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accompanying the

COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

on the possibilities of further improving the environmental characteristics of recreational craft engines

IMPACT ASSESSMENT

{COM(2007) 313}
{SEC(2007) 819}

1. INTRODUCTION

This impact assessment summary accompanies the Report on the possibilities of further improving the environmental characteristics of recreational craft engines, which the Commission is submitting to the European Parliament and the Council pursuant to Article 2 of Directive 2003/44/EC, amending Directive 94/25/EC relating to Recreational Craft.

It builds on a detailed assessment process which consisted of two main phases.

In the first phase, a stocktaking study was carried out to identify the state of the art and expected developments in pollution reduction technologies for recreational marine engines and to make an inventory of existing and future emission legislation for recreational craft in other parts of the world. Based on this identification and inventory, and in consultation with the involved stakeholders, four possible regulatory scenario options for further reducing emissions from recreational craft have been identified. In addition, the stocktaking study addressed in detail the other elements referred to in Article 2 of Directive 2003/44/EC, which the European Parliament and Council have asked the European Commission to take account of in the above mentioned Communication. The final report of the stocktaking study as well as an executive summary can be consulted on the EUROPA website[1].

In the second phase of the assessment process, a detailed impact assessment study has been carried out, to analyse the technical costs and to identify the environmental, economic and social impacts of each of the four scenario options developed in the context of the stocktaking study. The costs and benefits of these impacts have been quantified and compared through a multi-criteria analysis using the "no policy change" option as the baseline option for the comparison. The reports delivered in the context of this impact assessment study are also available for consultation on the EUROPA website[1].

Stakeholders which could be significantly affected by, or involved in, further developments in emission legislation for marine recreational craft in the European Union have been widely and closely consulted by the study contractors throughout the entire assessment process. In the first phase, this stakeholder consultation has focused on representative industry and user associations at European level, whilst for the second phase the consultation has been extended to individual enterprises in the recreational maritime sector and to environment agencies in the Member States.

In addition, the impact assessment process has been accompanied by a number of stakeholders meetings organised by the Commission services, aimed at also informing and consulting the other stakeholders involved in the implementation of the Recreational Craft Directive (competent authorities in the Member States, standardisation and user organisations and notified bodies).

1 http://ec.europa.eu/enterprise/maritime/maritime_regulatory/directive_03_44.htm

2. WHAT ISSUE IS THE POLICY EXPECTED TO TACKLE?

- What is the issue/problem in a given policy area expressed in economic, social and environmental terms including unsustainable trends?
- What are the risks inherent in the initial situation?
- What are the underlying motive forces?
- What would happen under a "no policy change" scenario?
- Who is affected?

There are approximately 6.0 million[2] recreational marine craft in Europe.[3] Of this total figure, approximately 1.1 million are sailboats, 4.8 million motorboats and 0.1 million personal watercraft (such as jet skis). The use of recreational marine craft in Europe contributes to environmental costs with regard to both exhaust emissions and sound emissions. However, according to CORINAIR 94,[4] the air emission inventory for Europe, emissions from recreational marine craft are minimal compared with other pollution sources such as energy industries, manufacturing industries, road transport, etc. In Europe recreational marine craft are estimated to contribute approximately 0.34% of total carbon monoxide emissions, 0.5% of total hydrocarbon emissions and 0.1% of total NO_X emissions.

Although the aggregate emissions from recreational marine craft are low compared with other sources, they can lead to localised problems in areas that have a high concentration of recreational craft at certain times of peak activity (such as weekends). The implementation of the emission limits for carbon monoxide, hydrocarbons, nitrogen oxides and particulate matters specified in Directive 2003/44/EC will contribute substantially in reducing the amount of pollutants released into the air and water by recreational craft and as such contribute to the improvement of air and water quality in these areas as well.

Notwithstanding the already low contribution by recreational craft to overall air pollution and the further reduction in contribution that will be achieved when the entire European recreational fleet will fully comply with the emission limits specified in Directive 2003/44/EC, the European Parliament and the Council have requested the Commission to report on the possibilities of further improving the environmental characteristics of recreational marine engines.

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2 British Marine Federation (BMF) European Overview 2004: The Marine Leisure Industry at Your Fingertips

3 Europe is defined in the BMF Overview as comprising the 25 EU Member States (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Portugal, Spain, Sweden, the Netherlands, the UK, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia), the applicant countries (Bulgaria, Romania, Turkey and Croatia), and the EFTA member states (Norway and Switzerland).

4 CORINAIR 94 (1998) European Topic Centre in Air Emissions: CORINAIR 1994 Inventory.

The underlying motive force for this request in Article 2 of Directive 2003/44/EC is based on the perceived need to further reduce emissions of air pollutants and noise from recreational craft to meet environment protection requirements.

The perceived problem of recreational craft emissions is derived from a *negative externality* market failure, whereby the cost to society of pollution from emissions is not captured within market mechanisms. Groups affected by this negative externality include humans using recreational craft, other humans in areas where recreational craft are used (e.g. residents and bathers) and flora and fauna in areas where recreational craft are used.

This problem should also be considered in the wider context of the Thematic Strategy on Air Pollution and following related environmental objectives and initiatives:

– The Thematic Strategy on Air Pollution was adopted by the European Commission in September 2005[5]. This Strategy proposed new health and environmental objectives to be attained by 2020 as well as a range of new measures to bring about their attainment, including new engine NOx emissions standards for ships. More recently, the Council's conclusions[6] and the European Parliament's resolution[7] concerning the Thematic Strategy on Air Pollution also supported further action to reduce emissions from ships.

– Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management laid the foundations for a common strategy to define and establish objectives for ambient air quality. According to this Directive, the Council was to adopt limit values and, as appropriate, alert thresholds for a number of specific pollutants. Pursuant to that requirement, Directive 1999/30/EC contains limit values for concentrations of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead and alert thresholds for concentrations of sulphur dioxide and nitrogen dioxide in ambient air.

– Sea going recreational craft with engines over 130 kW, are covered by the rules for air pollution of the IMO, the International Maritime Organization. In 2002, the European Commission adopted a strategy to tackle air pollution from ships[8]. Following the publication of this strategy, the Council of Ministers urged the Member States of the European Union to submit concrete proposals to the IMO to introduce stricter standards for NOx emissions from ships' engines and invited the European Commission to investigate the feasibility of Community measures should action at the IMO fail to deliver new standards by the end of 2006[9]. Whether the EC will do so depends on the outcome of the next meeting of the

5 Communication on a Thematic Strategy on Air Pollution COM(2005) 446; http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0446en01.pdf

6 Conclusions of the Council of Ministers of the EU of 9 March 2006; http://ec.europa.eu/environment/air/cafe/pdf/council_concl_them_strategy.pdf

7 EP Resolution of 26 September 2006 on the Thematic Strategy on Air Pollution; http://www.europarl.europa.eu/registre/recherche/NoticeDetaillee.cfm?docid=203998&doclang=EN

8 European Union strategy to reduce atmospheric emissions from seagoing ships (COM(2002) 595; http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002DC0595:EN:HTML

9 Conclusions of the Council of Ministers of the EU of 22 December 2003; http://ec.europa.eu/environment/air/pdf/031222_ship_emissions_council.pdf

MEPC, the Marine Environment Protection Committee, when IMO will be addressing this issue.

