to the current NSW regulation. However, it may be voluntarily included. Moreover, MS could address this particular issue during work in progress for furtherance of the European single window. In any case, this means of verification of boarding events is considered valid at this preliminary stage.

Finally, another critical check involves maritime services. The actual environmental performance of MoS should be monitored in order to control deviations from original values used to calculate the eco-incentive amount. If there are significant deviations, the eco-incentive should be re-calculated, in which case shipowners may be asked to provide specific information to allow a check at any time. Moreover, a cross-check with validated sources of information may be considered, such as THETIS or the Automatic Identification System (AIS).

In short, our preliminary investigation generates a positive assessment on the legal, administrative and technological aspects of the scheme design at the implementation stage. Certain issues require further analysis before actual implementation. However, the scheme design proves to be compatible at this stage of the analysis.

G. FINAL CONSIDERATIONS AND MOVING FORWARD

The MAE Action ends with a proposal and is intended for debate. A move towards actual implementation based on the proposed approach requires a broad consensus.

Preliminary contacts were made 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 of different actors as regards the sustainability goal in freight mobility, given the extraordinary challenges facing all modes of transport.

Secondly, to obtain better knowledge of the operational structures and specific technical, legal and economic fields where these actors play, representing the specific frameworks under which these challenges should be developed and achieved.

Further to these contacts, the MAE team was able to confirm at all meetings that there was willingness and an active sense of responsibility allowing joint effort under the sustainable mobility framework. Nevertheless, sector-specific priorities and constraints still undermine this great potential and require new approaches and triggering mechanisms.

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

Conversely, this decarbonization approach of transport operators changes when reducing 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 at the time they are monetized.

In these cases, transport operators are not stimulated and tend to accommodate their practices to strict compliance with sector-specific regulations setting environmental standards for each mode of transport. In

doing so, they seek to not jeopardize 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 or generated the commercial viability of the necessary technology to fully mitigate all emission factors. This requires common approaches to improve the effectiveness of public support, combining EU and MS action to stimulate the greenest solutions at any given time, including both global and local impacts.

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. Specific actions to attain such merits would be proposed by the transport market.

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

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

When estimating EU contribution to 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 Handbook on External Costs of Transport.

Consequently, eco-incentive measures would extend the scope of the current CEF approach, where only actions proving a funding gap receive EU support. This has proved to be an adequate approach for infrastructure investments as well as pilot actions in the field of innovation and new technologies. However, it may not be as effective to trigger actions with great socio-environmental benefits but with a nil or low funding gap. Such actions could make the case for eco-incentive measures. In other words, when there are multiple market alternatives that are compliant with binding regulations and can be adopted by stakeholders with almost no funding gap, there is no clear mechanism available

to grant positive incentives requiring that the market decide on actions that can achieve the greatest socio-environmental merits.

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

Moreover, when it comes to monetizing external costs, this regional approach will facilitate consensus among the MS involved as to the value of local factors, relegating global factors to a EU consensus.

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

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

On 28 November 2018, the EC presented a highly ambitious strategic long-term vision for a prosperous, modern, competitive and climate neutral economy[68]. Net-zero GHG emissions are envisioned for the EU by 2050, in line with the also highly challenging objective of the Paris Agreement to keep global warming well below 2°C and pursue efforts to keep it at 1.5°C. Transport is targeted along the way in this transition, as it accounts for approximately a quarter of all GHG emissions in the EU. All transport modes must therefore jointly contribute 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 its strategy to other decarbonization possibilities, including new or improved alternative fuels, improved efficiency, behavioral changes in companies by reducing or internalizing external costs, etc. Moreover, reducing air pollution, congestion, accidents and noise along with this transition to decarbonization is also mentioned in the strategy as regards local transport impacts, especially in urban areas.

On 13 April 2018, by means of a Resolution issued by the Marine Environment Protection Committee (MEPC), the IMO adopted an initial strategy for GHG emission reduction in ships[69]. This initial strategy is also mentioned by the EC 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).

[69] Resolution MEPC.304(72).

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's initial strategy is also very ambitious, 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 out GHG emissions from international shipping as soon as possible but within this century. However, the IMO's initial strategy sets certain targets such as a reduction in total annual GHG emissions by at least 50% by 2050 when compared to 2008, or a reduction in 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 must make an extraordinary effort to meet these ambitious targets. However, it is interesting to highlight this reference to carbon intensity (i.e. CO_2 emissions per transport work), which again requires transport efficiency as a means towards decarbonization, not necessarily based only on technology (e.g. increasing vessel capacity, optimizing cargo, reducing speed, etc.).

