Synopsis Report of Consultation Activities under Work Package 3

Milan Elkerbout
Felice Simonelli
Hien Vu
Chiara Del Giovane
Julie Bryhn
Mihnea Catuti
Alessandro Muscio

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Table of contents

List of figures

List of abbreviations

BF	Blast furnace
BOF	Basic oxygen furnace
CAPEX	Capital expenditure
CBAM	Carbon border adjustment mechanism
CCfD	Carbon contracts for difference
CfD	Contracts for difference
CCS	Carbon capture and storage
CCU	Carbon capture and usage
CCUS	Carbon capture, usage and storage
CEPS	Centre for European Policy Studies
EAF	Electric arc furnace
ELV	End-of-life vehicle
ETS	Emissions Trading System
EU	European Union
GHG	Greenhouse gas
GPP	Green public procurement
HEU	Horizon Europe
IPCEI	Important project of common European interest
MSR	Market stability reserve
NECP	National energy and climate plans
OPEX	Operating expenditure
PEM	Polymer electrolyte membrane
PPA	Power purchase agreements
R&D	Research and development
R&D&I	Research, development and innovation
RE	Renewable electricity
RES	Renewable energy sources
RES-E	Electricity from renewable energy sources
RFCS	Research Fund for Coal and Steel
SOEC	Solid oxide electrolyser cell

Executive Summary

Consultation activities plays a key role in collecting data and information, gathering feedback and validating the findings of the research work carried out under Work Package 3 of the Green Steel for Europe project. Stakeholder consultation activities for WP3 focus on four main steps:

- **Identification of policy problems**. A targeted online survey and follow-up interviews were conducted to define the policy problems affecting the decarbonisation of the steel industry, thus also helping identify the objectives that new EU policy interventions should aim to achieve.
- **Selection of policy options**. A targeted online survey was carried out to define a number of policy options to address the problems and achieve the set objectives.
- **Assessment of economic, social, environmental and industrial leadership impacts**. In-depth interviews, expert review and a public online consultation were organised to define impacts of the policy options.
- **Validation of draft deliverables and findings**. The main findings of the Impact Assessment will be presented at the final event of the Green Steel for Project. Stakeholder feedback will be collected during the Questions and Answers session.

Further details about the methodology used for the consultation activities under the Green Steel Project are presented in the Consultation Strategy (Deliverable D4.1 of this project). The main findings of the consultations activities are structured around six chapters presented below.

Renewable electricity

Stakeholders believed that the insufficient installed capacity and generation of renewable electricity (RES-E) significantly widened the potential gap between demand and supply of RES-E and impinged on the decarbonisation of the EU steel industry. Other specific problems, i.e. high costs of RES-E and the variability in both RES-E generation and electricity demand in the steel sector, also contribute to the insufficient amount of RES-E for decarbonisation steelmaking technologies. Among the 20 policy options proposed to bridge the existing and potential gap between the supply and demand of RES-E, stakeholders showed their highest support for the followings.

- Option RE1: improving EU funding programmes for commercially-ready and new RE technologies.
- Option RE2: drafting EU guidelines to streamline the permitting process for RE projects
- Option RE3: improving the mechanism for compensation of indirect emission costs in the electricity price
- Option RE4: drafting EU guidelines to promote and harmonise demand-response measures across Member States
- Option RE5: reducing energy costs for RES-E purchased via PPAs or green energy offers
- Option RE6: reducing the costs of balancing and shaping services in national markets
- Option RE7: revising and implementing policies on energy storage in the Green Deal

Stakeholders shared quite similar views on the impacts of the above policy options. The most significant impacts were increased availability of renewable energy and lower energy costs borne by the EU steel industry. Options RE1, RE5 and RE7 received relatively higher support in terms of effectiveness, efficiency, feasibility and coherence.

Green hydrogen

The limited cost competitiveness of green hydrogen was considered the most significant problems entailing insufficient availability of affordable green hydrogen for the steel sector decarbonisation, followed by the limited availability of electrolysers relying on renewable energy and the poor link between supply and demand for green hydrogen. Out of a long list of 20 policy options to increase the availability of affordable green hydrogen, the followings received highest preference from the stakeholders.

- Option GH1: supporting Member State initiatives towards early deployment
- Option GH2: supporting financing and deployment of electrolysers (public or private)
- Option GH3: improving the EU-wide framework for Guarantees of Origins for energy from RES
- Option GH4: offering a premium to producers of green hydrogen, e.g. through CCfDs
- Option GH5: providing financial support for the development of hydrogen transport infrastructure

Stakeholders believed that the above options would generate biggest impacts on the availability of green hydrogen, contributing to lowering the emission of greenhouse gas of the steel sector and supporting the green transition of the EU. Options GH1 and GH4 scored highest in terms of effectiveness, efficiency, feasibility and coherence. Steel-sector respondents however considered the proposed policy options less effective compared to non-steel sector respondents. The only exception was option GH4, which steel and non-steel sector respondents viewed as similarly effective.

Carbon capture usage and storage

Stakeholders agreed that the high costs and limited availability of CO_2 storage options impinges on the decarbonisation of the EU steel sector. Other specific problems (high costs and limitations of the CO_2 capture process, limited climate neutrality of carbon capture and usage, and the cross-chain problems) were considered moderately relevant. Twenty-nine policy options were considered to improve the availability of CCUS solutions, with the followings received highest support from the respondents.

- Option CCUS1: Supporting a market for low carbon/decarbonised products, for example through standards or public procurement
- Option CCUS2: affirming other modes of CO2 transportation beyond pipelines, and recognising and incentivising negative emissions technologies in the ETS
- Option CCUS3: providing funding (CAPEX and OPEX) for CO2 storage and transportation infrastructure
- Option CCUS4: Increasing carbon price to incentivise emissions reductions, potentially as a result of higher (short-term) climate targets
- Option CCUS5: providing increased public support and funding for R&D&I to optimise capture at high rates
- Option CCUS6: incentivising the use of CO2 that is compatible with climate-neutrality in the ETS
- Option CCUS7: providing a platform where different actors in the value chain meet and coordinate

- Option CCUS8: supporting clusters/ industrial symbiosis (e.g. through establishing an IPCEI)

The most significant impacts of these options, according to stakeholders, were increased availability of CCUS solutions for the steel sector and increased Member States budgets. Overall, options CCUS5 and CCUS8 scored the highest in terms of effectiveness, efficiency, feasibility and coherence; and the combination of these two options would result in even higher effectiveness.

Carbon pricing

The lack of complementary policies in addition to carbon pricing were believed to reduce the effectiveness of the EU carbon pricing system on the decarbonisation of the steel sector. Besides, stakeholders believed that other specific problems, including low carbon price and the risk of carbon leakage, would also prevent the EU steel sector from meeting its decarbonisation targets. Among the 25 policy options to ensure that carbon pricing effectively contributes to steel sector emissions reduction, the following ones were considered most relevant.

- Option CP1: hybrid Market Stability Reserve design
- Option CP2: reducing steel sector abatement costs
- Option CP3: enabling market differentiation low and high carbon steel
- Option CP4: green public procurement
- Option CP5: Introducing carbon contracts for difference
- Option CP6: implementing a Carbon Border Adjustment Mechanism
- Option CP7: introducing a separate industrial competitiveness policy for the steel industry

Steel sector, non-steel sector and non-industry respondents did not differ greatly in their assessment of the different options. The respondents agreed that these policy options are expect to have highest impacts on the costs of doing business for the steel industry and other industries, the emission of GHG of the steel sector and the green transition in the EU. When it comes to effectiveness, efficiency, feasibility and coherence, the respondents were generally in favour of options CP2, CP3, CP5 and CP6.

Scrap

Stakeholders considered that both the increasing demand for steel scrap in third countries and the losses of steel throughout the use cycle and impurities constrain the availability of high-quality steel scrap to a similar extent. Out of the 13 proposed policy solutions, the following one were believed to be more effective in ensuring a sufficient amount of high-quality steel scrap in Europe.

- Option SC1: revising the EU regulatory framework on waste
- Option SC2: improving the quality of scrap available in the EU
- Option SC3: ensuring that final products are recyclable

The most remarkable impacts of the above options, according to the respondents, were increased availability of steel scrap, improved R&D&I in technologies improving the quality of steel scrap, and resource efficiency and the circular economy. Option SC2 has similar level of efficiency, feasibility and coherence as the other two options, but would be remarkably more effective in ensuring sufficient amount of high-quality scrap for the EU steel sector.

Funding

The respondents agreed that the limitations in existing public financing programmes reduced the funding opportunities for decarbonisation technologies in the EU steel industry to a high extent, followed by the relatively higher production costs and high-risk profile of low-carbon steelmaking projects. Among the 23 proposed solutions, the following policy options were considered most relevant to ensure sufficient funding to develop and deploy low-carbon steelmaking solutions:

- Option FD1: promoting the use of EU funding programmes to finance OPEX of low-carbon steel
- Option FD2: mobilising private funding to support CAPEX of decarbonisation technologies
- Option FD3: ensuring public support for CAPEX beyond direct public funding, e.g. through accelerated depreciation or tax abatements
- Option FD4: introducing risk mitigation and loan guarantee instruments for investments in decarbonisation technologies
- Option FD5: introducing a compulsory standard - integration of low carbon standards in the Best Available Techniques Reference
- Option FD6: promoting low-carbon steel products in public procurement
- Option FD7: developing a green label for low-carbon steel
- Option FD8: ensuring that EU resources, including those of Next Generation EU, will support the green transition in the steel industry
- Option FD9: identifying pathways (2030 and 2050) for decarbonisation technology routes and ensuring that both EU and national policymakers account for them
- Option FD10: creating synergies in EU level funding via the Clean Steel Partnership
- Option FD11: creating additional synergies in EU level funding via blending and sequencing of different opportunities

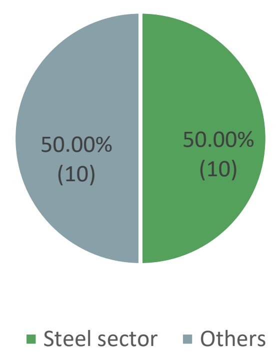
These policy options would have most impacts on steel companies' increased ability to funding sources and higher R&D&I in decarbonisation technologies, thus accelerating the decarbonisation of the sector. Meanwhile, stakeholders also believed that some options might increase the cost of doing business in the EU for the steel industry (e.g. option FD5) or raise the compliance costs, transaction costs or information obligations for steel companies (e.g. option FD6). The options that stakeholders put forward in terms of effectiveness, efficiency, feasibility and coherence were options FD1, FD4 and FD5, FD6.

1. Introduction

Survey on problem identification

The survey aimed to gather feedback from stakeholders on the problems affecting the decarbonisation of the European Union (EU) steel industry. It was carried out by the Centre for European Policy Studies (CEPS) between 14 October and 8 November 2020, via the EUSurvey platform. 20 stakeholders participated in the survey, representing 19 organisations and companies operating in both the steel industry (50%) and other sectors (50%; Figure 1). The majority of respondents operate in EU countries, except for one that is based only in the United Kingdom.

Figure 1: Problem identification - respondents by sector



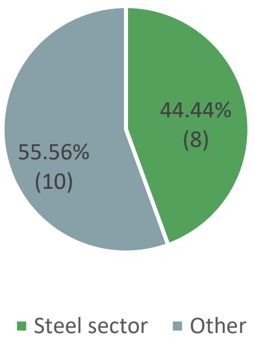
Source: authors' own compilation on survey results

The survey's questionnaire was structured around six policy areas affecting the decarbonisation of the EU steel industry: i) renewable electricity; ii) EU carbon pricing; iii) carbon capture, usage and storage; iv) green hydrogen; v) iron and steel scrap; and vi) funding. It comprised both close-ended questions (requesting the participants to provide their rating of different problems and drivers) and open-ended questions (where the respondents had the possibility to provide additional feedback on the topics under assessment). The answers to the close-ended questions have been converted for the analysis into a scale from 0 to 4, reflecting the respondents' agreement to a topic: not at all (0/4), to a limited extent (1/4), to some extent (2/4), to a high extent (3/4) and to the fullest extent (4/4).

Survey on policy objectives and options

The survey aimed to gather feedback from stakeholders on the proposed policy solutions to achieve relevant objectives for the decarbonisation of the EU steel industry. It was carried out by CEPS between 8 and 15 December 2020, via the EUSurvey platform. 18 stakeholders participated in the survey, representing 18 organisations and companies operating in both the steel industry (56%) and other sectors (44%; Figure 2). The majority of respondents operate in EU countries, except for one that is based only in the United Kingdom.

Figure 2: Policy objectives and options - respondents by sector



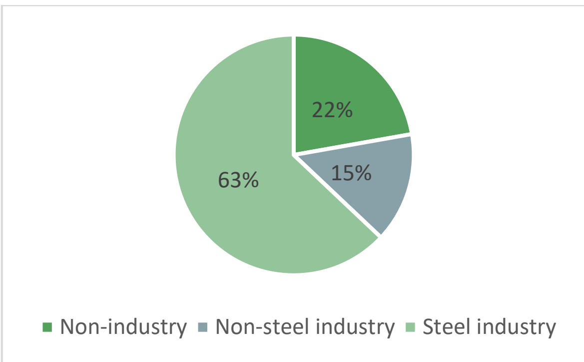
Source: authors' own compilation on survey results.

The survey's questionnaire was structured around six policy areas affecting the decarbonisation of the EU steel industry: i) renewable electricity; ii) EU carbon pricing; iii) carbon capture, usage and storage; iv) green hydrogen; v) iron and steel scrap; and vi) funding. It comprised both close-ended questions (requesting the participants to provide their rating of different policy options) and open-ended questions (where the respondents had the possibility to provide additional feedback on the topics under assessment). The answers to the close-ended questions have been converted for the analysis into a scale from 0 to 4, reflecting the respondents' agreement to a topic: not at all (0/4), to a limited extent (1/4), to some extent (2/4), to a high extent (3/4) and to the fullest extent (4/4).

Stakeholder consultation on impacts and comparison of policy options

The consultation activities aimed to gather feedback from stakeholders on the impacts of the different policy options for the decarbonisation of the EU steel industry identified in the study. The consultation is composed by information obtained by interview minutes, expert review, and a public survey via the EUsurvey platform. The consultation was carried out between 22 March and 22 April 2021. Twenty-two stakeholders participated in in-depth interviews, ten project partners provided their expert review and twenty-two stakeholders participated in the online survey. Two third of the respondents operate in the steel industry in EU countries.

Figure 3: Impacts and comparison of policy options - respondents by sector



Source: Authors' elaboration on survey results.

The survey's questionnaire is structured around six policy areas affecting the decarbonisation of the EU steel industry: i) renewable electricity, ii) EU carbon pricing, iii) carbon capture, usage and storage, iv) green hydrogen, v) iron and steel scrap, and vi) funding. The survey's questionnaire comprised both close-ended questions (requesting the participants to provide their assessment of the impacts of the proposed policy options and a comparison of the policy options) and open-ended questions (where the respondents had the possibility to provide additional feedback on the topics under assessment). The answers to the close-ended questions for the assessment of the impacts of the proposed policy options have been converted for the analysis into a scale from -2 to 2 reflecting the respondents' assessment of the impact of the policy options: very negative (-2), negative (-1), neutral (0), positive (1), and very positive (2). The answers to the close-ended questions for the comparison of the policy options have been converted for the analysis into a scale from 1 to 5 reflecting respondents' agreement to the question proposed: (1/5) not at all; (2/5) to a limited extent; (3/5) to some extent; (4/5) to a high extent; or (5/5) to the fullest extent

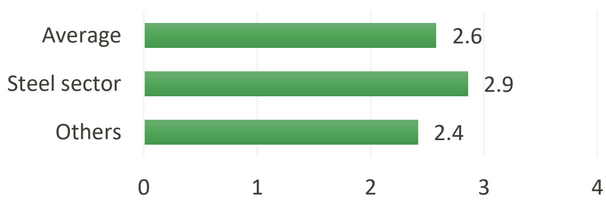
2. Renewable electricity

Problem identification

General problem RE: potential gap between demand and supply of renewable electricity

On average, the respondents agreed to a high extent (2.6/4) that the potential gap between demand and supply of electricity from renewable energy sources (RES-E) impinges on the decarbonisation of the EU steel industry (Figure 4). Respondents from the steel sector were more concerned about this problem (2.9/4) than non-steel sector respondents (2.4/4).

Figure 4: Potential gap between demand and supply of renewable electricity



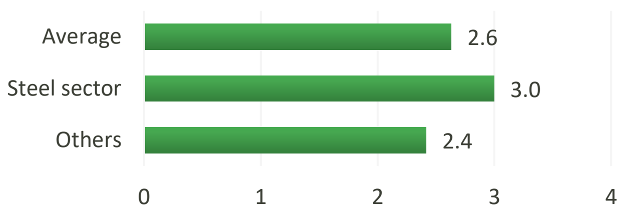
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the potential gap between demand and supply of renewable electricity will hinder the decarbonisation of the EU steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: Authors' elaboration on survey results.

Specific problem RE1: insufficient installed capacity and generation of RES-E

As shown in Figure 5, the respondents agreed to a high extent (2.6/4) that limited supply of RES-E would prevent the EU steel sector from meeting its decarbonisation targets. On average, respondents from the steel sector acknowledged to a higher extent (3.0/4) the specific problem than respondents from other sectors (2.4/4).

Figure 5: Limited supply of renewable electricity

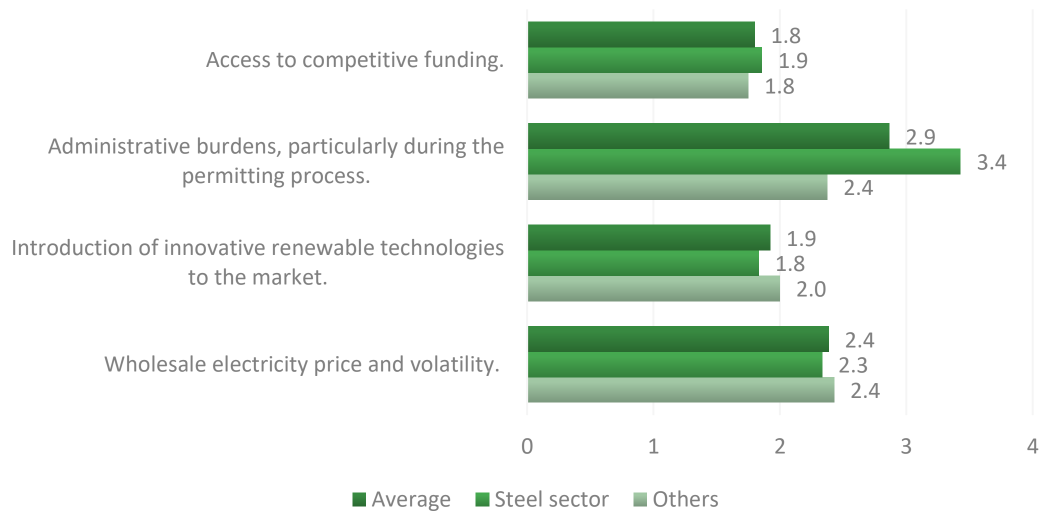


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that limited supply of renewable electricity in the EU will prevent the steel sector from meeting its decarbonisation targets?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The respondents agreed to a high extent (2.9/4) that administrative burdens, particularly during the permitting process, hinder the development of RES-E projects in certain Member States (Figure 6). Sector-wise, respondents from the steel industry agreed to a higher extent (3.4/4) with the relevance of this driver, while respondents from other sectors agreed to a lesser extent (2.4/4). The respondents agreed to some extent about the other three drivers, i.e. limited access to funding, difficulties in bringing innovative renewable energy technologies to the market and issues related to the electricity market (1.8, 1.9 and 2.4/4, respectively).

Figure 6: Drivers hindering the installation of new renewable electricity generation capacity in the EU



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers identified hinder the installation of new renewable electricity generation capacity in the EU?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own compilation on survey results.

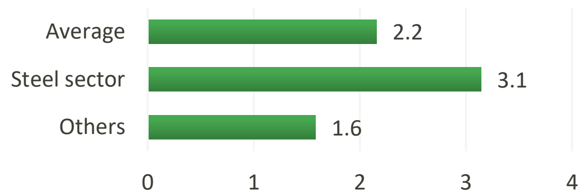
One non-steel sector respondent identified another driver hindering the installation of new RES-E generation capacity in the EU that was missing in the analysis: the stakeholder argued that the absence of a regulatory framework for energy storage (e.g. power-to-gas technology) contributes to increasing the magnitude of the specific problem identified.

About half of the respondents provided additional considerations on the availability of RES-E generation capacity in the EU and its impacts on the decarbonisation of the steel industry. One steel-sector respondent suggested that the study should also cover regulatory aspects affecting electricity generation within steel plants. Four stakeholders from the steel sector recognised that some Member States face more challenges to provide the RES-E needed to decarbonise their steel sector than other EU countries, mainly due to i) the limited funding to invest in renewable technologies; ii) the social acceptance of some renewable technologies; and iii) the limited renewable energy sources (RES), such as wind, solar and hydro. To solve this issue, one stakeholder proposed using financial power purchase agreements (PPAs) allowing steel companies to purchase RES-E from other EU countries. Another stakeholder from the steel sector identified the problem that Member States need to invest in new transmission lines to carry RES-E to the users (including steel plants). One stakeholder from the steel sector and two from other sectors considered the correlation between the availability of RES-E and the production of the green hydrogen needed to decarbonise the industry. More specifically, one of these stakeholders argued that decarbonising the steel sector required a huge amount of green hydrogen, which would significantly increase the steel production costs. To address this challenge, one respondent proposed to i) develop industrial-scale production of green hydrogen - to be supported by public funding; and ii) invest in research, development and innovation (R&D&I) to improve hydrogen-based steelmaking technologies.

Specific problem RE2: higher costs of renewable electricity compared to conventional electricity

The respondents agreed to some extent (2.2/4) that the high costs of RES-E would slow down the electrification of the steel sector and prevent it from meeting its decarbonisation targets (Figure 7). Across the different sectors, steel-sector stakeholders expressed higher concern about this problem (3.1/4) than respondents from non-steel sectors (1.6/4).

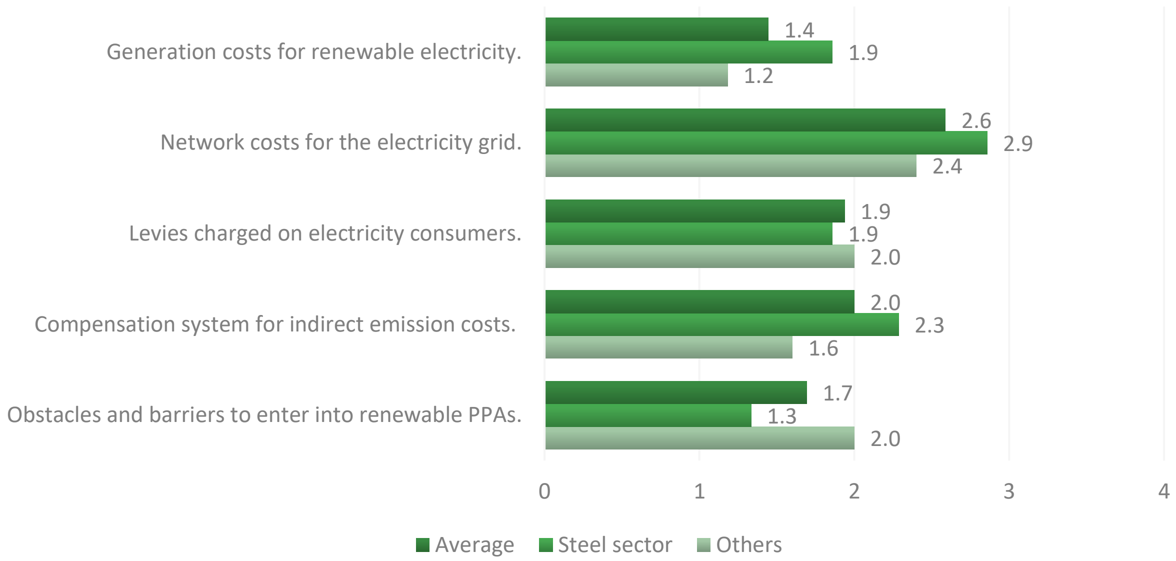
Figure 7: High costs of renewable electricity



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that high costs of renewable electricity will slow down the electrification of the steel sector and prevent it from meeting its decarbonisation targets?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).
Source: authors' own compilation on survey results.

As shown in Figure 8, the respondents identified network costs as the main driver contributing to increasing the costs of RES-E (2.6/4). The stakeholders believed that the other barriers (higher generation costs, the renewable-support levies, the issues related to the compensation system for indirect emission and barriers to developing PPAs) contribute to a lesser extent to the problem of high costs of RES-E (1.4, 1.9, 2.0 and 1.7/4, respectively).

Figure 8: Drivers increasing the costs for renewable electricity and reducing the cost competitiveness of the EU steel industry



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers identified will increase the costs for renewable electricity and reduce the cost competitiveness of the EU steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).
Source: authors' own composition on survey results

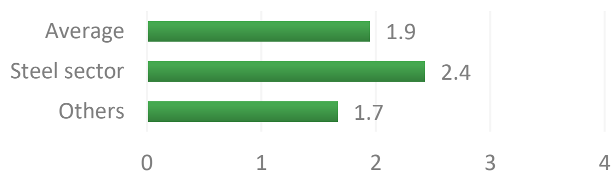
One steel-sector respondent identified other drivers which would increase the costs for renewable electricity and reduce the cost competitiveness of the EU steel industry. More specifically, the stakeholder believed that the lack of a credible harmonisation of the energy market and different taxation policies in power supply across different Member States, as well as the ineffective support of the current compensation for indirect EU Emissions Trading System (ETS) costs, contribute to increasing the price paid for RES-E.

Six respondents provided additional considerations on the costs of RES-E and their impacts on the decarbonisation of the steel industry. In particular, two respondents from both steel and non-steel sectors argued that some renewable technologies (e.g. onshore wind and solar) are already cost-competitive against conventional electricity. A non-steel sector respondent believed that the transmission costs and taxes play an important role in increasing the electricity price; therefore, local production of RES-E might be an unavoidable option to reduce such costs. Another non-steel sector respondent argued that a huge amount of green hydrogen would be needed to decarbonise the steel industry in the medium/long term. The same respondent proposed two solutions: i) the industry could take advantage of PPAs to purchase electricity generated by an electricity plant located within a short distance of the steel plants; or ii) steel plants could purchase electricity from the grid with green certificates. Finally, one respondent from a non-steel sector argued that the current levies financing renewables support schemes reflect the cost of production and system integration of various RES, while the generation costs of one renewable technology can be different from others. As a result, the current cross-subsidisation across energy carriers or sectors creates market distortions. Therefore, the respondent proposed that each renewable technology's bill shall integrate only the cost, charges and levies linked to the production, transport and retail of that specific technology.

Specific problem RE3: variability in both renewable electricity generation and electricity demand in the steel sector

As shown in Figure 9, the respondents agreed to some extent (1.9/4) that the variability of demand and supply would make it more difficult and costly for the steel sector to rely on RES-E, and prevent it from meeting its decarbonisation targets. Across the sectors, respondents from the steel industry acknowledged this problem to a higher extent than stakeholders from other sectors (2.4 and 1.7/4, respectively).

Figure 9: Variability of demand and supply in renewable electricity

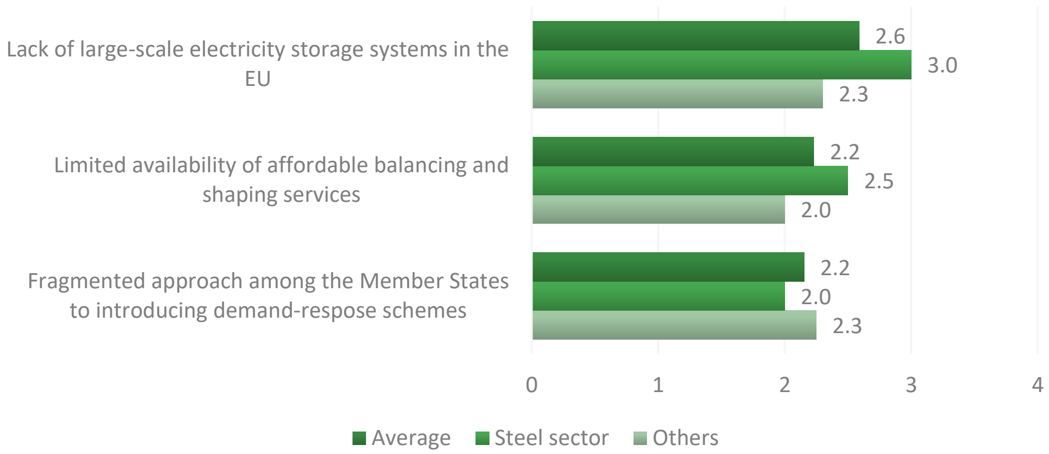


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that variability of demand and supply will make it more difficult and costly for the steel sector to rely on renewable electricity and prevent it from meeting its decarbonisation targets?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Stakeholders agreed to a high extent (2.6/4) that the most significant driver contributing to this specific problem is the lack of large-scale electricity storage systems in the EU to compensate for temporary imbalances between demand and production (Figure 10). Stakeholders from the steel industry expressed a higher consensus on the importance of this driver (3.0/4) than stakeholders from other sectors (2.3/4). Both steel and non-steel sectors reported quite similar scores for the other two drivers (limited availability of balancing and shaping services in some Member States, and fragmented approach to introducing demand-response schemes at the national level): results for these drivers ranged from 2.0 to 2.5/4.

Figure 10: Drivers making it relatively more difficult to match demand and supply of renewable electricity



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers make it more difficult to match demand and supply of renewable electricity in the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own compilation on survey results.

One respondent from the steel sector identified another driver which would make it more difficult to match the demand and supply of RES-E in the steel industry: the steel sector has not yet developed and deployed a reliable energy demand forecast for their production. In this regard, the respondent suggested that artificial intelligence-based systems can address the above challenge by forecasting energy demand in steel plants. Another respondent from the steel sector believed that a problem might arise when a high amount of RES-E is consumed and suggested the use of gas in steelmaking.

Seven respondents provided additional considerations on the variability of demand and supply of RES-E and its impact on the decarbonisation of the EU steel industry. One steel-sector respondent suggested that energy storage technologies (e.g. converting electricity to hydrogen) could be used to manage at least part of the variability of supply and demand. Another respondent from the steel sector argued that steel companies do not necessarily need to match renewable electricity demand and supply on a real-time basis to buy RES-E. Instead, the respondent proposed the solution of using financial PPAs (available in most countries today), which would allow companies to make renewable electricity purchases without requiring physical renewable electricity supply. However, in case steel plants wish to match the demand and supply of renewable electricity, the respondent agreed that measures such as intermediary balancing and shaping services, and use of storage technologies and load management solutions could be effective. Three non-steel sector stakeholders proposed additional solutions to overcome the problem of variable RES-E demand and supply for steel plants: i) smart grid integration; ii) demand-side flexibility in steel production; and iii) promotion of green hydrogen (hydrogen from RES-E) or blue hydrogen (hydrogen from natural gas in combination with carbon capture technologies) in steelmaking technology routes.

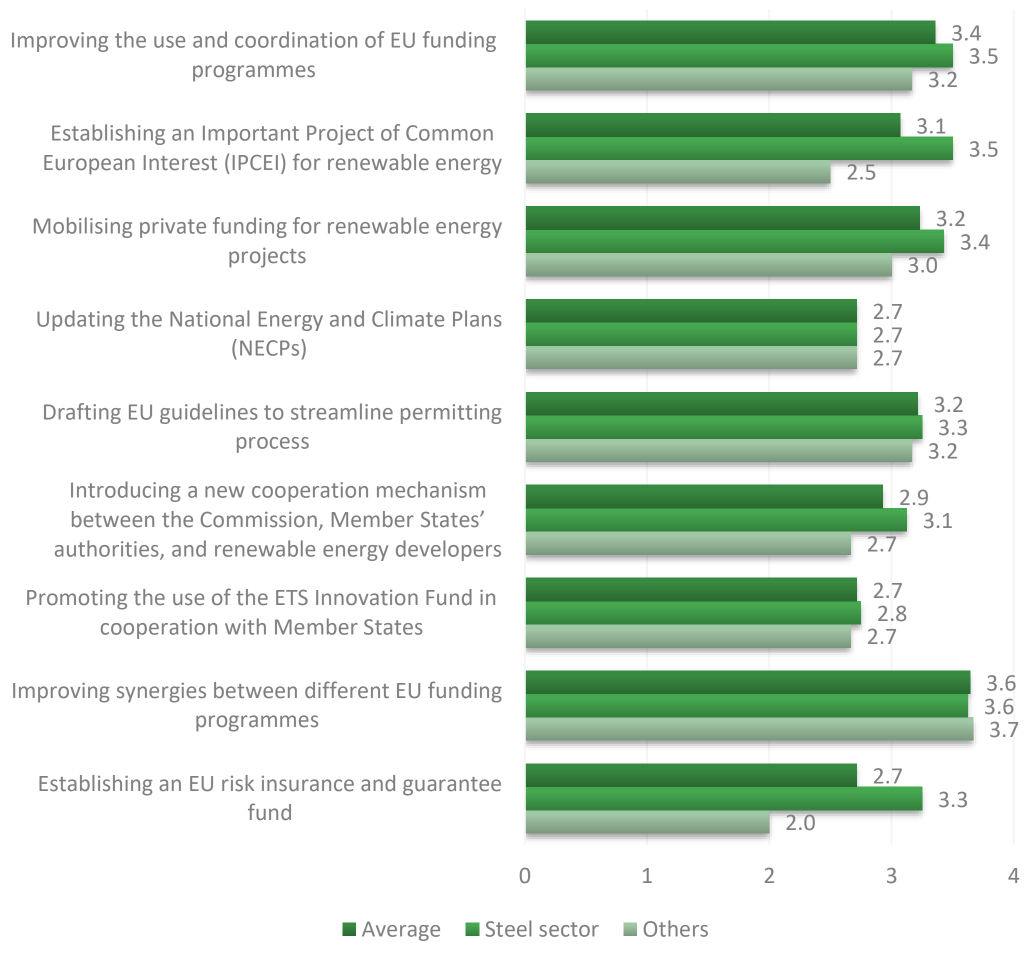
Other considerations on the general problem

One respondent from a non-steel sector provided a list of actions to ensure a level playing field among energy carriers and provide adequate price signals to favour demand flexibility, namely i) a tax reform to enable the full internalisation of the environmental costs of each product; ii) the removal of fossil fuel subsidies; and iii) the removal from the electricity bills of taxes and charges unrelated to supply costs.

Policy objectives and options

Both steel and non-steel sector stakeholders believed that improving the synergies between different EU funding programmes to bring new renewable energy technologies to the market could be the most effective option to accelerate the installation of new RES-E generation capacity in the EU (3.6/4 on average; Specific Objective RE1). Stakeholders from the steel sector also showed strong support for the options of improving the use and coordination of EU funding programmes for commercially-ready renewable energy technologies, establishing an Important project of common European interest (IPCEI) for renewable energy and mobilising private funding for renewable energy projects (3.5, 3.5 and 3.4/4, respectively; Figure 11).

Figure 11: Policy solutions to accelerate the installation of RES-E generation capacity

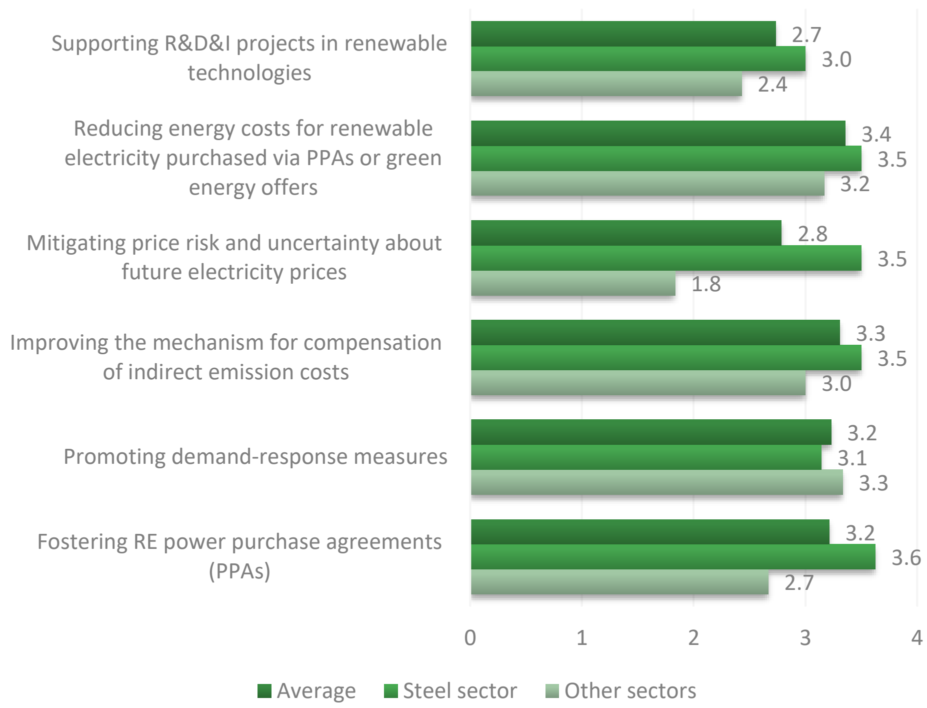


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective RE1, i.e. accelerating the installation of new renewable electricity generation capacity in the EU and ensuring that a sufficient quantity of renewable electricity is available for low-carbon steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own compilation on survey results

The stakeholders also believed to a high extent that the majority of the proposed policy options would contribute to reducing the costs to source RES-E (Specific Objective RE2; Figure 12). The preferred option is reducing energy costs for RES-E purchased via PPAs or green energy offers (3.4/4 on average). Interestingly, stakeholders from non-steel sectors considered that mitigating price risk and uncertainty about future electricity prices would contribute to a limited extent to reach Specific Objective RE2 (1.8/4), while stakeholders from the steel sector believed that the proposed option would contribute to a high/full extent to reach the objective (3.5/4).

Figure 12: Policy options to reduce costs to source RES-E

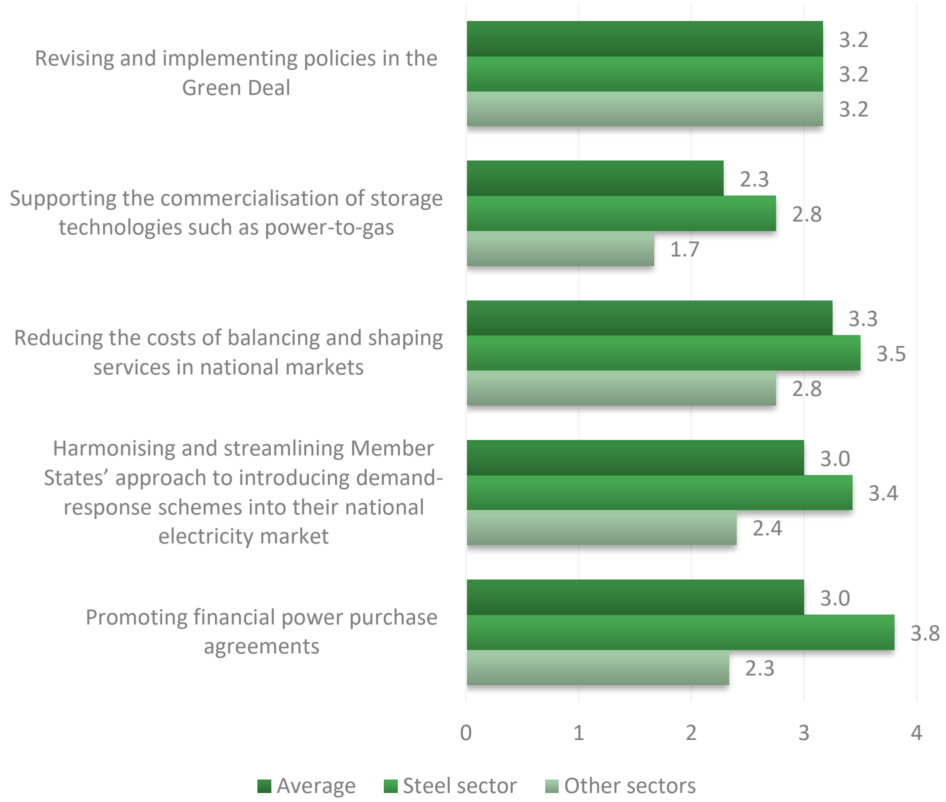


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective RE2, i.e. reducing costs to source renewable electricity and ensuring affordable renewable electricity for low-carbon steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results

As shown in Figure 25, the stakeholders believed that four over the five proposed policy options contribute at least to a high extent to managing the variability of RES-E generation, and matching power supply and demand in steelmaking (Specific Objective RE3). According to the stakeholders from the steel sector, the promotion of financial PPAs is the most effective option to achieve Specific Objective RE3 (3.8/4).