If in the light of this report it would not deem appropriate to submit proposals for further reducing these emissions, the "no policy change" scenario would entail that the overall recreational craft emissions resulting from the implementation of the emission limits specified in Directive 2003/44/EC would remain at the level indicated in Table 26.

The primary groups which would be directly or indirectly affected by further emission reduction measures are producers and users of recreational craft and their engines as summarised in figure 1 below.

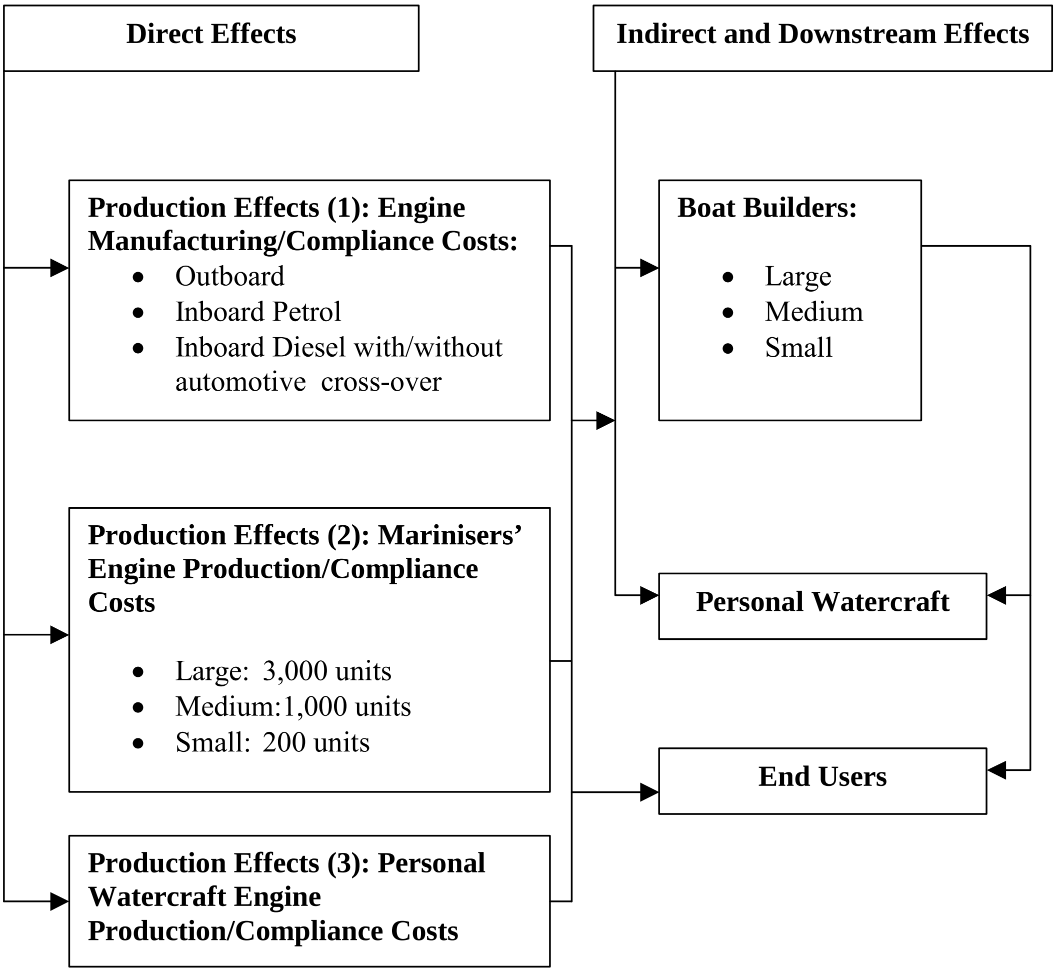

Figure 1: Primary Impact Groups

3. WHAT MAIN OBJECTIVE IS THE POLICY/PROPOSAL EXPECTED TO REACH?

- What is the overall policy objective in terms of expected impacts?
- Has account been taken of any previously established objectives?

The overall policy objective of the Commission Report is to explore the possibilities of further improving the environmental impact of recreational craft engines by identifying possible regulatory scenario options and assessing their economic, environmental and social impacts. By using the results of this assessment in a multi criteria analysis the costs and benefits of each of the scenario options are compared against the "no policy change" scenario to determine whether it would be appropriate to submit legislative proposals for further reducing the emission limits for recreational craft.

The objective of identifying possible regulatory scenario options for further reducing emissions from recreational craft fits within the context of overall EU policies to promote environmental sustainability, and in particular to protect natural systems, human health and quality of life. In assessing the impact of these options due account has been taken of the overall objectives of the EU Strategy for Sustainable Development, and in particular of the Better Regulation Action Plan and the Commission's Impact Assessment Guidelines.

4. WHAT ARE THE MAIN POLICY OPTIONS AVAILABLE TO REACH THE OBJECTIVE?

- What is the basic approach to reach the objective?
- Which policy instruments have been considered?
- What are the trade-offs associated with the proposed option?
- What "designs" and "stringency levels" have been considered?
- Which options have been discarded at an early stage?
- How are subsidiarity and proportionality taken into account?

The basic approach followed to reach the objective is schematically presented in figure 2. The technical feasibility assessment has resulted in the identification of following pollution reduction technologies for recreational craft engines.

– For outboard spark ignition (SI) engines: a change from two-stroke technology to direct injection two-stroke and four-stroke technology. Catalytic after treatment is considered problematic in view of the limited space available in outboard engines to install such equipment.

– For inboard SI engines: updating of the technology equivalent to the developments in other fields of application, in particular automotive, and possibly the use of catalytic after treatment.

– For inboard compression ignition (CI) engines: updating of the technology equivalent to the developments in other fields of application, in particular that of engines used in non-road mobile machinery.