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

Finally, in June 2019, the EC published a new update of the Handbook on External Costs of Transport[72], the main common reference to measure and monetize external costs at EU level and, consequently, a fundamental cornerstone of the common EU approach on the eco-incentive measures proposed.

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

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

[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 a revision of Regulation (EU) 1315/2013 planned for 2020.

[72] See note 17.

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

H. APPENDIX 1 – List of references

- Amici della Terra; I vantaggi ambientali e sociali del trasporto merci via mare. I costi esterni della navigazione a confronto con strada, rotaia e aereo; 2001
- Boletín Oficial del Estado (España); Real Decreto 61/2006, de 31 de enero, por el que se determinan las especificaciones de gasolinas, gasóleos, fuelóleos y gases licuados del petróleo y se regula el uso de determinados biocarburantes; 2006
- Boletín Oficial del Estado (España); Bases reguladoras del concurso para la selección de autopista/s del mar entre España y Francia en la fachada Atlántico-Mancha-Mar del Norte (versión consolidada); 2007
- Boletín Oficial del País Vasco (BOPV); Orden de 30 de septiembre de 2008, de la Consejera de Transportes y Obras Públicas, por la que se convocan ayudas para el fomento del transporte combinado de mercancías; 2008
- Brittany ferries; Contribution de l'Union Européenne à l'amélioration de l'acessibilite des territories; Jean-Marc Roué; 2015
- Bureau de Promotion du Short Sea Shipping (BP2S); Ecobonus, from regional successful experiences towards an EU wide scheme? (presentation); 2012
- CE Delft; Handbook on estimation of external costs in the transport sector; M. Maibach, C. Schreyer, D. Sutter (INFRAS); H.P. van Essen, B.H. Boon, R. Smokers, A. Schroten (CE Delft); C. Doll (Fraunhofer Gesellschaft – ISI); B. Pawlowska, M. Bak (University of Gdansk); 2008
- CE Delft; External and infrastructure costs of HGVs in the EU28 in 2013; Arno Schroten, Sanne Aarnink; 2015
- CE Delft; Revenues from HGV taxes and charges in the EU28 in 2013; Arno Schroten; 2016
- CE Delft; SECA Assessment: Impacts of 2015 SECA marine fuel sulphur limits; Eelco den Boer, Saliha Ahdour, Harold Meerwaldt; 2016
- Centre for European Policy Studies and Economisti Associati ; Assessing the costs and benefits of regulation (final report); Andrea Renda, Lorna Schrefler, Giacomo Luchetta, Roberto Zavatta; 2013
- Chalmers University of Technology (Sweden); Capacity utilisation in short sea shipping; Linda Styhre; 2010

- Comisión Intergubernamental Hispanofrancesa; Modelo de Convenio de explotación de la Autopista del Mar entre España y Francia; 2007
- Community of European Railway and Infrastructure Companies (CER); A funding scheme supporting sustainable and efficient freight transport services (position paper); 2014
- Conference of peripheral maritime regions (CPMR); CPMR Atlantic Arc Commission Transport Working Group (speech); Francisco Martín; 2015
- Conference of peripheral maritime regions (CPMR); Update on the CPMR General Secretariat mobilisation on accessibility & transport (presentation); 2016
- Conference paper; Assessment of motorways of the sea through a method based on analysis of decision groups; Alicia Munin, Alba Martínez López, Daniel Peña; 2014
- Conference paper; The aggregate-disaggregate-aggregate (ADA) freight model system; Moshe Ben-Akiva, Gerard de Jong; 2008
- Conference paper; A European Ecobono. Addressing the need of a joint solution for the European Transport System; Juan José Usabiaga Santamaría; 2010
- Conference paper; Estimating impact of transport policies on MoS projects; Deepak Baindur, José Viegas; 2011
- Conference paper; Could subsidies for maritime freight transportation achieve social and environmental benefits? The case of ecobonus; Dimitrios Tsamboulas, Andrea Chiappetta, Panayota Moraiti, Iosif Karousos; 2014
- Council of the European Union; Council conclusions on the Mid-Term Review of the EU's Maritime Transport Policy until 2018 and Outlook to 2020 (Athens Declaration); 2014
- Council of the European Union; Council conclusions on priorities for the EU's maritime transport policy until 2020: Competitiveness, Decarbonisation, Digitalisation (Valletta Declaration); 2017
- Council of the European Union; Council Directive 92/106/EEC of 7 December 1992 on the establishment of common rules for certain types of combined transport of goods between Member States; 1992
- Decanato della Facoltà di Scienze economiche (Lugano); An Adaptive Conjoint Analysis of Freight Service Alternatives: Evaluating the Maritime Option; Angela Stefania Bergantino, Simona Bolis; 2004