Figure 13: Policy options to manage the variability of RES-E generation



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective RE3, i.e. managing the variability of renewable electricity generation, and matching power supply and demand in steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results

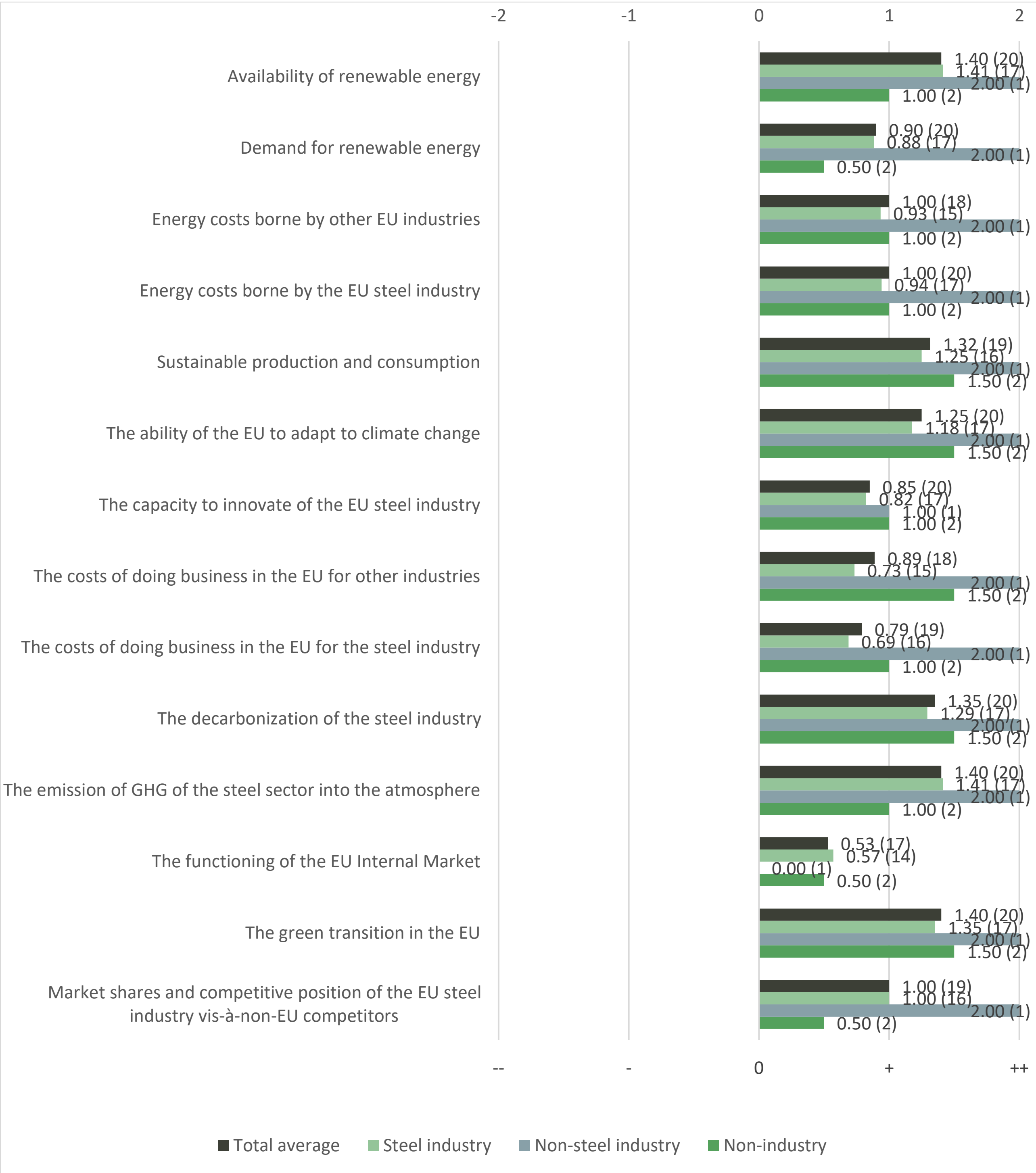
Besides the proposed policy solutions, stakeholders also believed that several other options too can help ensure a sufficient amount of affordable RES-E for decarbonising the EU steel sector. Two respondents from non-steel sectors suggested using the NECPs as a tool to increase the availability of RES-E, e.g. through increasing national renewable energy targets and removing barriers to enter PPAs. Another respondent from a non-steel sector suggested that integrating green hydrogen production into steel plants can support electricity storage during peak electricity production periods. The same respondent stressed the importance of integrating the electricity system of steel plants with the surrounding local grid to balance the electricity usage of both the plants and local communities. Finally, another non-steel sector stakeholder recommended using mandatory quotas for RES-E in electricity consumption for steel production.

Impacts of options

Impacts of option RE1: improving EU funding programmes for commercially-ready and new RE technologies.

According to the respondents, the option of improving EU funding programmes for commercially-ready and new RE technologies would generate the highest positive impacts on the availability of renewable energy and the green transition in the EU (Figure 14), recording the highest total score on average (1.40 in a range from -2 to 2).

Figure 14: Impacts of improving EU funding programmes for commercially-ready and new RE technologies



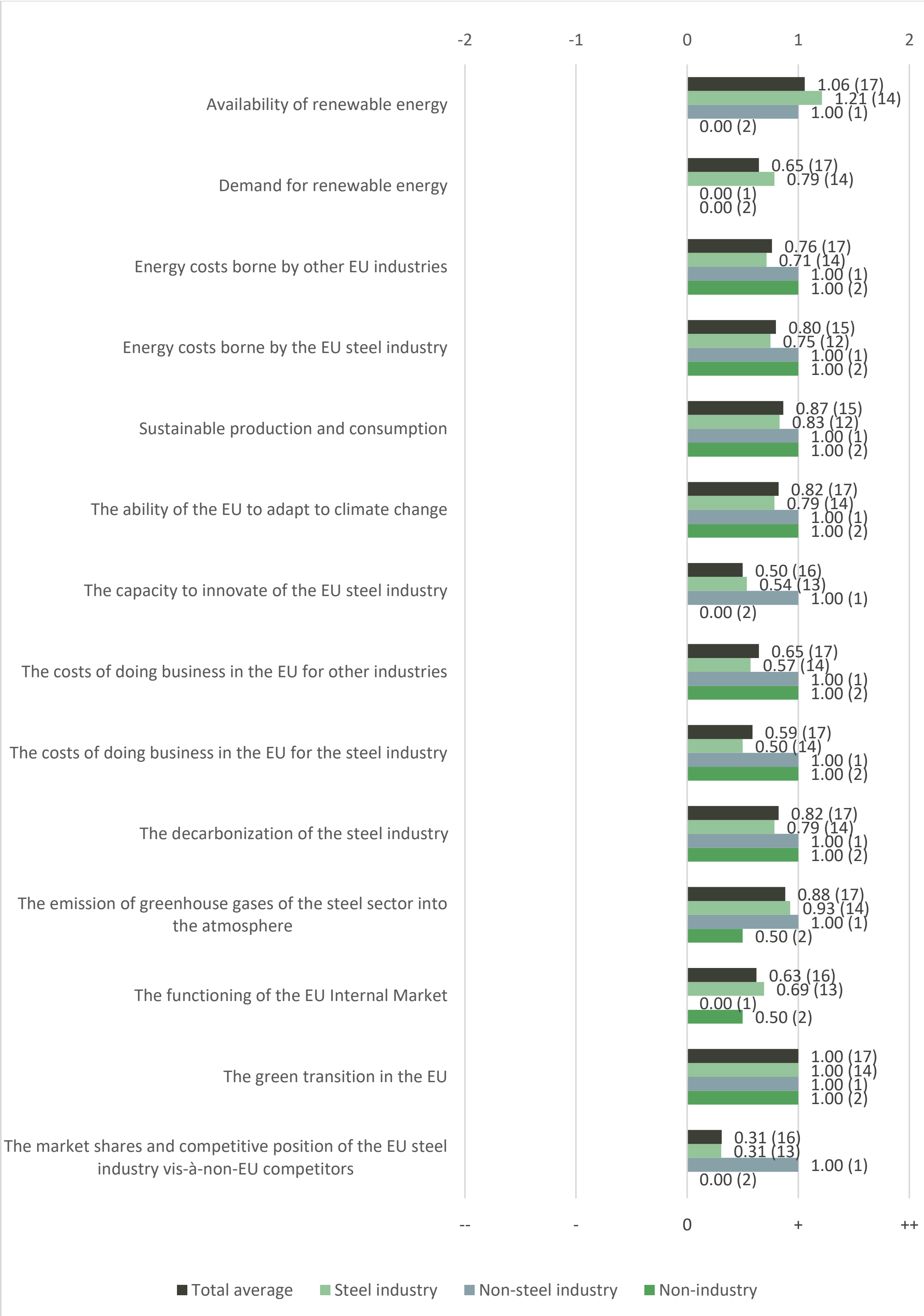
Note: the figure presents stakeholders' answers to question RE.IA.1, i.e. "What impact would option 1 (improving EU funding programmes for commercially-ready and new RE technologies) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option RE2: drafting EU guidelines to streamline the permitting process for RE projects

As shown in Figure 15, the option of drafting EU guidelines to streamline the permitting process for RE projects would generate the highest positive impacts on the availability of renewable energy, recording the highest total score on average (1.06 in a range from -2 to 2).

Figure 15: Impacts of EU guidelines to streamline the permitting process for RE projects



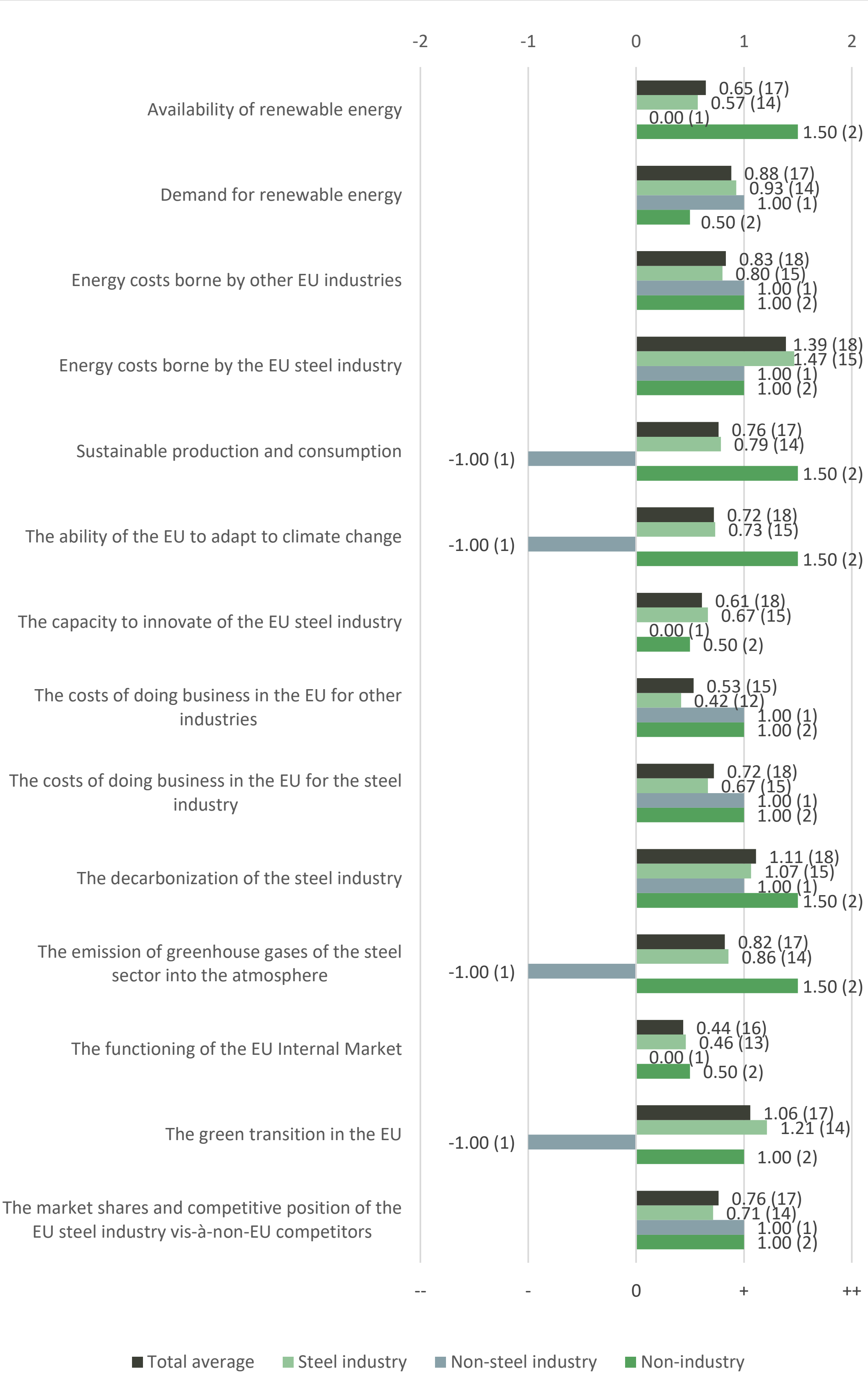
Note: the figure presents stakeholders' answers to question RE.IA.2, i.e. "What impact would option 2 (drafting EU guidelines to streamline the permitting process for RE projects) have on...?". Respondents provided their *best estimate based on the following scale: very negative (--), negative (-),neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.*

Source: authors' own composition on survey results.

Impacts of option RE3: improving the mechanism for compensation of indirect emission costs in the electricity price

Figure 16 shows that the option of improving the mechanism for compensation of indirect emission costs in the electricity price would generate the highest positive impacts on the energy costs borne by the EU steel industry, recording the highest total score on average (1.39 in a range from -2 to 2).

Figure 16: Impacts of improving the mechanism for compensation of indirect emission costs in the electricity price



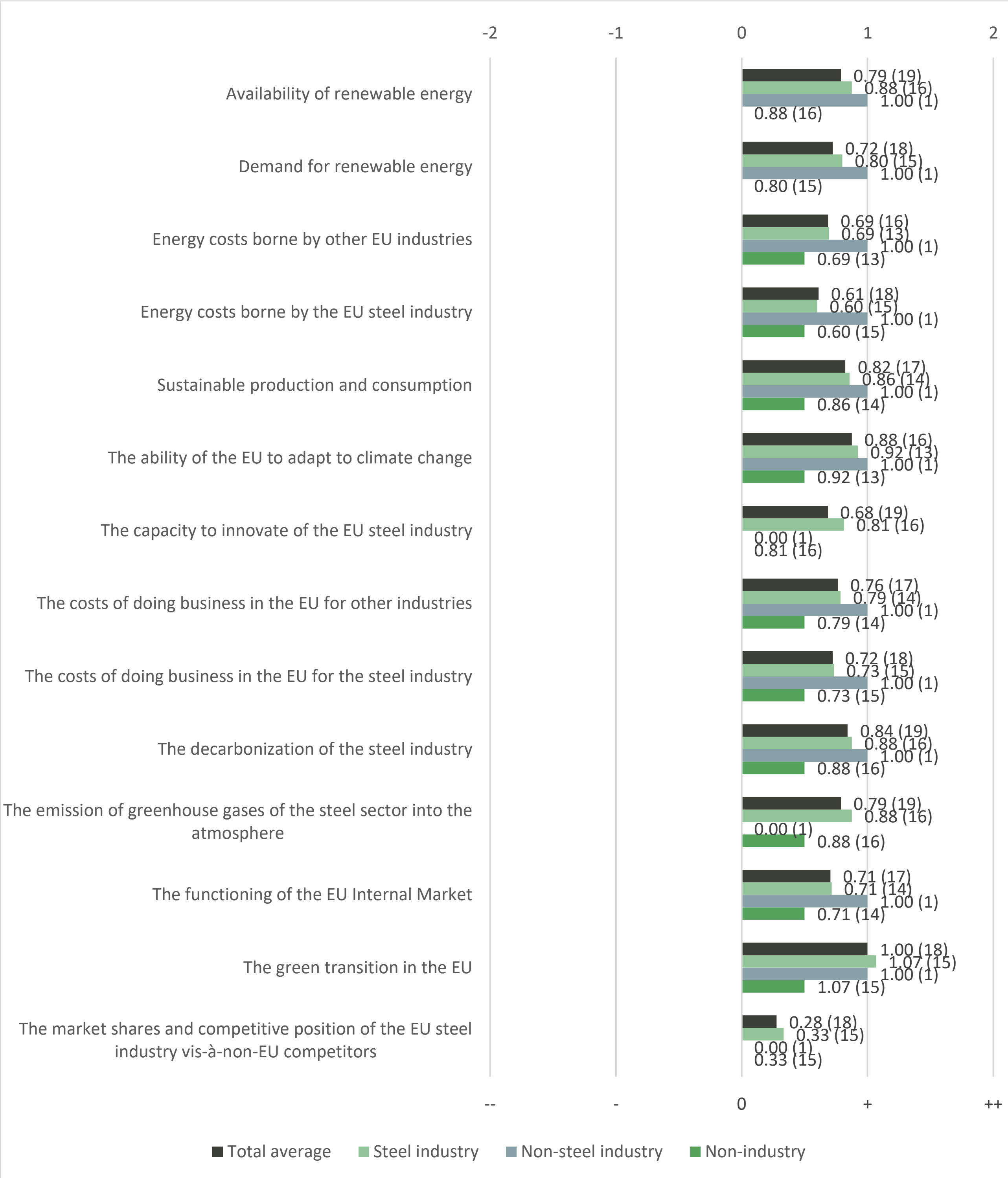
Note: the figure presents stakeholders' answers to question RE.IA.3, i.e. "What impact would option 3 (improving the mechanism for compensation of indirect emission costs in the electricity price) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option RE4: drafting EU guidelines to promote and harmonise demand-response measures across Member States

According to the respondents, the option of drafting EU guidelines to promote and harmonise demand-response measures across Member States would generate the highest positive impacts on the green transition in the EU (Figure 17), recording the highest total score on average (1.00 in a range from -2 to 2).

Figure 17: Impacts of drafting EU guidelines to promote and harmonise demand-response measures across Member States



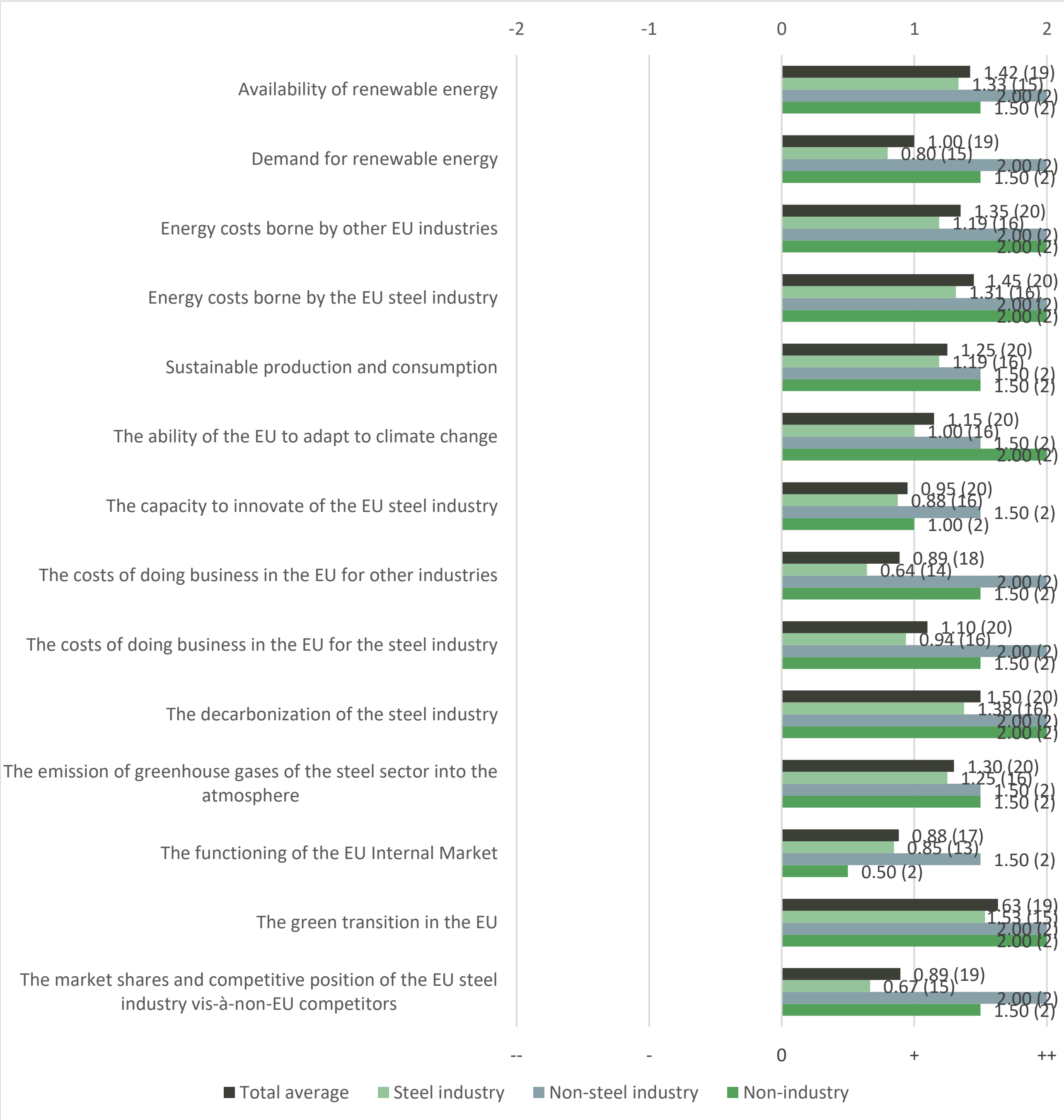
Note: the figure presents stakeholders' answers to question RE.IA.4, i.e. "What impact would option 4 (drafting EU guidelines to promote and harmonise demand-response measures across Member States) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option RE5: reducing energy costs for RES-E purchased via PPAs or green energy offers

According to the respondents, the option of reducing energy costs for RES-E purchased via PPAs or green energy offers would generate the highest positive impacts on the green transition in the EU (Figure 18), recording the highest total score on average (1.63 in a range from -2 to 2).

Figure 18: Impacts of reducing energy costs for RES-E purchased via PPAs or green energy offers



Note: the figure presents stakeholders' answers to question RE.IA.5, i.e. "What impact would option 5 (reducing energy costs for RES-E purchased via PPAs or green energy offers) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive

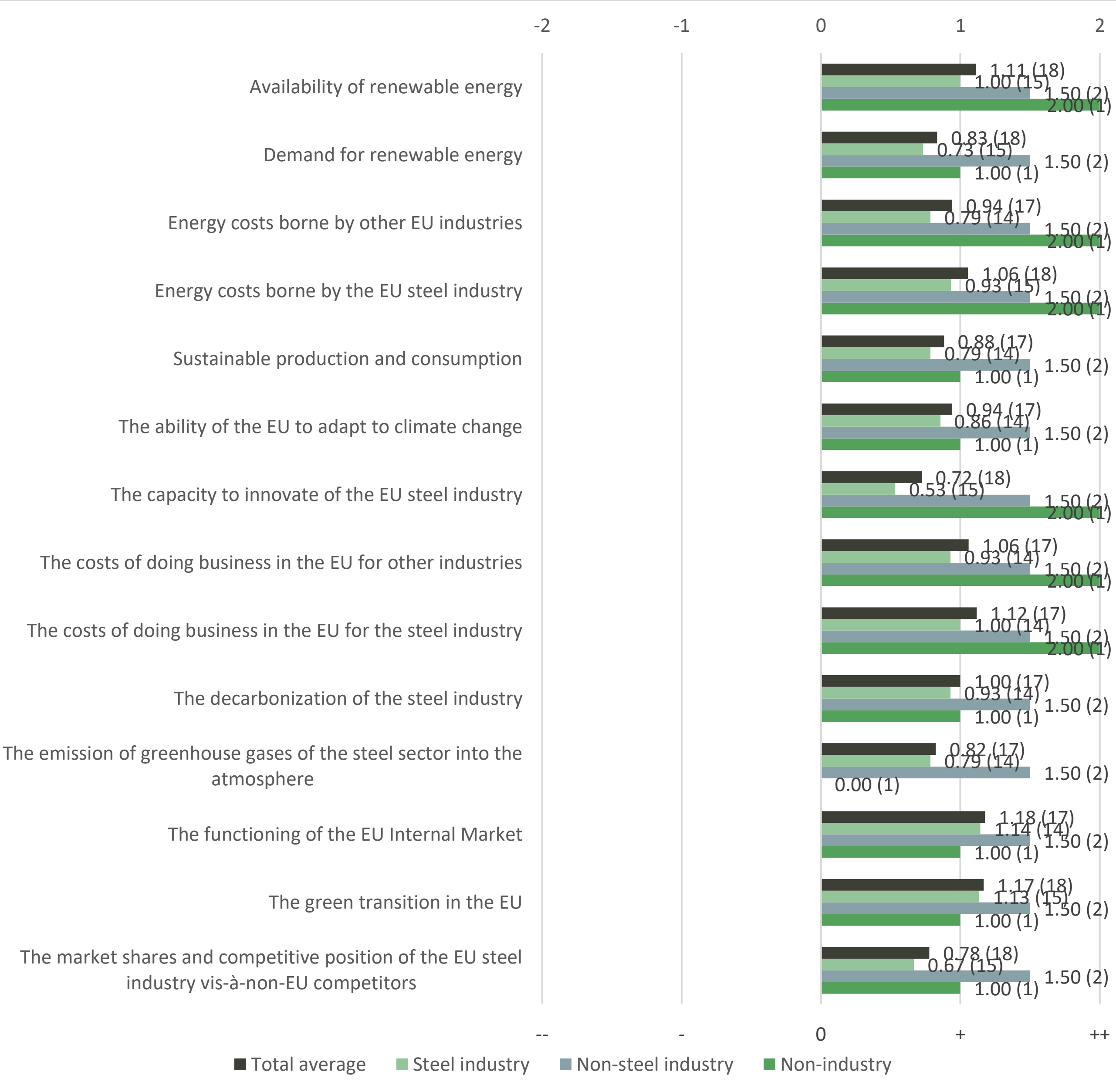
(+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option RE6: reducing the costs of balancing and shaping services in national markets

Figure 19 shows that the option of reducing the costs of balancing and shaping services in national markets would generate the highest positive impacts on the functioning of the EU internal market, recording the highest total score on average (1.18 in a range from -2 to 2).

Figure 19: Impacts of reducing the costs of balancing and shaping services in national markets.



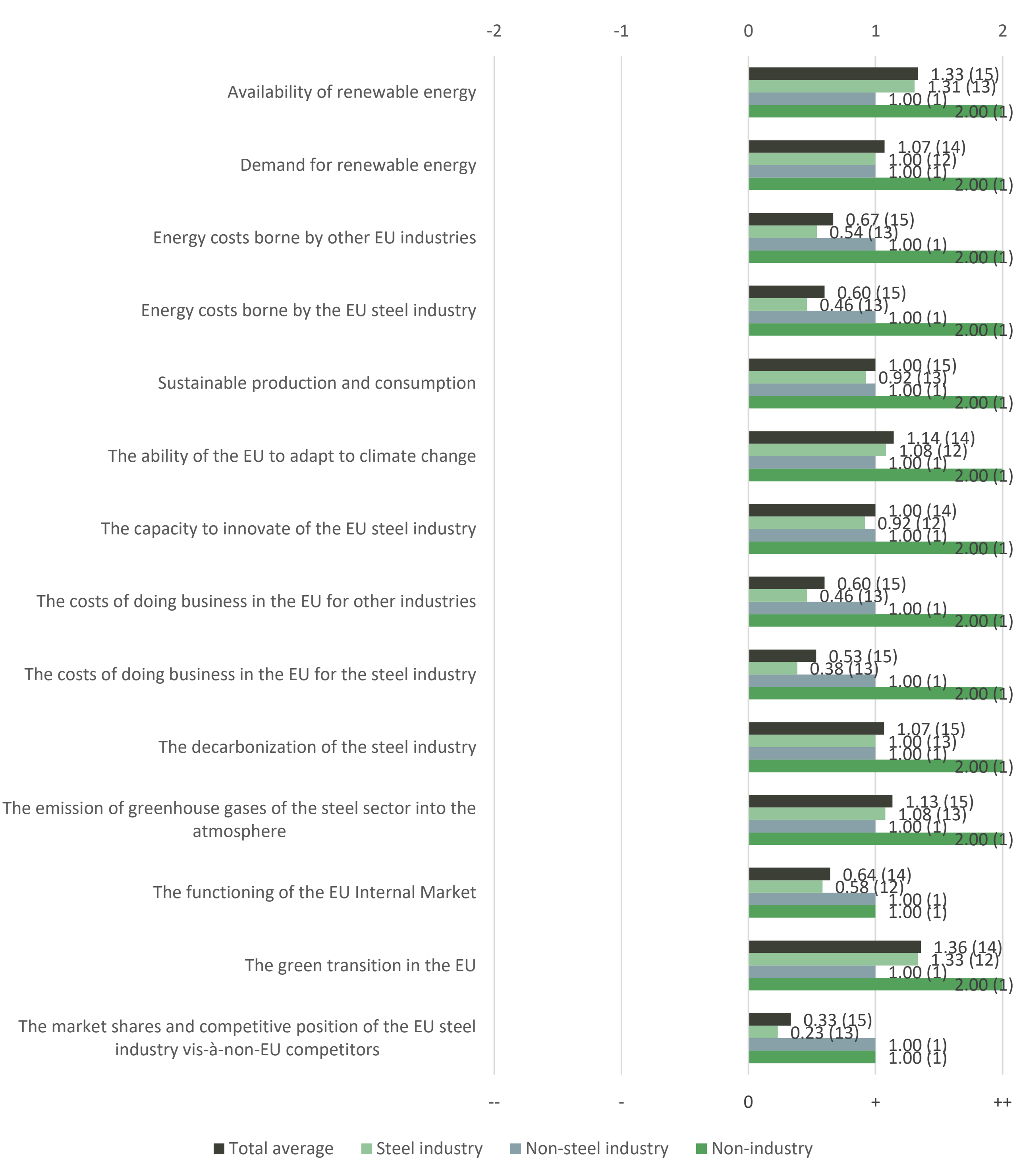
Note: the figure presents stakeholders' answers to question RE.IA.6, i.e. "What impact would option 6 (reducing the costs of balancing and shaping services in national markets) have on...?". Respondents *provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.*

Source: authors' own composition on survey results.

Impacts of option RE7: revising and implementing policies on energy storage in the Green Deal

As shown in Figure 20, the option of revising and implementing policies on energy storage in the Green Deal would generate the highest positive impacts on the green transition in the EU, recording the highest total score on average (1.36 in a range from -2 to 2).

Figure 20: Impacts of revising and implementing policies on energy storage in the Green Deal



Note: the figure presents stakeholders' answers to question RE.IA.7, i.e. "What impact would option 7 (revising and implementing policies on energy storage in the Green Deal) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

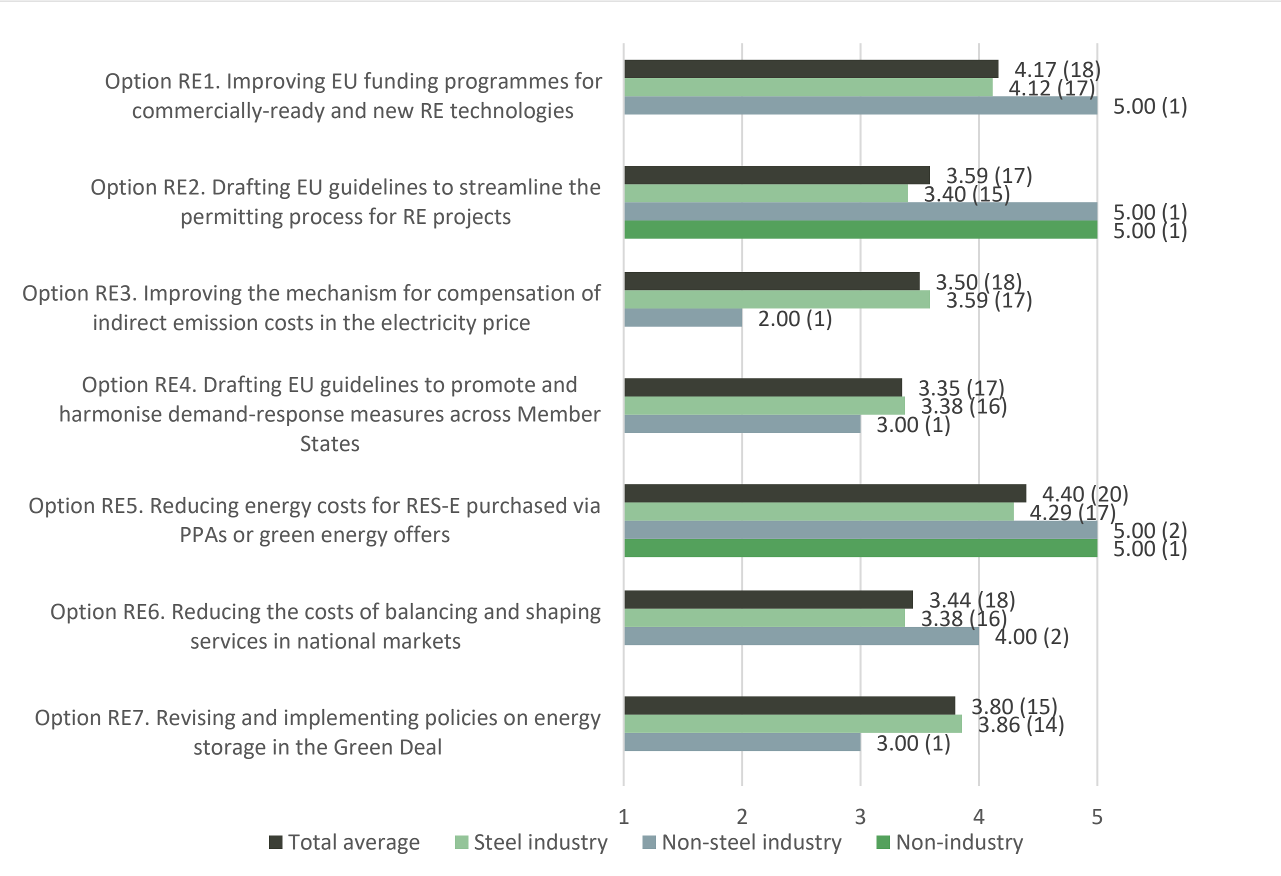
Source: authors' own composition on survey results.

Comparison of options

Effectiveness

According to the survey, the option of reducing energy costs for RES-E purchased via PPAs or green energy offers is the one recording the highest total score on average (4.4/5) when the options are assessed on their ability to help bridge the existing and potential gap between the supply and demand of RES-E, and support the decarbonisation of the EU steel industry towards 2050 by ensuring that RES-E is available at competitive prices for both direct use in steelmaking and green hydrogen production (Figure 21).

Figure 21: Comparison of the effectiveness of the policy options – RES-E



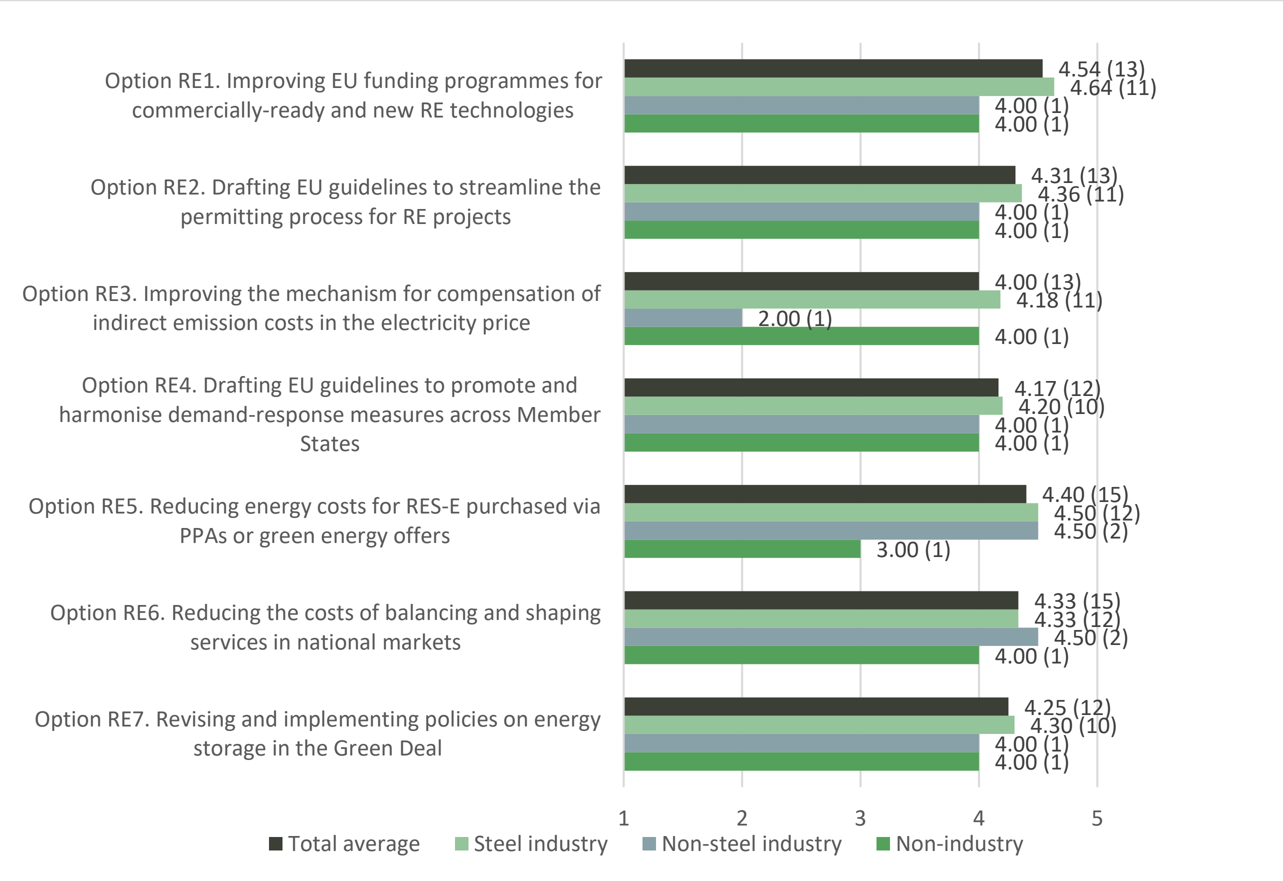
Note: the figure presents stakeholders' answers to question RE.COMP.1, i.e. "Would the policy options listed in the table below help bridge the existing and potential gap between the supply and demand of RES-E, and support the decarbonisation of the EU steel industry towards 2050 by ensuring that RES-E is available at competitive prices for both direct use in steelmaking and green hydrogen production?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Coherence

Figure 22 shows that the option of improving EU funding programmes for commercially-ready and new RE technologies is the one recording the highest total score on average (4.54/5) when the options are assessed on their coherence with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.).

Figure 22: Comparison of the coherence of the policy options – RES-E



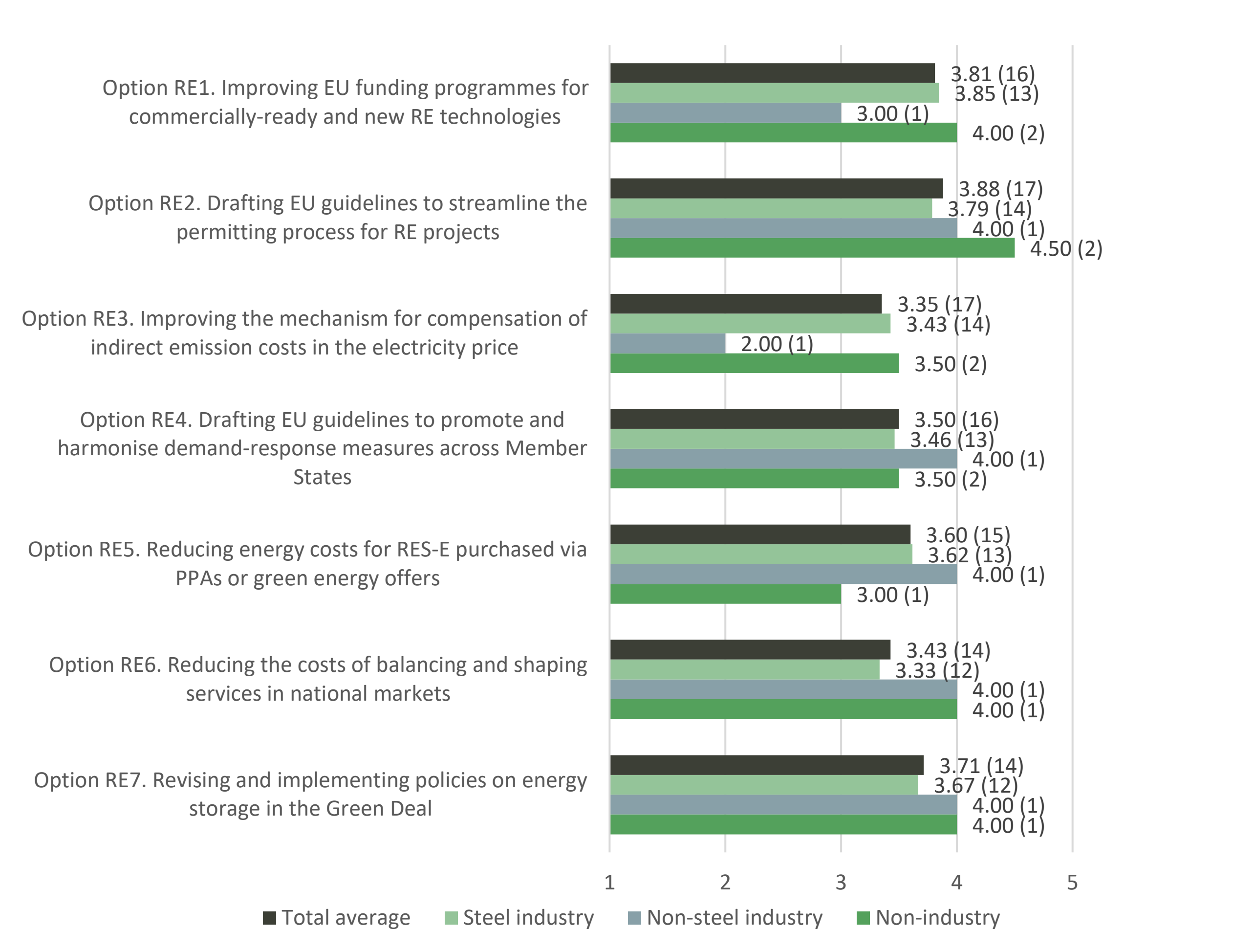
Note: the figure presents stakeholders' answers to question RE.COMP.2, i.e. "Are the policy options listed in the table below coherent with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.)?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Feasibility

As shown in Figure 23, according to the survey the option of improving EU funding programmes for commercially-ready and new RE technologies is the one recording the highest total score on average (3.81/5) when the options are assessed on the possibility to receive enough support from EU and national policymakers to be properly implemented.