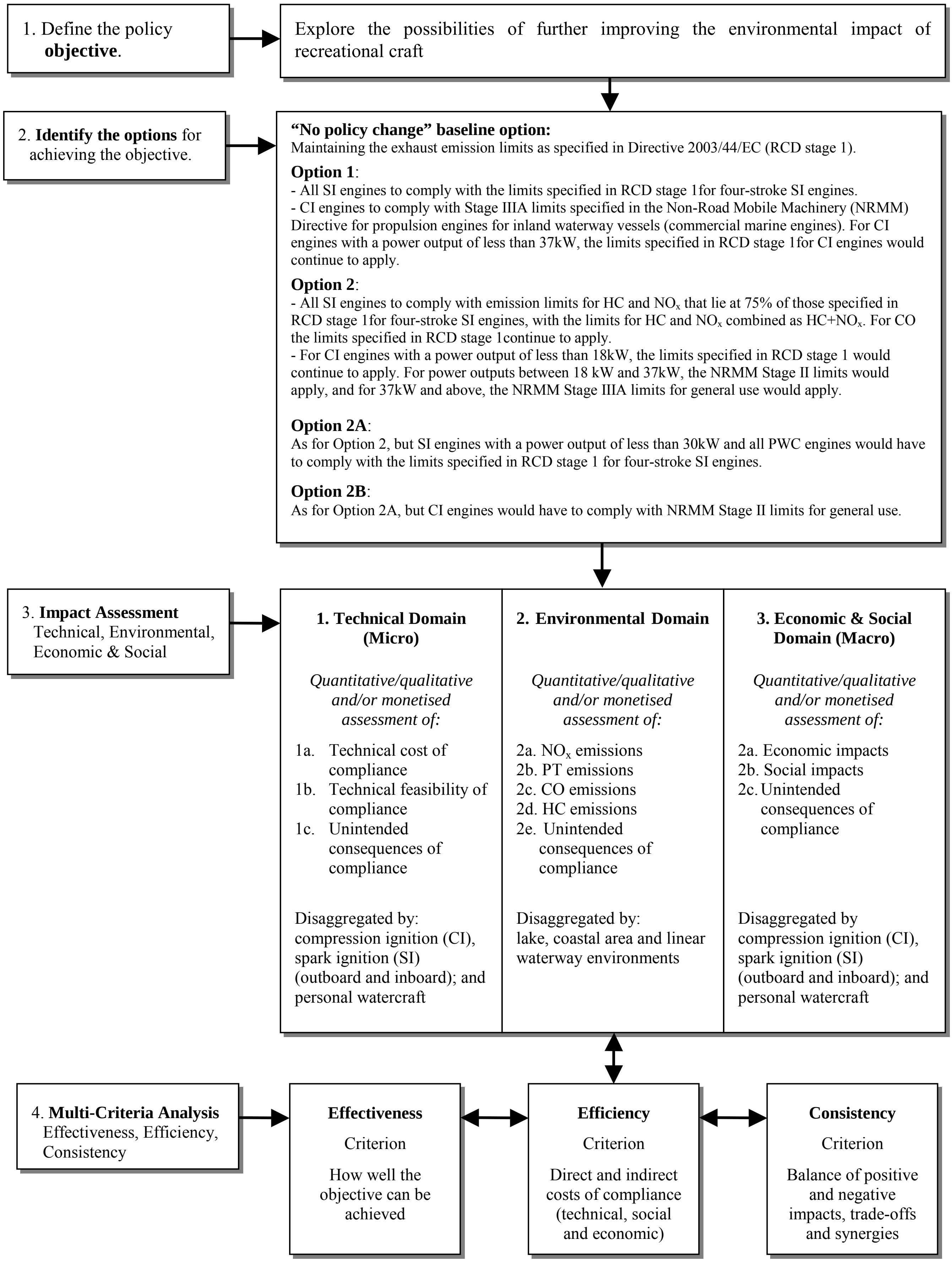

Figure 2: Summary of the impact assessment approach followed

Based on this technical feasibility assessment, four possible regulatory scenario options have been identified, their technical and social compliance cost calculated and their environmental benefits estimated. In addition to the four identified regulatory scenario options to further reduce the emission limits specified in Directive 2003/44/EC, the "no policy change" has been taken into account as the baseline option. The details of each of these five options are summarised under point 2 of figure 2.

Considering the limited number of possible regulatory scenario options that resulted from the technical feasibility assessment, no options screening for these options has been undertaken. The impacts of the four possible regulatory scenario options have therefore been compared against the baseline option, using effectiveness, efficiency and consistency as the criteria in the multi-criteria analysis. The methodology used has been based on the Commission's Economic Impact Guidelines (2005) to ensure that the approach is transparent, reproducible and robust.

The principles of subsidiarity and proportionality upon which Directive 2003/44/EC is based have been maintained by respecting the framework the Directive is specifying for the development of possible further Community legislation governing the environmental performance of recreational craft. Subsidiarity and proportionality have been taken into account when assessing the relevance of the contribution of recreational craft to overall and local air pollution and by qualifying the environmental impact of the identified options at European level.

The option to consider the possibility of a non-legislative instrument has been discarded at an early stage due to the anticipated difficulties of ensuring and maintaining the compatibility between a non-legislative instrument and the legally binding emission requirements of the Directive and the legal uncertainty the co-existence of a non-legislative instrument with a legal one (the Directive) could create for stakeholders.

5. WHAT ARE THE IMPACTS – POSITIVE AND NEGATIVE – EXPECTED FROM THE DIFFERENT OPTIONS IDENTIFIED?

- What are the expected positive and negative impacts of the options selected, particularly in terms of economic, social and environmental consequences, including impacts on management of risks? Are there potential conflicts and inconsistencies between economic, social and environmental impacts that may lead to trade-offs and related policy decisions?
- How large are the additional ('marginal') effects that can be attributed to the policy proposal, i.e. those effects over and above the "no policy change" scenario? Description in qualitative terms and quantified as far as possible. Monetarisation may be used where appropriate.
- Are there especially severe impacts on a particular social group, economic sector (including size-class of enterprises) or region?
- Are there impacts outside the Union on the Candidate Countries and/or other countries ("external impacts")?
- What are the impacts over time?

- What are the results of any scenario, risk or sensitivity analysis undertaken?

5.1. Summary of the technical cost compliance analysis

5.1.1. Introductory comments

The variable cost ranges below represent the costs for improved or added technology on every engine to comply with the limits specified in the regulatory scenario options. The fixed costs are associated with the development, validation and certification of the improved engine required to meet the emission limits of the scenario options. For each case within the options a typical "middle-of-the-range" example has been used as the basis of the cost analysis. Therefore for a fair comparison the variable costs are presented as percentage increases of Manufacturers Recommended Retail Price (RRP) for a typical "middle-of-the-range" engine.

5.1.2. Spark ignition engines

Table 1 summarises the capability and associated cost for spark ignition engines to comply with the emission limits specified in the four regulatory scenario options identified.

		Engine rated power P (in kW)	Without after-treatment		With after-treatment	
			Typical variable cost range (% increase in RRP engine price)	Typical fixed cost range (in million Euro and per engine family)	Typical variable cost range (% increase in RRP engine price)	Typical fixed cost range (in million Euro and per engine family)
Four stroke outboard and PWC engines	Option 1	all power levels	no change to baseline option technology required			
	Option 2	P < 6	current engines can meet limits without technology change			
		6 ≤ P < 20	0 to 12%	0 to 0,15	not required	
		20 ≤ P < 30	0 to 9%	0 to 0,25	not required	
		30 ≤ P < 75	3 to 6%	1,4	12 to 18%	6 to8
		75 ≤ P < 150	3 to 5%	1,4	10 to 16%	6 to8
		P ≥ 150	3 to 8%	2	10 to 16%	6 to8
		PWC	no change to baseline option technology required			
	Option 2A	P < 30	no change to baseline option technology required			
		P ≥ 30	See costs for option 2 above			
Two stroke outboard and PWC engines	Option 1	P < 30	Incapable to comply with baseline option			
		P ≥ 30 incl PWC	0 to 9%	0 to 1,6	considered not feasible	
	Option 2	P < 30	Incapable to comply with baseline option			
		P ≥ 30 incl PWC	0 to 7.5%	0 to 1,4	considered not feasible	
	Option 2A	P < 30	Incapable to comply with baseline option			
		P ≥ 30 incl PWC	See costs for option 2 above			

Inboard engines	Options 1, 2, 2A	all power levels	current engines can meet limits without technology change

Table 1: Estimated compliance capability and costs for SI engines

For four-stroke spark ignition outboard and PWC engines Option 1 is identical to the "no policy change" baseline option and does not require any further developments. Options 2 and 2A can be met through development of existing pollution reduction technologies for the majority of engines below 75 kW. Above 75 kW, some engines will need a considerable change in emission reduction performance which will only be attainable through the addition of new technology – most likely after-treatment systems. Because the application of catalyst after-treatment technology to an outboard engine is not a proven solution, an estimated fixed cost of 6 to 8 million EURO has been used for a worst case scenario requiring a re-design of the entire outboard engine architecture to comply with regulatory scenario options 2 and 2A.