ϕ Department for Environment, Food and Rural Affairs (UK); UK ship emissions inventory (final report); Entec; 2010

ϕ Department for Transport (UK); Guide to the Waterborne Freight Grant (WFG) Scheme; 2015

ϕ Department for Transport, Local Government and the Regions (DTLR), London; Economic Valuation with Stated Preference Techniques. Summary Guide; David Pearce and Ece Özdemiroglu; 2002

ϕ DFDS; DFDS Sustainability Progamme (presentation); 2016

ϕ DNV GL; Preparing for the MRV Regulation; 2015

ϕ ECORYS; Evaluation of the Marco Polo I Programme (2003-2006). Mid-term and ex-post evaluations; 2007

ϕ ECORYS; Evaluation of the Marco Polo II Programme (2007-2013). Ex-ante evaluation;2004

ϕ Environmental Impact Assessment Review; Assessment of external costs for transport project evaluation: Guidelines in some European countries; Umberto Petruccelli; 2015

ϕ Europe Economics Chancery House; Evaluation of the Marco Polo Programme (2003-2006) Final Report; 2011

ϕ European Automobile Manufacturers' Association (ACEA); Marginal social cost pricing in transport policy; Professor Rémy Prud'homme; -

ϕ European Commission; White Paper on transport. European transport policy for 2010: time to decide; 2001

ϕ European Commission; Community guidelines on State aid to maritime transport; 2004

ϕ European Commission; Motorways of the Sea. A Vademecum issued in conjunction with the call for proposals TEN-T 2005; 2005

ϕ European Commission; Community guidelines on State aid complementary to Community funding for the launching of the Motorway of the Sea; 2008

ϕ European Commission; Notification of an open call for proposals concerning Motorways of the Sea projects in the Baltic Sea area (2009 - 2013); 2009

ϕ European Commission; White paper on transport. Roadmap to a single European transport area - Towards a competitive and resource efficient transport system (including staff working document); 2011

ϕ European Commission; Guide to Cost-Benefit Analysis of Investment Projects. Economic appraisal tool for Cohesion Policy 2014-2020; 2014

ϕ European Commission; Questionnaire on a funding scheme supporting sustainable and efficient freight transport services; 2014

ϕ European Commission; Community guidelines on State aid for environmental protection and energy; 2014

ϕ European Commission; Fact-finding studies in support of the development of an EU strategy for freight transport logistics. Analyisis of the EU logistics sector; Ecorys, Fraunhofer, TCI, Prognos, AUEB-RC/TRANSLOG; 2015

ϕ European Commission; Fact-finding studies in support of the development of an EU strategy for freight transport logistics. Analysis of the EU Combined Transport; KombiConsult GmbH, Intermodality Ltd, PLANCO Consulting GmbH, Gruppo CLAS S.p.A.; 2015

ϕ European Commission; Motorways of the Sea Detailed Implementation Plan (1st and 2nd work programmes); Brian Simpson; 2016, 2018

ϕ European Commission; Vademecum for a better utilisation of EU instruments (on European funding for sustainable shipping); European Sustainable Shipping Forum; 2016

ϕ European Commission; Communication on a European Strategy for Low-Emission Mobility, including staff working paper; 2016

ϕ European Commission; Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union; 2016

ϕ European Commission; Proposal for a Council Directive amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures; 2016

ϕ European Commission; Commission staff working document. Refit ex-post evaluation of Combined Transport Directive 92/106/EEC. Final Report (SWD(2016) 141 final); 2016

ϕ European Commission; Commission staff working document. Refit ex-post evaluation of Combined Transport Directive 92/106/EEC. Executive Report (SWD(2016) 140 final); 2016