Figure 23: Comparison of the feasibility of the policy options – RES-E



Note: the figure presents stakeholders' answers to question RE.COMP.3, i.e. "Do you expect that the policy options listed in the table below will receive enough support from EU and national policymakers to be properly implemented?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Summary of stakeholder feedback - RES-E

Stakeholders under the three groups shared quite similar views on the impacts of the seven policy options. Their views on the effectiveness, feasibility and coherence of the options also aligned well. However, some divergences of opinions were recorded, particularly when it comes to the mechanism of the impacts:

- under policy option RE1 (EU funding for RE technologies), while steel-sector stakeholders believed that improved funding for both new and mature RE technologies would increase the availability of RE for steel and other industries, stakeholders from research institutions stressed the importance of directing funding to innovation in new RE technologies only;

- under policy option RE3 (compensation of indirect emission costs), while stakeholders operating in the steel sector expressed high support for the improved mechanism of compensation of indirect emission costs, a respondent from the research institution group saw this option as less relevant to reduce the energy costs. Another stakeholder from the steel sector raised concerns about the risk of competition distortion if the compensation rate is raised;
- under policy option RE5 (PPAs and green energy offers), while stakeholders from both steel and non-steel sectors saw big potential in reducing energy costs borne by industries, a stakeholder representing a research institution estimated that the impacts of this option on cost reduction would be relatively low and would probably materialise only through lower financial costs for PPAs. Another stakeholder from research institutions suggested an additional sub-option, i.e. to use model contracts to reduce the complexity of the contracting and negotiation of PPAs;
- under policy option RE6 (balancing and shaping costs in national markets), stakeholders representing research institutions believed that the option would reduce the energy costs borne by industries, while steel manufacturers considered that the energy cost reduction impact might be questionable because such a system requires huge investment in transmission infrastructure and use of intelligent management;
- under policy option RE7 (energy storage), views were heterogenous among steel producers. While some steelmakers argued that the option could help lower the energy costs for steel and other industries, another group of steelmakers casted doubt about such impacts because energy storage is not yet cost-competitive and the storage process itself could also be energy-intensive.

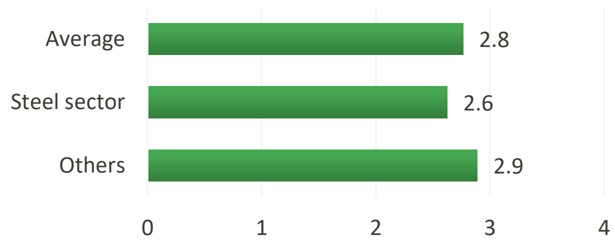
3. Green hydrogen

Problem identification

General problem GH: insufficient availability of affordable green hydrogen

Overall, the availability of green hydrogen in the EU was seen as a major obstacle for the steel sector decarbonisation (2.8/4). Steel sector respondents were slightly less concerned about this problem (2.6/4) than non-steel sector respondents (2.9/4; Figure 24).

Figure 24: Insufficient availability of affordable green hydrogen

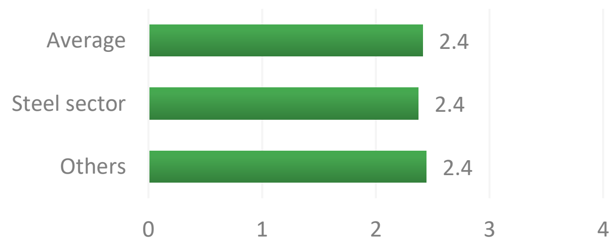


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the insufficient availability of affordable green hydrogen in the EU will hinder the decarbonisation of the EU steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4). Source: authors' own composition on survey results.

Specific problem GH1: limited availability of renewable-power run electrolysers

As shown in Figure 25, the limited availability of electrolysers relying on renewable energy was considered a moderately important problem (2.4/4), with steel and non-steel sector respondents answering about the same (average difference of 0.03).

Figure 25: Limited availability of electrolysers relying on renewable energy



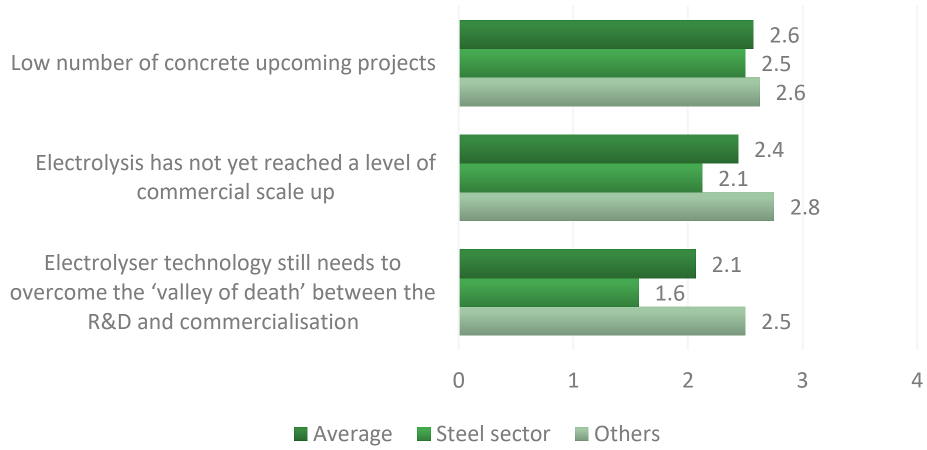
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the limited availability of electrolysers relying on renewable energy will contribute to the general problem of insufficient availability of green hydrogen for steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 26, among the proposed drivers of the limited availability of electrolysers relying on renewable energy, the number of concrete upcoming projects being too low to meet the

European Commission's target of 6GW of installed capacity by 2024[1] was seen as the most important one (2.6/4). The fact that electrolyser technology has not yet reached a level of commercial scale-up, being used mostly in demonstration and smaller-scale projects, was seen as the second most important driver (2.4/4). Sector-wise, respondents from the steel industry agreed to a lower extent with these drivers, compared to respondents from other sectors.

Figure 26: Drivers curtailing the installed capacity of electrolysers relying on renewable energy



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the installed capacity of electrolysers relying on renewable energy will contribute to the general problem of insufficient availability of green hydrogen for steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Two respondents identified other drivers limiting the installed capacity of electrolysers and availability of green hydrogen for the EU steel industry. One steel sector respondent focused on the relative inefficiency of electrolysers, which only convert 50% of electricity into hydrogen, considering this as wasteful. One non-steel respondent concentrated on the need for high volumes of dedicated RES-E, the immaturity of the technology and the end-use limitations of hydrogen more generally.

Five respondents provided additional considerations on the issue of installed electrolyser capacity and how it can affect the use of green hydrogen in decarbonising the EU steel industry. Importantly, two steel sector respondents pointed to the fact that hydrogen with similar levels of greenhouse gas (GHG) emissions can be produced from nuclear power. Another steel sector respondent signalled the physical limitations of polymer electrolyte membrane (PEM) electrolysers, stressing the importance of research and development (R&D) for solid oxide electrolyser cell (SOEC) electrolysers. One non-steel sector respondent pointed to the need to decarbonise current hydrogen supply, which is mostly produced from unabated natural gas, whose production can generate 830 $MtCO_2$/year, and the need to use hydrogen as an energy carrier in hard-to-abate sectors, which can increase the importance of developing electrolyser capacities. Another non-

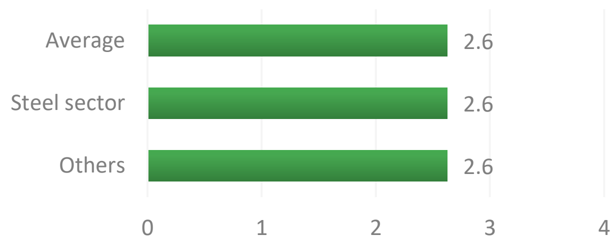
[1] European Commission (2020b), "A Hydrogen strategy for a climate-neutral Europe", https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf, p.3.

steel sector respondent indicated the need to establish targets for the decarbonisation of gas, which would offer investors certainty for deploying large volumes of renewable and low-carbon gas for the industry.

Specific problem GH2: High costs of green hydrogen

As shown in Figure 27, the limited cost competitiveness of green hydrogen was considered a moderately important problem (2.6/4), by both steel and non-steel sector respondents.

Figure 27: Limited cost competitiveness of green hydrogen

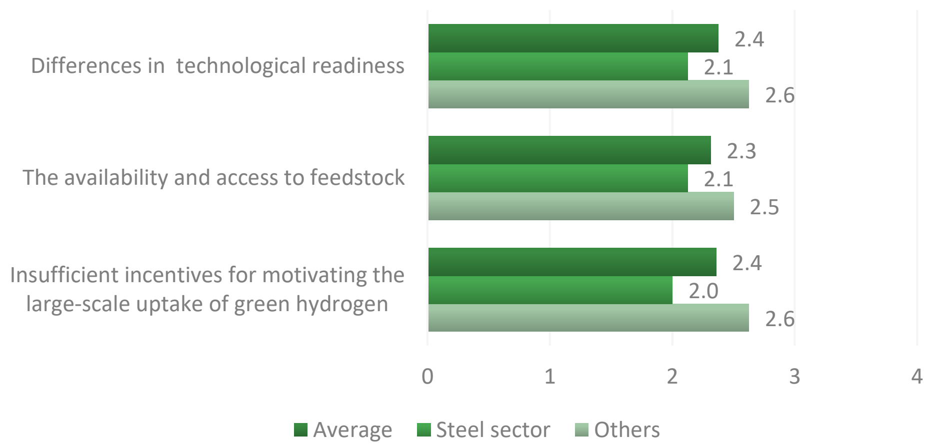


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the limited cost competitiveness of green hydrogen will contribute to the general problem of insufficient availability of green hydrogen for steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

All drivers listed in Figure 28, i.e. relatively better cost competitiveness of blue and green hydrogen, the better availability of and access to feedstock for fossil-based hydrogen production, and the insufficient incentives for motivating the scale-up of green hydrogen, were considered to contribute at least to some extent to the limited cost competitiveness of green hydrogen (between 2.3 and 2.4/4). Sector-wise, respondents from the steel sector agreed to a lesser extent on the three drivers than respondents from other sectors.

Figure 28: Drivers reducing the cost competitiveness of green hydrogen



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers impinge on the cost competitiveness of green hydrogen and hinder deployment of green hydrogen for the *steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).*

Source: authors' own composition on survey results.

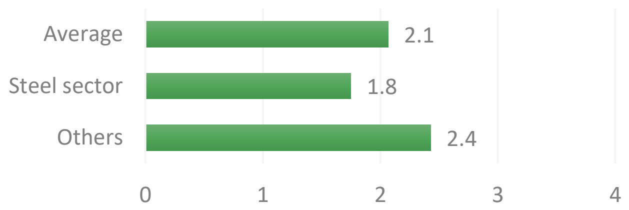
Two respondents identified another driver affecting the cost competitiveness of green hydrogen: current market prices for hydrogen do not fully internalise the GHG emission costs stemming from the production of grey hydrogen, as these should be compensated through support mechanisms, such as carbon contracts for difference (CCfD).

Six respondents provided additional considerations on the cost competitiveness of hydrogen and how it can affect the use of green hydrogen in decarbonising the EU steel industry. Steel sector respondents identified issues such as the need to evaluate the full value chain emissions of different types of hydrogen, to differentiate between blue and green hydrogen, and to factor in the demand for green hydrogen stemming from other sectors, such as mobility and chemicals, which could make it unaffordable for the steel sector, requiring high amounts of green hydrogen. One non-steel sector respondent emphasised the cost disadvantage of green hydrogen compared to grey and blue hydrogen, while another highlighted that the supply potential for green hydrogen should be sufficient for covering demand from the steel sector.

Specific problem GH3: poor link between demand and supply of green hydrogen

As shown in Figure 29, the problem of the poor link between supply and demand for green hydrogen was considered to be of a relatively lower relevance (2.1/4), with steel-sector respondents placing significantly less importance on this issue (1.8/4) than non-steel sector respondents (2.4/4)

Figure 29: Poor link between supply and demand for green hydrogen

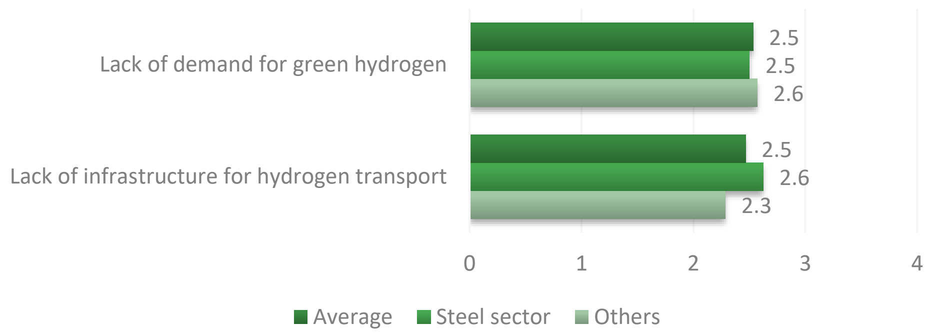


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the poor link between the supply and demand for green hydrogen will contribute to the general problem of insufficient availability of green hydrogen for steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As Figure 30 shows, both the limited demand for green hydrogen and the lack of infrastructures were seen as equally moderately important factors affecting the link between demand and supply of green hydrogen (2.5/4). No significant difference is detected between steel sector and non-steel sector respondents.

Figure 30: Drivers limiting the link between the supply and demand for green hydrogen



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers limit the link between supply and demand for green hydrogen and hinder deployment of green hydrogen for the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

One respondent identified another driver that limits the link between supply and demand for green hydrogen: blending hydrogen and natural gas is not an efficient alternative and can create a lock-in of CO_2 assets, and should thus not be promoted.

Two respondents added some considerations on market issues related to green hydrogen supply and demand, and how they can affect the decarbonisation of the EU steel industry. One non-steel sector respondent commented on the need for defining a new methodological approach and governance model for both national and EU energy cross-border infrastructure planning, to: i) achieve the EU 2020 objectives; ii) co-optimise all energy carriers (electricity, gas, hydrogen, heat, etc.); iii) give due consideration to market-based solutions capable to substitute infrastructure investments (demand-side response or storage); iv) tackle conflicts of interest that can affect the planning process (e.g. transmission system operator's preference for grid-based solutions); and v) focus on long-term efficiency, avoiding lock-ins and stranded assets. Another non-steel sector respondent highlighted that hydrogen blending could in fact provide an opportunity to integrate hydrogen and supply it to consumers without significant infrastructure investments needs. This could in time be converted to pure hydrogen infrastructure. However, another responder highlighted that blending hydrogen with natural gas would only make sense at the distribution system level and not at the transmission system level, given both the technical constraints and how hydrogen may be used by certain end consumers.

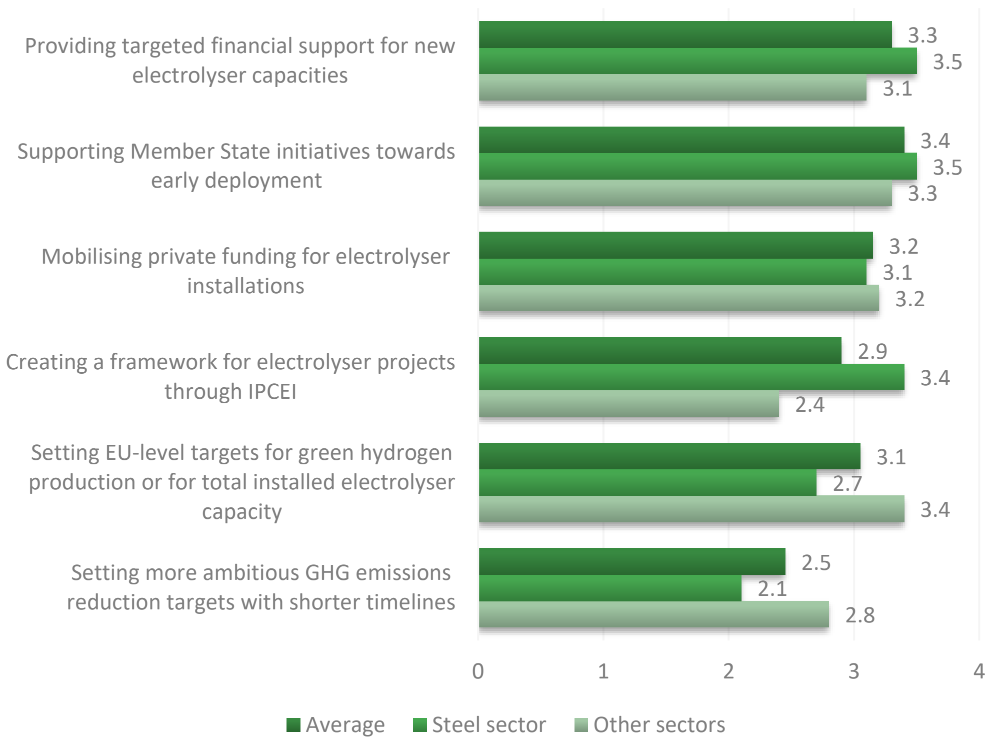
Other considerations on the general problem

One respondent provided additional considerations on the general problem, i.e. the issues related to the limited availability of affordable green hydrogen to decarbonise the EU steel industry. More specifically, a non-steel sector respondent stressed the importance of avoiding transitional solutions that are not carbon neutral, if the net-zero GHG emissions reduction target by 2050 is to be met, especially as 2050 is only one investment cycle away. This implies that all investments should be based on a cost-benefit analysis, including the stranded costs related to assets that produce CO_2. Especially if such assets function in a regulated regime, such costs can increase final consumer bills.

Policy objectives and options

Regarding Specific Objective GH1 (stimulating the installation of new electrolysers), both steel and non-steel sector stakeholders were in favour of supporting Member State initiatives towards early deployment (3.5 and 3.3/4, respectively), and mobilising private funding for electrolyser installations by fast adoption and progressive implementation of the EU sustainable finance framework (3.1 and 3.2/4, respectively). Non-steel sector stakeholders also supported setting EU-level targets for green hydrogen production or for a total installed electrolyser capacity (3.4 compared to 2.7/4 for steel sector respondents), while steel sector stakeholders favoured providing targeted financial support for new electrolyser capacities through instruments as the ETS Innovation Fund (3.5 compared to 3.1/4 for non-steel sector stakeholders; Figure 31).

Figure 31: Policy options to stimulate the installation of new electrolysers

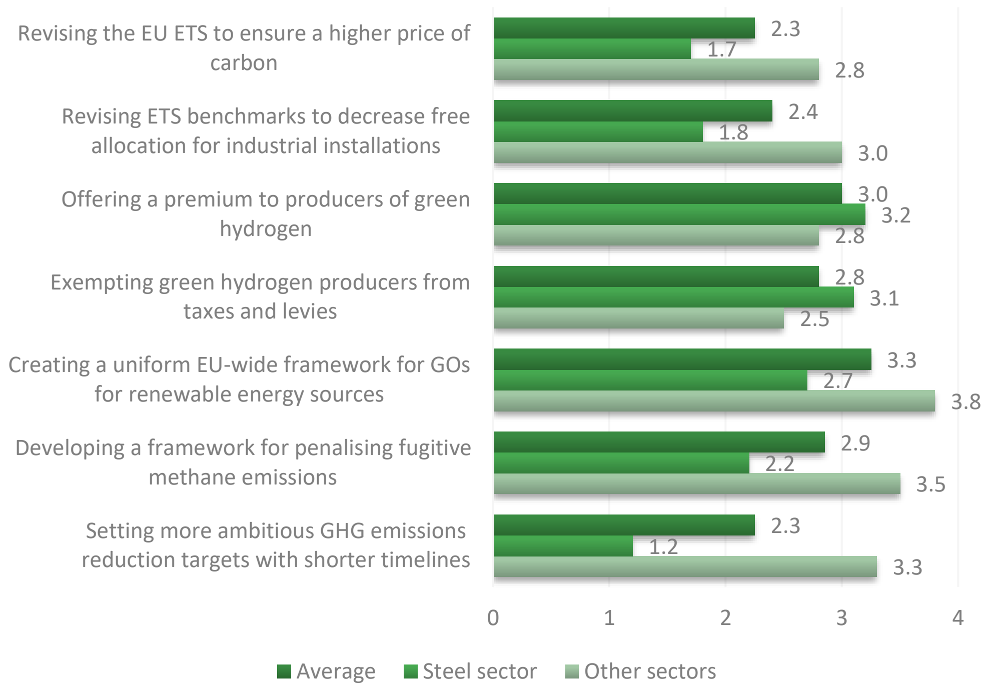


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective GH1, i.e. stimulating the installation of new electrolysers?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

When it comes to Specific Objective GH2 (creating a more competitive market environment for green hydrogen), both steel and non-steel sector stakeholders believed that offering a premium to producers of green hydrogen, for example through CCfDs, could be helpful (3.2 and 2.8/4, respectively). Non-steel sector stakeholders favoured the options of creating a uniform EU-wide framework for Guarantees of Origins for energy from RES (3.8 compared to 2.7/4 for steel sector respondents) and developing a framework for penalising fugitive methane emissions that could be associated with grey and blue hydrogen productions (3.5 compared to 2.2/4 for steel sector respondents), while steel sector stakeholders preferred exempting green hydrogen producers from taxes and levies paid (3.1 compared to 2.5/4 for non-steel sector respondents; Figure 32).

Figure 32: Policy options to create a more competitive market environment for green hydrogen

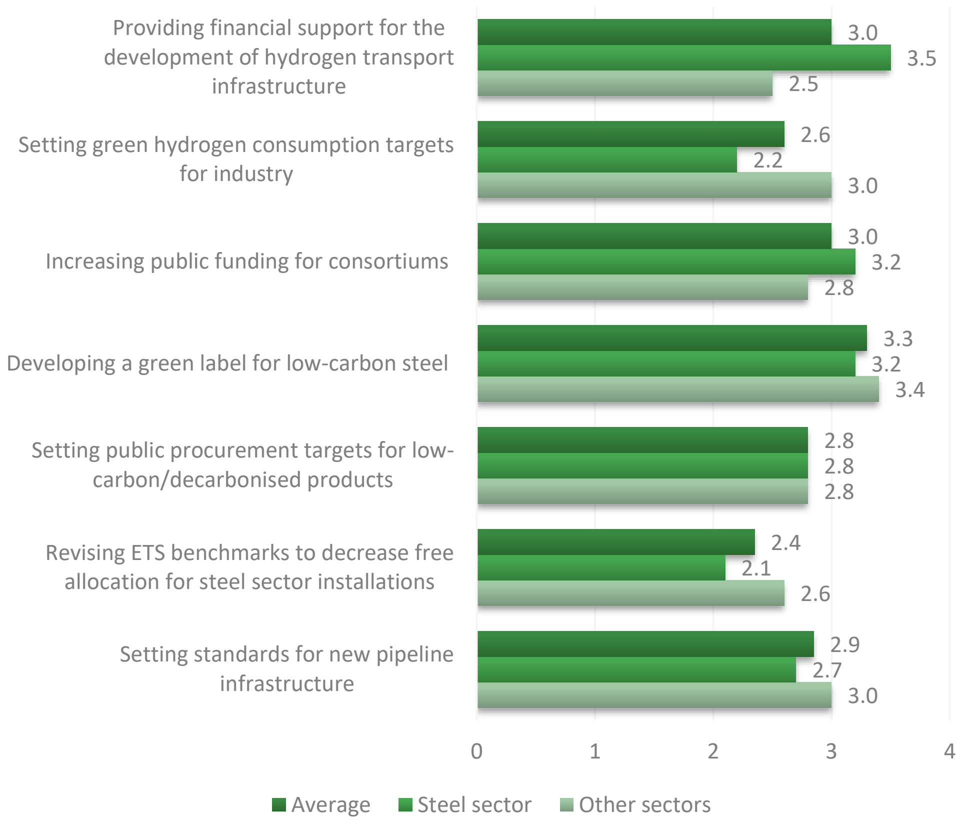


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective GH2, i.e. creating a more competitive market environment for green hydrogen?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Regarding Specific Objective GH3 (ensuring consistent demand for green hydrogen and that it can be transported from the source of supply), both steel and non-steel sector stakeholders had a favourable opinion of developing a green label for low-carbon steel (3.2 and 3.4/4, respectively). Among the different options, steel sector stakeholders preferred providing financial support for the development of hydrogen transport infrastructure (3.5 compared to 2.5/4 for non-steel sector respondents) and increasing public funding for consortia to encourage cooperation among market actors (3.2 compared to 2.8/4 for non-steel sector respondents). Differently, non-steel sector stakeholders had a more favourable view of setting green hydrogen consumption targets for industry (3.0 compared to 2.2/4 for steel sector respondents) and setting standards for new pipeline infrastructure (3.0 compared to 2.7/4 for steel sector respondents; Figure 33).

Figure 33: Policy options to ensure consistent demand for green hydrogen and to ensure that it can be transported from the source of supply



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective GH3, i.e. ensuring consistent demand for green hydrogen and that it can be transported from the source of supply?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

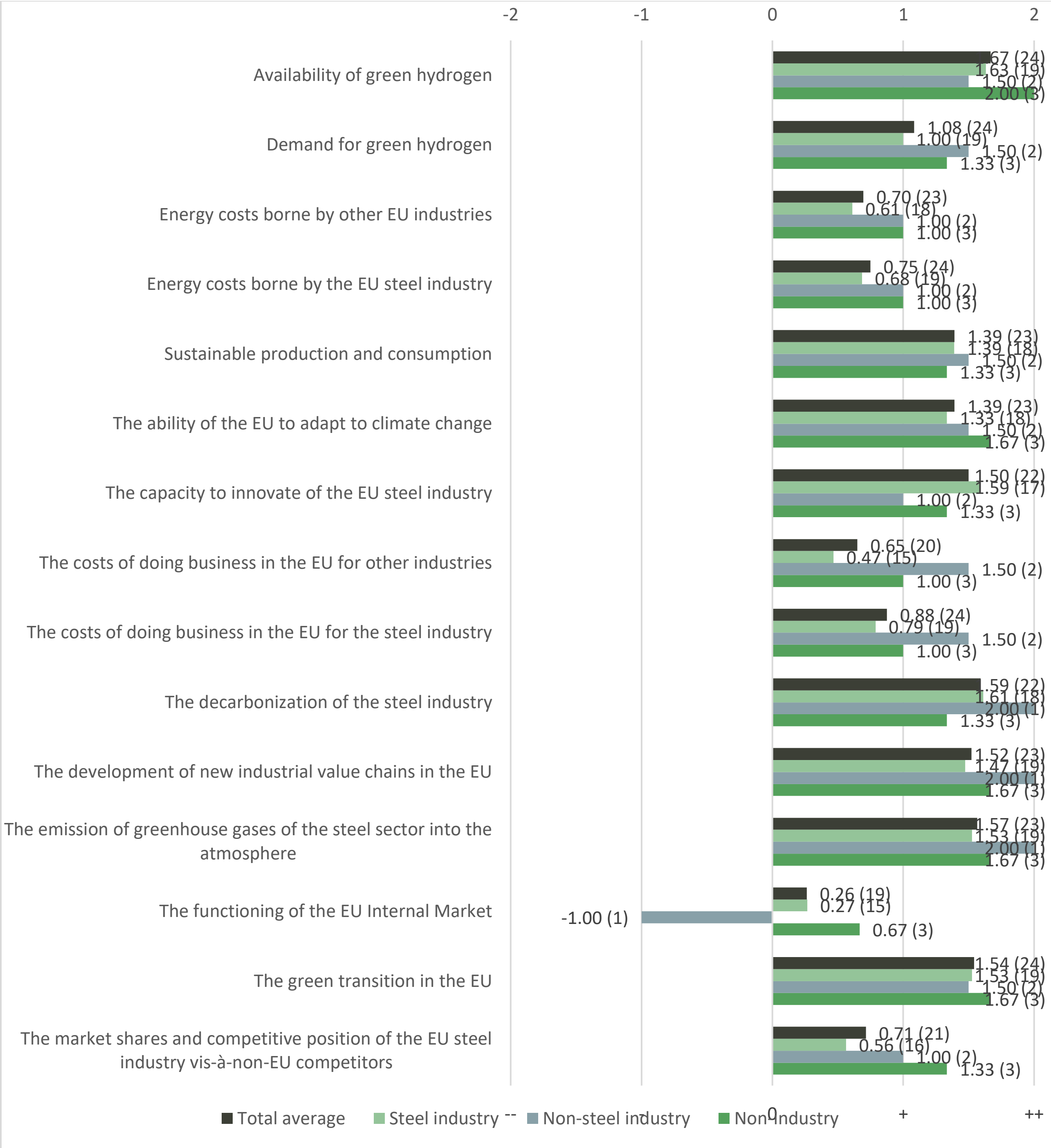
Besides the proposed policy options, one partner organisation also suggested the option to finalize swiftly the mapping of current and future requirements of EU energy infrastructure to inform investment planning.

Impacts of options

Impacts of option GH1: supporting Member State initiatives towards early deployment

As shown in Figure 34, the option of supporting Member State initiatives towards early deployment would generate the highest positive impacts on the availability of green hydrogen, recording the highest total score on average (1.67 in a range from -2 to 2).

Figure 34: Impacts of supporting Member State initiatives towards early deployment



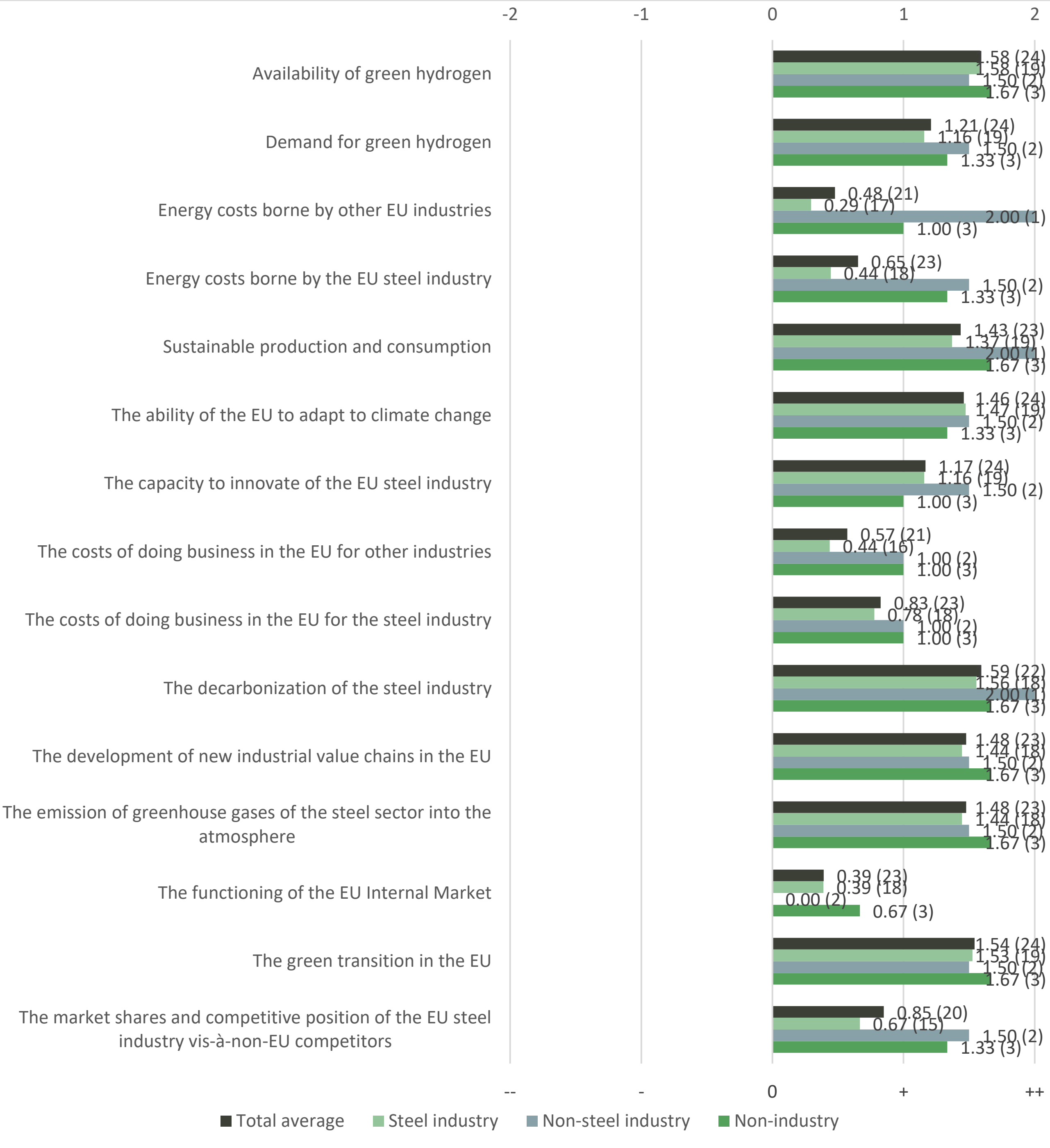
Note: the figure presents stakeholders' answers to question GH.IA.1, i.e. "What impact would option GH1 (supporting Member State initiatives towards early deployment) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option GH2: supporting financing and deployment of electrolysers (public or private)

According to the respondents, the option of supporting financing and deployment of electrolysers (public or private) would generate the highest positive impacts on the decarbonisation of the steel industry (Figure 35), recording the highest total score on average (1.59 in a range from -2 to 2).

Figure 35: Impacts of supporting financing and deployment of electrolysers



Note: the figure presents stakeholders' answers to question GH.IA.2, i.e. "What impact would option GH2 (supporting financing and deployment of electrolysers (public or private) at EU level) have on...?".

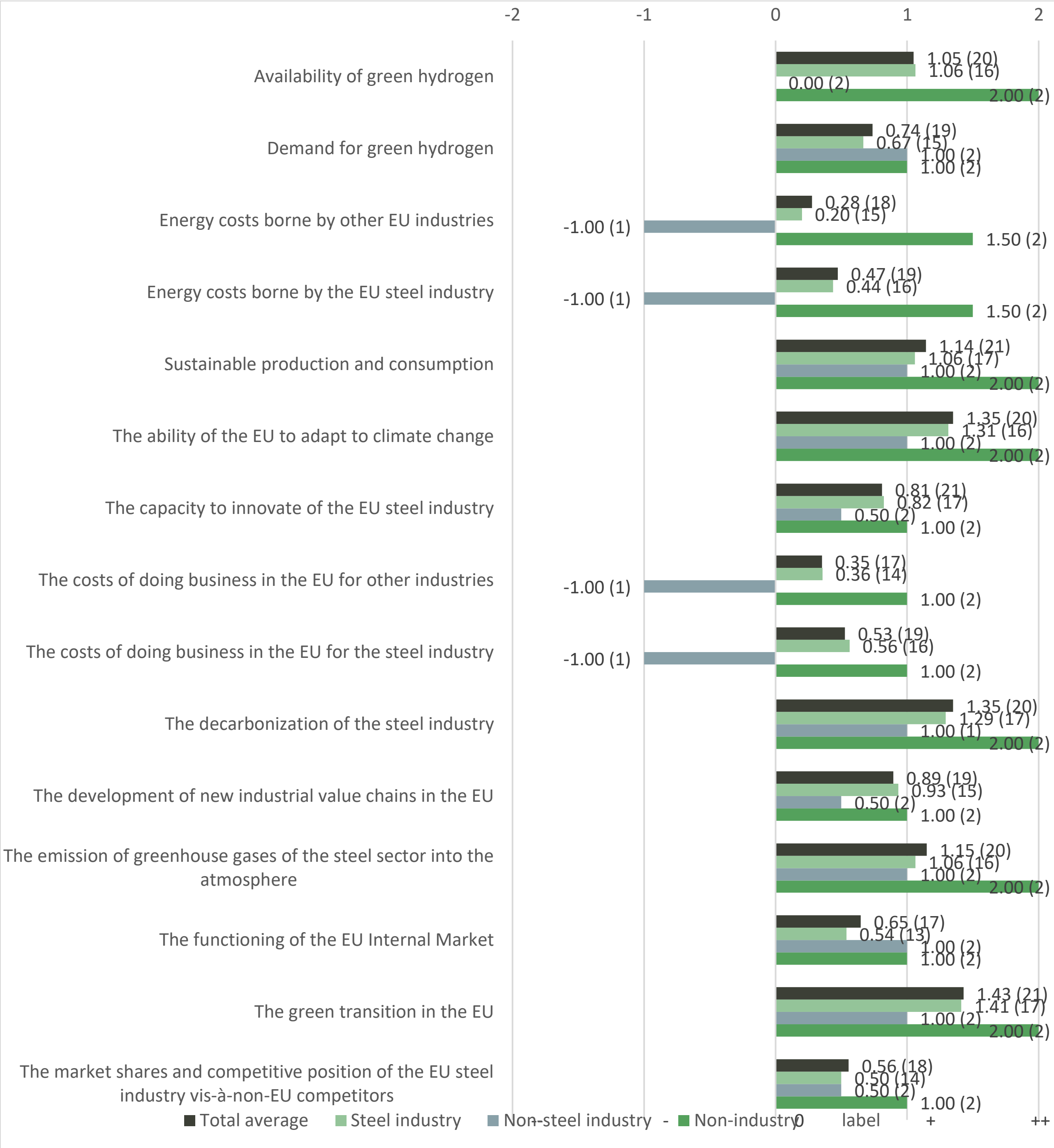
Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option GH3: improving the EU-wide framework for Guarantees of Origins for energy from RES

Figure 36 shows that the option of improving the EU-wide framework for Guarantees of Origins for energy from RES would generate the highest positive impacts on the green transition in the EU, recording the highest total score on average (1.43 in a range from -2 to 2).

Figure 36: Impacts of improving the EU-wide framework for Guarantees of Origins for energy from RES



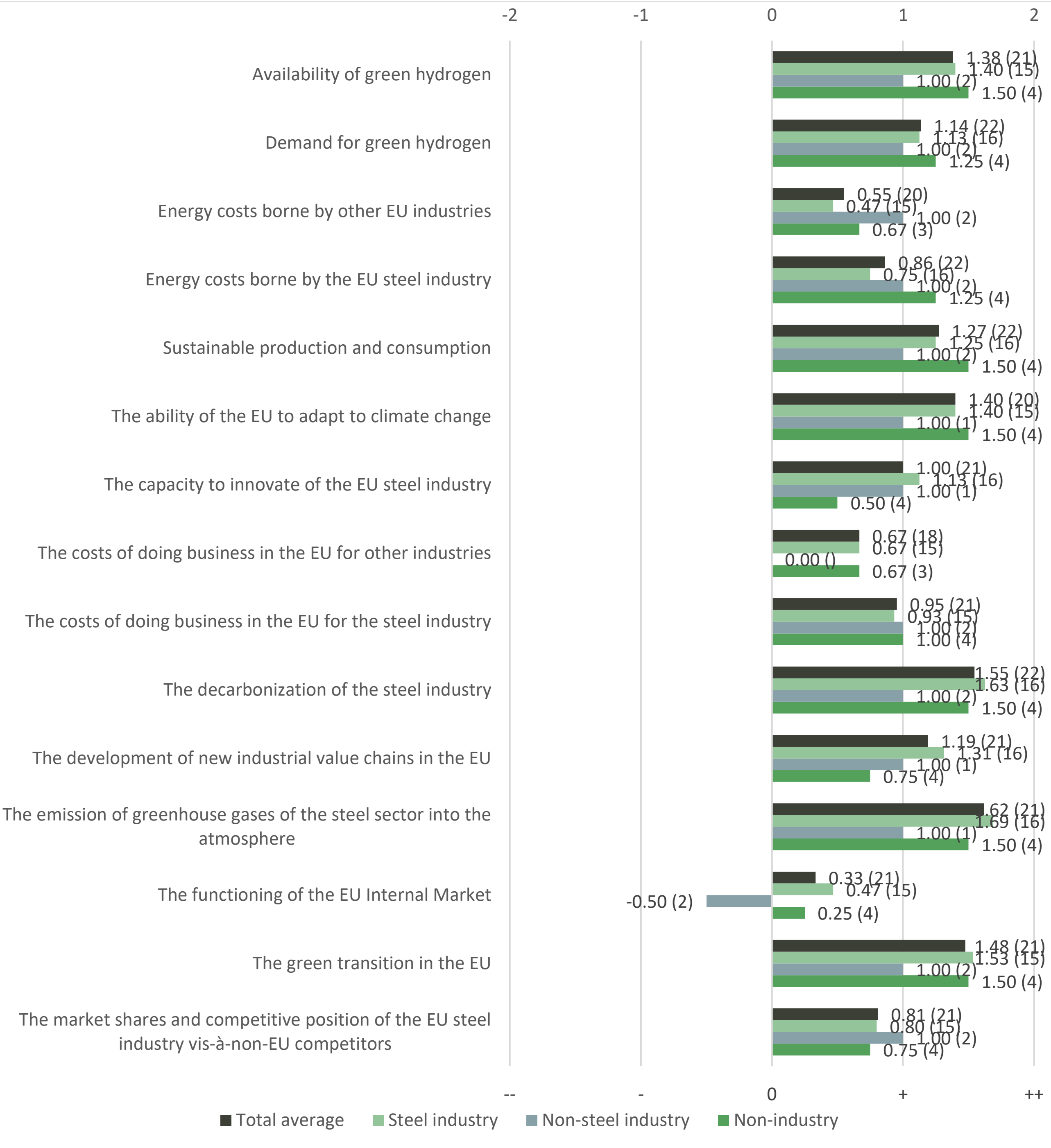
Note: the figure presents stakeholders' answers to question GH.IA.3, i.e. "What impact would option GH3 (improving the EU-wide framework for Guarantees of Origins for energy from RES) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option GH4: offering a premium to producers of green hydrogen, e.g. through CCfDs

According to the respondents, the option of offering a premium to producers of green hydrogen, e.g. through CCfDs, would generate the highest positive impacts on the emission of GHG of the steel sector into the atmosphere (Figure 37), recording the highest total score on average (1.62 in a range from -2 to 2).