Two stroke spark ignition outboard and PWC engines would need to apply direct injection (DI) technology to comply with the "no policy change" baseline option, but this seems not economically feasible for small outboard engines with a power output of less than 30 kW. Where emissions compliance cannot be achieved through DI technology development, it is assumed that the production of this type and size of engines will be discontinued pending development of suitable after-treatment technologies

For inboard engines, all manufacturer supplied data indicate that current engines can meet all limits considered under the regulatory scenario options.

5.1.3. Compression ignition engines

Table 2 summarises the technical cost compliance analysis for recreational marine compression ignition (CI) engines as well as for NRMM certified CI engines which are marinised, i.e. adapted for use in a recreational marine environment, whereby for each case within the regulatory scenario options a typical "middle-of-the-range" example has been used as the basis of the cost calculation.

		Recreational Marine CI engine		Marinised NRMM CI engine	
	Engine rated power P (in kW)	typical variable cost range (% increase in engine price)	typical fixed cost range (in million Euro and per engine family)	typical variable cost range (% increase in engine price)	typical fixed cost range (in million Euro for the engineering of a marinised version)
Option 1	P < 37	2,7%	1,4	3,3%	0,66
	P > 37	0,4 to 0,5%	1,4 to 1,6	0,4%	0,67 to 0,71
Options 2 & 2A	P < 18	4,7%	1,4	5,6%	0,66
	18 < P < 37	2,5%	1,4	3%	0,67
	P > 37	4 to 5,5%	2,8 to 3,4	4,8 to 8,5%	0,72 to 1,01
Option 2B	P < 18	3,5%	1,4	4,2%	0,66

	18 < P < 37	2,2%	1,4	2,6%	0,67
	P > 37	0,2%	1,4 to 1,6	0,4 to 0,7%	0,71 to 0,94

Table 2: Estimated compliance costs for recreational marine CI engines and for marinising NRMM certified CI engines

5.2. Summary of the economic impact assessment

5.2.1. Introductory comments

Gross compliance costs have been calculated by combining the above mentioned technical compliance costs with the results of the structural analysis of the industry and a series of assumptions relating to industry structure.

5.2.2. Spark ignition outboard engines (four stroke and two stroke)

5.2.2.1. Compliance costs

The level of fixed and variable compliance costs for four stroke spark ignition outboard engines has been calculated based on the figures and assumptions indicated in tables 3 and 4 below.

Option	Power (kW)	Fixed Cost without A/T (m€)	Fixed Cost with A/T (m€)	% not requiring A/T	% requiring A/T	Number of manufacturers	Fixed Costs without A/T (m€)	Fixed Costs With A/T (m€)	Total Fixed Costs (m€)
1	all levels	0	0	na	na	6	0	0	0
2	P<3	0	0	0%	0%	5	0	0	0
	3-6	0	0	0%	0%	6	0	0	0
	6-20	0,15	0	100%	0%	6	0,90	0	0,90
	20-30	0,25	0	100%	0%	6	1,50	0	1,50
	30-75	1,4	8,0	90%	10%	6	7,56	4,80	12,36
	75-150	1,4	8,0	50%	50%	6	4,20	24,00	28,20
	P>150	2,0	8,0	10%	90%	3	0,60	21,60	22,20
2A & 2B	P<3	0	0	na	na	5	na	na	0
	3-6	0	0	na	na	6	na	na	0
	6-20	0	0	na	na	6	na	na	0
	20-30	0	0	na	na	6	na	na	0
	30-75	1,4	8,0	90%	10%	6	7,56	4,80	12,36

	75-150	1,4	8,0	50%	50%	6	4,20	24,00	28,20
	P>150	1,4	8,0	10%	90%	3	0,60	21,60	22,20

Table 3: fixed compliance costs for four stroke spark ignition Outboard engines (upper band)

Option	**Power (kw)**	**Variable Cost without A/T (€)**	**Variable Cost with A/T (€)**	**% Not requiring A/T**	**% requiring A/T**	**Engine Sales per Power Category**	**Variable Costs without A/T (m€)**	**Variable Costs With A/T (m€)**	**Total Variable Costs (m€)**
1	all levels	0	0	na	na	na	0	0	0
2	P<3	0	0	0%	0%	33000	0	0	0
	3-6	0	0	0%	0%	23760	0	0	0
	6-20	326	0	100%	0%	29040	9,454	0	9,454
	20-30	417	0	100%	0%	10560	4,405	0	4,406
	30-75	481	1444	90%	10%	23760	10,295	3,431	13,726
	75-150	694	2222	50%	50%	10560	3,665	11,730	15,396
	P>150	1330	2494	10%	90%	1320	0,175	2,963	3,138
2A & 2B	P<3	0	0	na	na	33000	na	na	0
	3-6	0	0	na	na	23760	na	na	0
	6-20	0	0	na	na	29040	na	na	0
	20-30	0	0	na	na	10560	na	na	0
	30-75	481	1444	90%	10%	23760	10,295	3,431	13,726
	75-150	694	2222	50%	50%	10560	3,665	11,730	15,396
	P>150	1330	2494	10%	90%	1320	0,175	2,963	3,138

Table 4: variable compliance costs for four stroke spark ignition Outboard engines (upper band)

Combining the results of tables 3 and 4 leads to an estimated gross total compliance costs for four stroke spark ignition outboard engines as summarised in table 5.

Option	Gross Fixed Compliance Cost (€m)	Gross Variable Compliance Cost (€m)	Gross Total Compliance Cost (€m)
1	0	0	0
2	52,6 – 65,1	46,1	98,6 – 111,2
2A	50,1 – 62,7	32,2	82,3 – 94,9
2B	50,1 – 62,7	32,2	82,3 – 94,9

Table 5: total compliance costs for four stroke spark ignition Outboard engines (lower & upper band)

For two stroke spark ignition outboard engines with a power output P > 30 kW, the compliance cost calculations are summarised in Tables 6 to 8 below.