- European Commission; The 2011 Annual work programme under the second Marco Polo Programme; 2011
- European Commission; 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); 2013
- European Commission; 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: staff working document (SWD (2013) 174 final); 2013
- European Commission; 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); 2013
- European Commission; The 2013 Annual work programme under the second Marco Polo Programme; 2013
- European Commission; Projects selected for funding under the Marco Polo I & II programmes; 2003-2012
- European Commission; Impact assessment guidelines; 2009
- European Commission; Ex-ante evaluation. A practical guide for preparing proposals for expenditure programmes; 2001
- European Commission; Update of the Handbook on External Costs of Transport. Final Report; Ricardo-AEA; 2014
- European Commission; MoS challenges & opportunities for maritime transport infrastructure (presentation); Herald Ruyters; 2014
- European Commission; 2014 CEF multi-annual work program. MoS funding priority; 2014
- European Commission; Freight Transport Services (presentation); Szymon Oscislowski ; 2014
- European Commission; CEF transport 2015 calls for proposals. MoS proposals recommended for funding (general call); 2015
- European Commission; Aiuto di Stato N 496/2003 (Italia) per lo sviluppo delle catene logistiche e il potenziamento dell'intermodalità (C(2005)1155 fin); 2005

ϕ European Commission; Commissioin Decision SA.33412 (2011/N) - Italy, on the prolongation of the aid scheme for the development of logistics chains and the upgrading of intermodality (Ecobonus) (C (2012) 5020 final); 2012

ϕ European Commission; Commission Decision 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 (C (2013) 4392 final); 2013

ϕ European Commission; Commission Decision on State aid SA.44628 (2016/N) - Italy. 'Marebonus' - scheme to incentivise the highways of the sea (C (2016) 8459 final); 2016

ϕ European Commission; Analysis Recent Trends EU Shipping and Policy support to improve competitiveness in short sea shipping in the EU (final report); 2015

ϕ European Commission; Reglamento (CE) No 1998/2006 de la Comisión relativo a la aplicación de los artículos 87 y 88 del Tratado a las ayudas de minimis; 2006

ϕ European Community Shipowners' Associations (ECSA); Monitoring Economic Impact of Low Sulphur Requirement. ECSA-ESSF survey for ship operators (presentation); Maria Deligianni; 2016

ϕ European Community Shipowners' Associations (ECSA); Short Sea Shipping: the full potential yet to be unleashed; Niels Smedegaard; 2016

ϕ European Court of Auditors; Special Report nº3/2013 of the European Court of Auditors "Have the Marco Polo Programmes been effective in shifting traffic off the road?"; 2013

ϕ European Economic and Social Committee; Opinion on the Motorways of the sea in the logistics chain; 2008

ϕ European Environment Agency; Size, structure and distribution of transport subsidies in Europe; 2007

ϕ European Environment Agency; EMEP/EEA air pollutant emission inventory guidebook 2013; 2013

ϕ European Parliament; Improving the concept of Motorways of the Sea; 2014

ϕ European Transport; The cost of modal shift; a short sea shipping service compared to its road alteranative (Greece); Ernestos Tzannatos, Stratos Papadimitriou, Aphrodite Katsouli; 2014

ϕ European Union; Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union; 2008

ϕ European Union; Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council on the financial rules applicable to the general budget of the Union; 2012

ϕ European Union; Regulation (EU) 2015/757 of the European Parliament and of the Council on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport; 2015

ϕ European Union; Directive (EU) 2016/802 of the European Parliament and of the Council relating to a reduction in the sulphur content of certain liquid fuels; 2016

ϕ European Union; Regulation (EC) No 1382/2003 of the European Parliament and of the Council on the granting of Community financial assistance to improve the environmental performance of the freight transport system (Marco Polo Programme); 2003

ϕ European Union; "Regulation (EC) No 1692/2006 of the European Parliament and of the Council establishing the second 'Marco Polo' programme for the granting of Community financial assistance;

ϕ to improve the environmental performance of the freight transport system (Marco Polo II)"; 2006;

ϕ European Union; Regulation (EC) No 923/2009 of the European Parliament and of the Council amending Regulation (EC) No 1692/2006 establishing the Marco Polo II programme; 2009

ϕ European Union; Regulation (EU) No 1316/2013 of the European Parliament and of the Council establishing the Connecting Europe Facility (CEF); 2013

ϕ European Union; Regulation (EU) No 1315/2013 of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network; 2013

ϕ Franco Angeli Edizioni; La valutazione di un intervento gli effetti dell'incentivo ecobonus (ex post cabotage); Marica D'Elia, Guido Pellegrini, Agostina Zanoli ; 2015