Figure 37: Impacts of offering a premium to producers of green hydrogen



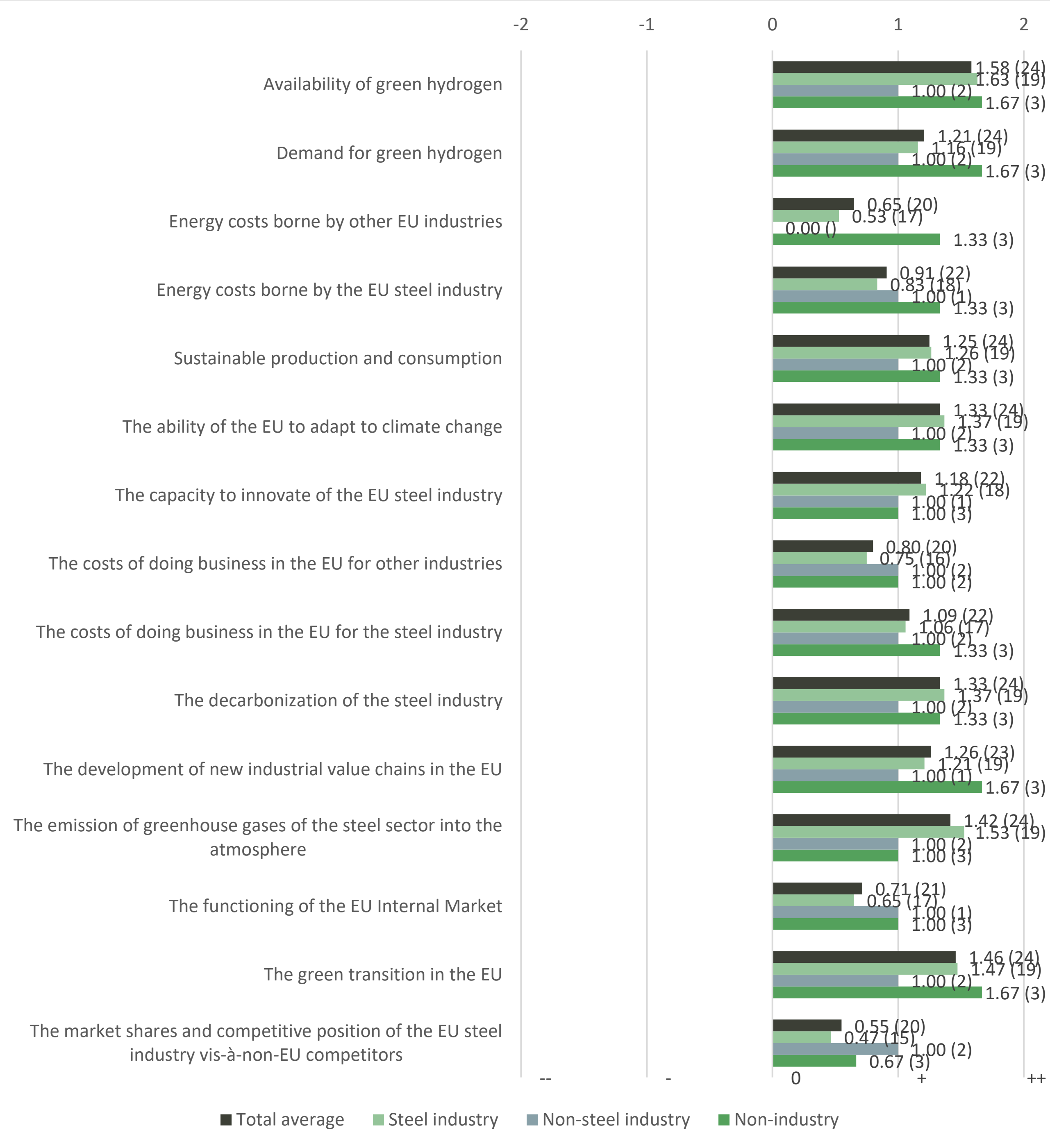
Note: the figure presents stakeholders' answers to question GH.IA.4, i.e. "What impact would option GH4 (offering a premium to producers of green hydrogen, e.g. through CCfDs) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option GH5: providing financial support for the development of hydrogen transport infrastructure

As shown in Figure 38, the option of providing financial support for the development of hydrogen transport infrastructure would generate the highest positive impacts on the availability of green hydrogen, recording the highest total score on average (1.58 in a range from -2 to 2).

Figure 38: Impacts of providing financial support for the development of hydrogen transport infrastructure



Note: the figure presents stakeholders' answers to question GH.IA.5, i.e. "What impact would option GH5 (providing financial support for the development of hydrogen transport infrastructure) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

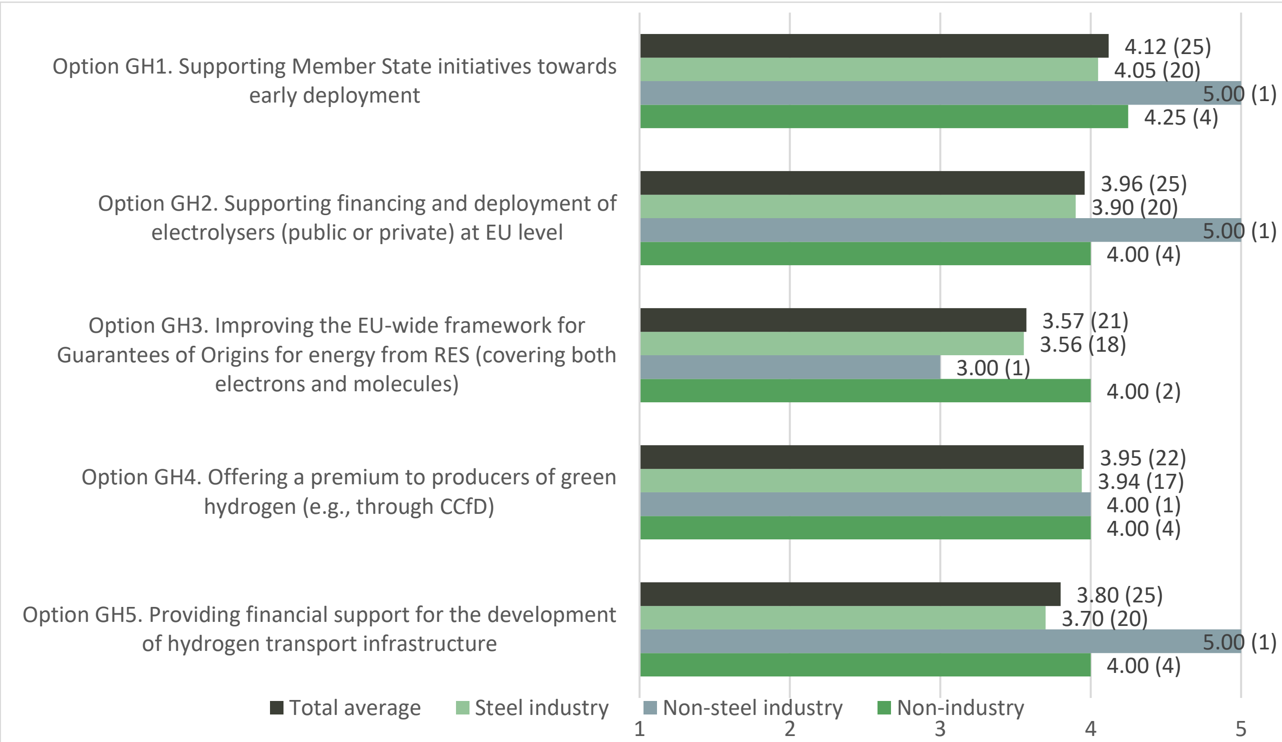
Source: authors' own composition on survey results.

Comparison of options

Effectiveness

Figure 39 shows that the option of supporting Member State initiatives towards early deployment is the one recording the highest total score on average (4.12/5) when the options are assessed on their ability to help bridge the existing and potential gap between the supply and demand of RES-E, and support the decarbonisation of the EU steel industry towards 2050 by ensuring that RES-E is available at competitive prices for both direct use in steelmaking and green hydrogen production.

Figure 39: Comparison of the effectiveness of the policy options – Green hydrogen



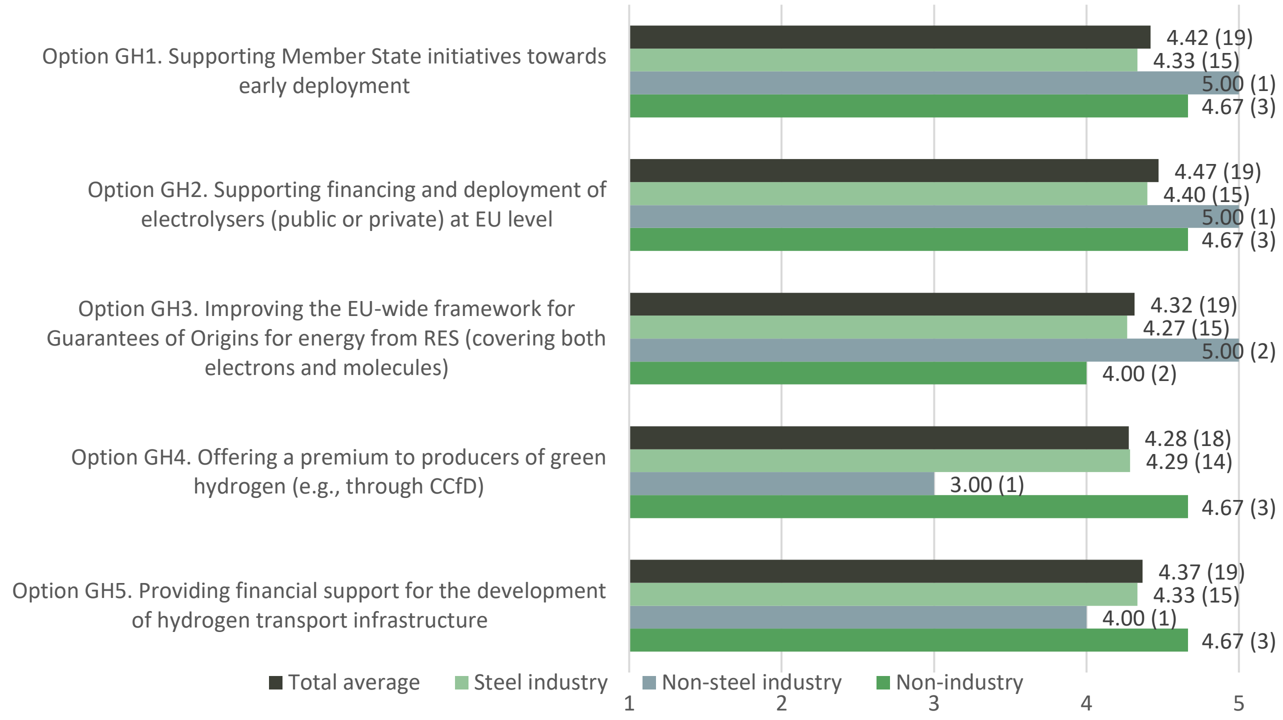
Note: the figure presents stakeholders' answers to question GH.COMP.1, i.e. "Would the policy options listed in the table below help bridge the existing and potential gap between the supply and demand of RES-E, and support the decarbonisation of the EU steel industry towards 2050 by ensuring that RES-E is available at competitive prices for both direct use in steelmaking and green hydrogen production?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Coherence

As shown in Figure 40, the option of supporting financing and deployment of electrolysers (public or private) at EU level is the one recording the highest total score on average (4.47/5) when the options are assessed on their coherence with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.).

Figure 40: Comparison of the coherence of the policy options – Green hydrogen



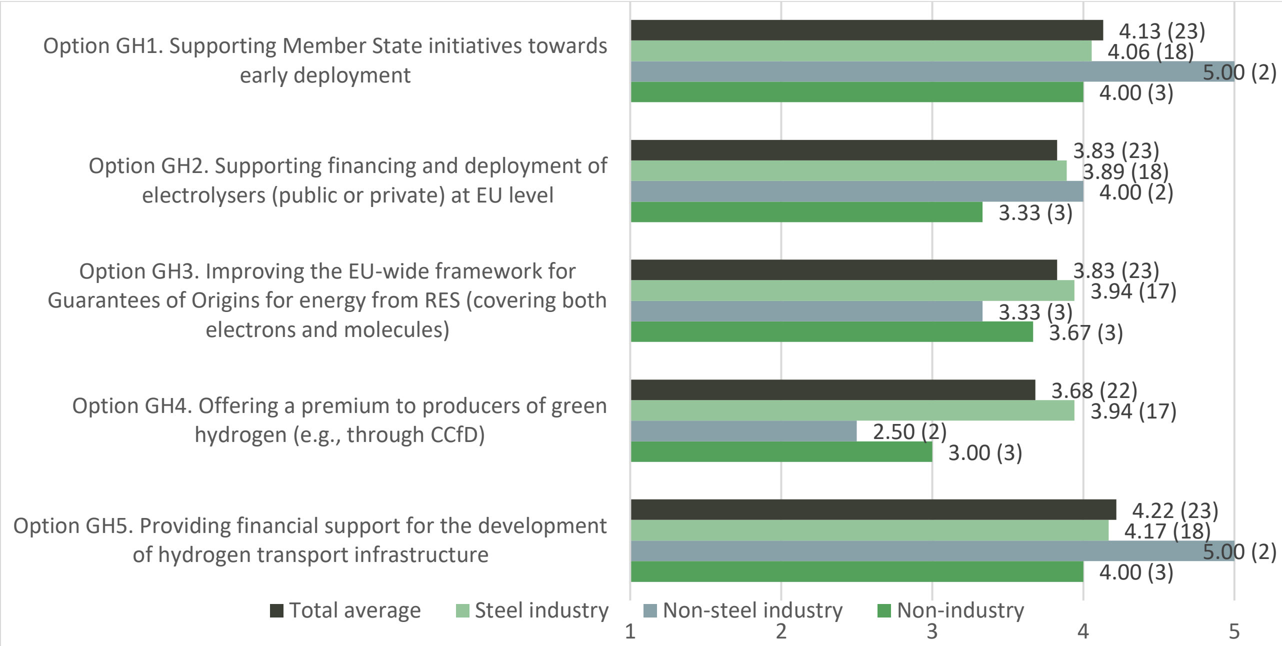
Note: the figure presents stakeholders' answers to question GH.COMP.2, i.e. "Are the policy options listed in the table below coherent with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.)?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Feasibility

According to the survey, the option of providing financial support for the development of hydrogen transport infrastructure is the one recording the highest total score on average (4.22/5) when the options are assessed on the possibility to receive enough support from EU and national policymakers to be properly implemented (Figure 41).

Figure 41: Comparison of the feasibility of the policy options – Green hydrogen



Note: the figure presents stakeholders' answers to question GH.COMP.3, i.e. "Do you expect that the policy options listed in the table below will receive enough support from EU and national policymakers to be properly implemented?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Summary of stakeholder feedback – Green hydrogen

When it comes to effectiveness, the stakeholders responding to the public consultation viewed all options as effective, with a preference for GH1 and GH4, while GH3 scored the lowest in this regard. In terms of impact on the availability of green hydrogen, the stakeholders participating in the survey viewed all policy options as having a positive impact, with GH1 and GH5 having the highest impact and GH3 the lowest. Also, stakeholders generally considered that all policy options are conducive to the decarbonisation of the industry through the use of hydrogen technologies. As a result, all policy options are deemed compatible with EU targets and objectives for energy and climate, and thus coherent with other relevant EU initiatives. As for feasibility, the stakeholders believed that GH2 is the least likely to receive enough support from EU and national policymakers to be properly implemented, with GH5 and GH1 considered as the most likely to receive such support.

Regarding the difference between steel and non-steel sector respondents:

- under policy option GH1 (supporting Member State initiatives towards early deployment of electrolysers), steel sector respondents believed this to be effective to a lesser extent than non-steel sector respondents;

- under policy option GH2 (supporting financing and deployment of electrolysers (public or private) at EU level), non-steel sector respondents believed this to be effective to a higher extent than steel sector respondents;
- under policy option GH3 (improving the EU-wide framework for Guarantees of Origins for energy from RES), steel sector respondents viewed this option as less effective compared to non-steel sector respondents;
- under policy option GH4 (offering a premium to producers of green hydrogen, e.g. through CCfDs), steel and non-steel sector respondents viewed this as similarly effective;
- under policy option GH5 (providing financial support for the development of hydrogen transport infrastructure), steel sector respondents believed this to be effective to a lesser extent than non-steel sector respondents.

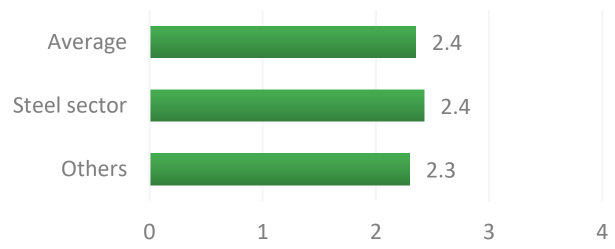
4. Carbon capture usage and storage

Problem identification

General problem CCUS: limited availability of CCUS solutions

On average, the respondents agreed to some extent (2.4/4) that the limited availability of carbon capture, usage and storage (CCUS) solutions is an obstacle to the decarbonisation of the EU steel sector (Figure 42), with stakeholders from the steel sector considering the problem slightly more important than those from other sectors (2.4 and 2.3/4, respectively).

Figure 42: Limited availability of CCUS solutions



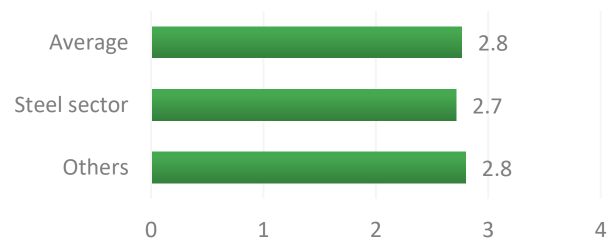
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the limited availability of CCUS solutions will hinder the decarbonisation of the EU steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Specific problem CCUS1: High costs and limited availability of CO2 storage

As shown in Figure 43, the cost and limited availability of storage options were considered an important problem (2.8/4) for the availability of CCUS solutions for steel sector decarbonisation. Respondents representing the steel sector considered it a slightly more important problem than respondents from other sectors (difference of 0.1)..

Figure 43: High costs and limited availability of storage options

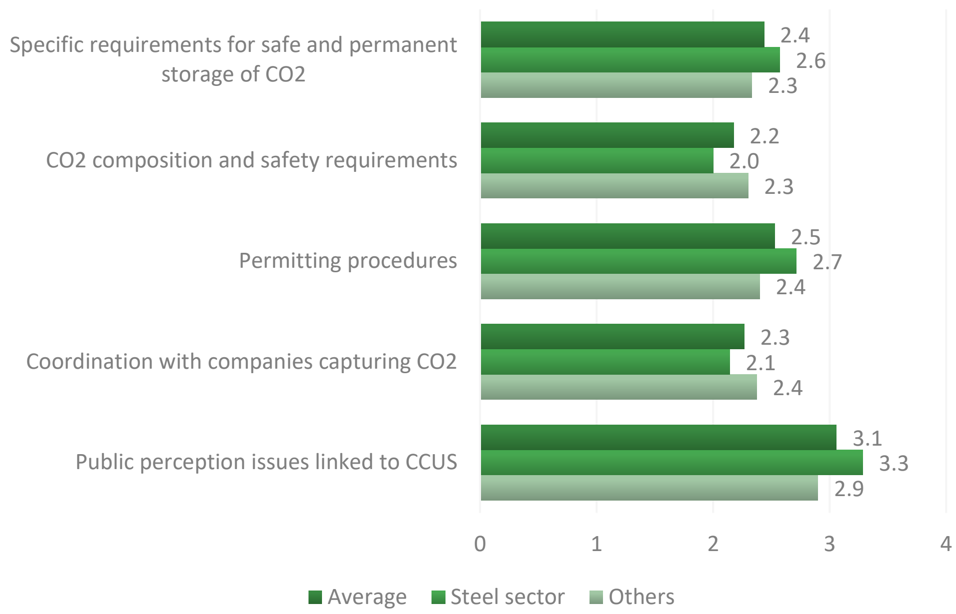


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the cost and limited availability of storage options will contribute to the general problem of CCUS being unavailable to help the steel sector decarbonise?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 44, public perception issues were considered to be the most important driver (3.1/4) limiting the availability and increasing the costs of storage options for CO_2, while permitting procedures (2.5/4) and specific requirements for safe and permanent storage (2.4/4) were considered the second and third most significant drivers. Respondents representing the steel sector generally found these three drivers playing a more decisive role than the other respondents. Coordination issues among companies and uncertainty about available volumes (2.3/4), and CO_2 composition and safety requirements (2.2/4) were considered the least relevant among the identified drivers and were notably found to be less important by the steel sector than by the others.

Figure 44: Drivers increasing the costs and limiting the availability of CO2 storage



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers increase the costs and limit the availability of CO_2 storage, hindering deployment of CCUS for the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

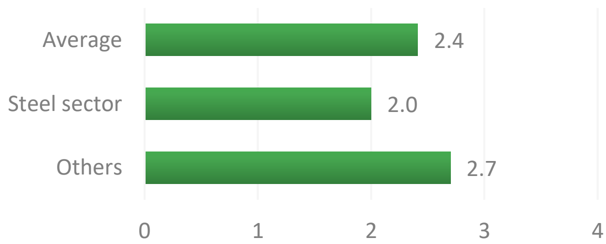
Source: authors' own composition on survey results.

Four respondents from other sectors provided additional considerations on the issue of CO_2 storage and how it can affect the use of CCUS in decarbonising the EU steel industry. Even though public perception was considered the most important driver, one respondent argued that the public perception issue for carbon capture and storage (CCS) is overstated. The same respondent also stated that cost is a problem, while availability is not, and suggested separating the two issues in the survey. Another respondent also recommended broadening the questions posed and argued that other technologies and solutions, such as product and process redesign reducing energy demand and carbon intensity as well as other sustainable and circular approaches, can diminish the need for CCS. Details on the costs and requirements for CCUS deployment were provided by one respondent, who noted that costs depend on geography, amount of CO_2 and distance to destination, and that complex studies are required for assessing storage options in geological formations. The same respondent noted that there are deposits with an estimated significant storage potential, but in practice storage is available mostly in Northern European countries. The issue of transport infrastructure was brought up by another respondent, who highlighted that this needs to be in place in advance of a mature market for decarbonised products and services. To help de-risk early development of CCUS value chains, the respondent suggested support for transportation and storage infrastructure would be important, while the creation of clusters around large emission sources could provide scale opportunities through the sharing of transport infrastructure. From the policy side, the respondent suggested enabling gas infrastructure to transport CO_2 as a regulated activity, including offshore, towards storage overseen by national regulatory authorities with appropriate mandates.

Specific problem CCUS2: high costs and limitations of the CO2 capture process

As shown in Figure 45, respondents considered the costs and limitations of CO_2 capture processes to be a moderately important problem (2.4/4), with those representing non-steel sectors finding it more important (2.7/4) than those representing the steel industry (2.0/4).

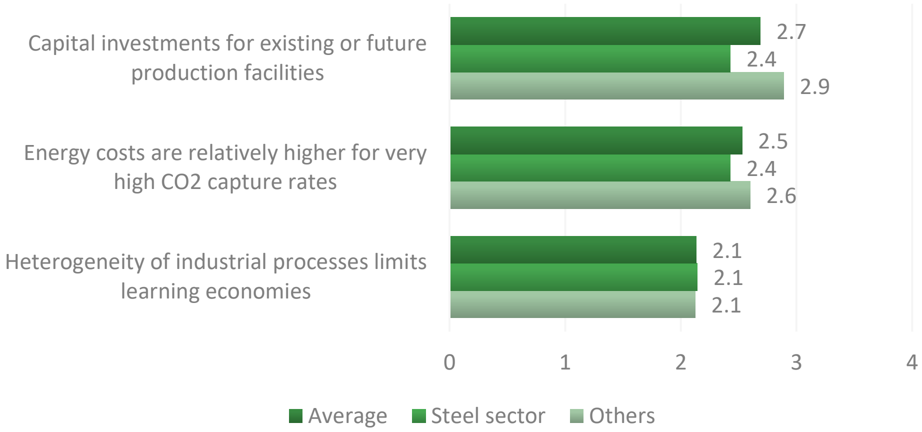
Figure 45: High-costs and limitations of the CO2 capture process



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the costs and limitations of the CO_2 capture process will contribute to the general problem of CCUS being unavailable so far to help the EU steel sector decarbonise?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4). Source: authors' own composition on survey results.

As shown in Figure 46, among the drivers identified, the need for capital investments was considered the most important (2.7/4), with respondents from non-steel sectors considering it to be of slightly higher relevance (2.9/4) than respondents from the steel industry (2.4/4). The energy intensity and high costs associated with high capture rates were found to be the second most important driver (2.5/4) and difficulty in achieving learning economies due to heterogeneity of industrial processes the least important (2.1/4), with very little difference in responses from the steel and non-steel sectors.

Figure 46: Drivers increasing the costs of CO_2 capture



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers increase the costs of CO_2 capture and hinder deployment of CCUS for the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

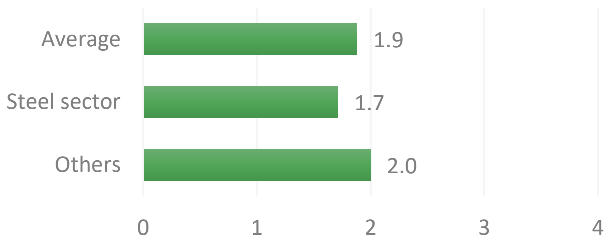
Source: authors' own composition on survey results.

Notably, two respondents suggested alternative drivers, i.e. societal opposition (which however is already covered in connection with the availability of storage options), and limited and decreasing R&D investment, which they found to have high importance (3.0/4). One respondent from a non-steel sector provided additional considerations on issues related to CO_2 capture and how it can affect the use of CCUS in decarbonising the EU steel industry. Specifically, the need for social acceptance was emphasised due to the necessity for storage and transportation networks. Moreover, the same respondent noted that the CCUS technology is still in development and in many cases its performance falls below a 100% capture rate.

Specific problem CCUS3: limited climate neutrality of CCU

As shown in Figure 47, the limited climate neutrality of carbon capture and usage (CCU) was only considered to be of low to moderate importance (1.9/4) on average and the least important problem among those identified for CCUS. Respondents from non-steel sectors found it to be a moderate problem (1.7/4), while steel sector respondents considered it less important (2.0/4).

Figure 47: Limited climate neutrality of CCU

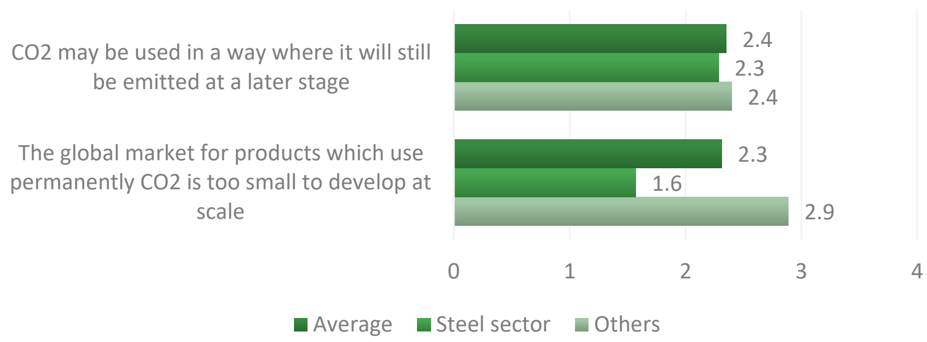


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the limited climate neutrality of CCU contributes to the general problem of CCUS being unavailable so far to help the *steel sector decarbonise?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).*

Source: authors' own composition on survey results.

As shown in Figure 48, respondents considered the two identified drivers to be of similar moderate importance, with slightly more importance given to the issue of the lack of compatibility with the EU's climate neutrality objective (2.4/4), compared to a too-small market for CCU (2.3/4). In comparison with the other respondents, stakeholders from the steel sector generally found both drivers less important, especially the latter.

Figure 48: Drivers limiting the climate neutrality of CCU



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers limit the climate neutrality of CCU and hinder deployment of CCUS for the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

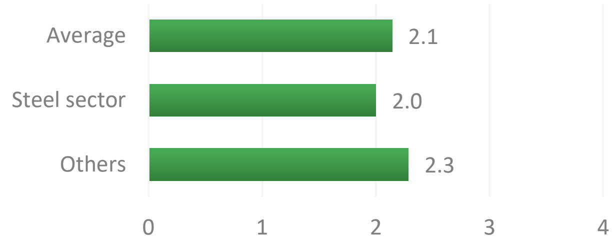
Source: authors' own composition on survey results.

Three respondents provided additional considerations on the issue of using captured CO_2 and how it can affect the use of CCUS in decarbonising the EU steel industry. One respondent from a non-steel sector noted that products made with CCU are currently not competitive with other products, while another from the steel sector was more positive towards the demand for CO_2 use, particularly within the chemical industries, and reminded that the overall idea of CCU is that it should be recirculated. A respondent from another sector noted the incompatibility of the use of CO_2 for enhanced oil recovery, a common use of CO_2 to date, with a decarbonisation scenario that abandons fossil fuels. The same respondent highlighted the potential future demand for CO_2 through the production of concrete or methanol but emphasised that storage would be necessary in any case due to the scale of demand not being likely to cover all global emissions.

Specific problem CCUS4: cross-chain problems

As shown in Figure 49, cross-chain problems were also considered as a moderate problem (2.1/4), with respondents from non-steel sectors considering it to be somewhat more important (2.3/4) than those representing the steel sector (2.0/4).

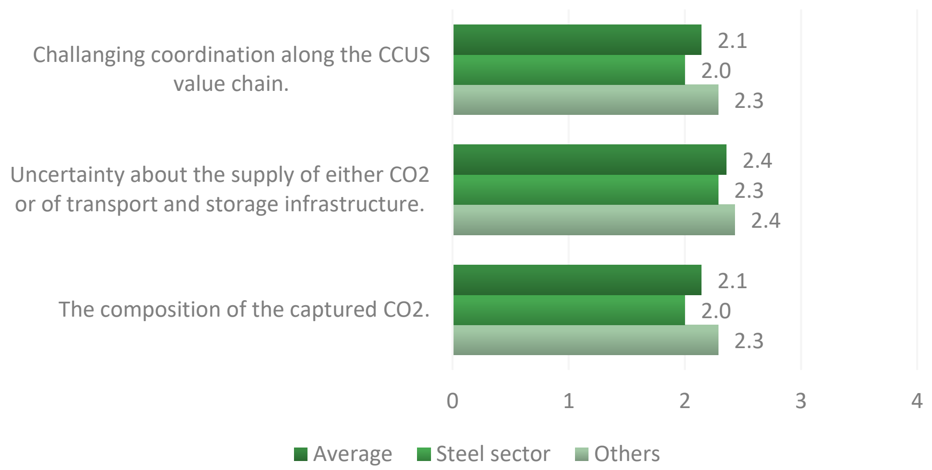
Figure 49: The role of cross-chain problems in the unavailability of CCUS



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that cross-chain problems will contribute to the general problem of CCUS being unavailable so far to help the steel sector decarbonise?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4). Source: authors' own composition on survey results.

As shown in Figure 50, all identified drivers were seen as moderately important, with stakeholders from the steel sector generally finding them less important compared to the other respondents (differences in the range of 0.25-0.54). Uncertainty about the supply of either CO_2 or transport and storage infrastructure was seen as the most important driver (2.4/4), while the challenge of coordinating among actors and information asymmetry was considered as equally important as the composition of the captured CO_2, and transport, storage and use implications (2.1/4 for both).

Figure 50: Drivers contributing to the increase of cross-chain risk hindering the deployment of CCUS for the steel industry



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers increase cross-chain risk and hinder deployment of CCUS for the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4). Source: authors' own composition on survey results.

Three respondents provided additional considerations on the issue of cross-chain risk and how it can affect the use of CCUS in decarbonising the EU steel industry. A respondent from the steel sector noted that current transport options are limited to pipelines but pointed to the potential of transportation by ship as a viable alternative. One respondent from another sector also focused on transport infrastructure and highlighted that the transport of CO_2 could pose a challenge, especially in areas without close access to storage sites, due to the ununiform geographical distribution of storage sites. The respondent further specified that retrofitting existing gas networks may not be a viable solution. Another respondent from a non-steel sector did not find the concept addressed in the question sufficiently clear.

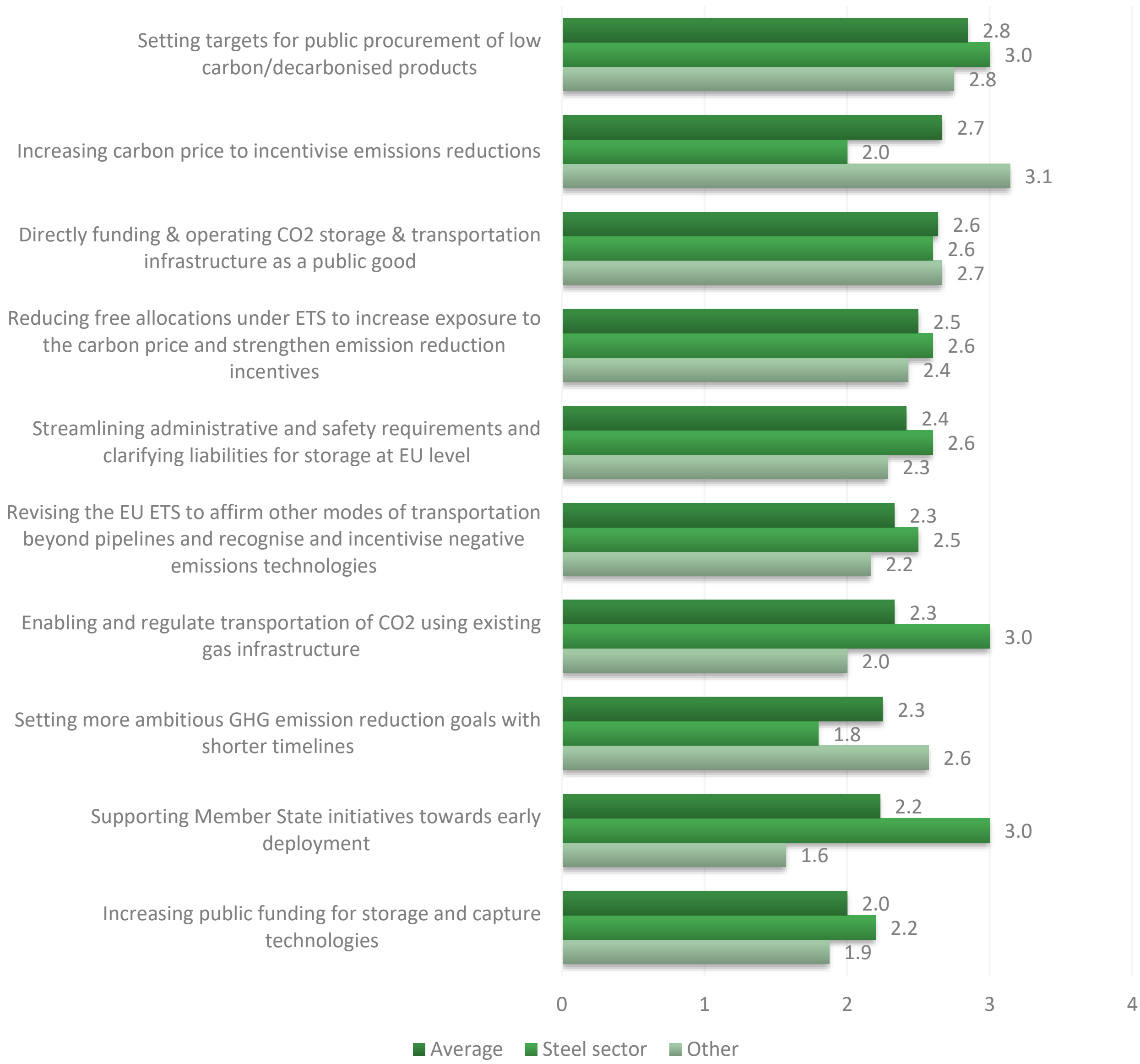
Other considerations on the general problem

One respondent from a non-steel sector provided additional considerations on the general problem addressed in this section of the survey, i.e. the issues affecting the deployment of CCUS as a means to decarbonise the EU steel industry. More specifically, the stakeholder explained that the CCUS technology (including its maturity level and efficiency rate) still shows some limitations and leads to relatively higher costs when capturing from sources that do not have a particularly high CO_2 concentration, such as steel. By contrast, industries that obtain high concentration CO_2 as a by-product hardly need capture, but only to purify and compress the gas for transport, which leads to lower capture costs of around $ 20-50/t CO_2.

Policy objectives and options

On average, setting targets for public procurement of low-carbon or decarbonised products was considered the most important policy option (2.8/4) among those to improve access to safe and permanent storage options, including the availability of suitable sites and transportation (Specific Objective CCUS1; Figure 51). The second most popular option overall was increasing the carbon price to incentivise emission reductions (2.7/4), with stakeholders from non-steel sectors indicating that they found it even more important (3.1/4) than setting public procurement targets, while steel sector respondents did not find this option equally convincing (2.0/4). Significant differences between the stakeholder groups were also seen for the relevance of enabling and regulating CO_2 transport using existing gas infrastructure (difference of 1.0) as well as the importance of supporting Member State initiatives (difference of 1.4), with stakeholders from the steel sector considering these options more important compared to the other respondents. The option of directly funding CO_2 storage and transportation infrastructure and operating it as a public good was the third most popular option on average (2.6/4) and reducing free allocations under the ETS the fourth (2.5/4), with small differences in the importance given by the different stakeholder groups.

Figure 51: Policy options to improve access to safe and permanent storage options, including the availability of suitable sites and transportation

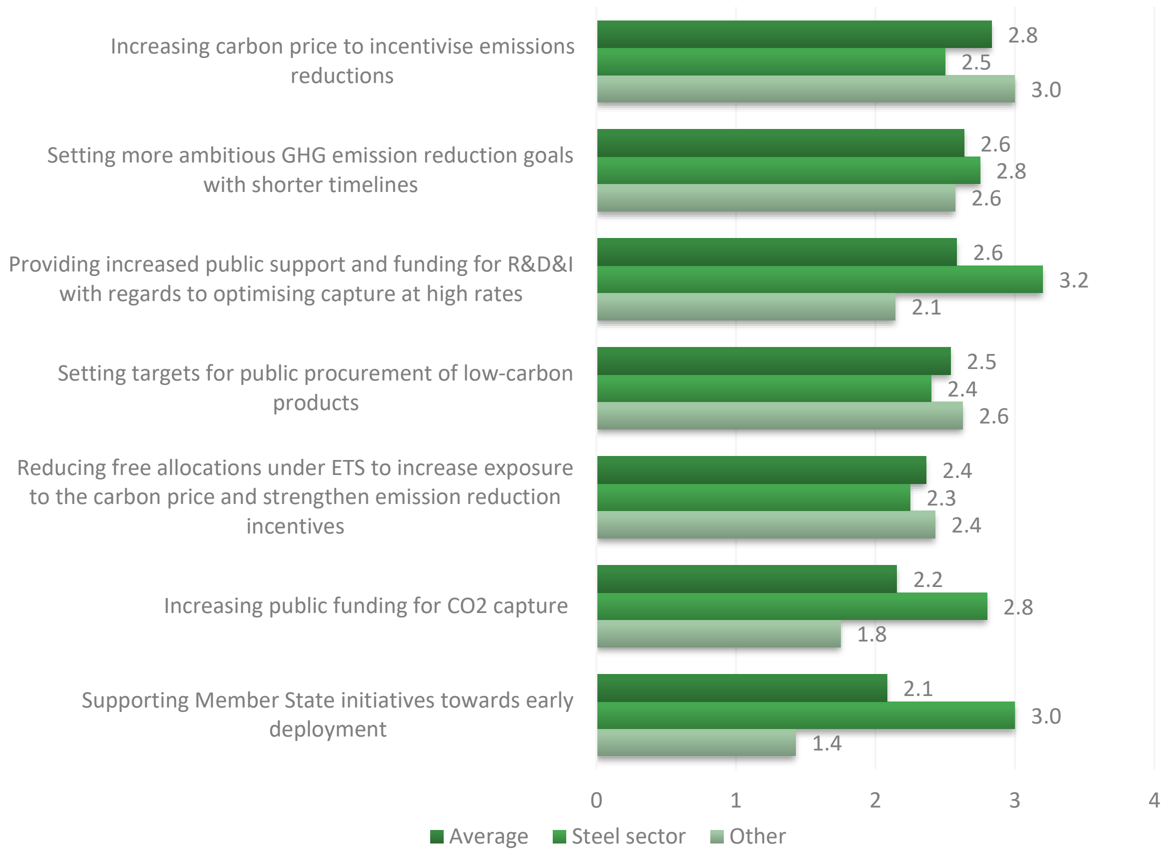


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CCUS1, i.e. improving access to safe and permanent storage options, including the availability of suitable sites and transportation?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

With regards to the objective of improving the business case for CO_2 capture, especially at high capture rates (Specific Objective CCUS2), increasing the carbon price to incentivise emission reductions was considered the most relevant option overall (2.8/4; Figure 52). Respondents from the steel sector, however, found that providing increased public support and funding for R&D&I with regards to optimising capture at high rates as well as supporting Member States' initiatives towards early deployment were the most important options (3.2 and 3.0/4, respectively). On average, setting more ambitious GHG reduction targets with shorter timelines and providing increased public support and funding for R&D&I with regards to optimising capture at high rates were considered as the second most important options (both 2.6/4.0).