Option	Fixed Compliance Cost per Engine Family (€m)	No of Engine Families	% of Engine Families following relevant compliance route	No of nanufacturers	Total Fixed Costs (€m)
1	1,6	2	20%	4	2,6
2	1,4	2	60%	4	6,7
2A	1,4	2	60%	4	6,7
2B	1,4	2	60%	4	6,7

Table 6: fixed compliance costs for two stroke spark ignition Outboard engines (P > 30 kW)

Option	Variable Compliance Cost per Engine (€)	Number of Engines	% of Engine Families following relevant compliance route	Total Variable Costs (€m)
1	1045	18000	20%	3,8
2	871	18000	60%	9,4
2A	871	18000	60%	9,4
2B	871	18000	60%	9,4

Table 7: variable compliance costs for two stroke spark ignition Outboard engines (P > 30 kW)

Option	Gross Fixed Compliance Cost (€m)	Gross Variable Compliance Cost (€m)	Gross Total Compliance Cost (€m)
1	2,6	3,8	6,4
2	6,7	9,4	16,1
2A	6,7	9,4	16,1
2B	6,7	9,4	16,1

Table 8: gross total compliance costs for two stroke spark ignition Outboard engines (P > 30 kW)

Combining the gross total compliance cost figures for four stroke and two stroke spark ignition outboard engines in Tables 5 and 8 gives the following overall result.

Option	Gross Fixed Compliance Cost (€m)			Gross Variable Compliance Cost (€m)			Gross Total Compliance Cost (€m)		
	2S	4S	Total	2S	4S	Total	2S	4S	Total
1	2,6	0	2,6	3,8	0	3,8	6,4	0	6,4
2	6,7	52,5-65,1	59,2-71,8	9,4	46,1	55,5	16,1	98,6 – 111,2	114,7-127,3
2A	6,7	50,1-62,7	56,8-69,4	9,4	32,2	41,6	16,1	82,3 – 94,9	98,4-111
2B	6,7	50,1-62,7	56,8-69,4	9,4	32,2	41,6	16,1	82,3 – 94,9	98,4-111

Table 9: gross total compliance costs for two stroke and four stroke spark ignition outboard engines combined

In addition to the gross total compliance costs outlined above, the administrative costs incurred for certification and compliance assessment with the regulatory options has been estimated to be around € 7300 for each outboard engine manufacturer, resulting in a total cost of about € 51000 for the outboard engine sector.

5.2.2.2. Distributional issues:

Impact on number of jobs: the first round effects of any regulatory readjustment will be largely concentrated outside Europe, since 6 of the 7 spark ignition outboard manufacturers are located outside of the EU.

However, case study evidence suggests that any further emission limit reduction over and above the baseline option ("no policy change" scenario) would seriously endanger the future of the only wholly European-based SME manufacturing outboard engines, involving a loss of 86 jobs on an estimated total of 320 full time equivalent direct and indirect jobs created by outboard engine manufacturing and assembling enterprises in Italy and France.

Price effects: impact on prices has been calculated in table 10, based on the assumption that the fixed compliance costs will be amortised over a ten-year period, which is approximately the average economic lifetime of an engine model, and over an average annual sale of 132000 engines, with an average retail price of € 4112. Taking into account a price elasticity of -2, demand is likely to fall by 1,4 to 20 %.

Option	Total Fixed Compliance Costs (€m)	Total Variable Compliance Costs per Annum (€m)	Fixed Costs per Annum (€m)	Gross Compliance Costs per Annum (€m)	Additional Compliance Costs per Unit per Annum (€)	Estimated average increase in retail price (%)
1	2,6	3,8	0,3	4,1	27,3	+0,7%
2	65,1	55,5	6,5	62	413	+10%
2A	62,7	41,6	6,3	47,9	319	+7,75%
2B	62,7	41,6	6,3	47,9	319	+7,75%

Table 10: Compliance Costs per Unit, per Annum (Upper Band) and estimated impact on unit price

The impact on third countries and international relations is considered to be minimal, as well as the macroeconomic impacts, in view of the relative small scale of the sector and its structure. Any differential impact on public authorities is also likely to be minimal between the options, as the level and nature of the implementation costs will be the same for any of the four regulatory scenario options.

5.2.3. *Compression ignition engines*

5.2.3.1. Compliance costs

The key assumptions for estimating the compliance costs for compression ignition engines are annual sales of 40000 engines, with about 15 enterprises based in Europe manufacturing on average 5 diesel engine families and another 15 enterprises marinising on average 3 diesel engine families for recreational marine use. Engine sales are assumed to be distributed 50:50 between engine manufacturers and marinisers. The compliance costs are cost over and above those incurred for compliance with the baseline option ("no policy change" scenario), and relate to technical, engineering and certification costs associated with marine and marinised compression ignition engines.

The "prime route" relates to the development of existing engines certified for compliance with the current emission limits in force (baseline option) to comply with the four regulatory scenario options considered. The "alternative route" relates to engines already certified to Stage II or IIIA emission limits of the Non-Road Mobile Machinery Directive (NRMM), modified for use in marine applications (i.e. "marinised")[10].

Based on the above key assumptions and the technical compliance cost figures in table 2, the gross fixed and variable compliance costs for compression ignition engines have been calculated and are summarised in table 11 below.

Option	Gross Fixed Compliance Cost (€m)	Gross Variable Compliance Cost (€m)	Gross Total Compliance Cost (High) (€m)
1	141,3	6,1	147,4
2	220,7	24,5	245,2
2A	220,7	24,5	245,2
2B	144,6	5,6	150,2

Table 11: Gross Total Compliance Costs for compression engines based on annual sales of 40000 engines

In addition to the gross total compliance costs outlined above, the administrative costs incurred for certification and compliance assessment with the regulatory options has been estimated to be around € 7300 for each diesel engine manufacturer and mariniser, resulting in a total cost of about € 219000 for the diesel engine sector.

[10] The recent Commission proposal COM(2007)18 envisages a reduction of sulphur content to 10ppm by 2009 for gas-oils used for non-road applications, while those for inland waterways would have their sulphur content reduced to 10ppm by 2011. These changes are intended to facilitate the introduction of engines with better emission characteristics and thereby help to reduce pollutant emissions from these applications. Engines for recreational craft operating on inland waterways could also benefit from this future improvement in fuel quality.

5.2.3.2. Distributional issues:

Impact on SMEs: The burden of compliance with the regulatory scenario options will be felt primarily by European based manufactures and in particular EU based marinisers and smaller engine manufacturers. These undertakings tend to be SMEs, employing between 20 and 60 workers each.

In order to have a better understanding of the potential impact on EU based manufacturers and marinisers and for illustrative purposes, compliance costs for a representative cross-section of marinisers has been estimated in table 12. It is assumed that a larger mariniser will produce 3000 engines per year, with up to 5 engine families, and approximately 60 Full Time Equivalent (FTE) employees. A medium sized mariniser is assumed to produce 1000 engines per year, across three engine families and with a workforce of 35 FTEs, whilst a small sized mariniser will produce 200 engines per year across one engine family and employ approximately 20 FTEs.