ϕ Friends of the Earth Italy; Evidence on the environmental costs and benefits of the Italian motorways of the sea (presentation); Andrea Molocchi; 2005

ϕ Groupe de travail écobonus / écomer (BP2S); Proposition concrète d'un écobonus à la française; 2010

- INEA; MoS projects portfolio (2004-2013); 2004-2013
- Ingegneria Ferroviaria; An analysis on the potential Motorways of the Sea alternative to “all-road” transport in the Ligurian-Northern Tyrrhenian area; Marino Lupi, Alessandro Farina, Francesco Pilato, Antonio Pratelli; 2017
- Institute of Estuarine & Coastal Studies (IECS), Logistics Institute (University of Hull); Assessment of the Carbon and Environmental Footprint of Ports and Maritime Transport; -
- Int. J. Ocean Systems Management; European motorways of the sea: lessons from the Spanish experience; Xavier Gesé Aperte, Alfred J. Baird; 2012
- International Transport Forum; The Impact of International Sulphur Regulations for Ships (presentation); Olaf Merk; 2016
- Istituto Superiore di Formazione e Ricerca per i Trasporti (ISFORT); Autostrade del Mare 2.0. Risultati, criticità, proposte per il rilancio; Andrea Appetecchia; 2014
- IT, SP, FR, MA; TEN-t project. West Med Corridors (Master plan); 2010
- Joint Research Centre (European Commission); External cost calculator for Marco Polo freight transport project proposals (call 2013 version); Martijn Brons, Panayotis Christidis; 2013
- Journal of Business and Economics; What Modelling Approach for the Time-space Consideration in Modal Choice Analysis of a Sustainable Alternative Mode?; Ndayishimiye Juste; 2014
- Journal of Engineering for the Maritime Environment; Fuels for short sea shipping: A comparative assessment with focus on environmental impact; Selma K. Bengtsson, Erik Fridell, Karin E. Andersson; 2014
- Journal of Maritime Research; Road and Maritime Transport Environmental Performance: Short Sea Shipping vs Road Transport; M. Castells, J.J. Usabiaga, F. Martínez; 2012
- Journal of Transport Geography; Potential freight distribution improvements using motorways of the sea; Pau Morales-Fusco, Sergi Saurí, Alejandro Lago; 2012
- Lloyd's List Intelligence; Market outlook (presentation); Christopher Pålsson; 2016

ϕ Maritime Economics & Logistics; Short sea shipping in today's Europe. A critical review of maritime transport policy; Ancor Suárez-Alemán; 2015

ϕ Maritime Economics & Logistics; Unaccompanied transport as a strategy in Ro-Ro short sea shipping; Miguel Ángel López-Navarro; 2013

ϕ Maritime Policy & Management; Motorways of the sea policy in Europe; Xavier Gese Aperte, Alfred J. Baird; 2012

ϕ Maritime Transport Co-ordination Platform (MTCP); The realisation of Motorways of the Sea. Atlantic / North Sea cases (presentation); 2005

ϕ Maritime Transport Co-ordination Platform (MTCP); The realisation of Motorways of the Sea. Western Mediterranen cases (presentation); 2005

ϕ Maritime Transport Co-ordination Platform (MTCP); Desk study on good flows in Europe for a pre-definition of Motorways of the sea (MOS); Ralf Fiedler, Peter W. Cardebring, Roman Poersch, Detlev Fischer; 2006

ϕ Ministerio de Fomento; Observatorio hispano-francés de tráfico en los Pirineos. Principales cifras actualizadas para los años 2010 y 2011; 2013

ϕ Ministerio de Fomento; Observatorio hispano-francés de tráfico en los Pirineos. Principales cifras actualizadas para el año 2009; 2011

ϕ PriceWaterhouseCoopers Advisory S.p.a; Misure di supporto al transporto ferroviario di merci; 2016

ϕ Puertos del Estado; Quality criteria for motorways of the sea and short sea shipping; 2005

ϕ RAND Europe; National and international freight transport models: overview and ideas for future development; Gerard de Jong, Hugh Gunn, Warren Walker; 2002

ϕ Rete Autostrade Mediterranee S.p.a. (RAM); The Italian Ecobonus. Concluding findings (presentation); Francesco Benevolo; 2013