Figure 52: Policy options to improve the business case for CO_2 capture, especially at high capture rates

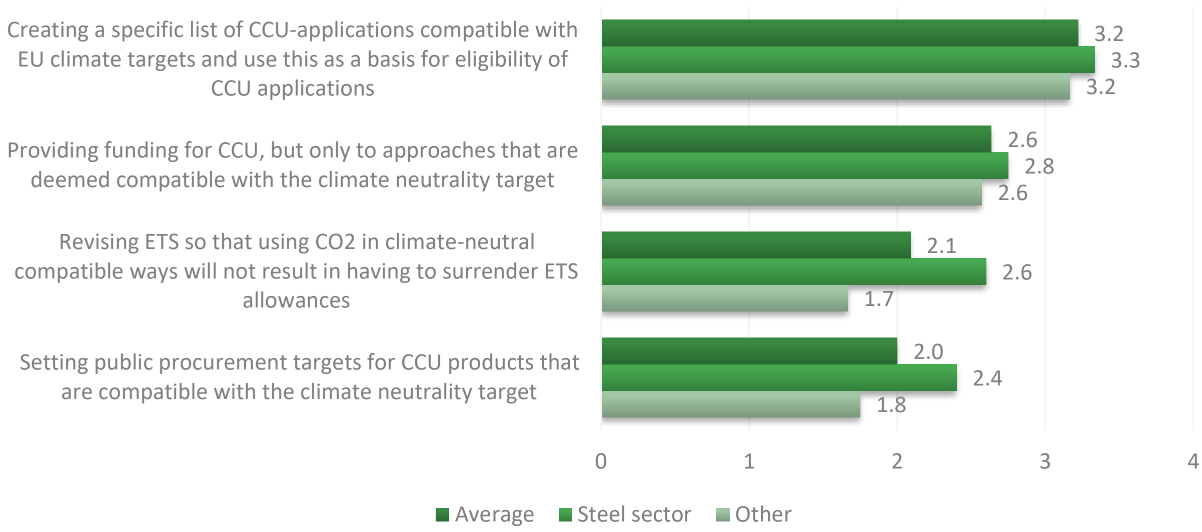


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CCUS2, i.e. improving the business case for CO_2 capture, especially at high capture rates, by helping reduce costs, facilitate learning or improve the economic rationale?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Specific Objective CCUS3 consists in increasing the market for CCU products and ensuring their compatibility with the EU's climate neutrality objective. In this regard, both steel sector and non-steel sector respondents considered as having high importance (3.2/4) the option of creating a specific list of CCUS applications compatible with the EU climate neutrality target and using this as a basis for eligibility for funding or e.g. inclusion as part of an ETS revision (Figure 53). Providing funding for CCU applications that are compatible with the climate neutrality target was considered as the second most relevant option (2.6/4) and revising the ETS to include use of CO_2 that is compatible with climate neutrality the third (2.1/4). Notably, steel sector respondents considered the latter option more important than non-steel sector stakeholders (difference of 0.9).

Figure 53: Policy options to increase the market for CCU products and ensure their compatibility with the EU's climate neutrality objective

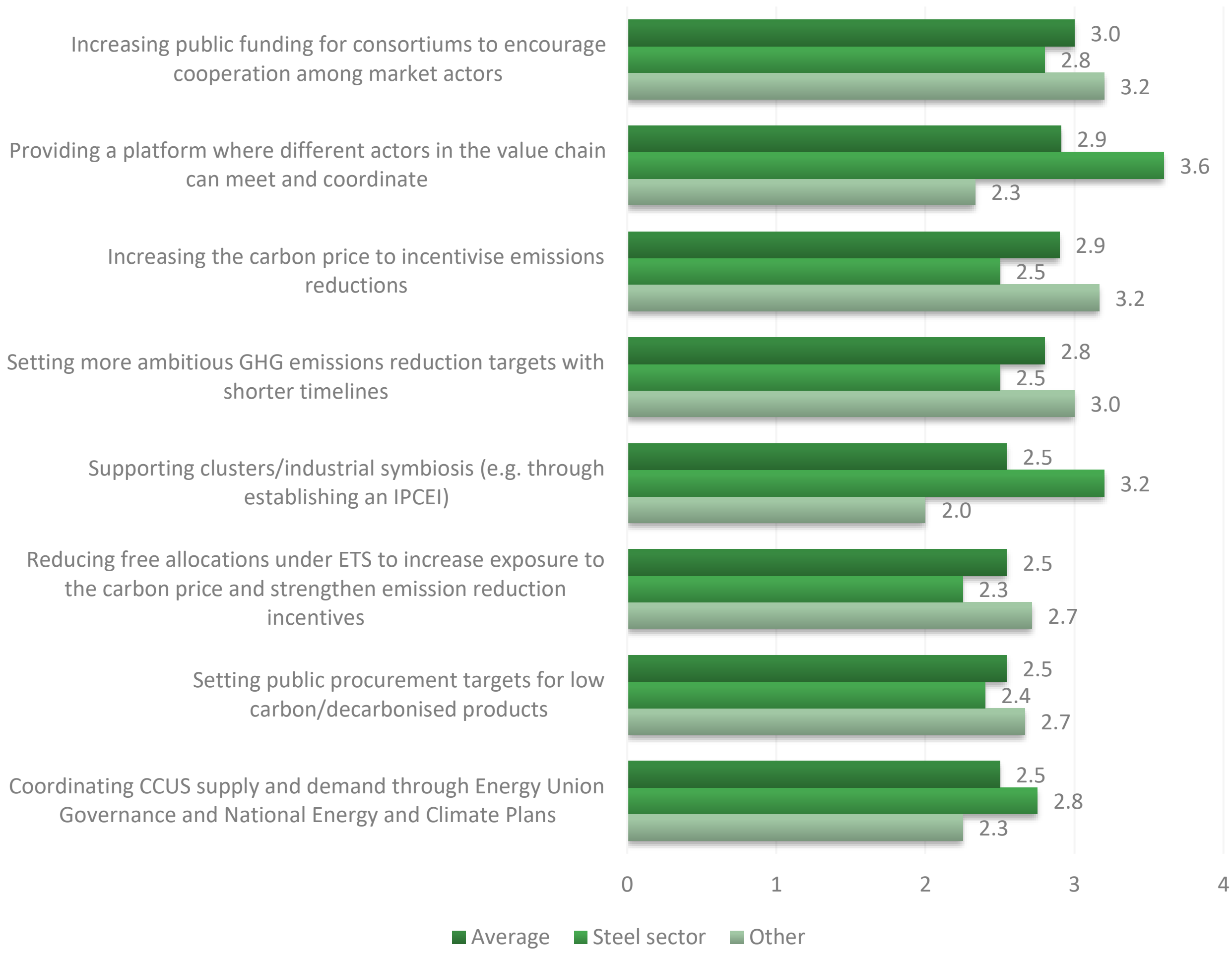


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CCUS3, i.e. expanding markets for CCU products and ensuring their compatibility with the EU climate neutrality objective?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

All the policy options to increase certainty and improve coordination for the different actors in the CCUS market (Specific Objective CCUS4) were considered of some or high relevance by the stakeholders consulted (Figure 54). Increasing public funding for consortia to encourage cooperation among market actors was seen as the most relevant option on average (3.0/4). However, steel sector respondents found that providing a platform for the different actors to meet and coordinate (e.g. by establishing a CCUS alliance) as well as supporting clusters or industrial symbiosis (e.g. by establishing an IPCEI) is of higher importance (3.6 and 3.2/4, respectively). Respondents from the non-steel sectors, on the other hand, found the signal effect of increasing the carbon price to incentivise emission reductions as equally important as increasing public funding for consortia (3.2/4).

Figure 54: Policy options to increase certainty and improve coordination for different actors in the CCUS market



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CCUS4, i.e. increasing certainty and improving coordination for the different actors in the CCUS market (e.g. supply of CO_2 transport and storage)?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

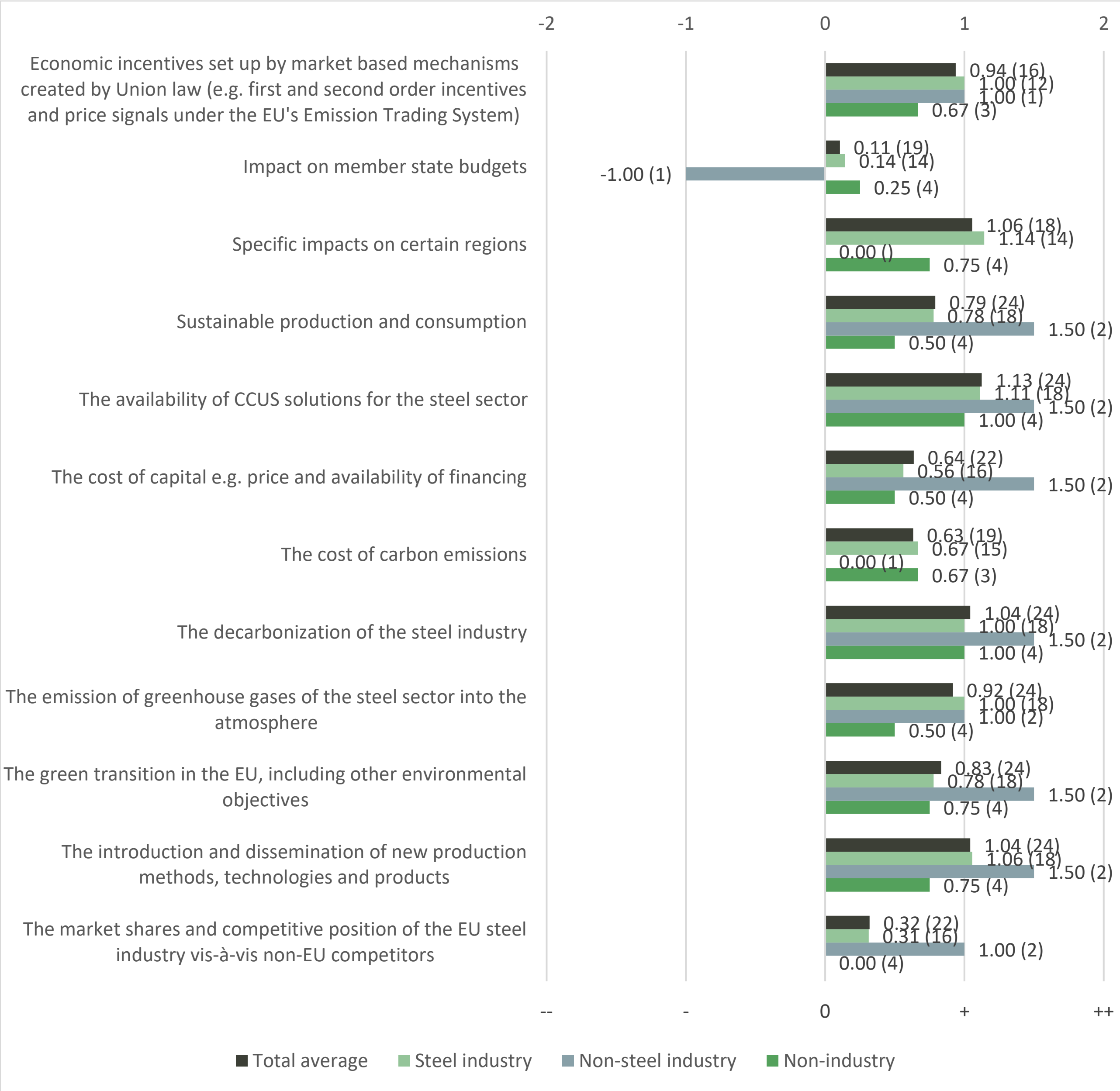
Source: authors' own composition on survey results..

Impacts of options

Impacts of option CCUS2: affirming other modes of CO_2 transportation beyond pipelines, and recognising and incentivising negative emissions technologies in the ETS

On average, the most significant positive impact of affirming other modes of CO_2 transportation beyond pipelines, and recognizing and incentivizing negative emissions technologies in the ETS (option CCUS2) is on the availability of CCUS solutions for the steel sector (scoring 1.13 in a range from -2 to 2; Figure 55). Stakeholders from the non-steel industry identified a negative impact of the option on Member States budgets (scoring -1 in a range from -2 to 2).

Figure 55: Impacts of affirming other modes of CO_2 transportation beyond pipelines, and recognising and incentivising negative emissions technologies in the ETS



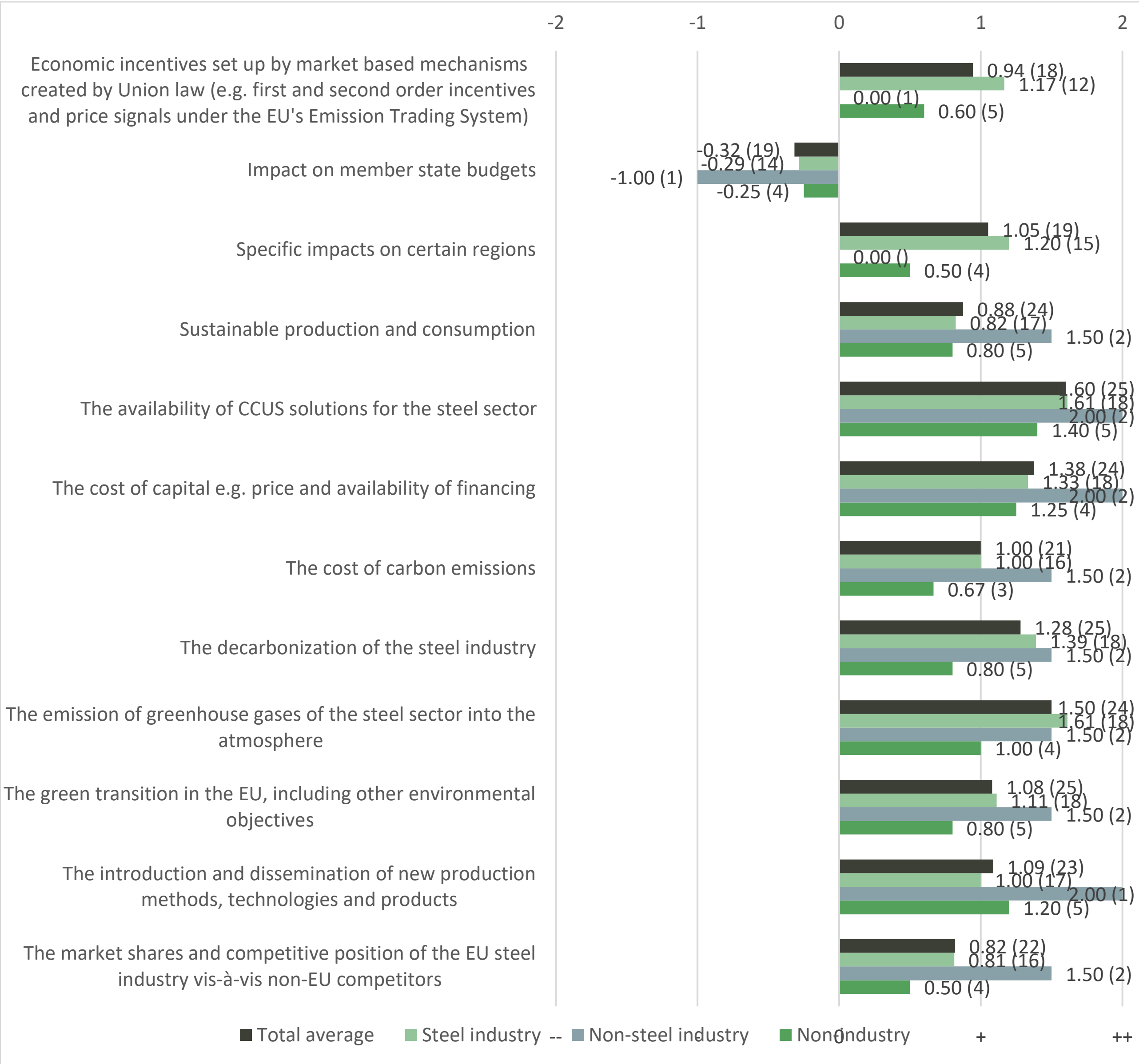
Note: the figure presents stakeholders' answers to question CCUS.IA.2, i.e. "What impact would option CCUS2 (affirming other modes of CO_2 transportation beyond pipelines, and recognising and incentivising negative emissions technologies in the ETS) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CCUS3: providing funding (CAPEX and OPEX) for CO_2 storage and transportation infrastructure

As shown in Figure 56, the respondents agreed that the most significant positive impact of providing funding (CAPEX and OPEX) for CO_2 storage and transportation infrastructure would be on the availability of CCUS solutions for the steel sector, scoring on average 1.60 in a range from -2 to 2. The same option would have the most negative impact on Member States budgets (scoring -0.32 in a range from -2 to 2).

Figure 56: Impacts of providing funding (CAPEX and OPEX) for CO_2 storage and transportation infrastructure



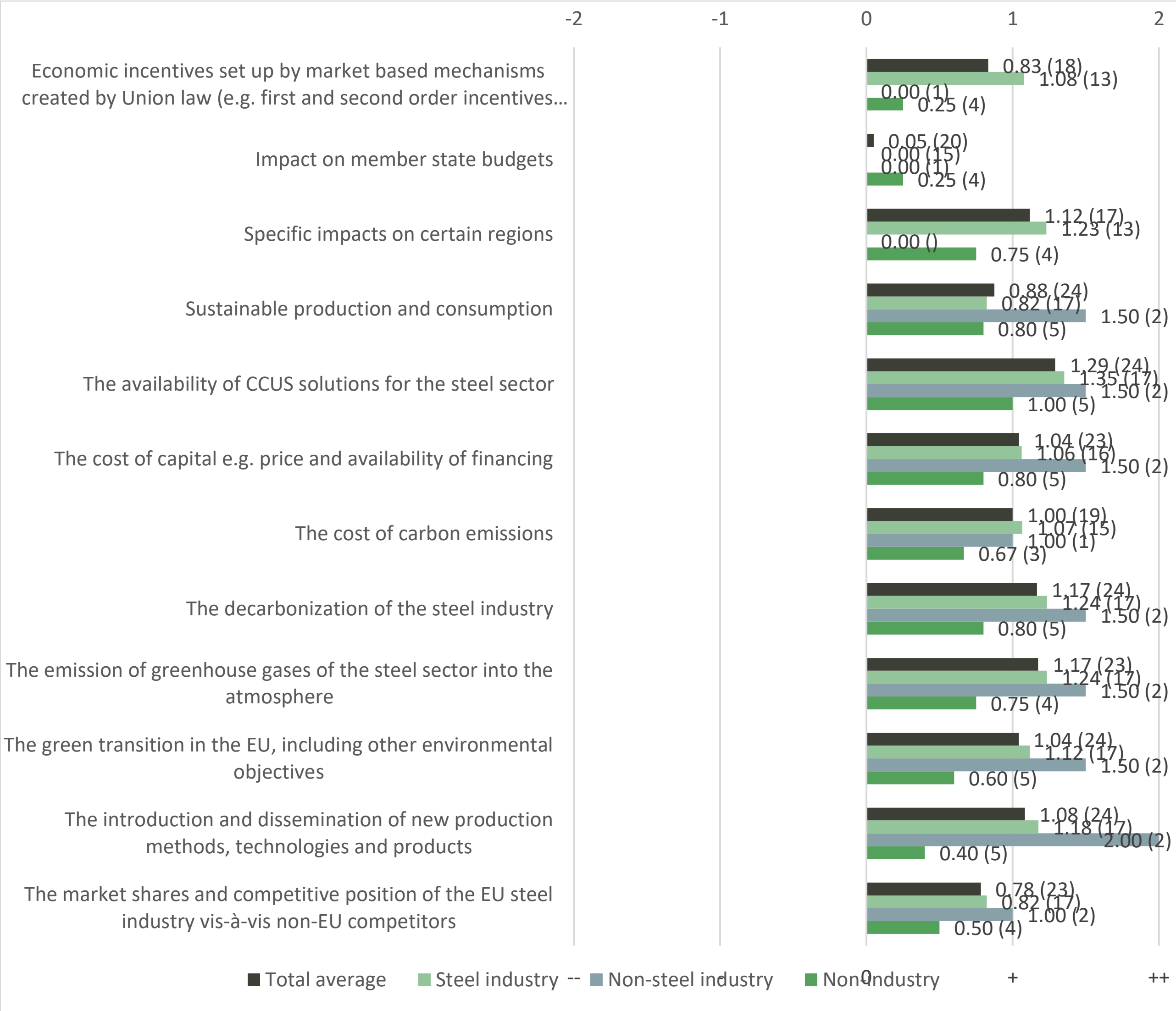
Note: the figure presents stakeholders' answers to question CCUS.IA.3, i.e. "What impact would option CCUS3 (providing funding (CAPEX and OPEX) for CO_2 storage and transportation infrastructure) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CCUS5: providing increased public support and funding for R&D&I to optimise capture at high rates

On average, respondents agreed that the most significant positive impact of providing increased public support and funding for R&D&I to optimise capture at high rates would be on the availability of CCUS solutions for the steel sector, scoring on average 1.29 in a range from -2 to 2 (Figure 57). Stakeholders from the non-steel industry also identified a very positive impact of the option on the introduction and dissemination of new production methods.

Figure 57: Impacts of providing increased public support and funding for R&D&I to optimise capture at high rates



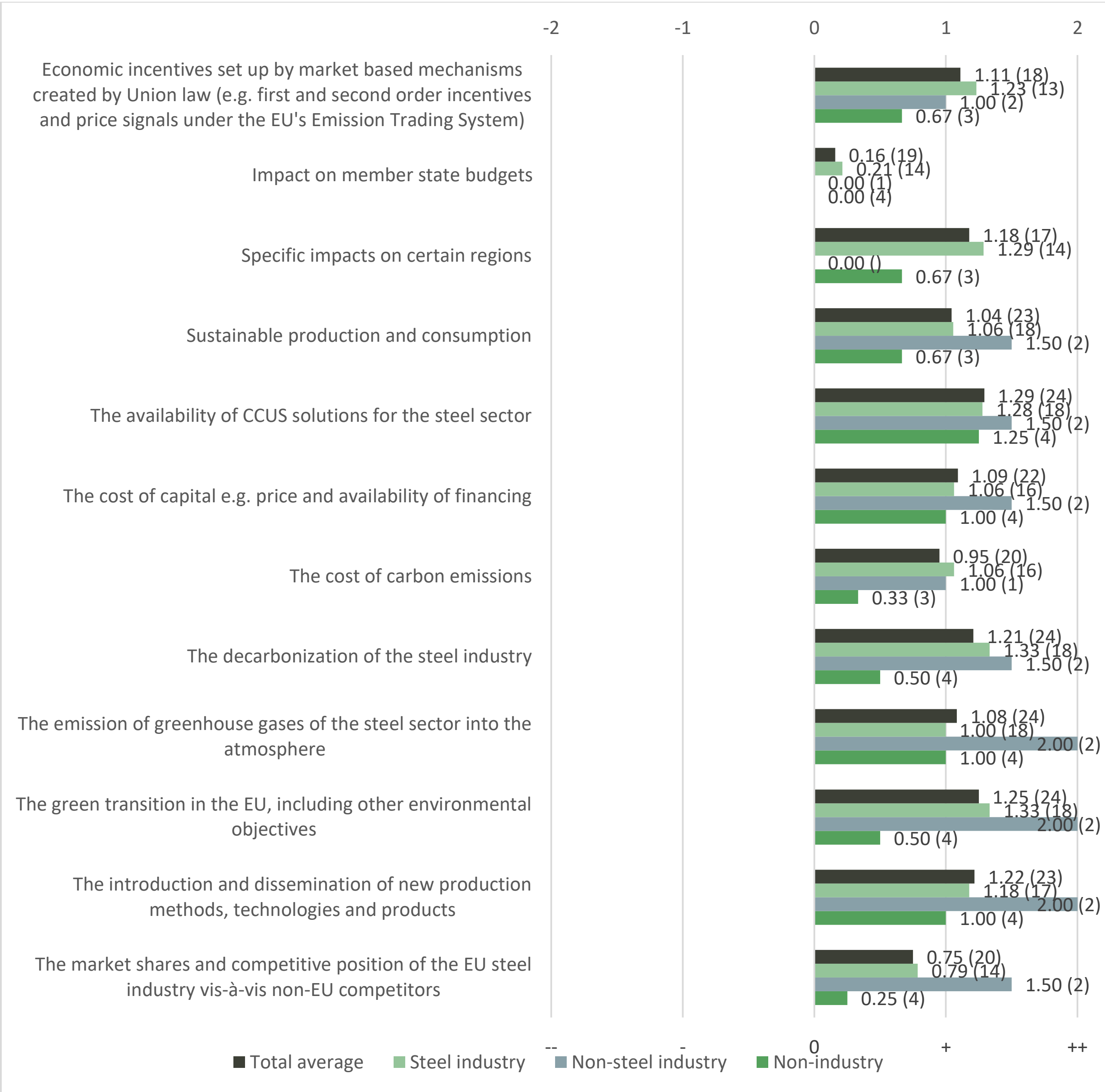
Note: the figure presents stakeholders' answers to question CCUS.IA.5, i.e. "What impact would option CCUS5 (providing increased public support and funding for R&D&I to optimise capture at high rates) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CCUS6: incentivising the use of CO_2 that is compatible with climate-neutrality in the ETS

As shown in Figure 58, respondents agreed that the most significant impact of incentivising the use of CO_2 that is compatible with climate-neutrality (option CCUS6) would be on the availability of CCUS solutions for the steel sector, scoring on average 1.29 in a range from -2 to 2.

Figure 58: Impacts of incentivising the use of CO_2 that is compatible with climate-neutrality in the ETS



Note: the figure presents stakeholders' answers to question CCUS.IA.6, i.e. "What impact would option CCUS6 (incentivising the use of CO_2 that is compatible with climate-neutrality in the ETS) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral

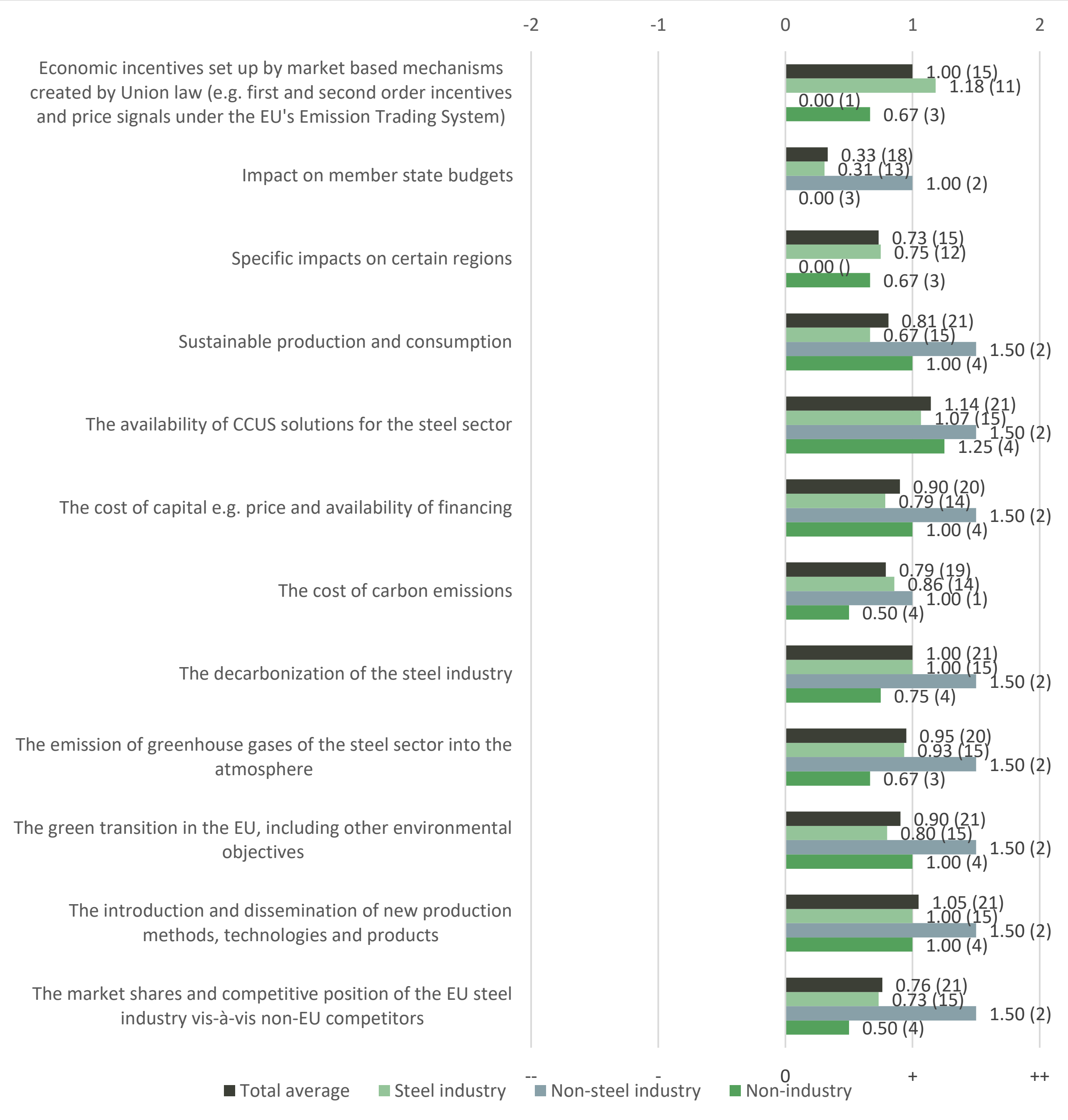
(0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CCUS7: providing a platform where different actors in the value chain meet and coordinate

Figure 59 shows that respondents agreed that the most significant impact of providing a platform where different actors in the value chain meet and coordinate (option CCUS7) would be on the availability of CCUS solutions for the steel sector, scoring on average 1.14 in a range from -2 to 2. Respondents from the non-steel industry assessed this effect more positively than respondents from the steel industry.

Figure 59: Impacts of providing a platform where different actors in the value chain meet and coordinate



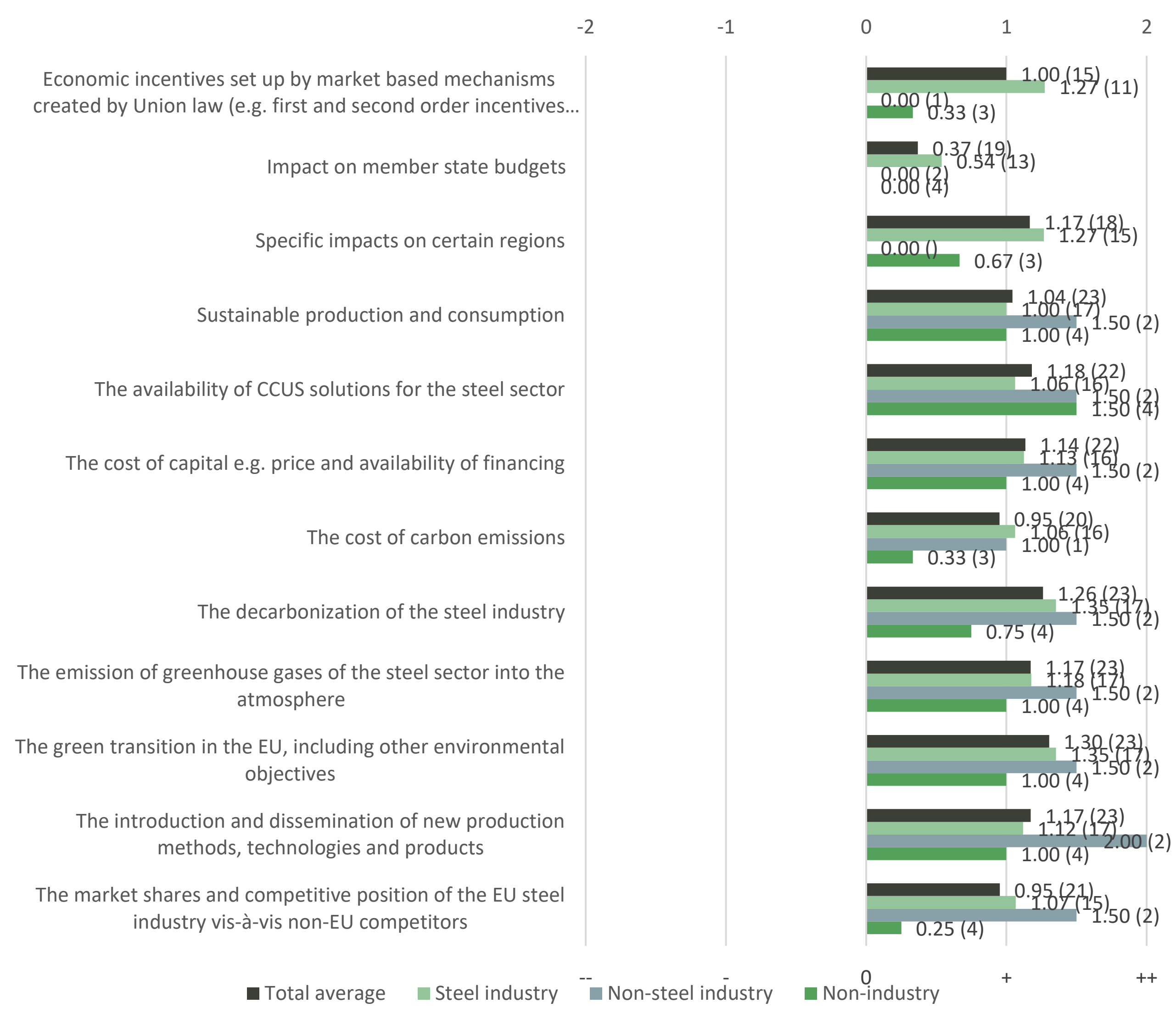
Note: the figure presents stakeholders' answers to question CCUS.IA.7, i.e. "What impact would option CCUS7 (providing a platform where different actors in the value chain meet and coordinate) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CCUS8: supporting clusters/ industrial symbiosis (e.g. through establishing an IPCEI)

On average, respondents agreed that the most significant positive impact of supporting clusters/industrial symbiosis (option CCUS8) would be on the green transition in the EU, including other environmental objectives, receiving an average score of 1.30 in a range from -2 to 2 (Figure 60).

Figure 60: Impacts of supporting clusters/ industrial symbiosis (e.g. through establishing an IPCEI)



Note: the figure presents stakeholders' answers to question CCUS.IA.8, i.e. "What impact would option CCUS8 (supporting clusters/industrial symbiosis (e.g. through establishing an IPCEI) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

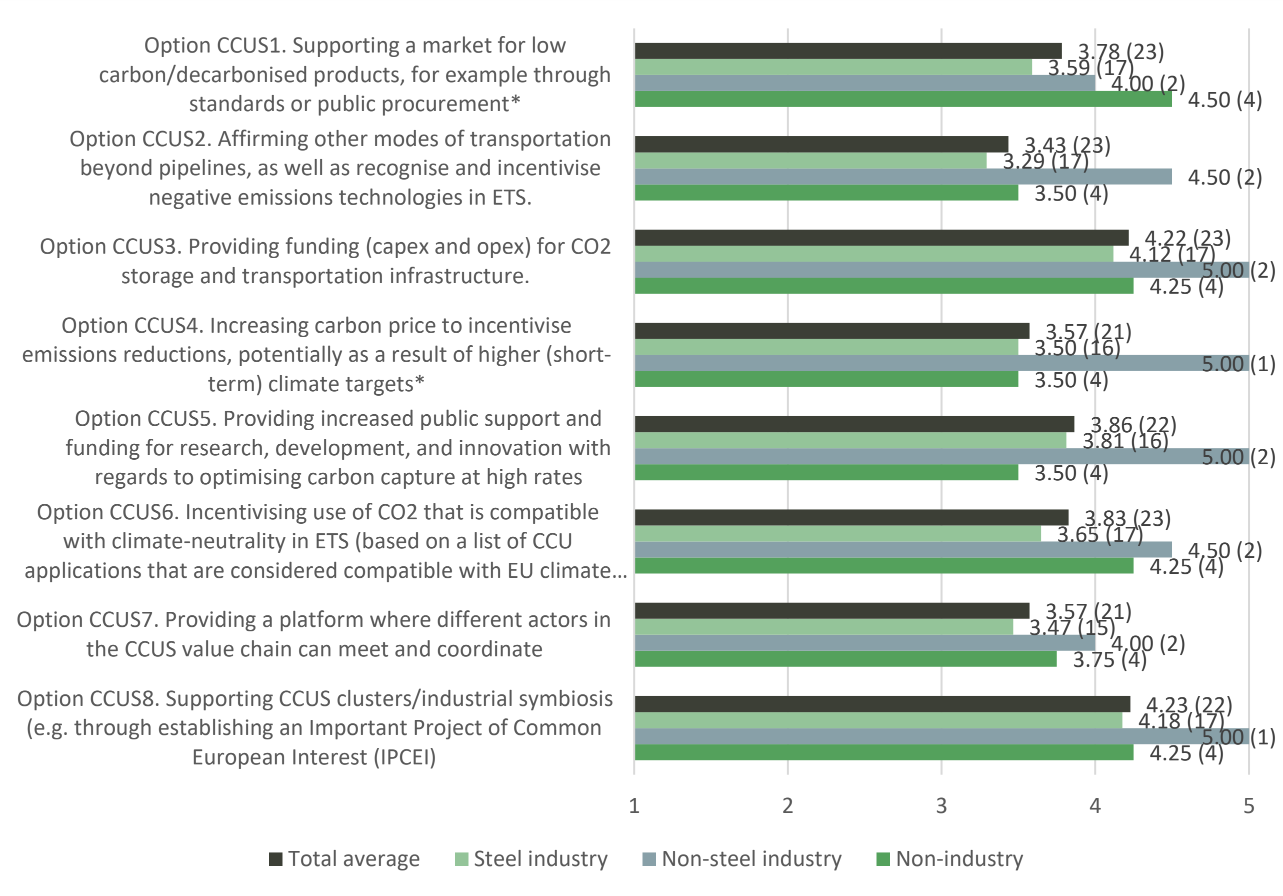
Source: authors' own composition on survey results.

Comparison of options

Effectiveness

As shown in Figure 61, on average the option of supporting clusters/industrial symbiosis (e.g. through establishing an IPCEI) has been ranked as the best option to improve the availability of CCUS solutions for it to be able to contribute to the emission reduction targets of the EU and the decarbonisation of hard-to-abate industries such as steel.