Option	Gross Compliance Cost Smaller Marinisers (€m)	Gross Compliance Cost Medium Mariniser (€m)	Gross Compliance Cost Larger Mariniser (€m)
1	0,708	2,192	3,882
2	0,967	3,225	6,451
2A	0,968	3,230	6,467
2B	0,793	2,471	4,442

Table 12: Illustrative Compliance Costs for marinisers (alternative route)

Given the scale of compliance costs faced by marinisers it is considered that all four regulatory scenario options would probably generate market restructuring. This would see the exit of some smaller scale, higher cost marinisers in favour of those larger manufacturers and marinisers that are able to spread fixed compliance costs over a larger scale of output and between different engine applications.

Price effects: impact on prices has been calculated in Table 13, based on the assumption that the fixed compliance costs will be amortised over a ten-year period, which is approximately the average economic lifetime of an engine model, and over an average annual sale of 40000 engines, with an average retail price of € 11574. Taking into account a price elasticity of -2, engine demand is likely to fall by 8,7 to 20,1 %.

Option	Total Fixed Compliance Costs (€m)	Total Variable Compliance Costs (€m)	Fixed Costs per Annum (€m)	Gross Compliance Costs per Annum (€m)	Additional Compliance Costs per Unit per Annum (€)	Estimated average increase in retail price (%)
1	141,3	6,1	14,1	20,2	505	+4,36%
2	245,2	24,5	22	46,5	1162,5	+10,04%
2A	245,2	24,5	22	46,5	1162,5	+10,04%

2B	150,2	5,6	14,5	20,1	502,5	+4,34%

Table 13: Compliance Costs per Unit, per Annum and estimated impact on unit price for CI engines

Impact on number of jobs: Direct job losses have been estimated by applying an employment elasticity factor to the change in demand. The employment elasticity factor indicates the percentage change in employment that is associated with the change in demand. The United Nations Economic Council for Europe has suggested an employment elasticity of between 0,5 and 0,2 for the 15 EU Member States for the period 2002 to 2005. For the purpose of this impact assessment an average employment elasticity of 0.35 has been used. The total direct and indirect jobs at risk have been estimated to total 1200 FTEs, based on an average direct employment of 25 FTEs for each of the 30 enterprises established in Europe and by applying a sectoral multiplier of 1.6 for the relationship between direct and indirect jobs. The results for all four regulatory scenario options are summarised in Table 14.

Option	Price Effect (%)	Likely Demand Effect (%)	Elasticity of Employment	Direct Jobs Effect (%)	Direct Job Losses	Indirect Job Losses	Total Jobs
1	+4,4	-8,8	0,35	-3,08	-23	-14	-37
2	+10	-20		-7	-53	-32	-85
2A	+10	-20		-7	-53	-32	-85
2B	+4,3	-8,6		-3,01	-23	-14	-37

Table 14: Estimate of potential job losses in EU based enterprises manufacturing and marinising diesel engines for recreational marine use

The impact on third countries and international relations is considered to be minimal, as well as the macroeconomic impacts, in view of the relative small scale of the sector and its structure. Any differential impact on public authorities is also likely to be minimal between the options, as the level and nature of the implementation costs will be the same for any of the four regulatory scenario options.

5.2.4. *Personal Watercraft(PWC)*

5.2.4.1. Compliance costs

Four stroke spark ignition engines for PWC are not likely to incur any additional compliance costs under the options 1, 2 and 2A (see Table 1).

The key assumptions for estimating the compliance costs for two-stroke spark ignition PWC engines are based upon annual sales of 5000 (a split of 50:50 has been assumed for sales of two stroke and four stroke spark ignition PWC engines), with 3 manufacturers from outside the EU importing their products into the EU. The average number of two stroke engine families per PWC manufacturer and subject to certification and re-tooling costs is estimated to be 1.

Fixed, variable and total compliance costs are summarised in Tables 15 to 17.

Option	Fixed Compliance Cost per Engine Family (€m)	No of Two Stroke Engine Families	% of Engine Families Following Relevant Compliance Route	No of manufacturers	Total Fixed Costs (€m)
1	1,6	1	20%	3	1,0
2	1,4	1	60%	3	2,5
2A	1,6	1	20%	3	1,0
2B	1,6	1	20%	3	1,0

Table 15: Fixed Compliance Costs of Two Stroke Spark Ignition PWC Engines

Option	Variable Compliance Cost per Engine (€)	No of Two Stroke Engines	% of Engines Following Relevant Compliance Route	Total Variable Costs (€m)
1	1045	5000	20%	1,04
2	871	5000	60%	2,6
2A	1045	5000	20%	1,04
2B	1045	5000	20%	1,04

Table 16: Variable Compliance Costs of Two Stroke Spark Ignition PWC Engines

Option	Gross Fixed Compliance Cost (€m)	Gross Variable Compliance Cost (€m)	Gross Total Compliance Cost (€m)
1	1,0	1,04	2,04
2	2,5	2,6	5,1
2A	1,0	1,04	2,04
2B	1,0	1,04	2,04

Table 17: Total Compliance Costs of Two Stroke Spark Ignition PWC Engines

5.2.4.2. Distributional issues:

Price effects: impact on prices has been calculated in Table 18, based on the assumption that the fixed compliance costs will be amortised over a ten-year period, which is approximately the average economic lifetime of an engine model, and over an average annual sale of 5000 engines, with an average retail price of € 11607.

Option	Total Fixed Compliance Costs (€m)	Total Variable Compliance Costs per Annum (€m)	Fixed Costs per Annum (€m)	Gross Compliance Costs per Annum (€m)	Additional Compliance Costs per Unit per Annum (€)	Estimated average increase in retail price (%)
1	1,0	1,04	0,1	1,1	220	+1,9%
2	2,5	2,6	0,25	2,85	570	+4,9%
2A	1,0	1,04	0,1	1,1	220	+1,9%
2B	1,0	1,04	0,1	1,1	220	+1,9%

Table 18: Compliance Costs per Unit, per Annum and estimated impact on unit price for two stroke spark ignition PWC engines

Taking into account a price elasticity of -2, engine demand is likely to fall by 3,8 to 9,8 %.

Impact on number of jobs: Direct job losses have been estimated by applying an employment elasticity factor to the change in demand. As for compression ignition engines, an average employment elasticity of 0.35 has been used. The total direct and indirect jobs at risk have been estimated to total 480 FTEs, based on an average direct employment of 300 FTEs in the EU based manufacturing plant for PWC engines and by applying a sectoral multiplier of 1.6 for the relationship between direct and indirect jobs. The results for all four regulatory scenario options are summarised in Table 19.

Option	Price Effect (%)	Likely Demand Effect (%)	Elasticity of Employment	Direct Jobs Effect (%)	Direct Job Losses	Indirect Job Losses	Total Job Losses
1	+1,9%	-3,8	0,35	-1,33	-4	-2	-6
2	+4,9%	-9,8		-3,43	-10	-6	-16
2A	+1,9%	-3,8		-1,33	-4	-2	-6
2B	+1,9%	-3,8		-1,33	-4	-2	-6

Table 19: Estimate of potential job losses in EU based enterprises manufacturing PWC engines

As for outboard engines and compression ignition engines, the **impact on third countries and international relations** is considered to be minimal, as well as the **macroeconomic impacts**, in view of the relative small scale of the sector and its structure. Any differential **impact on public authorities** is also likely to be minimal between the options, as the level and nature of the implementation costs will be the same for any of the four regulatory scenario options.