ϕ Rete Autostrade Mediterranee S.p.a. (RAM); Towards a new scenario for the Mediterranean: the role of the MoS (presentation); Francesco Benevolo; 2016

ϕ Review of Economics Perspectives; The Role of Ferry and Ro-Ro Shipping in Sustainable transport; Izabela Kotowska; 2015

ϕ RoRo SECA Project; Mitigating and reversing the side-effects of environmental legislation on Ro-Ro shipping in Northern Europe (project results); 2017

ϕ SP, FR, IR, IT; TEN-t project. Western Europe Sea Transport & Motorways of the Sea (WEST-MOS). Consolidated Report; 2005

ϕ Stena; The Methanol Experience (presentation); Per Wimby; 2016

ϕ Surface Freight Transportation; A comparison of the costs of road, rail, and waterways freight shipments that are not passed on to consumers; United States Government Accountability Office; 2011

ϕ Sustainability; Environmental Factors and Intermodal Freight Transportation: Analysis of the Decision Bases in the Case of Spanish Motorways of the Sea; Miguel Ángel López-Navarro; 2014

ϕ Technical University of Denmark; Environmental Performance Evaluation of Ro-Ro Passenger Ferry Transportation; Hans Otto Kristensen, Constantin Hagemeister; 2012

ϕ Technical University of Denmark; Key Performance Indicators to Assess and Reverse the Negative Impacts of SECA Policies for Ro-Ro Shipping; Thalis Zis, Harilaos N. Psaraftis;

ϕ Technical University of Denmark; Environmental KPIs for the Motorways of the Sea (presentation); Harilaos N. Psaraftis; 2016

ϕ The Norwegian Coastal Administration's Head Office; The Norwegian Coastal Administration’s Guide for the Aid Scheme for Short Sea Shipping; 2017

ϕ Transport & Environment; Are Trucks Taking Their Toll? II; 2016

ϕ Transport & Environment; Truck CO2. Why market forces alone cannot deliver the goods; 2016

ϕ Transport & Mobility Leuven; Road versus short sea shipping: comparing emissions and external costs; Kris Vanherl, Eef Delhaye; 2012

ϕ Transport Policy; An stated preference analysis of Spanish freight forwarders modal choice on the south-west Europe Motorway of the Sea; María Feo, Raquel Espino, Leandro García; 2010

ϕ Transport Reviews; Short Sea Shipping in Supply Chains. A Strategic Assessment; P. Morales, S. Sauri, G. De Melo; 2013

- Transportation Research; Modelling mode choice for freight transport using advanced choice experimients; Ana I. Arencibia, María Feo-Valero, Leandro García-Menéndez, Concepción Román; 2015
- TRI Edinburgh Napier University; Review and Analysis of Motorways of the Sea Policy in Europe; Xavier Gese Aperte, Alfred Baird; 2010
- Trident Alliance; Sulphur regulations for a level playing field at sea (presentation); Anna Larsson; 2016
- Universidad Politécnica de Cataluña (PFC); El reequilibrio modal y el Ecobono; Juan José Usabiaga Santamaría; 2009
- University of Bologna; The Italian Motorways of the Sea system: current situation, policies and prospects; Antonio Danesi, Chiara Lepori, Marino Lupi; 2015
- University of Lugano (Switzerland); Logistics Strategy and Transport Service Choices: An Adaptive Stated Preference Experiment; Simona Bolis, Rico Maggi; 2003
- University of Pisa; The development of the Italian motorways of the sea network in the years 2008–2012; Marino Lupi, Alessandro Farina; 2014
- Zero Vision Tool; ECA Bonus pre-study; 2016
- Van Miert High Level Group Report on TEN-T; 2003
- Motorways of the Sea. Much more than Short Sea Shipping (pocket book); WiderMoS project; 2014
- When is short sea shipping environmentally competitive?; Erik Fridell, Harald M. Hjelle; 2012
- 2012 FR-SP summit. Joint Declaration (Paris); 2012
- 2013 FR-SP summit. Joint Declaration (Madrid); 2013
- 2014 FR-SP summit. Joint Declaration (Paris); 2014
- 2014 IT-SP summit. Joint Declaration (Rome); 2014

I. APPENDIX 2 – MAE technical annexes

Available at www.mae-project.eu

- The Italian Ecobonus experience
- Review and analysis of the state aid legal framework
- Administrative and Technological aspects

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

Co-financed by the Connecting Europe Facility of the European Union

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