Figure 61: Comparison of the effectiveness of the policy options – CCUS



Note: the figure presents stakeholders' answers to question CCUS.COMP.1, i.e. "Would the policy options listed in the table help improve the availability of CCUS solutions for it to be able to contribute to the emission reduction targets of the EU and the decarbonisation of hard-to-abate industries such as steel?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

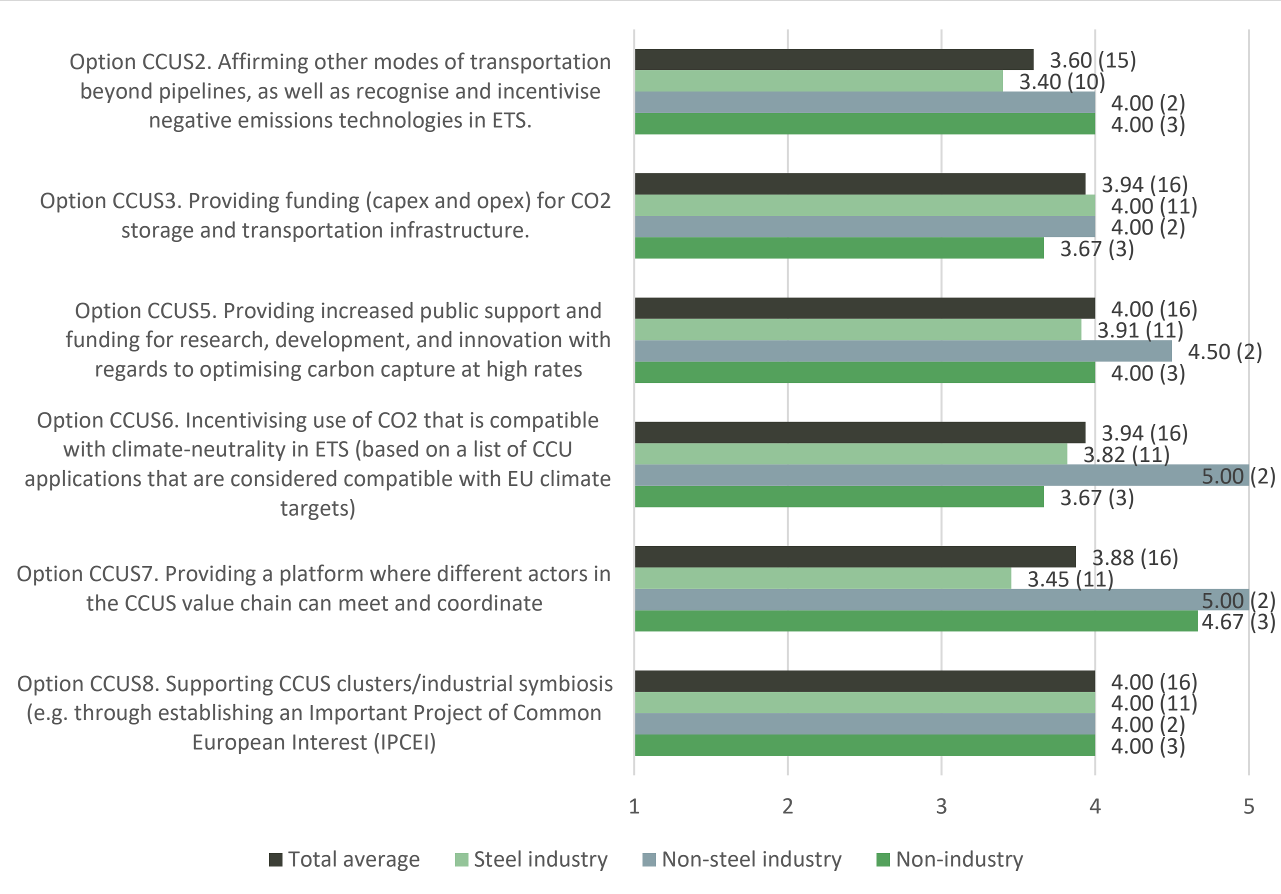
Source: authors' own composition on survey results.

Coherence

Figure 62 shows that, according to the survey, the options of (i) providing increased public support and funding for R&D&I with regards to optimising carbon capture at high rates and (ii) supporting

CCUS clusters/industrial symbiosis have the highest total score on average (4.00/5) when the options are assessed on their coherence with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.).

Figure 62: Comparison of the coherence of the policy options – CCUS



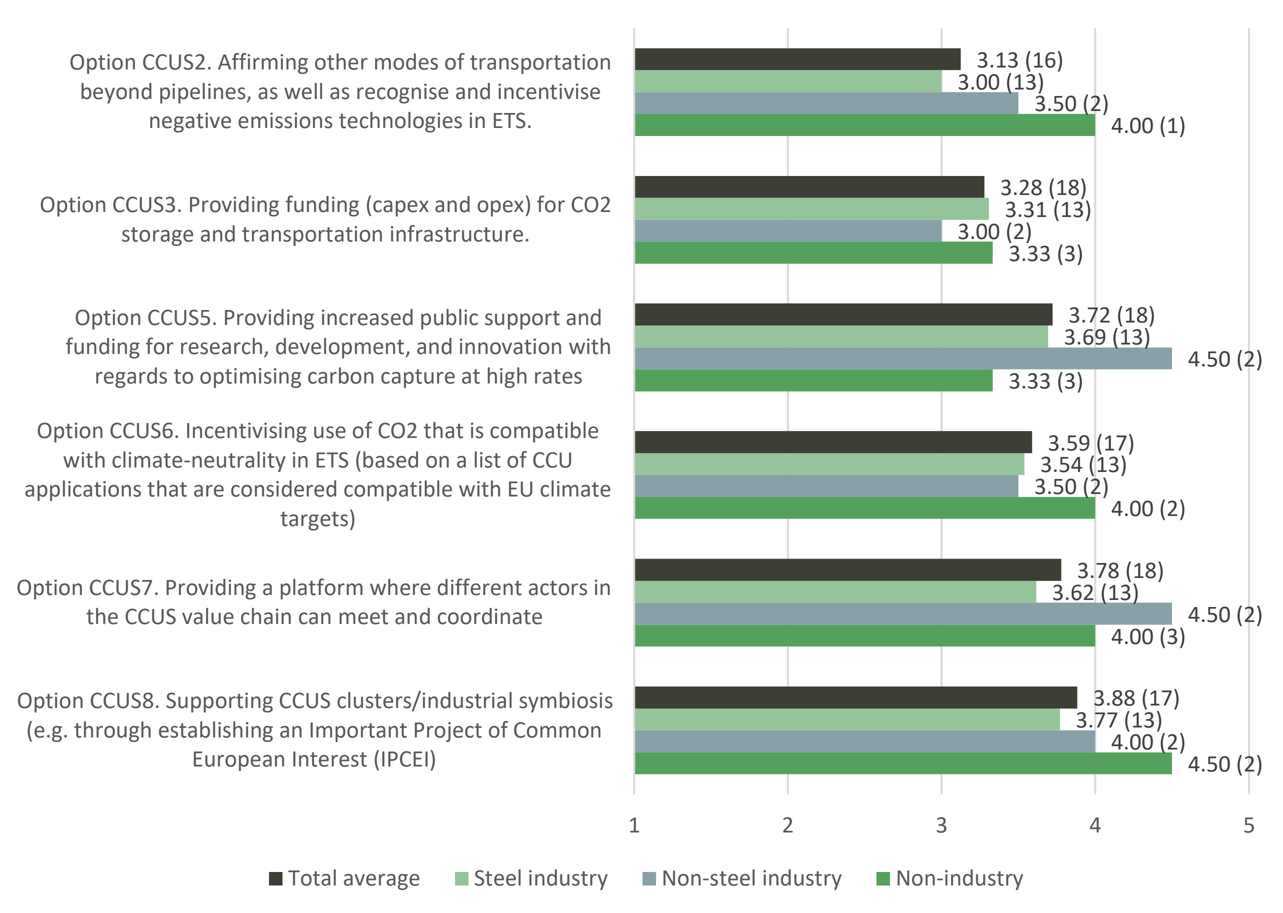
Note: the figure presents stakeholders' answers to question CCUS.COMP.2, i.e. "Are the policy options listed in the table below coherent with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.)?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Feasibility

According to the survey, the option of supporting CCUS clusters/industrial symbiosis (e.g. through establishing an IPCEI) is the one receiving the highest score (3.88/5) when the policy options are assessed on the possibility to receive enough support from EU and national policymakers to be properly implemented (Figure 63).

Figure 63: Comparison of the feasibility of the policy options – CCUS



Note: the figure presents stakeholders' answers to question CCUS.COMP.3, i.e. "Do you expect that the policy options listed in the table below will receive enough support from EU and national policymakers to be properly implemented?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own compilation on survey results.

Summary of stakeholder feedback - CCUS

Support for clusters, industrial symbiosis and the creation of an IPCEI (CCUS8) was overall the option considered by stakeholders to be the most effective, coherent and feasible, and could be a key policy option in developing a strong CCUS value chain in Europe. However, for improving the availability of CCUS solutions, a combination of options would likely be most effective: due to the interlinkages of the various stages, policy efforts should address a combination of these at the same time. Notably, capture at high rates would be necessary for the technology to play an effective role towards the long-term objective of net zero emissions. As such, option CCUS5, focused on optimizing capture at high rates, could be critical. Nevertheless, CCUS technology exists and could be implemented already. Consequently, optimisation of the technology could be ensured alongside other options aimed at incentivising investment in and implementation of CCUS solutions. Certain trade-offs with regards to the availability of existing infrastructure and distribution of resources for other decarbonisation technologies, however, should not be neglected.

From a comparative point of view, answers can be assessed as follows:

- several stakeholders noted that a combination of options would be best to effectively ensure the availability of CCUS solutions for industries such as steel. Some respondents also put emphasis on addressing the investment case, with some focusing on carbon price signals and others on funding needs. The need for R&D&I was also highlighted by a couple of respondents;
- while most stakeholders considered the options to be in line with the spirit of EU policy and legislation in the area of energy, climate and environment, one respondent noted that in some areas coherence could be improved. One example provided was CO_2 transport for usage being ineligible under the EU taxonomy rules. Notably, another stakeholder brought up a need for international cooperation, which could also require policy coherence;
- overall, a few stakeholders were convinced that the options would receive more support from EU institutions compared to national policymakers. One respondent also highlighted that positions on CCUS among Member States diverge, while others considered that national policymakers may favour other decarbonization technologies. Political opinions were also considered to diverge between CCU and CCS, with another respondent noting that options focused on the former (CCUS6) could struggle more to receive sufficient support compared to options focused on the latter.

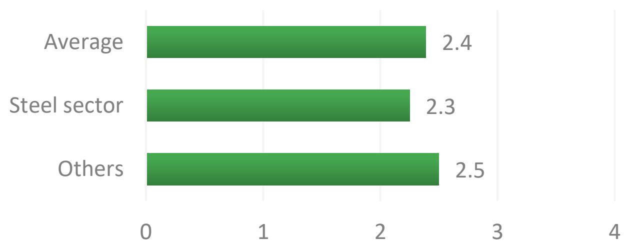
5. Carbon pricing

Problem identification

General problem CP: functioning of the EU carbon pricing system

On average, the respondents agreed to some extent (2.4/4) that the EU carbon pricing system creates a challenge to the decarbonisation of the EU industry (Figure 64). More in detail, steel sector stakeholders were slightly less concerned about carbon pricing issues (2.3/4) than non-steel sector respondents (2.5/4).

Figure 64: Functioning of the EU carbon pricing system

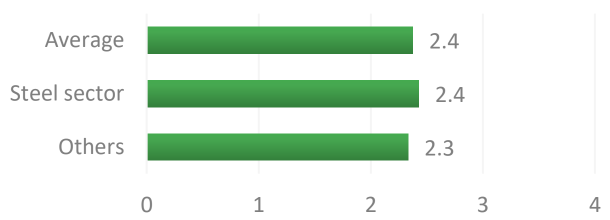


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the problems affecting the functioning of the EU carbon pricing system will hinder the decarbonisation of the EU steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4). Source: authors' own composition on survey results.

Specific problem CP1: low carbon prices

As shown in Figure 65, the respondents agreed to some extent (2.4/4 on average) that the specific problem of insufficient carbon prices compared with the steel sector abatement costs would prevent the EU steel sector from meeting its decarbonisation targets. On average, steel sector respondents expressed *a slightly* higher level of concern than non-steel sector respondents (2.4/4 and 2.3/4 respectively).

Figure 65: Low carbon price

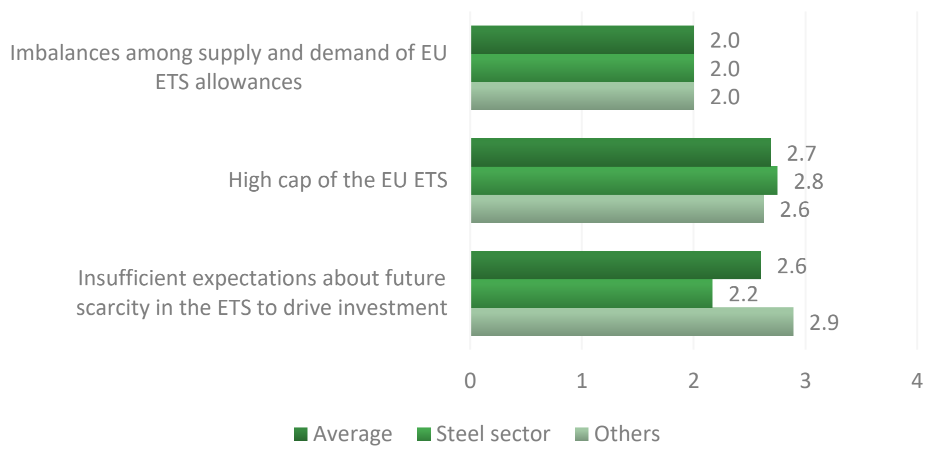


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the low carbon price contributes to the general problem of the current carbon pricing system being inadequate to decarbonise the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 66, the respondents considered that the level of the ETS cap and the expectations about future scarcity in the ETS were the most relevant drivers (2.7 and 2.6/4, respectively). Sector-wise, respondents from the steel industry considered the latter driver to play a less important role (2.2/4) compared to respondents from other sectors (2.9/4). The respondents from both steel and non-steel sectors considered that the rigidity of the EU ETS supply was the least relevant driver (2.0/4).

Figure 66: Drivers contributing to keeping the carbon price below the abatement costs for breakthrough technologies in the steel sector



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers identified contribute to keeping the carbon price below the abatement costs reported for breakthrough technologies in the steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

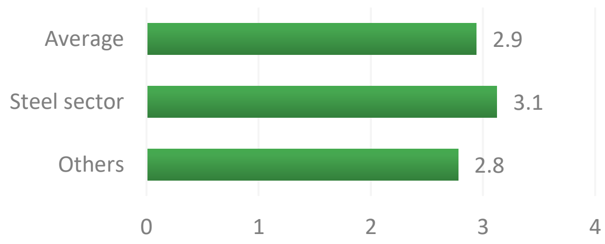
Six respondents provided additional considerations on the carbon price level and its impact on the decarbonisation of the steel industry. One respondent said that the carbon price alone will not drive investment in low-carbon technologies, as these investments are massive and will need to be made at the same time as paying the carbon cost of continuing with the normal production processes. Another respondent stated that the steel sector did receive around 95% as free allocation.

A few respondents provided more extensive comments. Both a carbon price floor (with a level that increases over time) and a carbon border adjustment mechanism (CBAM) were mentioned by one respondent as increasing the ability of the ETS to give the right price signals. Including other sectors in the ETS was also mentioned, although this should not come at a cost of the Effort-Sharing framework, to retain the incentives for the Member States to pass decarbonisation policies. However, in line with specific problem CP2, one respondent also noted that even a high price for carbon does not guarantee investment, as it is the business case that drives investment decisions. A carbon price can support this business case, but is not sufficient to make all types of low-carbon investment economically viable. In the absence of sufficient market signals, public policy and investment become more important. Finally, due to different abatement costs (that are changing over time) in different sectors, arguably no price of carbon is either too high or too low.

Specific problem CP2: carbon pricing alone is not enough

The lack of complementary policies (in addition to carbon pricing) was considered of high importance (2.9/4), with steel sector respondents finding it even slightly more relevant than non-steel sector respondents (difference of 0.34; Figure 67).

Figure 67: Inadequate complementary policies

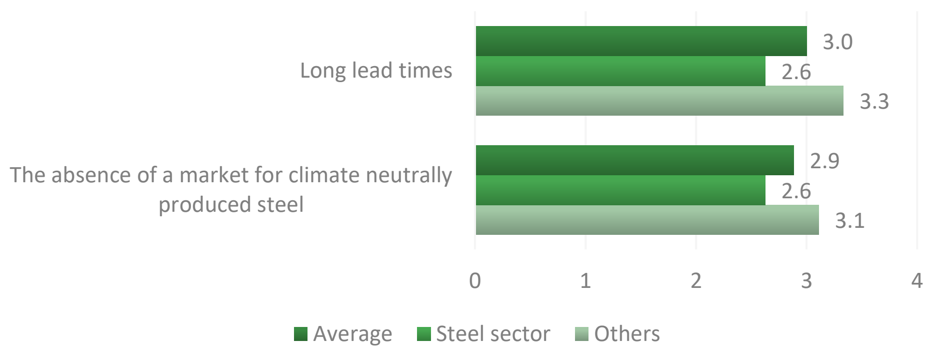


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that inadequate complementary policies will contribute to the general problem of the current carbon pricing system being insufficient to decarbonise the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Two drivers contributing to the above problem were listed: the long lead times and the absence of a market for climate-neutral steel. Both drivers were considered of high importance, with the long lead times scoring slightly higher than the absence of a market for low-carbon steel (3.0 and 2.9/4, respectively). Between steel sector and non-steel sector respondents, the latter found both drivers more important (Figure 68).

Figure 68: Drivers contributing to the problem of carbon pricing alone being insufficient to decarbonise the steel industry



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers contribute to the problem of carbon pricing alone being insufficient to decarbonise the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own compilation on survey results.

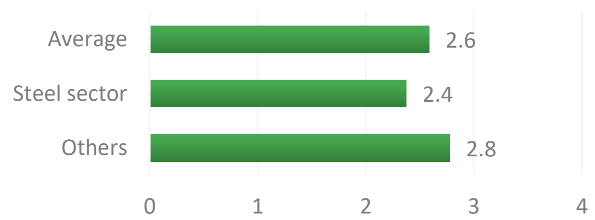
One respondent identified another driver, which actually better details driver 4.2.2 presented in the above figure: the absence of a product policy defining what sustainable materials are (even beyond steel) and setting out product performance requirements (whether for steel placed on the market, or downstream or end-use products made using steel) has hindered the market pull that the Ecodesign Directive[2] has provided.

A number of respondents provided additional considerations on the problem of the lack of complementary policies in addition to carbon pricing. A respondent noted that a carbon price on its own will not be sufficient to ensure clarity on what sustainable steel is (including it being low-carbon), nor will it provide the market pull by excluding under-performing products being placed on the market (whether from domestic production or imports). A more comprehensive policy mix is needed that can address production, products, including key end-use products, and drivers for uptake, such as green public procurement (GPP) criteria. Another respondent commented on the EU carbon leakage framework (based on free allocation and indirect costs compensation) and the fact that it could be combined with a new CBAM. Notably, some experts see the combination of free allocation and a CBAM as being incompatible with WTO rules. Other measures that could be considered include clean standards and a tax system based on carbon footprint. The insufficiency of just having a carbon price signal to trigger investment was also reflected upon the availability of clean technologies but also access to cleaner fuel supplies through well-established markets are also crucial. Certain solutions, like those based on renewable and low-carbon gases, require steel manufacturers to adapt their manufacturing process almost simultaneously to the development of sufficient supply.

Specific problem CP3: risk of carbon leakage

The respondents agreed to a high extent (2.6/4) that carbon leakage will contribute to an inadequate carbon pricing system (Figure 69). Across the sectors, respondents from the steel industry agreed with this problem to a lesser extent than stakeholders from other sectors (2.4 and 2.8/7, respectively).

Figure 69: Risk of carbon leakage



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the risk of carbon leakage will contribute to the general problem of the current carbon pricing system being insufficient to decarbonise the steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

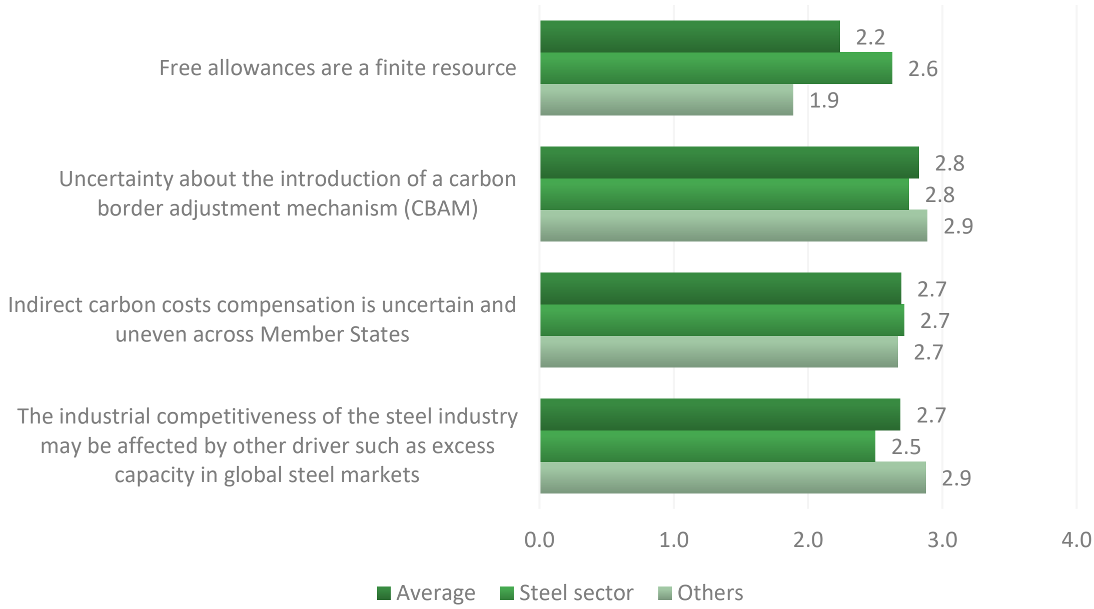
Source: authors' own composition on survey results.

As shown in Figure 70, all drivers were considered as having either some or high impact on the specific problem. The uncertainty about a CBAM was seen as the most important (2.8/4), while the

[2] See Directive 2009/125/EC as amended by Directive 2012/27/EU.

limited supply of free allowances was considered the least relevant (2.2/4). Nevertheless, the differences between the drivers were not large.

Figure 70: Drivers contributing to carbon leakage risk being a barrier to decarbonisation in the EU steel industry



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers contribute to carbon leakage risk being a barrier to decarbonisation in the EU steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The respondents provided additional considerations on the issue of carbon leakage risk and its impact on the decarbonisation of the EU steel industry. One respondent stated that a market prepared to pay a premium for low-carbon steel is crucial, while some stakeholders considered the current carbon leakage risk mitigation measures to be insufficient. Another respondent noted that free allocation has also been used as a source of revenue by some companies and a combination of free allocation, State aid and a CBAM would enable the industry to better invest in low-carbon technologies. However, combining these measures may be difficult from a WTO perspective, as it could be argued that they go beyond environmental protection. Finally, another respondent said that the creation of an EU market for increasingly decarbonized steel, together with access to renewable and decarbonized energy supplies, would facilitate the development of low-carbon steelmaking technologies. Innovation initiatives like the European Clean Hydrogen Alliance could facilitate the launch of projects and collaboration agreements on a market basis between steelmakers, technology providers and energy companies.

Other considerations on the general problem

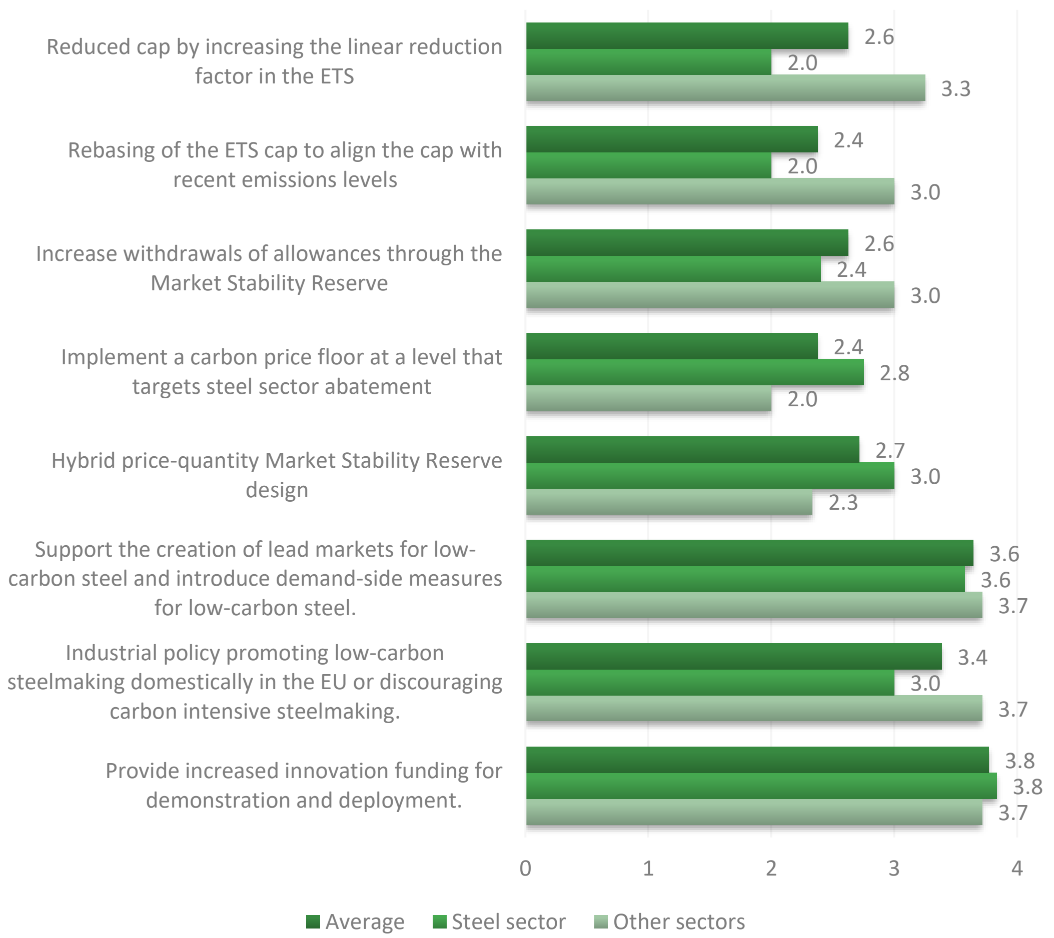
Two respondents provided additional considerations on the general problem, i.e. the fact that the EU carbon pricing system is incomplete and insufficient to decarbonise the EU steel industry. The first respondent stated that the higher ambition of the Green Deal would require an increased CO_2

pricing level to promote renewables and a lower-carbon electricity supply in general. Accordingly, a carbon floor price may be needed at EU level, in line with the measures that some Member States are considering. Such a measure should then be consistent with the carbon leakage risk mitigation framework and its combination with a potential new CBAM. The second respondent noted that to enable decarbonisation in the EU steel industry and successfully reach climate-neutral steel production in 2050 a broad mix of conditions must be fulfilled: (i) a competitive energy and hydrogen supply for the transformation must be ensured today to enable low-carbon production at scale later on (including the needed infrastructure); (ii) industrial competitiveness must be ensured in general; and (iii) markets must be created for the sale of climate-neutral steel.

Policy objectives and options

To address the gap between carbon prices and abatement costs as described in Specific Objective CP1, all stakeholders consulted generally preferred policy options that would reduce abatement costs in the steel industry (policy options CP1.6-1.8) over measures that would increase carbon prices. However, some measures that could increase the carbon price were nevertheless popular with non-steel sector respondents, such as a tighter cap and more withdrawals through the market stability reserve (MSR; Figure 71).

Figure 71: Policy options to address the gap between carbon prices and abatement costs in the steel industry

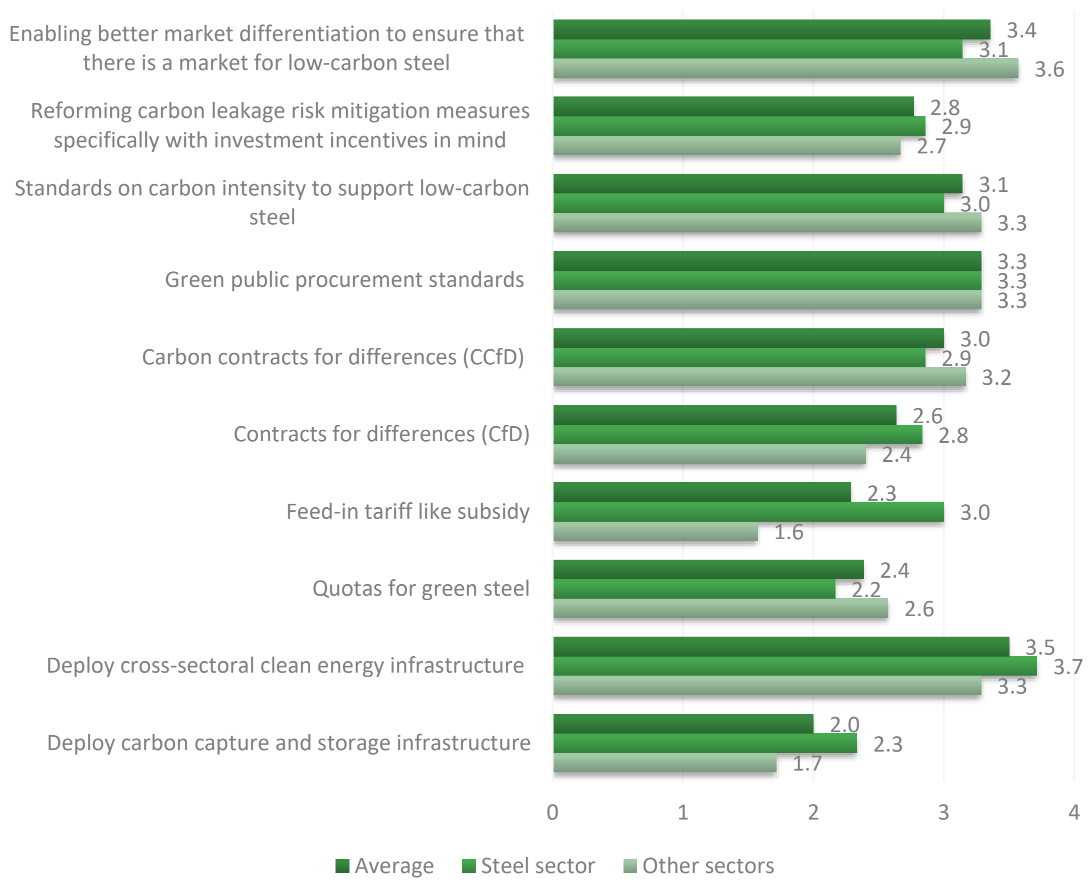


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CP1, i.e. reducing the differential between the EU ETS price and steel sector abatement costs, either by increasing the former or by reducing the latter?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Regarding Specific Objective CP2, i.e. adopting policies supporting steel sector decarbonisation that complement carbon pricing, all proposed policy options were considered to be at least somewhat useful, with four policies clearly receiving more support. Deployment of clean energy infrastructure was the most popular (option CP2.9, scoring 3.5/4), followed by policies that enable market differentiation between low-carbon and conventional steel. GPP and carbon intensity standards also received significant support. Differences can be observed between the steel industry and the other sectors for some options, e.g. feed-in tariffs like subsidies were popular in the steel sector but poorly received by respondents from other sectors (Figure 72).

Figure 72: Policy options to complement carbon pricing policies

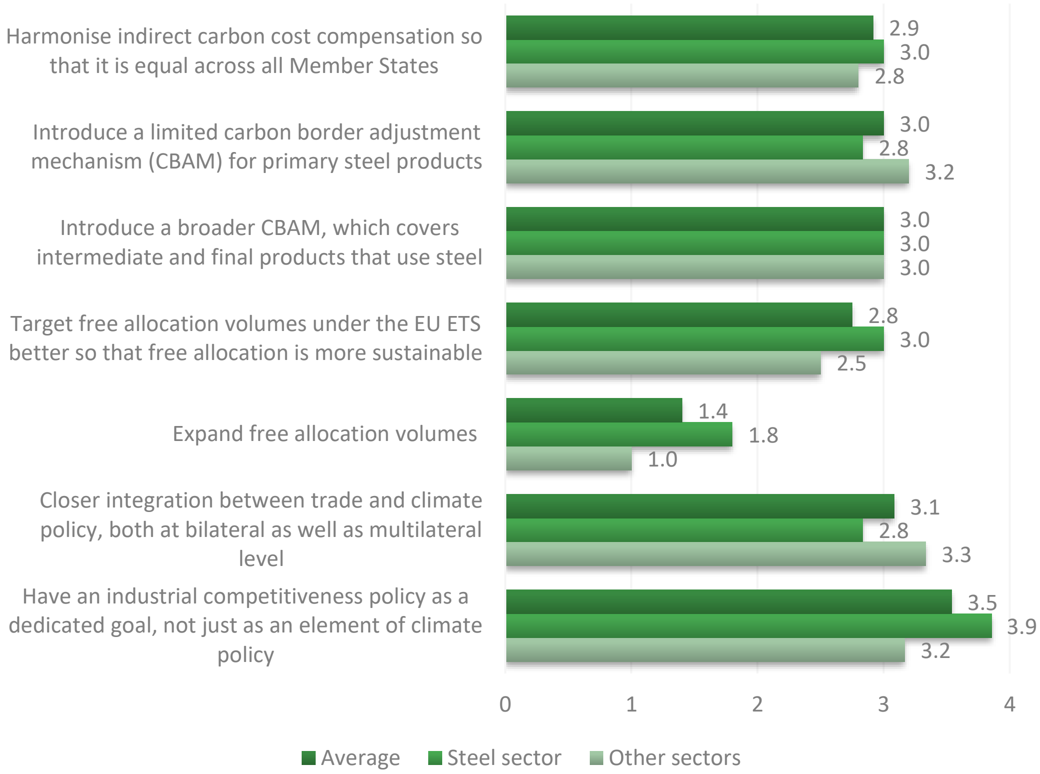


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CP2, i.e. implementing policies that address the weaknesses of carbon pricing while supporting steel decarbonisation?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

For Specific Objective CP3, i.e. mitigating the carbon leakage risk, one option was evidently favoured: to have a broad industrial competitiveness agenda for the steel sector, not just as part of the climate policy (option CP3.7, scoring 3.5/4). Another option was clearly not supported, i.e. the expansion of free allocation (CP3.5, scoring 1.4/4). All other options scored generally positively, with non-steel sector respondents being slightly more positive towards a CBAM and the steel sector favouring (potentially better targeted) free allocation (Figure 73).

Figure 73: Policy options to mitigate the risk of carbon leakage



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective CP3, i.e. mitigating the carbon leakage risk for both direct and indirect emissions?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

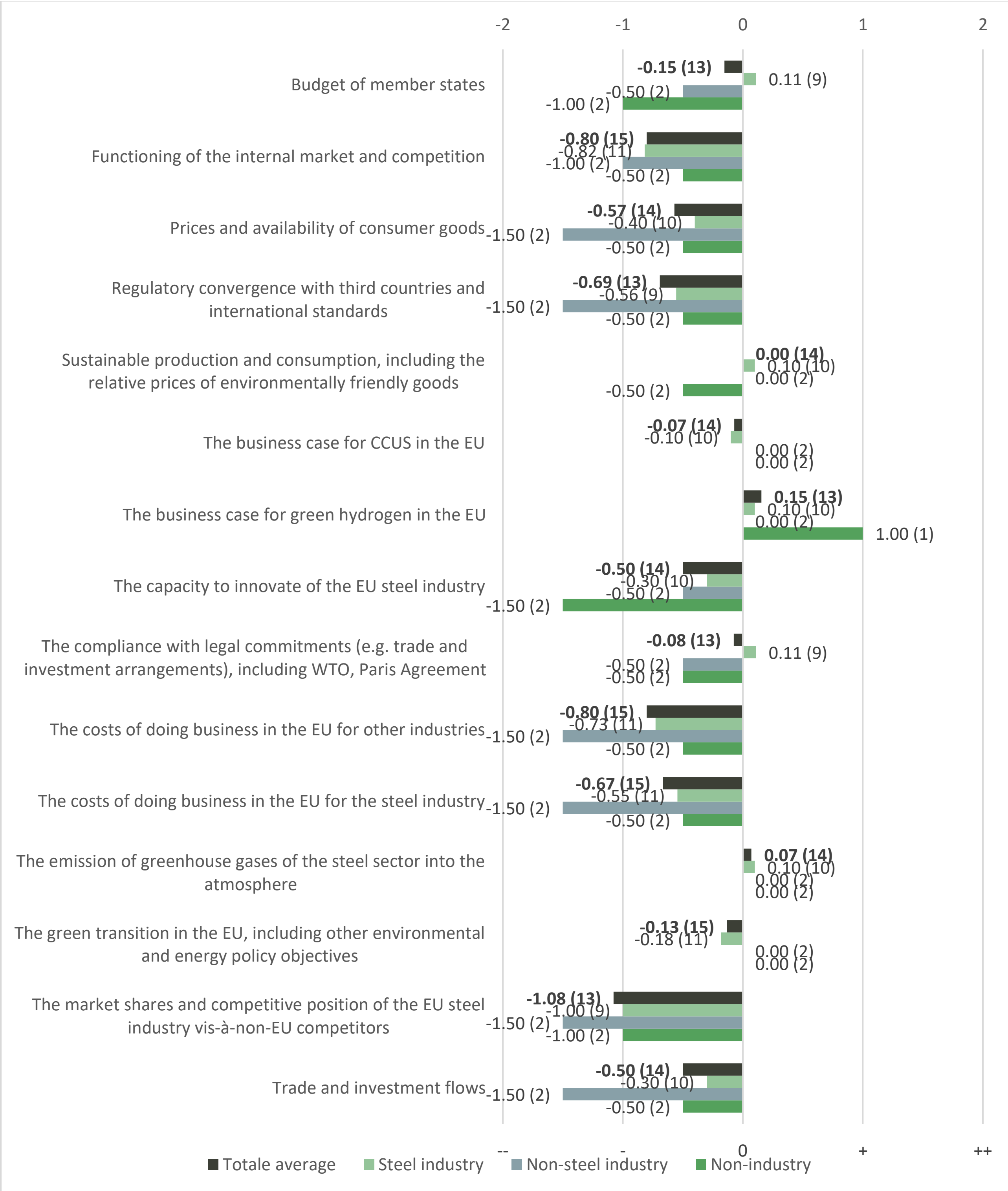
Besides the proposed policy options, one respondent from the steel industry suggested introducing a 'carbon-added tax' which would function in a similar way as VAT. One respondent from another sector suggested introducing output-based performance benchmarks for projects, expressed in relation to inputs and outputs (impacts) per production output (steel).

Impacts of options

Impacts of option CP1: adopting a hybrid design approach to the Market Stability Reserve (MSR)

According to the respondents, the option of introducing a hybrid design approach to the MSR would generate the most negative impact on the market shares and competitive position of the EU steel industry vis-à-vis non-EU competitors (Figure 74), recording the lowest total score (-1.08 in a range from -2 to 2). More in general, the option proposed would mostly generate negative effects on the aspects identified.

Figure 74: Impacts of a hybrid design approach to the MSR



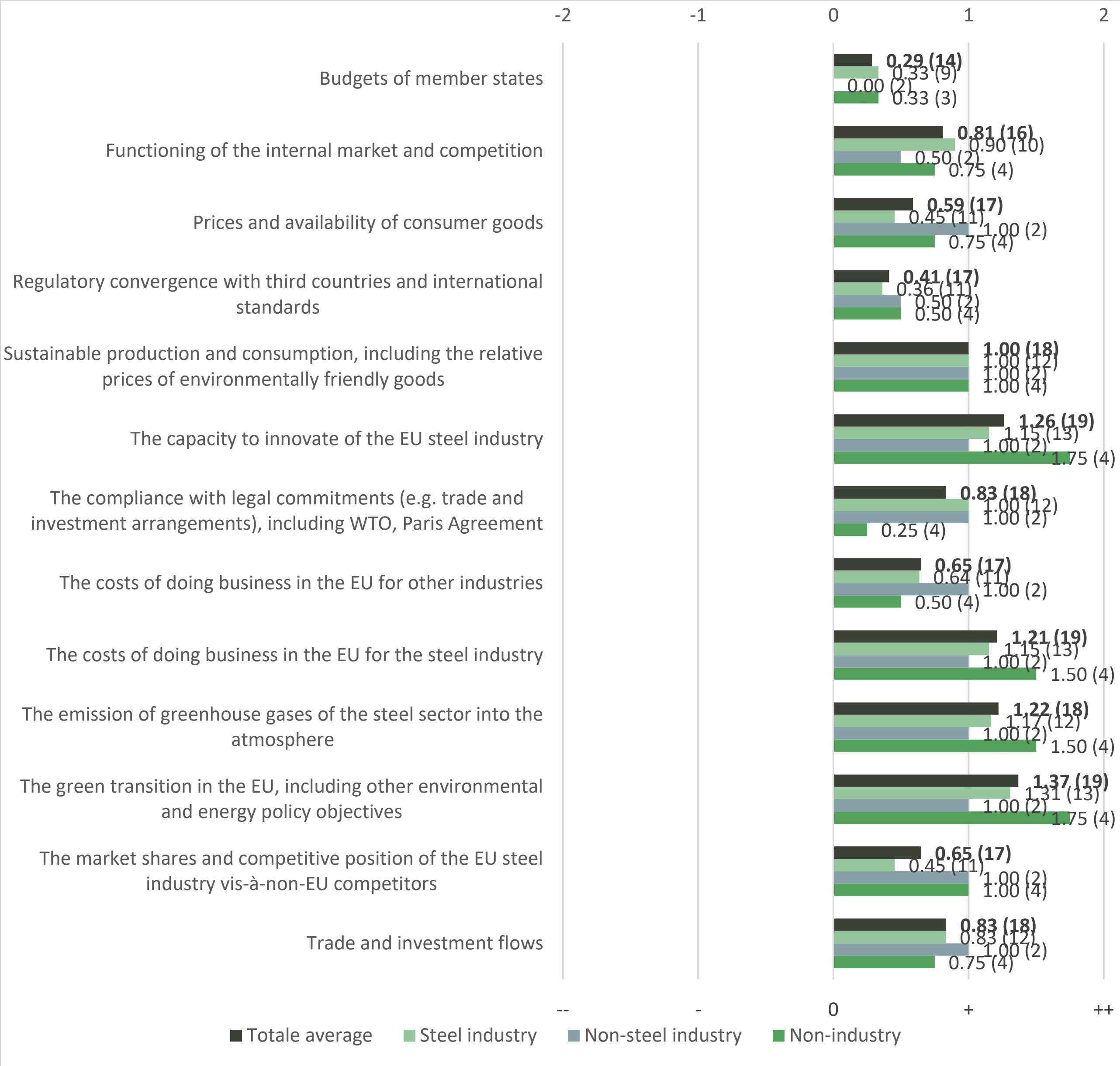
Note: the figure presents stakeholders' answers to question CP.IA.1, i.e. "What impact would option CP1 (hybrid design approach to the Market Stability Reserve (MSR)) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CP2: reducing the steel sector abatement costs

As shown in Figure 75, the option of reducing the steel sector abatement costs would generate the highest positive impacts on the green transition in the EU, including other environmental policy objectives, recording the highest total score on average (1.37 in a range from -2 to 2).