5.2.5. *Summary of economic and social impacts*

Option	CI Engines (€m)	SI Engines (€m)	PWC Engines (€m)	Total (€m)
1	147,4	6,4	2,0	155,8
2	245,2	114,7-127,3	5,1	365,0–377,6
2A	245,2	98,4-111	2,0	345,6–358,2
2B	150,2	98,4-111	2,0	250,6–263,2

Table 20: Summary of Gross Compliance Costs (lower-upper band) – (€m)

Option	CI Engines (%)	SI Engines (%)	PWC Engines (%)
1	+4,36	+0,7%	+1,9
2	+10,04	+10,0%	+4,9
2A	+10,04	+7,7%	+1,9
2B	+4,34	+7,7%	+1,9

Table 21: Summary of Estimated Price Effect (% increase in unit retail price)

Option	CI Engines	SI Engines	PWCs	Total
1	-37	-86	-6	-129
2	-85	-86	-16	-187
2A	-85	-86	-6	-177
2B	-37	-86	-6	-129

Table 22: Summary of Employment Effect (estimated number of direct and indirect job losses)

5.3. Summary of the environmental impact assessment

In order to assess the environmental impacts, a formulaic approach has been adopted allowing the exhaust emissions to air to be modelled under each of the four regulatory scenario options. Initially, fleet composition across Europe was investigated, including types of vessels, numbers and the engine mix within of groups of vessels in three typical environments, i.e. linear waterways (rivers and canals), coastal areas (estuaries, fjords, inland coastal) and inland water bodies (Lochs, lakes and reservoirs). Data on the numbers of vessels were limited and therefore estimates have been made based on limited registration data, aerial photography and European stocktaking data from industry sources.

Based on these data, a hypothetical fleet was defined for each of the three environments, with a predicted number of vessels, operated in a hypothetical environment aligned as closely to real situations as possible. To quantify impacts, sensitive receptors such as areas of conservation and residential areas were modelled in the scenario building. The engine sizes, types, usage and distribution within the fleet were used to calculate the total emissions per annum arising from the use of the recreational craft fleet. The overall emissions were then modelled using AERMOD to give long term and short term results for a range of air quality parameters. This allowed for the possible regulatory scenario options to be directly related to environmental impacts and compared to each other and the environmental quality standards.

The results of the environmental impact assessment are summarised in Tables 23 to 25 below, from which emerges the emission reduction potential for each of the four regulatory scenario options compared to the baseline option and this for each of the three typical environments. In the emission calculations a load factor has been applied to take account of the fact that recreational craft engines are not always used at full load.

Air pollutant→	CO		$HC + NO_x$		PT		Total	
↓Scenario	kton/y	%	kton/y	%	kton/y	%	kton/y	%
Baseline option	46,3		14,6		0,3		61,2	
Option 1	46,3	0	12,2	-16,4	0,2	-33	58,7	-4,1
Option 2	46,3	0	9,9	-32,2	0,2	-33	56,4	-7,8

Option 2A	46,3	0	9,7	-33,5	0,2	-33	56,2	-8,2
Option 2B	46,3	0	11,7	-19,9	0,2	-33	58,2	-4,9

Table 23: Summary of exhaust emissions in kilotonnes/year and reduction potential in % for lake environments

Air pollutant→	CO		HC + NO_x		PT		Total	
↓Scenario	kton/y	%	kton/y	%	kton/y	%	kton/y	%
Baseline option	90,6		23,3		0,3		114,2	
Option 1	90,6	0	18,7	-19,7	0,2	-33	109,3	-4,3
Option 2	90,6	0	16,3	-30,0	0,2	-33	107,1	-6,2
Option 2A	90,6	0	15,9	-31,8	0,2	-33	106,7	-6,6
Option 2B	90,6	0	18,0	-22,7	0,2	-33	108,8	-4,7

Table 24: Summary of exhaust emissions in kilotonnes/year and reduction potential in % for coastal environments

Air pollutant→	CO		HC + NO_x		PT		Total	
↓Scenario	kton/y	%	kton/y	%	kton/y	%	kton/y	%
Baseline option	16,2		3,0		0,0		19,2	
Option 1	16,2	0	1,8	-40,0	0,0	0	18	-6,3
Option 2	16,2	0	2,0	-33,0	0,0	0	18,2	-5,2
Option 2A	16,2	0	1,8	-40,0	0,0	0	18	-6,3
Option 2B	16,2	0	1,8	-40,0	0,0	0	18	-6,3

Table 25: Summary of exhaust emissions in kilotonnes/year and reduction potential in % for a typical inland waterway environments

The aggregated amount of exhaust emissions for the entire recreational craft fleet in Europe and the emission reduction potential for each of the regulatory scenario options are summarised in Table 26.

Air pollutant→	CO		HC + NO_x		PT		Total	
↓Scenario	kton/y	%	kton/y	%	kton/y	%	kton/y	%
Baseline option	153,1		40,9		0,6		194,6	

Option 1	153,1	0	32,7	-20	0,4	-33	186,2	-4,3
Option 2	153,1	0	28,2	-31	0,4	-33	181,7	-6,6
Option 2A	153,1	0	27,4	-33	0,4	-33	180,9	-7,0
Option 2B	153,1	0	31,5	-23	0,4	-33	185,0	-5,0

Table 26: estimated total amount of EU recreational marine exhaust emissions in kiloton per year and emission reduction potential in % for the regulatory scenario options compared to the baseline option

5.4. Comparing the impacts of the regulatory scenario options (multi-criteria analysis)

In accordance with the Commission's Impact Assessment Guidelines, a multi-criteria analysis has been made to produce a dynamic comparison of the four scenario options against the baseline option with regard to the following criteria: effectiveness (how well can the emission reduction objective achieved), efficiency (direct and indirect costs of compliance) and consistency (balance of positive and negative impacts - cost/benefit ratio). The results of this analysis are summarised in Table 27.

Criterion →	effectiveness (total emission reduction)	efficiency (total compliance & social cost)		consistency (compliance & social cost per kton/y emission reduction)	
Option 1	8,4 kton/y (-4.3%)	+155,5 m€	-129 jobs	+18,5 m€	-15,4 jobs
Option 2	12,9 kton/y (-6.6%)	+371,.3 m€	-187 jobs	+28,8 m€	-14,5 jobs
Option 2A	13,5 kton/y (-7.0%)	+351,9 m€	-177 jobs	+26,1 m€	-13,1 jobs
Option 2B	9,6 kton/y (-5.0%)	+256,9 m€	-129 jobs	+26,8 m€	-13,4 jobs

Table 27: results of the multi-criteria analysis for the scenario options compared to the baseline option in relative quantitative terms

To compare the range of positive and negative impacts of each of the options, the absolute values expressed in different units have been transformed into value scores by standardising the data with respect to mean and standard deviations. This standardisation enables to measure the relative dispersion around the mean of a group of variables in a consistent manner. The value scores have been weighted as indicated in Table 28. Effectiveness has been weighted higher than efficiency and consistency because of the primary objective of assessing the emission reduction potential of the regulatory scenario options considered.