Figure 75: Impacts of reducing the steel sector abatement costs



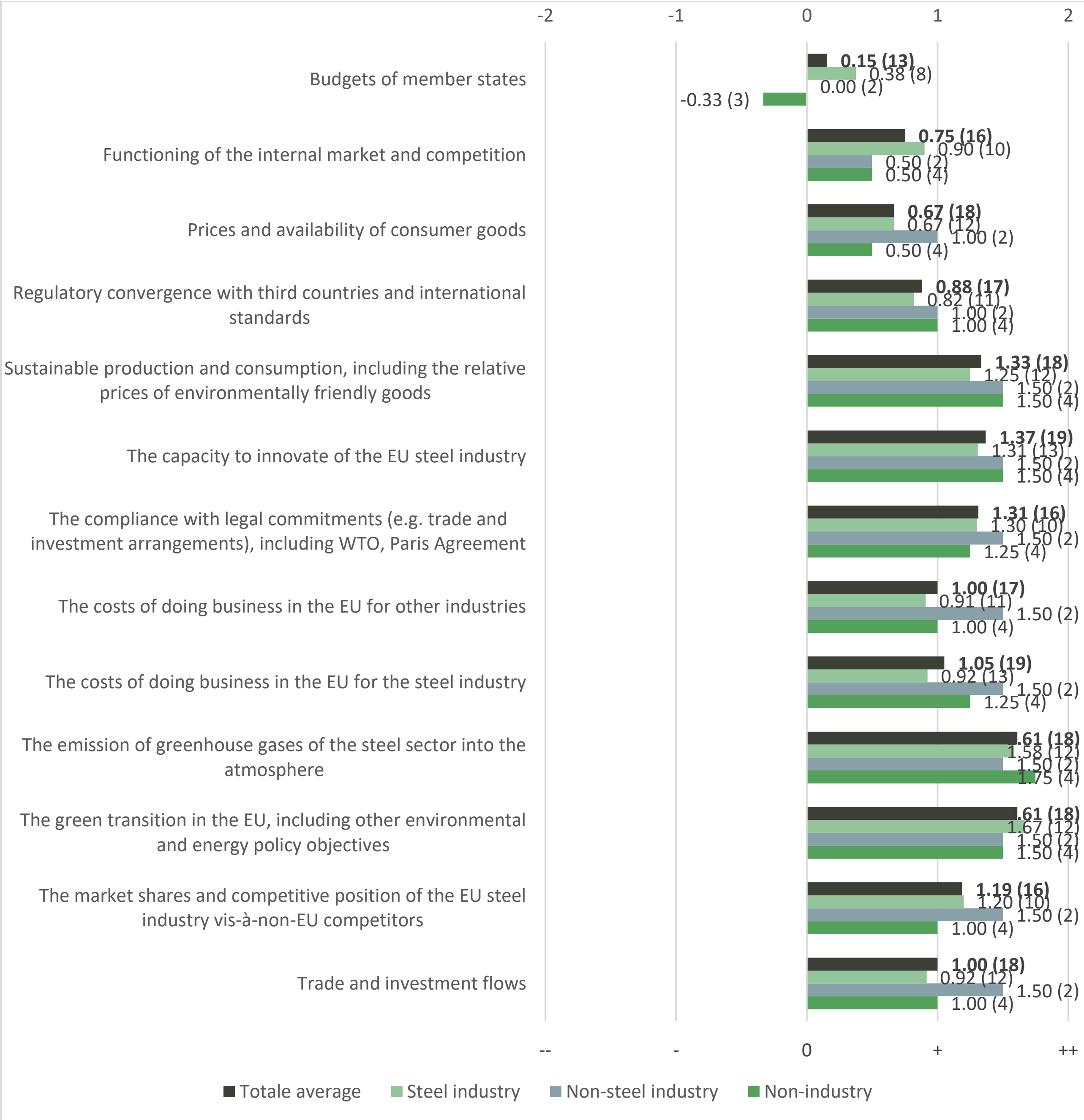
Note: the figure presents stakeholders' answers to question CP.IA.2, i.e. "What impact would option CP2 (reducing the steel sector abatement costs) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CP5: introducing carbon contracts for difference

Figure 76 shows that the option of introducing CCfDs would generate the highest positive impacts on the emission of GHG of the steel sector into the atmosphere and on the green transition in the EU, both recording the highest total score on average (1.61 in a range from -2 to 2).

Figure 76: Impacts of introducing carbon contracts for difference



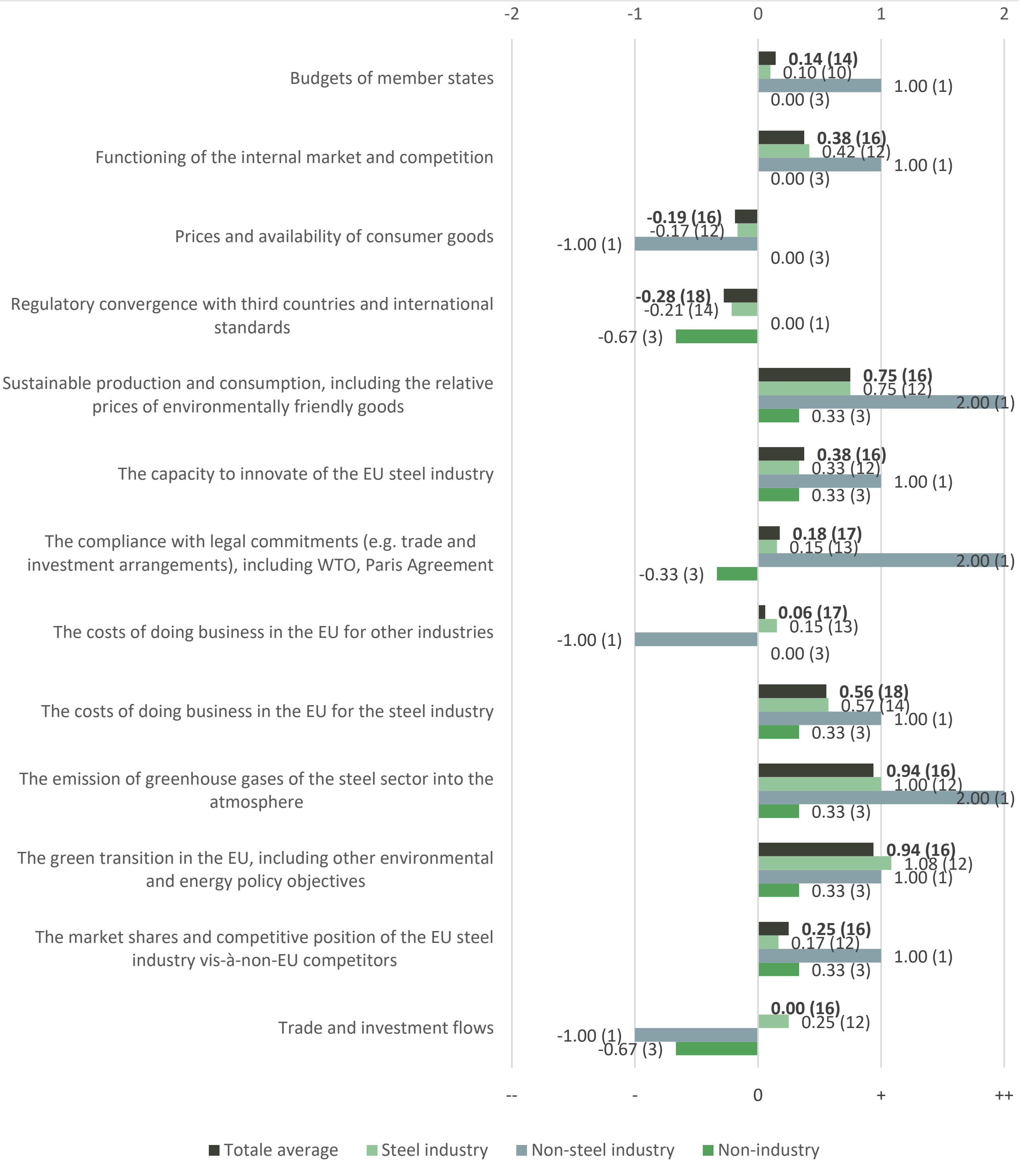
Note: the figure presents stakeholders' answers to question CP.IA.5, i.e. "What impact would option CP5 (introducing carbon contracts for difference) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CP6: introducing carbon border adjustments

According to the respondents, the option of introducing carbon border adjustments would generate the highest positive impacts on the emission of GHG of the steel sector into the atmosphere and on the green transition in the EU (Figure 77), both recording the highest total score on average (0.94 in a range from -2 to 2).

Figure 77: Impacts of introducing carbon border adjustments



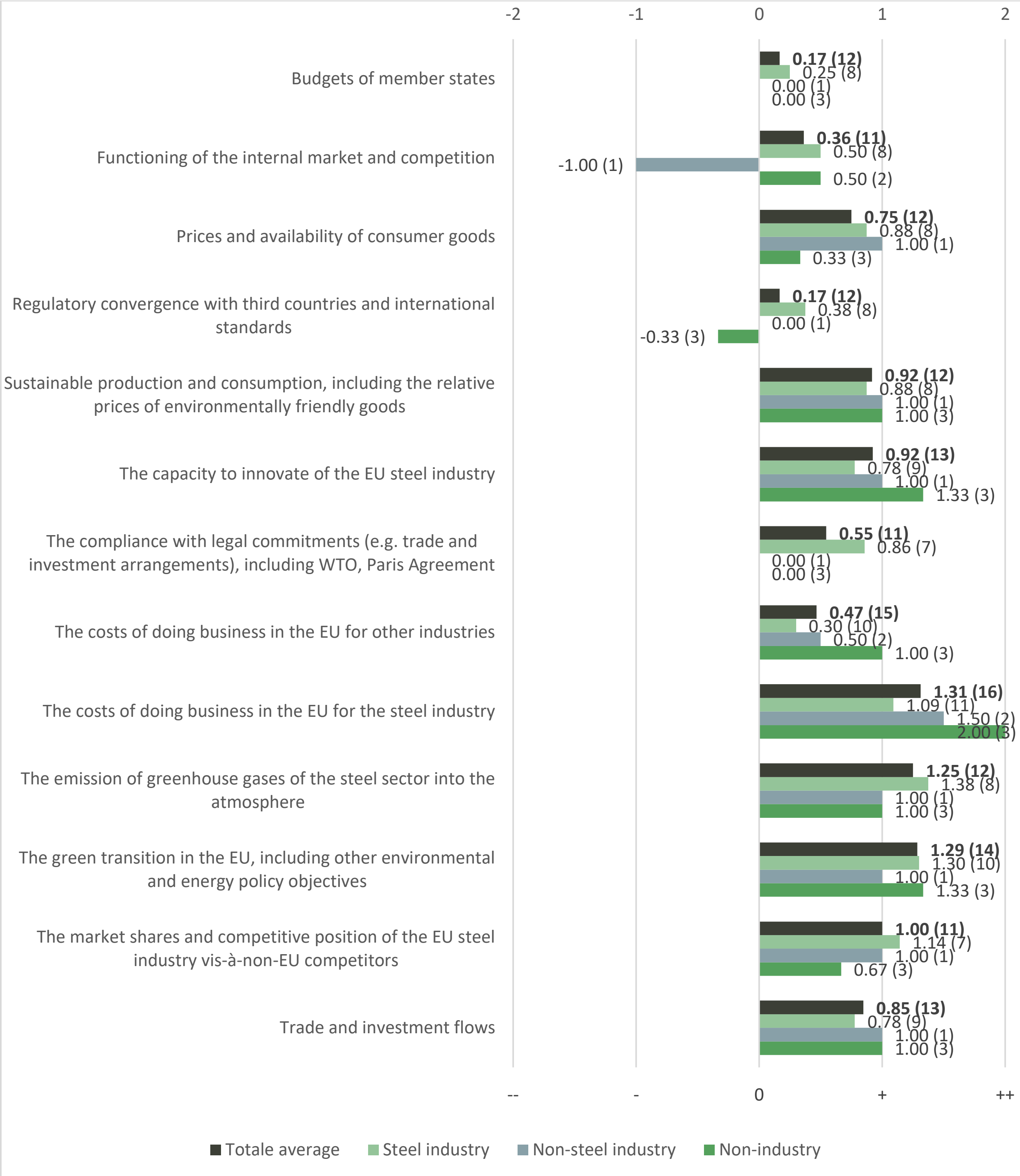
Note: the figure presents stakeholders' answers to question CP.IA.6, i.e. "What impact would option CP6 (introducing carbon border adjustments) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option CP7: introducing a separate industrial competitiveness policy for the steel industry

According to the respondents, the option of introducing a separate industrial competitiveness policy for the steel industry would generate the highest positive impacts on the costs of doing business in the EU for the steel industry (Figure 78), recording the highest total score on average (1.31 in a range from -2 to 2). Interestingly, respondents from the steel industry believed that the most significant impact generated by this option would be on the emission of GHG of the steel sector into the atmosphere.

Figure 78: Impacts of introducing a separate industrial competitiveness policy for the steel industry



Note: the figure presents stakeholders' answers to question CP.IA.7, i.e. "What impact would option CP7 (introducing a separate industrial competitiveness policy for the steel industry) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

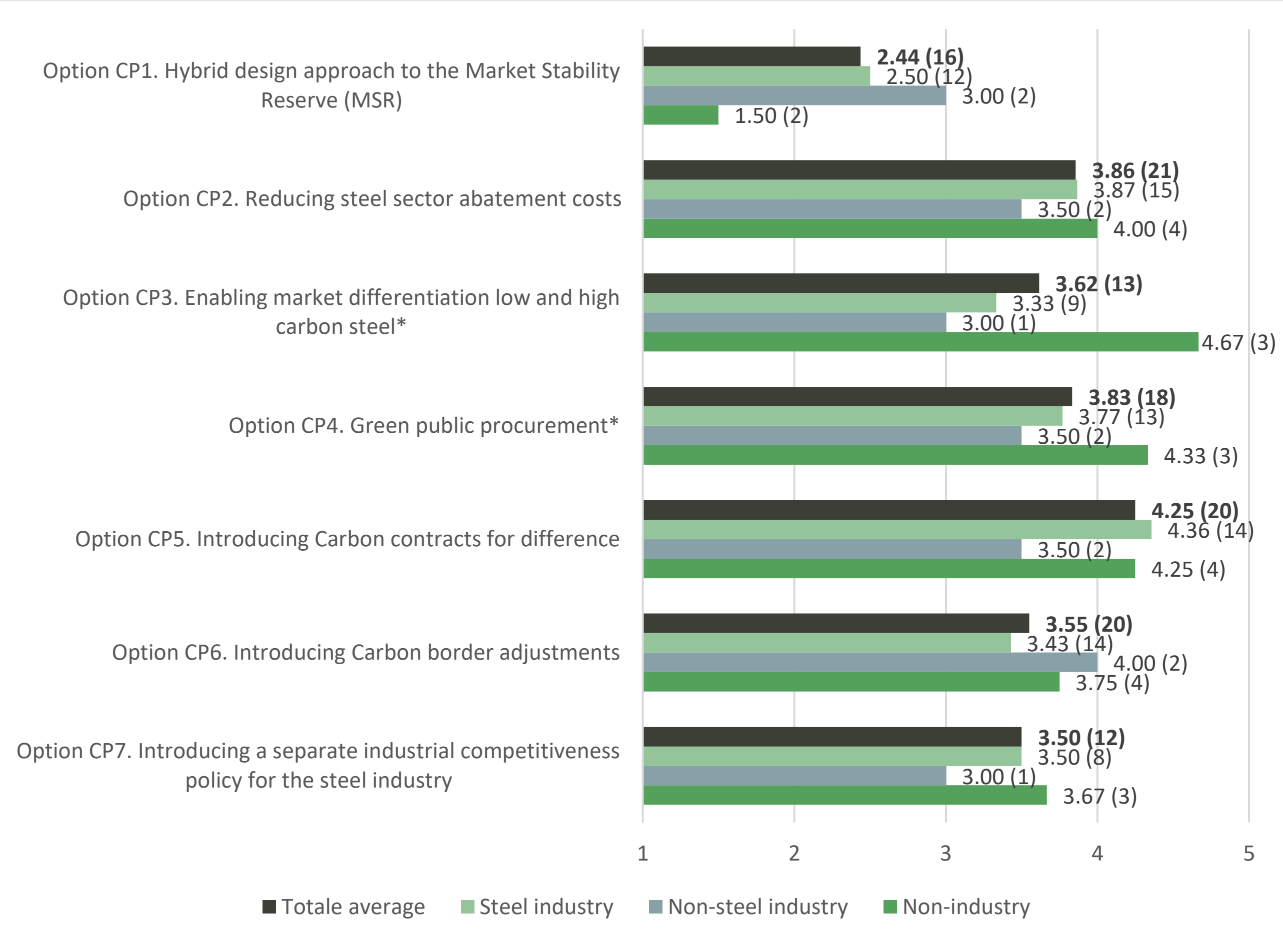
Source: authors' own composition on survey results.

Comparison of options

Effectiveness

Figure 79 shows that the option of introducing CCfDs is the one recording the highest total score on average (4.25/5) when the options are assessed on their ability to help ensure that carbon pricing policies in the EU effectively contribute to emission reductions in the steel sector, thereby supporting long-term EU climate policy objectives.

Figure 79: Comparison of the effectiveness of the policy options – Carbon pricing



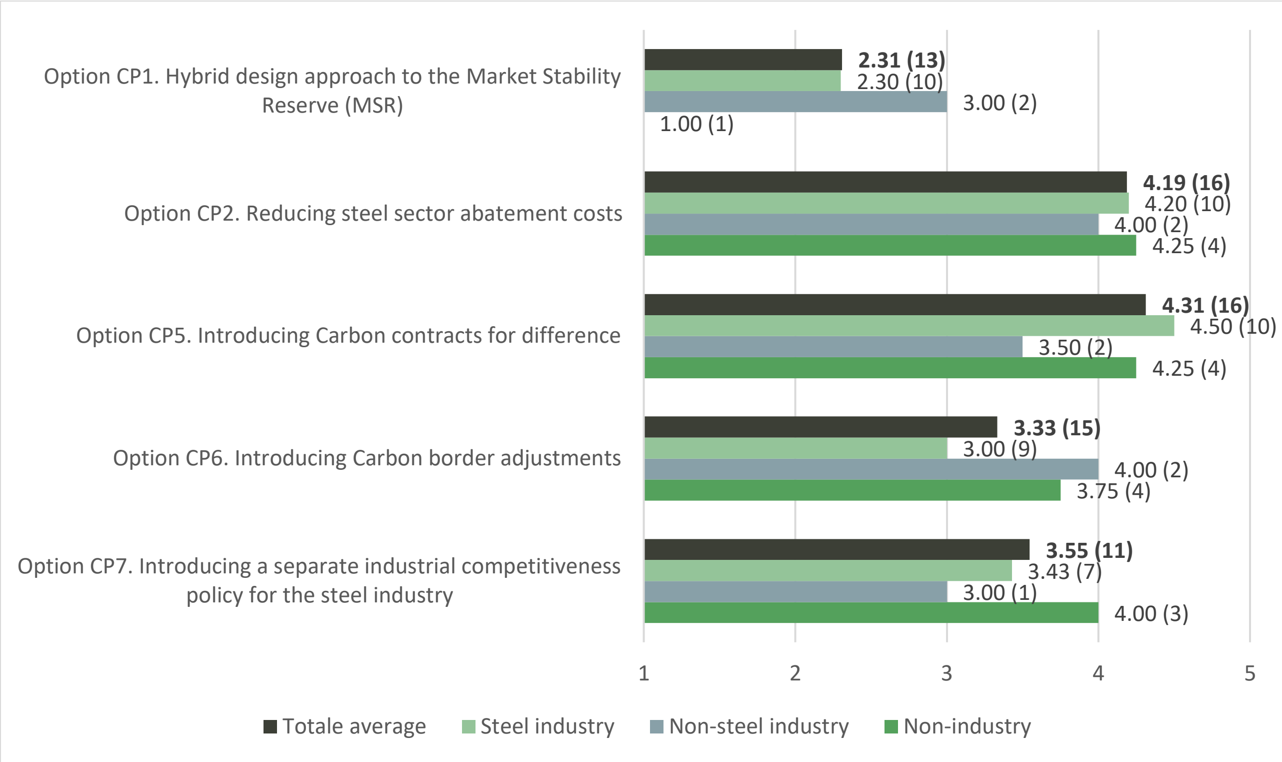
Note: the figure presents stakeholders' answers to question CP.COMP.1, i.e. "Would the policy options listed in the table below help ensure that carbon pricing policies in the EU effectively contribute to emission reductions in the steel sector, thereby supporting long-term EU climate policy objectives?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Coherence

As shown in Figure 80, the option of introducing CCfDs is the one recording the highest total score on average (4.31/5) when the options are assessed on their coherence with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, etc.).

Figure 80: Comparison of the coherence of the policy options – Carbon pricing



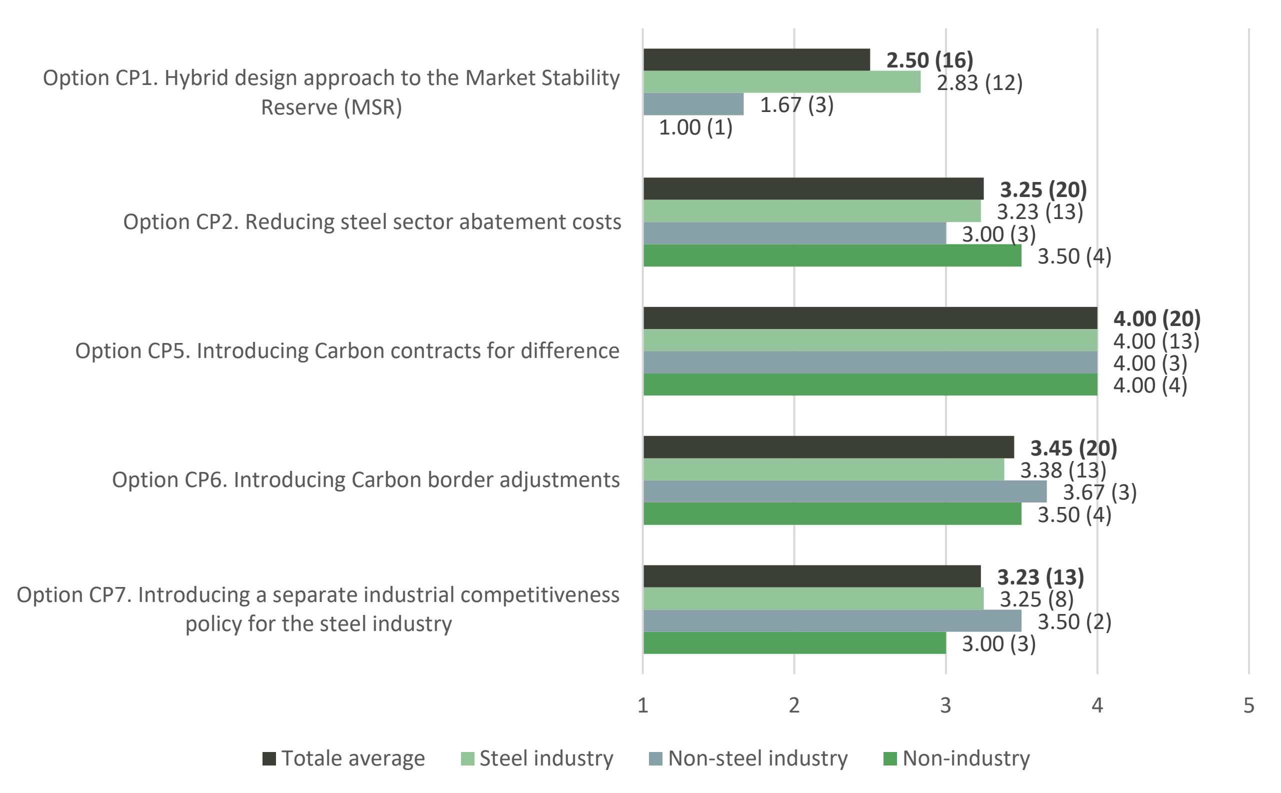
Note: the figure presents stakeholders' answers to question CP.COMP.2, i.e. "Are the policy options listed in the table below coherent with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, etc.)?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Feasibility

All the respondents agreed that the option of introducing CCfDs is the most likely to receive enough support from EU and national policymakers to be properly implemented (with an average total score of 4.00/5; Figure 81).

Figure 81: Comparison of the feasibility of the policy options – Carbon pricing



Note: the figure presents stakeholders' answers to question CP.COMP.3, i.e. "Do you expect that the policy options listed in the table below will receive enough support from EU and national policymakers to be properly implemented?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Summary of stakeholder feedback – Carbon pricing

Survey respondents were generally favourably disposed towards options that lead to lower abatement costs, rather than to increased (carbon) costs. On the whole, 'carrot' approaches were seen as more effective and feasible than 'stick' approaches. Specifically, demand-side measures and the creation of lead markets were regarded positively. CCfDs were seen as effective as a de-risking instrument to cover increased OPEX costs and thereby support investment in green steel production. The CBAM was also regarded as a potentially useful policy measure, although much depends on the design and steel sector respondents emphasised that free allocation should continue. Industrial competitiveness and carbon leakage prevention were highlighted as important, with steel sector respondents treating the two concepts as being the same. For some policy measures – such as the CBAM or lead market policies – the heterogeneity of the steel sector and its products was emphasised: the steel market or sector cannot be considered as one, which can complicate policy responses.

From a comparative point of view, the options were assessed as follows:

- CCfDs (option CP5) scored high in terms of effectiveness, feasibility and coherence. More generally, measures that could lead to lower abatement costs were seen as effective (option CP2), but the coherence with existing EU policies – focused on increasing the costs of high-carbon production rather than on making low-carbon production more competitive – was regarded as moderate;
- steel sector, non-steel sector and non-industry respondents did not differ greatly in their assessment of the different options, although non-industry respondents considered market differentiation between low- and high-carbon steel (option CP3) to be more coherent with existing EU policies compared to industrial respondents. Similarly, with regard to a hybrid design for the MSR (option CP1), non-industry respondents were noticeably more negative than the others, even though the option in general was not among the most favoured.

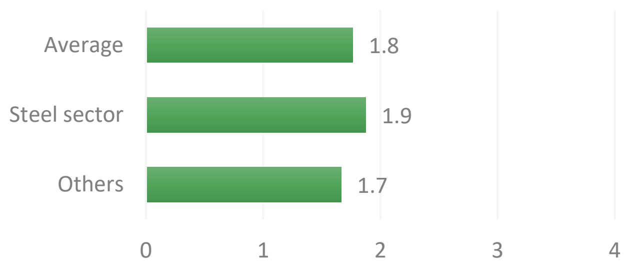
6. Steel and iron scrap

Problem identification

General problem SC: limited availability of high-quality scrap

On average, the respondents agreed to some extent (1.8/4) that the limited availability of high-quality scrap hinders the decarbonisation of the EU steel sector (Figure 82). No major difference was recorded between stakeholders belonging to the steel sector and other stakeholders (1.9 and 1.7/4, respectively).

Figure 82: Limited availability of high-quality scrap



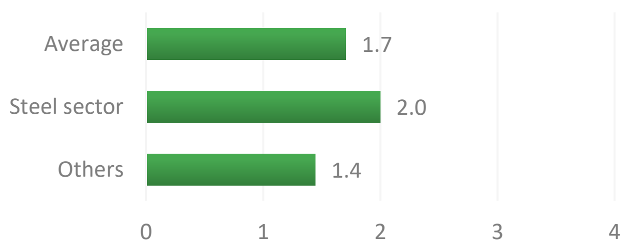
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the limited availability of high-quality scrap will hinder the decarbonisation of the EU steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Specific problem SC1: increasing demand for steel scrap in emerging economies

As shown in Figure 83, the participants in the survey believed to some extent (1.7/4) that the increased demand for steel scrap in emerging economies is a specific problem affecting the production of steel in the EU via the electric arc furnace (EAF) route. While respondents from the steel sector recognized to some extent (2.0/4) the specific problem, respondents from other sectors only agreed to a limited extent (1.4/4).

Figure 83: Increased demand for steel scrap in emerging economies

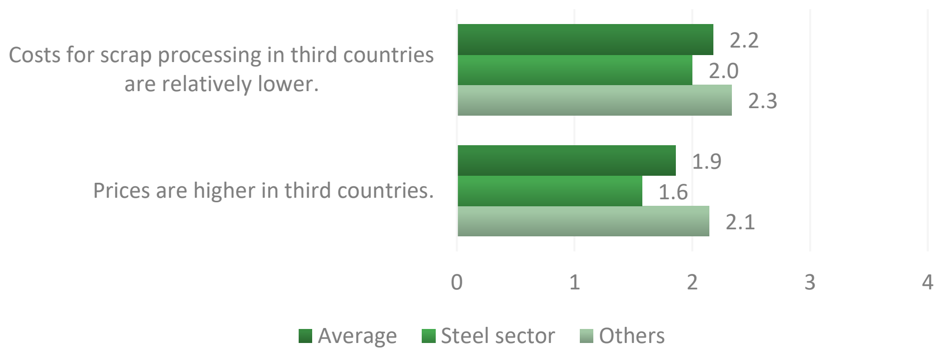


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the increased demand for steel scrap in emerging economies will constrain the availability of scrap in the EU and impinge on the ability of the EU steel industry to further expand production via the EAF route?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high

extent (3) and to the fullest extent (4).
Source: authors' own composition on survey results.

Figure 84 shows that the respondents agreed to some extent (2.2/4) that the lower costs for scrap processing in third countries encourage the export of EU scrap and limit the availability of scrap in the EU. No major difference was recorded between respondents from the steel industry and from other sectors (2.0 and 2.3/4, respectively). Some level of agreement was recorded also when it comes to the role played by higher prices for steel scrap in third countries (high enough to compensate for transport costs). In this case, respondents from the steel industry agreed to a lesser extent with this driver than respondents from other sectors (1.6 and 2.1/4, respectively).

Figure 84: Drivers fostering the exports of EU scrap and constraining the availability of scrap in the EU



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers identified increase EU scrap exports and constrain the availability of scrap in the EU?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

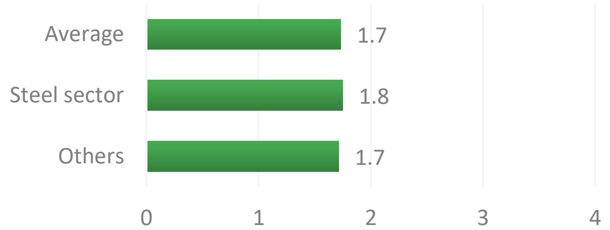
Source: authors' own composition on survey results.

Interestingly, one stakeholder from a non-steel sector argued that EU scrap is exported in non-EU countries because low-grade scrap cannot be used in the EU due to higher quality requirements for steel products, even in EAF. One stakeholder from the steel sector explained that the quality of scrap collected in the EU increases exports because it may be cheaper to export low-quality scrap to produce long products (e.g. rebars) outside Europe than performing additional sorting operations to yield the high-quality scrap needed by EU producers (e.g. for flat products). One respondent from another sector proposed that the EU waste legislation should include provisions allowing export for recycling only to extra-EU sites applying environmental standards similar to those in force in the EU and introduce minimum recycled content requirements in steel products.

Specific problem SC2: insufficient availability of high-quality domestic scrap

On average, the respondents agreed to some extent (1.7/4) that the losses of steel throughout the use cycle and impurities constrain the availability of scrap in the EU and impinge on the ability of the EU steel industry to further expand production via the EAF route (Figure 85). Both respondents from the steel industry and the other sectors agreed to some extent (1.8 and 1.7/4, respectively) with this specific problem.

Figure 85: Losses of steel throughout the use cycle and impurities

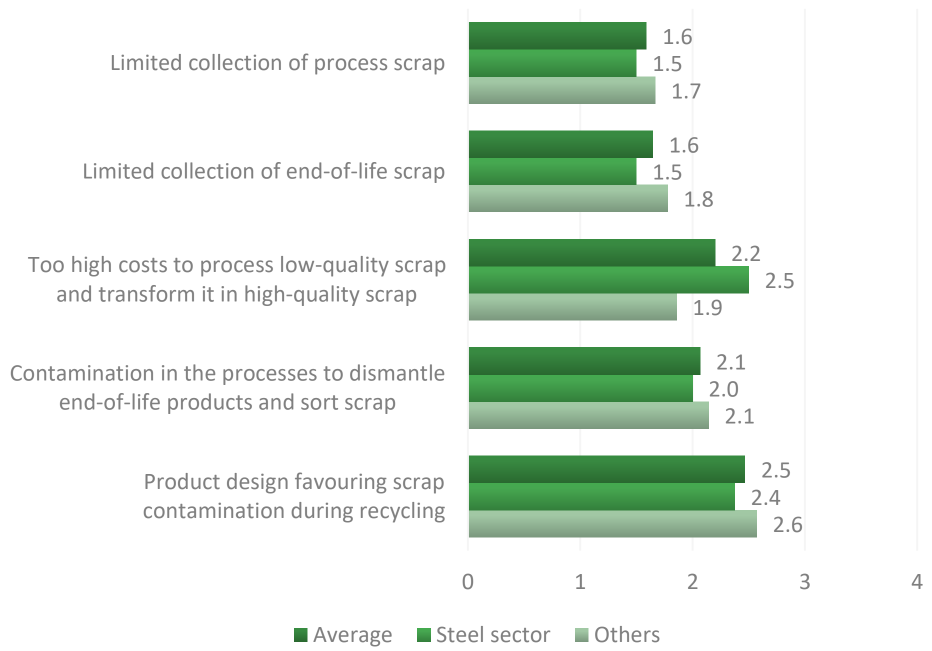


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that losses of steel throughout the use cycle and impurities will constrain the availability of scrap in the EU and impinge on the ability of the EU steel industry to further expand production via the EAF route?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 86, the respondents believed that the strongest driver contributing to decreasing the quality and availability of scrap in the EU was the product design, which favours scrap contamination during recycling (2.5/4). In addition, respondents agreed to some extent that the high cost to transform low-quality scrap into high-quality scrap and the contamination in the process of dismantling end-of-life products to sort scrap were other important drivers (2.2 and 2.1/4, respectively). Differently, the two other drivers identified, i.e. the limited collection of process scrap and end-of-life scrap, recorded less consensus among the consulted stakeholders (1.6/4).

Figure 86: Drivers affecting the quality and availability of scrap in the EU



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers identified affect the quality and availability of scrap in the EU?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

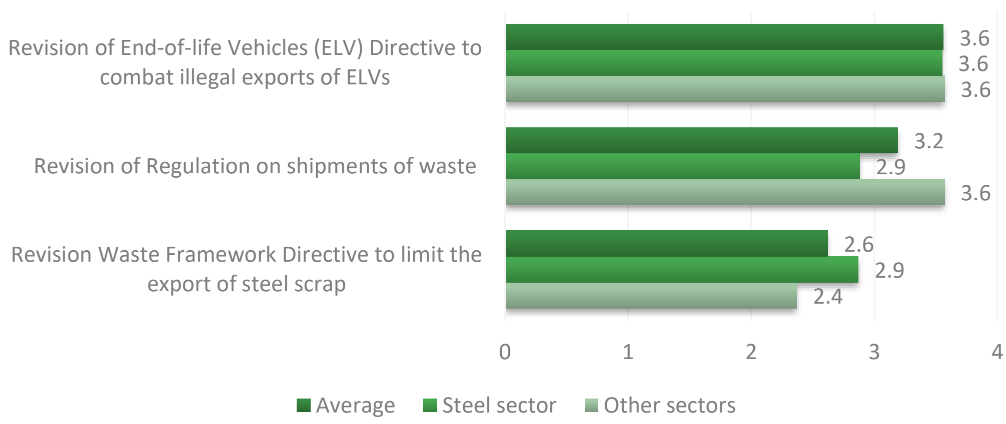
Other considerations on the general problem

One respondent from a non-steel sector shared an additional consideration on the general problem, i.e. the availability of scrap in the EU and its impact on the decarbonisation of the EU steel industry. The respondent emphasised that greater 'circularity' in the steel industry will most likely reduce EU demand for iron ore. This consideration seems to reflect another advantage of policies aiming to retain steel scrap in the EU, as these policies will reduce the dependency of the EU steel industry on large mining companies.

Policy objectives and options

Both steel and non-steel sector stakeholders strongly believed that the ongoing revision of the end-of-life vehicles (ELV) Directive should support the fight against illegal exports of ELVs. This option is expected to contribute the most to limiting the export of scrap generated in the EU to third countries (Specific Objective SC1) (3.6/4). Stakeholders from non-steel sectors also showed strong support for the option of revising the Regulation on shipments of waste (3.6/4). Finally, both stakeholder groups agreed that revising the Waste Framework Directive would contribute to a lesser extent to reducing the volume of scrap exported to third countries (2.6/4 on average; Figure 87).

Figure 87: Policy options to limit the export of scrap to non-EU countries

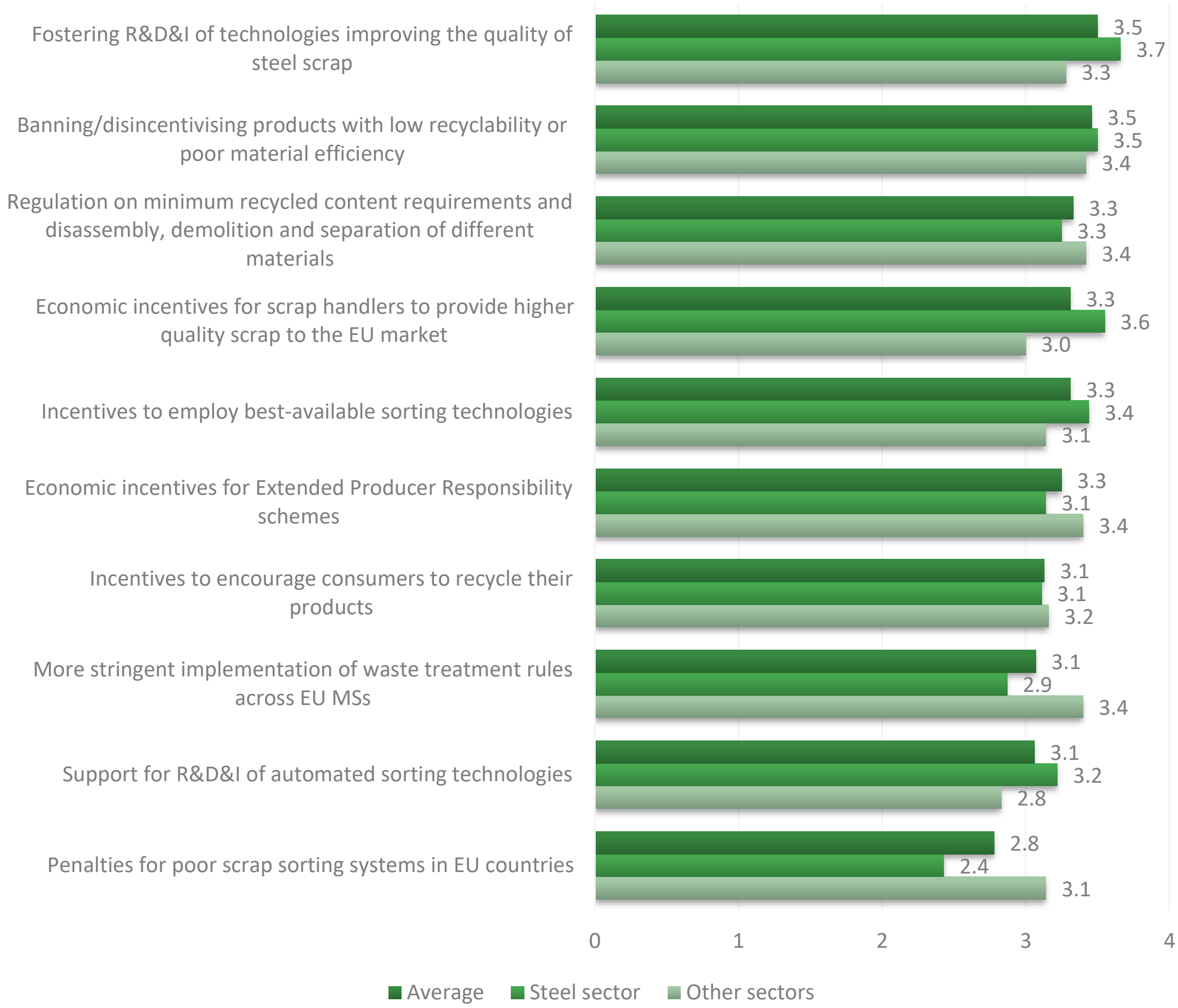


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective SC1, i.e. limiting the export of scrap generated in the EU to third countries?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The majority of the policy options proposed to achieve Specific Objective SC2 (obtaining higher quality scrap for the EAF route) received high to full support from both steel and non-steel stakeholders. The two most preferred options were fostering R&D&I in technologies that improve the scrap quality (3.5/4) and banning/disincentivising products with low recyclability or poor material efficiency (3.5/4; Figure 88).