	unadjusted scores				Weight (%)	adjusted scores			
option → ↓criterion	1	2	2A	2B		1	2	2A	2B
Effectiveness (emission reduction potential)	-0,94	0,54	0,54	-0,15	50	-0,467	0,272	0,272	-0,074

Efficiency 1 (compliance cost)	0,96	-1,02	-0,25	0,32	15	0,144	-0,153	-0,038	0,047
Efficiency 2 (social cost)	0,86	-1,02	-0,70	0,86	15	0,129	-0,153	-0,104	0,129
Consistency (cost/benefit)	0,68	-0,45	-0,25	0,01	20	0,136	-0,090	-0,049	0,003
Total score	1,56	-1,95	-0,65	1,04	100	-0,062	-0,125	0,0805	0,1052

Table 28: Summary of multi-criteria analysis expressed in unadjusted and adjusted value scores (higher positive scores indicate better performance for the criterion concerned)

6. STAKEHOLDER CONSULTATION

- Which interested parties were consulted, when in the process, and for what purpose?
- What were the results of the consultation?

Stakeholders which could be significantly affected by, or involved in, further developments in emission legislation for marine recreational craft in the European Union have been widely and closely consulted throughout the entire impact assessment process. In the first phase, in the context of the stocktaking study, the stakeholder consultation has focused on representative industry and user associations at European level. In the second phase, when the detailed impact assessment study was carried out, the consultation has been extended to individual enterprises in the recreational maritime sector and to environmental agencies in the Member States.

Consultations with industry associations and individual enterprises were held were held to gain first hand information on engine technologies, details of exhaust emissions, estimates of sales volumes and an outlook on future engine development lines from the manufacturers' perspective. Industry associations consulted: International Council of Marine Industry Associations (ICOMIA), ICOMIA's Marine Engine Committee (IMEC), European Association of Internal Combustion Engine Manufacturers (EUROMOT), Bundesverband Wassersportwirtschaft (BWVS), British Marine Federation (BMF), Italian Marine Industry Association (UCINA), Spanish Marine Federation (ANEN), French Nautical Industries Association (FIN), British Marine Engine and Equipment Manufacturers' Association (MEEMA), European Confederation of Nautical Industries (ECNI) and the US National Marine Manufacturers' Association (NMMA).

In addition, over 20 engine manufacturers active on the European market have been consulted, representing a reasonable balance between larger companies active on the international market on the one hand (all third country manufacturers listed in Table 29 as well as Perkins, Volkswagen and Volvo Penta) and small and medium sized enterprises on the other. Marinizers have been consulted in parallel as well.

EU engine manufacturers	Country	Non-EU engine manufacturers	Country
Aabenraa Motorfabrik	DK	Bombardier	US
Baudouin Moteurs	FR	Cummins Mercruiser Diesel	US
CRM	IT	Evinrude (Bombardier-brand)	US

IMS	IT	Mercury Marine	US
Iveco Power Train	IT	Honda	JP
Lombardini Marine	IT	Suzuki	JP
MTU	DE	Tohatsu	JP
Perkins (Caterpillar-brand)	UK	Yamaha	JP
Seatek	IT	Yanmar Marine	JP
Selva	IT		
Steyr	AT		
Volkswagen	DE		
Volvo Penta	SE		

Table 29: list of engine manufacturers consulted during the impact assessment process

Also a stakeholders' panel has been established to review and refine on a ongoing basis the technical, environmental, economic and social impacts under assessment.

As a result of this consultation with industry stakeholders two main divergent positions emerged. The first position is in favour of further emission reduction legislation, mainly with the aim to align EU legislation with the one in the United States. This position is supported by EUROMOT, representing the view of the diesel engine manufacturers operating on the global market, and by some petrol engine manufacturers as well. The other position is one of concern about the impact further emission reduction legislation may entail, and is mainly voiced by SMEs, irrespective of whether they are diesel or petrol engine manufacturers or marinisers.

In the context of the impact assessment study 11 Member State environment agencies were contacted via written correspondence setting out the key assumptions and methodological approach to calculating the theoretical environmental impacts of the proposed regulatory options. Written responses were received from the Environment Agency (UK) expressing concern that the cost to boating industry could be disproportionate to the environmental benefits of further regulation, and from the Danish Ministry of Environment and Energy being in favour of further emission reduction measures for recreational craft, but also acknowledging that total emissions from recreational craft are rather limited, but could locally have negative effects on the health and the environment.

In addition, the impact assessment process has been accompanied by 6 stakeholders' meetings organised by the Commission services over a period of 2 years, aimed at also regularly informing and consulting the other stakeholders involved in the implementation of the Recreational Craft Directive (competent authorities in the Member States, standardisation and user organisations and notified bodies) about the impact assessment process and its results and to provide the opportunity to raise questions and comments.

7. COMMISSION POSITION AND JUSTIFICATION

- What is the final policy choice and why?
- Why was a more/less ambitious option not chosen?
- Which are the trade-offs associated to the chosen option?

- If current data or knowledge are of poor quality, why should a decision be taken now rather than be put off until better information is available?
- Have any accompanying measures to maximise positive impacts and minimise negative impacts been taken?

From the results of the multi criteria analysis it can be concluded that each of the scenario options would have a social cost with between 13 to 15 jobs lost for each kiloton annual pollution reduction, combined with a relatively low reduction potential (between 4.3% and 7%) on the contribution by recreational craft to overall pollution.

In view of the call by Heads of State at the Lahti informal meeting in October 2006 for urgent action on climate change and the Commission's commitment to lead this policy process, a maximum effort should be made to further optimise this reduction potential. To achieve this goal, further scenarios should be explored and assessed which could be based upon the most stringent and technology driving emission rules for recreational craft already applied or envisaged in other parts of the world, for instance in the United States of America. Such approach would also have to take into account the need for EU engine manufacturers operating on the global market to maintain and strengthen their competitive position vis-à-vis third country competitors. When developing such an approach careful consideration will also have to be given to the vulnerable position of EU small and medium sized enterprises operating on the European market only.

Indeed, the social impact assessment has identified that the social cost of any further emission reduction measures would mainly be borne by small and medium sized enterprises established in the EU, and case study evidence indicates that implementation of any of the regulatory scenario options would seriously endanger the future on the only outboard engine manufacturer genuinely established in the European Union.

Therefore, appropriate accompanying measures might be envisaged to provide an optimum balance between maximum emission reductions and minimal social costs. Such measures could, for instance, consist in providing exemptions for low volume manufacturers, based upon mechanisms already applied in other Community legislation.

More time and study work will be needed to assess the impact and appropriateness of such an ambitious approach towards minimising the contribution of motorised recreational craft to climate change whilst at the same time mitigating the associated social costs and negative impacts on the competitiveness of small and medium sized enterprises established in the EU.

A lot of efforts have been invested in the collection and building of reliable data to base the impact assessment upon. Although some estimates needed to be made where insufficient information was available, the methodology applied has ensured that the results of the impact assessment are sufficiently transparent, reproducible and robust to support the proposed decision.