Figure 88: Policy options to obtain higher quality scrap for the EAF route in the EU



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Specific Objective SC2, i.e. obtaining higher quality scrap for the EAF route?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

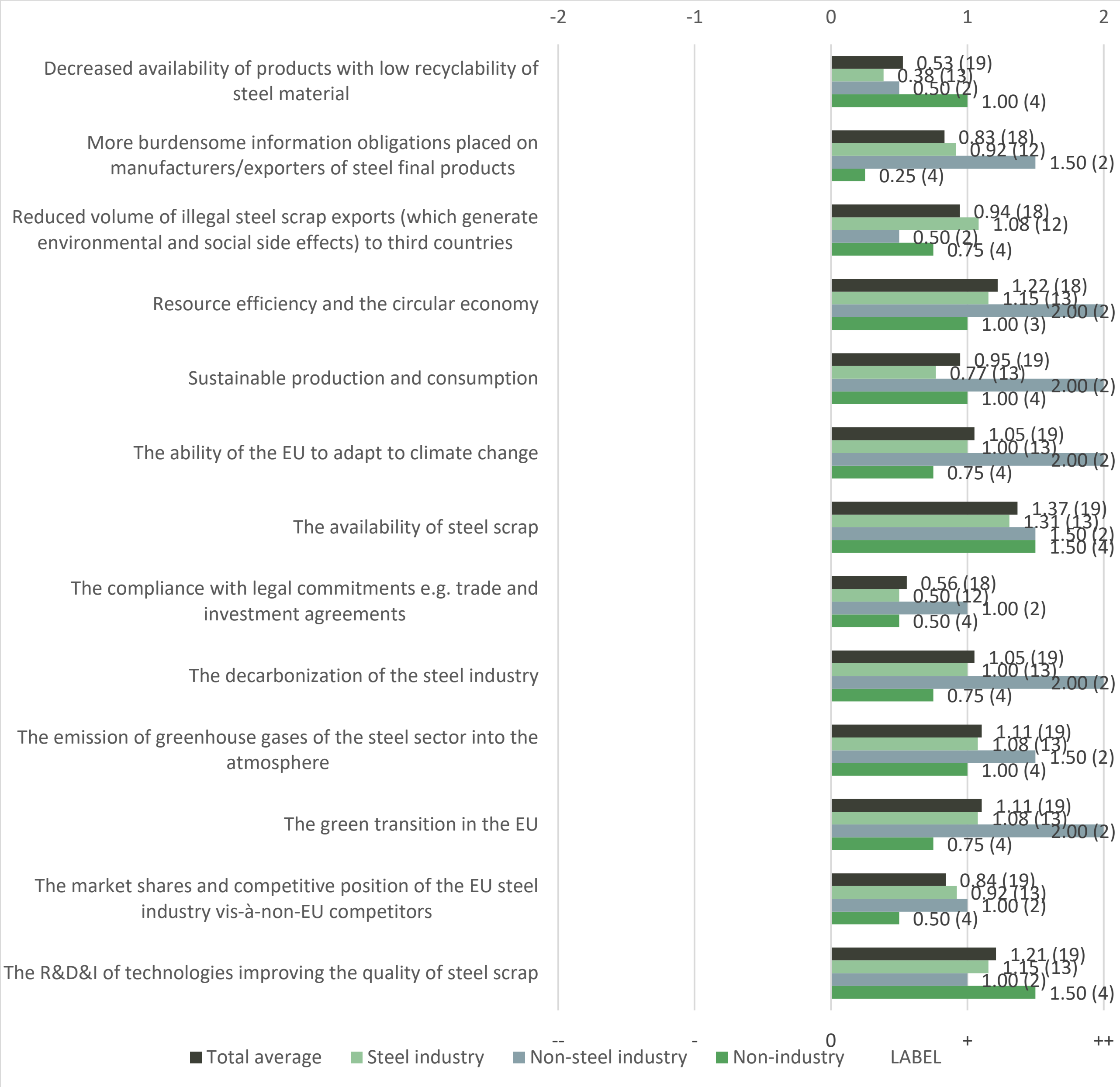
Besides the proposed policy options, one stakeholder from a non-steel sector also suggested the option to foster R&D&I in technologies that improve the reuse of scrap within the steel production process. A higher share of scrap in steelmaking would contribute to mitigating CO_2 emissions of the EU steel industry.

Impacts of options

Impacts of option SC1: revising the EU regulatory framework on waste

According to the respondents, the option of revising the EU regulatory framework on waste would generate the highest positive impacts on the availability of steel scrap (Figure 89), recording the highest total score on average (1.37 in a range from -2 to 2).

Figure 89: Impacts of the revision of the EU regulatory framework on waste



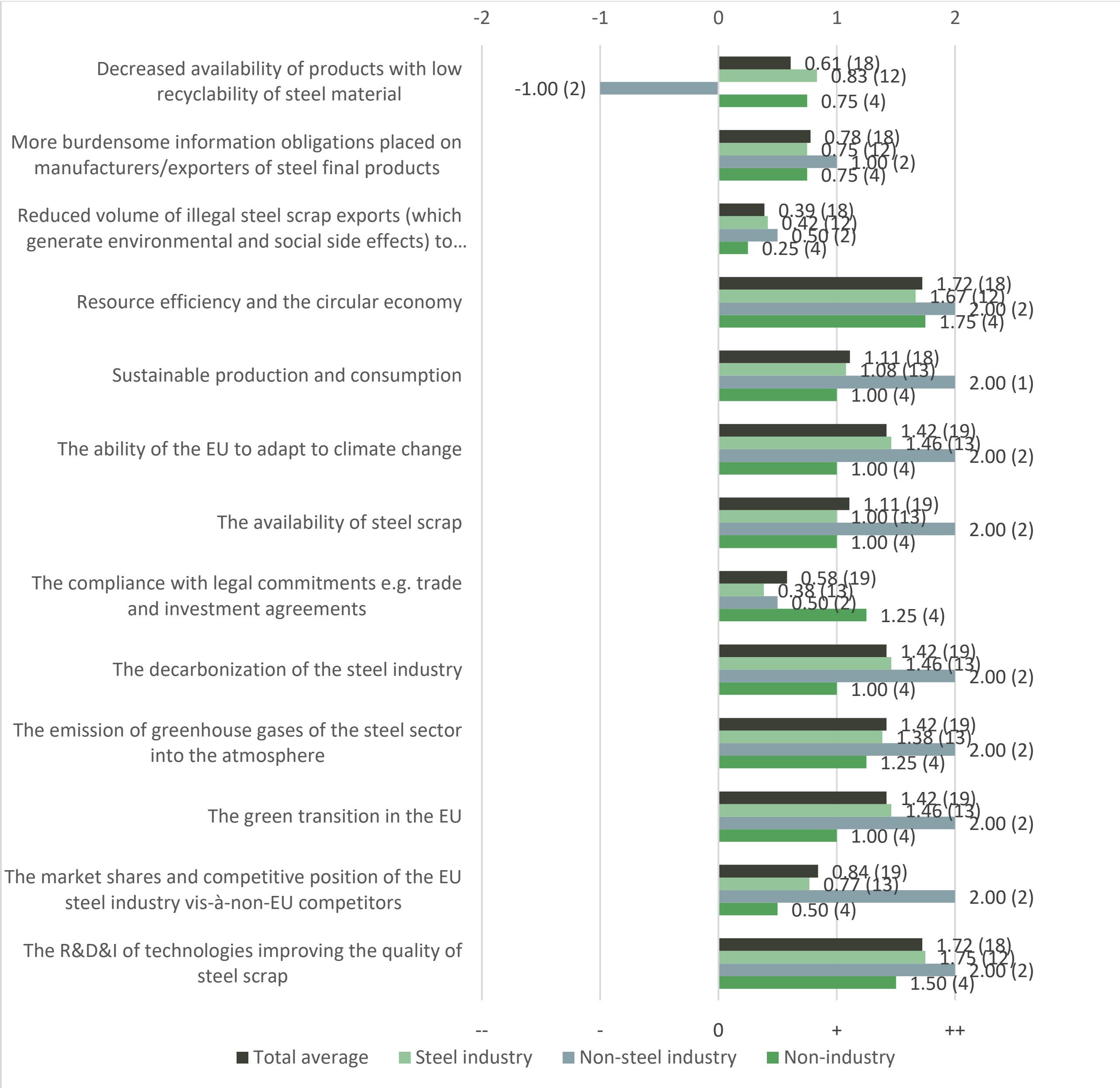
Note: the figure presents stakeholders' answers to question SC.IA.1, i.e. "What impact would option SC1 (revision of the EU regulatory framework on waste) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option SC2: improving the quality of scrap available in the EU

As shown inFigure 90, the option of improving the quality of scrap available in the EU would generate the highest positive impacts on resource efficiency and the circular economy, and on R&D&I in technologies improving the quality of steel scrap, both recording the highest total score on average (1.72 in a range from -2 to 2).

Figure 90: Impacts of improving the quality of scrap available in the EU



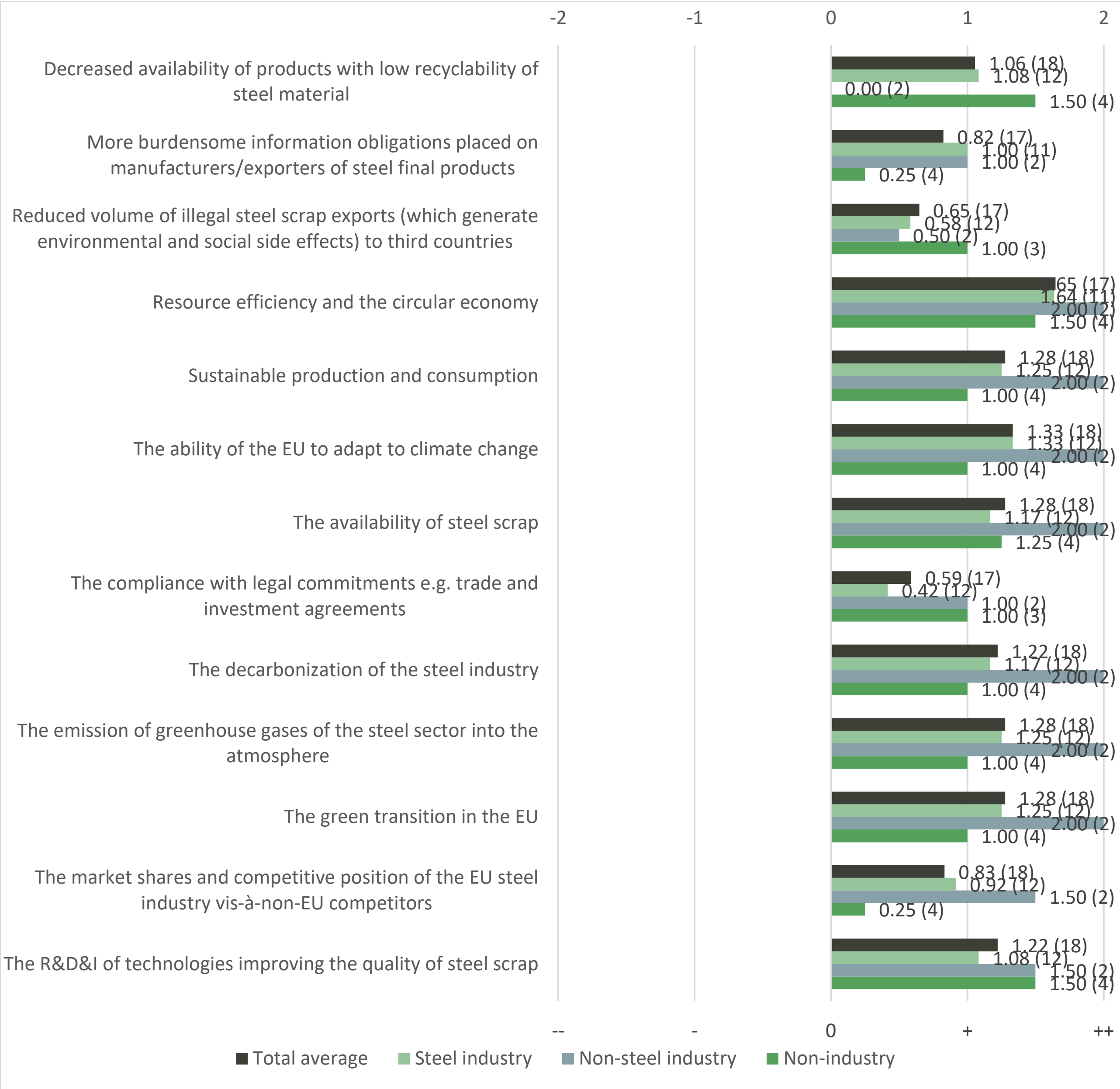
Note: the figure presents stakeholders' answers to question SC.IA.2, i.e. "What impact would option SC2 (improve the quality of scrap available in the EU) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option SC3: ensuring that final products are recyclable

Figure 91 shows that the option of ensuring that final products are recyclable would generate the highest positive impacts on resource efficiency, recording the highest total score on average (1.65 in a range from -2 to 2).

Figure 91: Impacts of ensuring that final products are recyclable



Note: the figure presents stakeholders' answers to question SC.IA.3, i.e. "What impact would option SC3 (ensuring that final products are recyclable) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

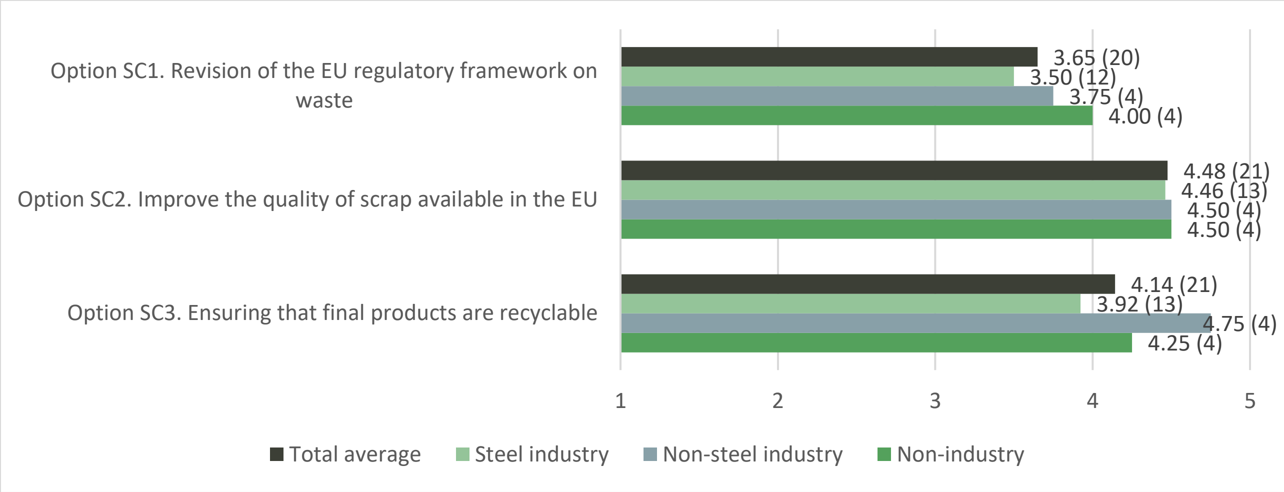
Source: authors' own composition on survey results.

Comparison of options

Effectiveness

According to the survey, the option of improving the quality of scrap available in the EU is the one recording the highest total score on average (4.48/5) when the options are assessed on their ability to ensure the availability of a sufficient amount of high-quality scrap in Europe (Figure 92).

Figure 92: Comparison of the effectiveness of the policy options – Scrap



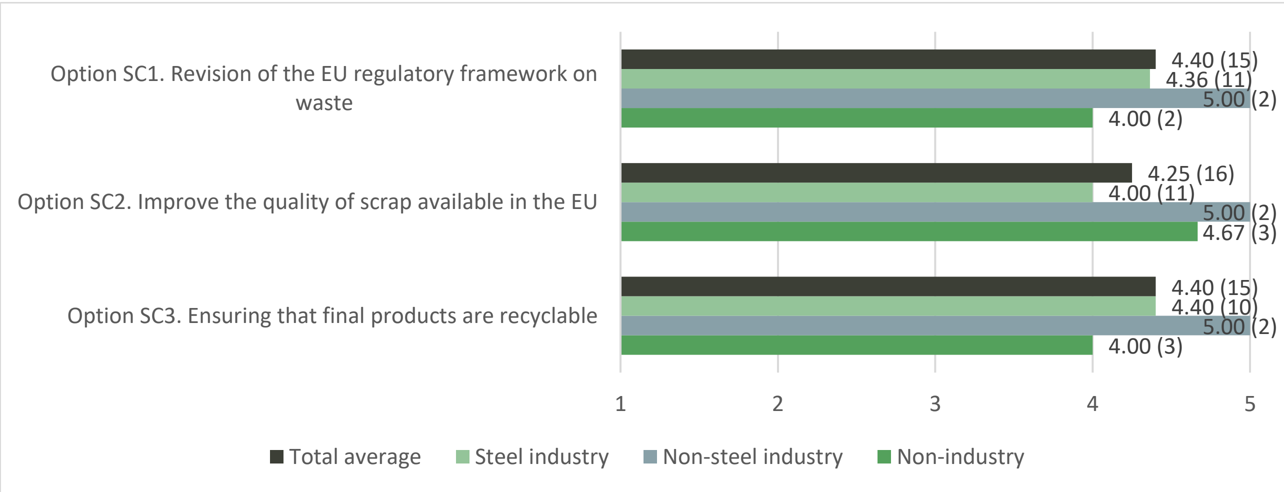
Note: the figure presents stakeholders' answers to question SC.COMP.1, i.e. "Would the policy options listed in the table below help ensure the availability of a sufficient amount of high-quality scrap in Europe?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Coherence

Figure 93 shows that, according to the survey, the options of revising the EU regulatory framework on waste and ensuring that final products are recyclable have the highest total score on average (4.40/5) when the options are assessed on their coherence with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.).

Figure 93: Comparison of the coherence of the policy options – Scrap



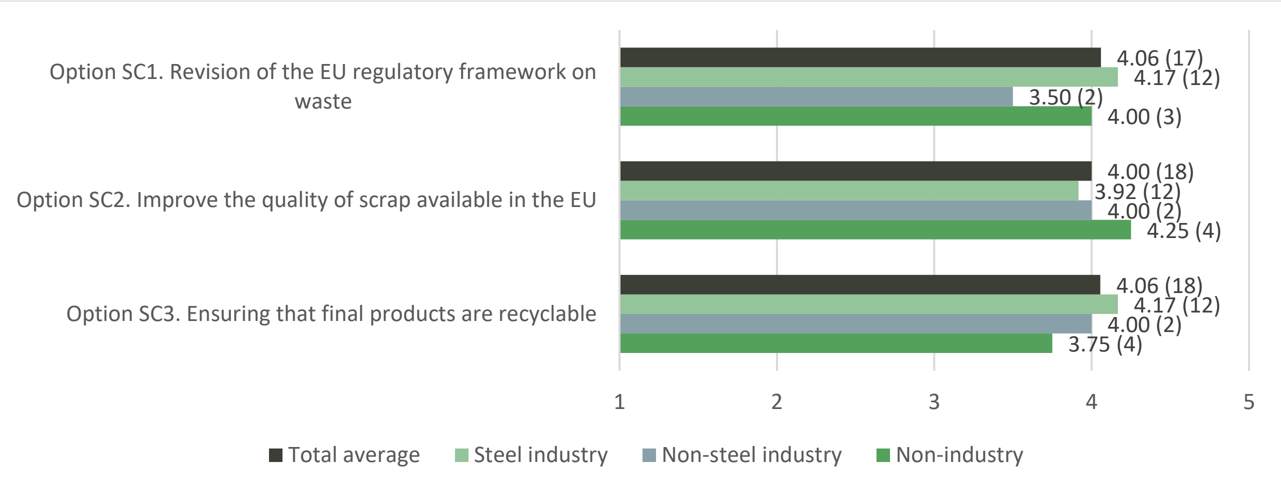
Note: the figure presents stakeholders' answers to question SC.COMP.2, i.e. "Are the policy options listed in the table below coherent with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans *package, etc.)?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.*

Source: authors' own composition on survey results.

Feasibility

As shown in Figure 94, the options of revising the EU regulatory framework on waste and ensuring that final products are recyclable have the highest total score on average (4.06/5) when the options are assessed on the possibility to receive enough support from EU and national policymakers to be properly implemented.

Figure 94: Comparison of the feasibility of the policy options – Scrap



Note: the figure presents stakeholders' answers to question SC.COMP.3, i.e. "Do you expect that the policy options listed in the table below will receive enough support from EU and national policymakers to be properly implemented?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Summary of stakeholder feedback - Scrap

The stakeholders participating in the consultation shared similar views on the magnitude and mechanism of the impacts of the three policy options. However, their views on the effectiveness of the options were more divergent:

- under policy option SC1 (revising the EU regulatory framework on scrap exports), steel-sector respondents agreed that stricter monitoring and control of scrap exports would contribute largely to increasing the availability of scrap for the EU. Non-steel industry stakeholders, however, believed that limiting scrap exports would entail distortions on scrap's availability and prices in the long run. Instead, the EU should take measures to incentivise the use of the scrap-based EAF route, e.g. through a better pricing mechanism for high-quality scrap;

- under policy option SC2 (improving the quality of scrap available in the EU), several steel-sector stakeholders considered that the EU's support for R&D&I on scrap handling would be sufficient to guarantee the recovery of high-quality scrap for EU producers. Meanwhile, other stakeholders from both steel and non-steel industries argued that public R&D&I support needs to be coupled with measures such as i) improved scrap quality assurance to promote trust between scrap buyers and sellers; and ii) a better pricing mechanism to increase the viability of investments in high-quality scrap recovery technologies;
- under policy option SC3 (ensuring that final products are recyclable), views among steel-sector respondents were not homogenous. While several stakeholders believed that this option would guarantee the recovery of high-quality scrap thanks to better disassembling of used products and separation of component materials, others argued that the measure might only increase the availability of scrap in general, not necessarily high-quality scrap.

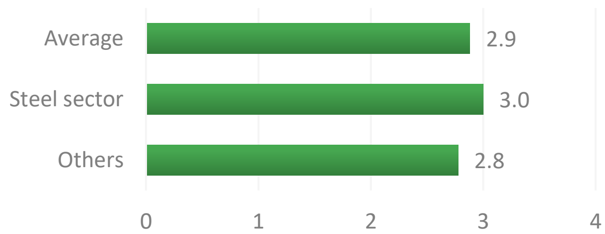
7. Funding

Problem identification

General problem FD: limited funding for decarbonisation technologies

On average, the respondents agreed to a high extent (2.9/4) that limited funding for decarbonisation technologies is slowing down the green transition in the EU steel industry (Figure 95). Both respondents from the steel sector and the other sectors agreed to a high extent (3.0 and 2.8/4, respectively) that limited funding is a major problem affecting the decarbonisation of the steel industry.

Figure 95: Limited funding for decarbonisation technologies



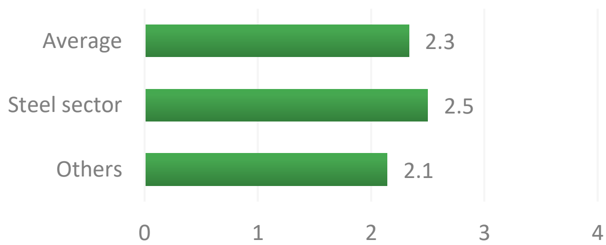
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that limited funding for decarbonisation technologies hinders the decarbonisation of the EU steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Specific problem FD1: high costs of low-carbon steel

As shown in Figure 96, stakeholders participating in the survey agreed to some extent (2.3/4) that the specific problem of the high production costs expected for low-carbon steel would limit funding opportunities for decarbonisation technologies. On average, respondents from the steel sector acknowledged to a high extent (2.5/4) this specific problem, while respondents from other sectors only to some extent (2.1/4).

Figure 96: High production costs expected for low-carbon steel



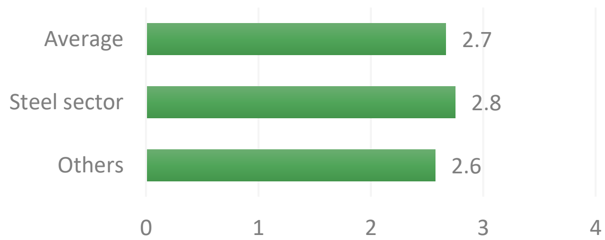
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the high production costs expected for low-carbon steel will limit funding opportunities for decarbonisation *technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).*

Source: authors' own composition on survey results.

Operational problem FD1.1: higher OPEX

The respondents agreed to a high extent (2.7/4) that high operating expenditure (OPEX) for low-carbon production would contribute to increasing the costs of low-carbon steel (Figure 97). Across the different sectors, both respondents from the steel industry and stakeholders from other sectors agreed to a high extent with this specific problem (2.8 and 2.6/4, respectively).

Figure 97: High OPEX for low-carbon steel

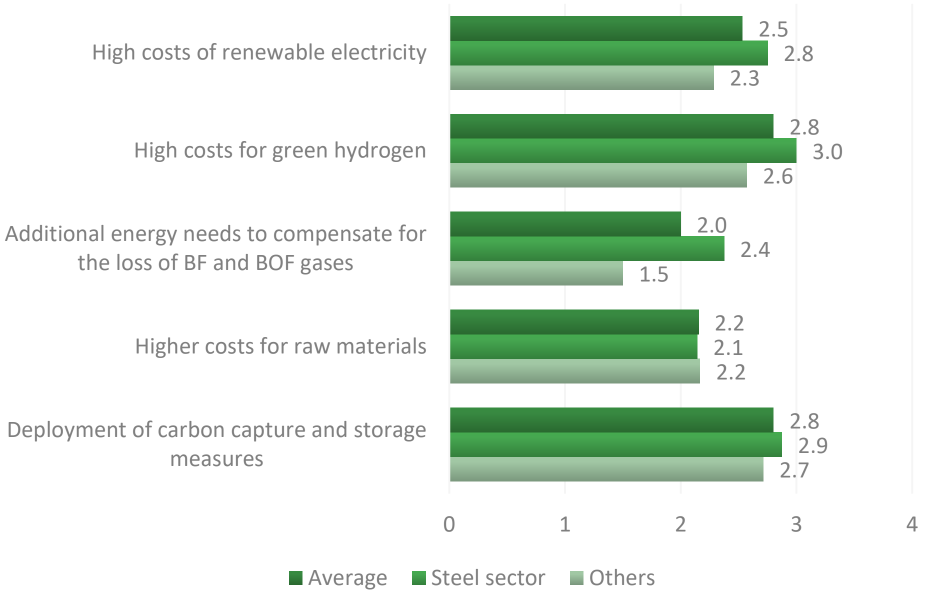


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that high OPEX for low-carbon steel will contribute to the increase in the costs of low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 98, the respondents believed that the main drivers that contribute to increasing OPEX for decarbonisation technologies for steelmaking are the higher energy costs of low-carbon production due to i) high costs for green hydrogen (2.8/4); and ii) high costs of RES-E (2.5/4). Differently, the respondents recognized to a lesser extent (2.0/4) that the higher energy costs of low-carbon technologies are due to additional energy needs to compensate for the loss of blast furnace (BF) and basic oxygen furnace (BOF) gases, with stakeholders from the steel industry agreeing to a higher extent to this driver (2.4/4) than stakeholders from other sectors (1.5/4). In addition, the respondents acknowledged to a high extent that the deployment of CCS measures would lead to higher OPEX for steel producers (2.8/4). Finally, the stakeholders agreed to some extent (2.2/4) that the higher costs for raw materials faced for decarbonisation technologies compared to conventional production routes is a driver which increases OPEX for low-carbon steelmaking.

Figure 98: Drivers increasing the OPEX for low-carbon steelmaking



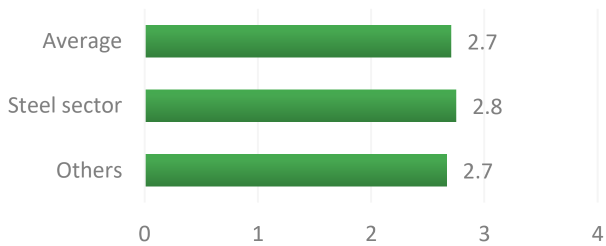
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers contribute to increasing OPEX for decarbonisation technologies for steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Operational problem FD1.2: higher CAPEX

The respondents agreed to a high extent (2.7/4) that high capital expenditure (CAPEX) for low-carbon production contributes to the increase in the costs of low-carbon steel (Figure 99). Both respondents from the steel industry and the other sectors agreed to a high extent with this operational problem (2.8 and 2.7/4).

Figure 99: High CAPEX for low-carbon steel

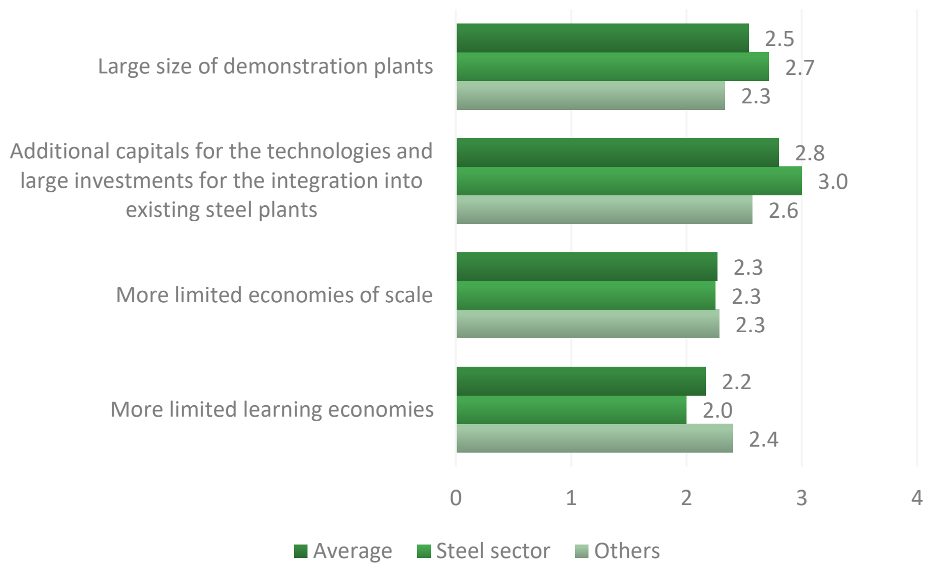


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that high CAPEX for low-carbon steel will contribute to the increase in the costs of low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 100, the respondents believed that the most significant driver contributing to increasing CAPEX for decarbonisation technologies for steelmaking is the fact that the commercial applications of these technologies require investments for the technologies themselves and for their integration into existing steel plants (2.8/4). Respondents from the steel industry agreed to a higher extent to this driver (3.0/4) than respondents from other sectors (2.6/4). In addition, the stakeholders acknowledged to a high extent (2.5/4) that the large size of demonstration plants leads to steel's remarkably higher CAPEX compared to other energy-intensive industries. Finally, the stakeholders believed that the other drivers, i.e. limited economies of scale and limited learning economies, contribute to a lesser extent to the problem of the high CAPEX for decarbonisation technologies for steelmaking (2.3 and 2.2/4, respectively).

Figure 100: Drivers increasing the CAPEX for low-carbon steelmaking



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers increase CAPEX for decarbonisation technologies for steelmaking?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

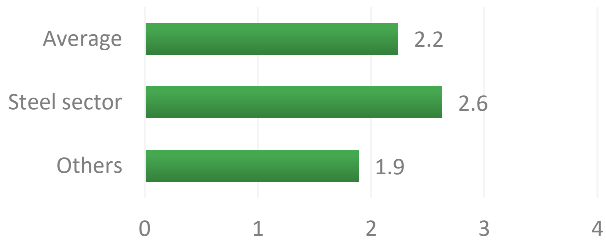
Two respondents provided additional considerations on the costs (both OPEX and CAPEX) of low-carbon steel and their impact on the decarbonisation of the EU steel industry. One respondent from the steel sector suggested that the funding must be long term, robust and reliable, and proposed two solutions for the decarbonisation of the steel industry: i) the use of CCfDs for hydrogen-based steelmaking solutions; and ii) the involvement of governments, that should 'pay' for carbon saved below a business-as-usual benchmark and for the additional climate protection delivered to society. Similarly to solution ii), another stakeholder from the steel sector proposed that governments should fund performance programmes to reimburse the steel industry for the amount of carbon saved below a certain threshold.

Specific problem FD2: investment risk

As shown in Figure 101, the respondents agreed to some extent (2.2/4) that the high-risk profile of low-carbon steelmaking projects would limit funding opportunities for decarbonisation technologies.

Across the sectors, respondents from the steel industry acknowledged this problem to a higher extent than stakeholders from other sectors (2.6 and 1.9/4, respectively).

Figure 101: High-risk profile of low-carbon steelmaking projects



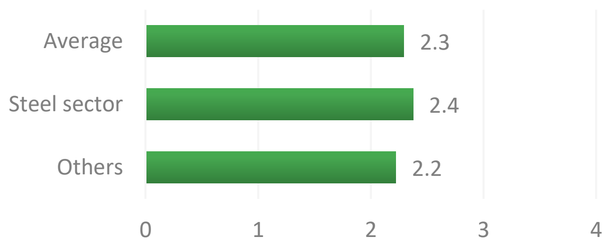
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the high-risk profile of low-carbon steelmaking projects will limit funding opportunities for decarbonisation technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Operational problem FD2.1: innovation risk

The respondents agreed to some extent (2.3/4) that innovation risks would increase the overall risks of investments in low-carbon steel (Figure 102). Across the different sectors, respondents from the steel industry agreed to a slightly higher extent with this operational problem than respondents from other sectors (2.4 and 2.2/4, respectively).

Figure 102: Innovation risks in low carbon steelmaking projects

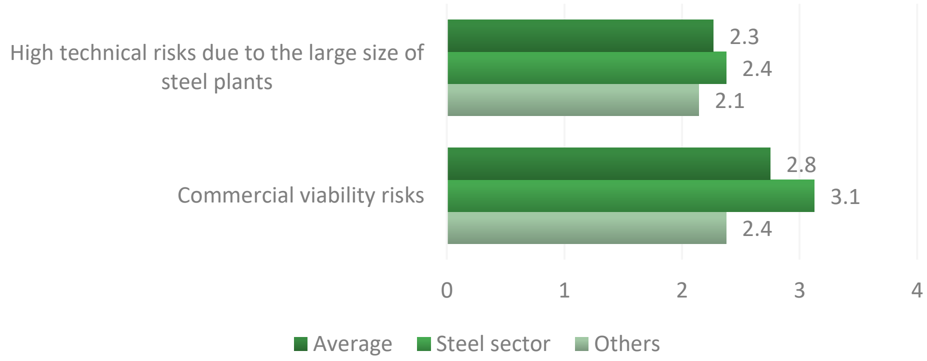


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that innovation risks will increase the overall risks of investments in low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The stakeholders concluded that the main driver contributing to increasing the innovation risks of low-carbon steel are the commercial viability risks for decarbonisation technologies (Figure 103). Stakeholders from the steel industry acknowledged the importance of this driver (3.1/4) more than respondents from other sectors (2.4/4). The stakeholders agreed to a lesser extent (2.3/4) with the other driver, i.e. the high technical risks in developing decarbonisation technologies.

Figure 103: Drivers increasing the innovation risks in low carbon steelmaking projects



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers will increase the innovation risks of low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

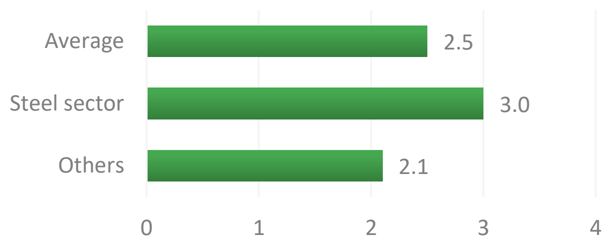
Source: authors' own composition on survey results.

One stakeholder from the steel sector identified as an additional driver the uncertainty around future EU and national rules, which might reduce the financial viability of technologically good solutions, i.e. a wrong definition of 'green electricity' or 'green hydrogen' could affect the marketability of new technologies.

Operational problem FD2.2: uncertainty around the market for low-carbon steel

As shown in Figure 104, the respondents agreed to a high extent (2.5/4) that the uncertainty around the market for low-carbon steel would increase the risks of investing in low-carbon steelmaking. On average, respondents from the steel sector recognised to a high extent (3.0/4) the specific problem, while respondents from other sectors agreed to some extent (2.4/4).

Figure 104: Uncertainty around the market for low-carbon steel

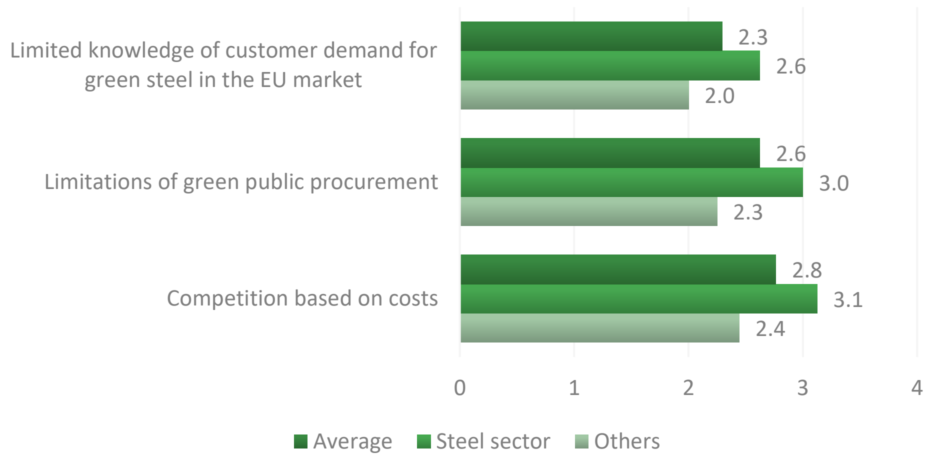


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that uncertainty around the market for low-carbon steel will increase the risks of investments in low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 105, the respondents agreed that the drivers contributing to increasing the uncertainty around the market of low-carbon steel are (in order of importance): i) cost-based competition, which allows customers to switch to steel produced in third countries with less stringent climate rules (2.8/4); ii) limitations in GPP criteria, which do not fully support the demand for green steel (2.6/4); and iii) limited knowledge of future demand for low-carbon steel (2.3/4). Sector-wise, respondents from the steel industry agreed to a relatively higher extent with these three drivers than respondents from other sectors.

Figure 105: Drivers increasing the uncertainty around the market for low-carbon steel



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers will increase the uncertainty around the market for low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

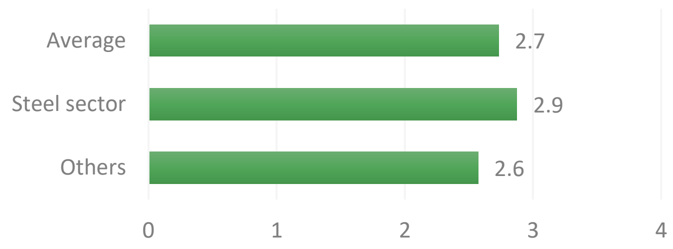
Source: authors' own composition on survey results.

Four respondents shared additional considerations on the risks associated with investments in low-carbon technologies in the EU steel sector. One stakeholder from the steel sector highlighted the economic pressure the steel industry has been facing for decades and stated that financing is more difficult in the steel industry than in other industries, especially for risky projects. One stakeholder from another sector suggested including into the analysis sustainable product policy or legislation addressing end-use products such as vehicles, buildings and construction to set product requirements, namely a clear indication for the environmental performance of steel to be used in final products on the market. Another stakeholder from a non-steel sector proposed a solution to tackle the uncertainty around the market for low-carbon steel: strong collaboration and joint commitment from both the private and public sectors to tackle important R&D&I challenges and bring breakthrough technologies to large scale demonstration. Finally, another stakeholder from a non-steel sector believed that some customers are aware of and might already have demand for low-carbon steel.

Specific problem FD3: limitations affecting public funding

The respondents agreed to a high extent (2.7/4) that the limitations affecting existing public funding programmes reduce funding opportunities for decarbonisation technologies in the EU steel industry (Figure 106). Across the different sectors, respondents from the steel industry recognised this specific problem to a higher extent (2.9/4) compared to respondents from other sectors (2.6/4).

Figure 106: Limitations affecting existing public funding programmes



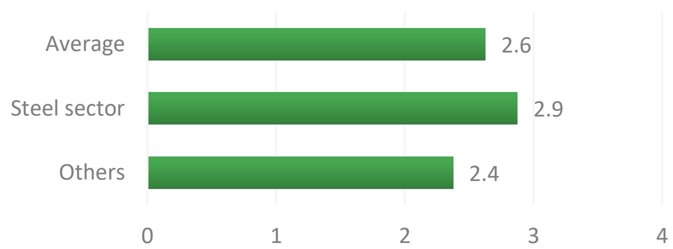
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that limitations affecting existing public funding programmes reduce funding opportunities for decarbonisation technologies in the EU steel industry?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Operational problem FD3.1: budget constraints

On average, the respondents acknowledged to a high extent (2.6/4) that government budget constraints at both EU and national level would further limit the effectiveness of public funding for low-carbon steel in the EU (Figure 107). The respondents from the steel sector agreed to a high extent (2.9/4) with the above problem, while the respondents from other sectors agreed to some extent (2.4/4).

Figure 107: Government budget constraints at both EU and national level

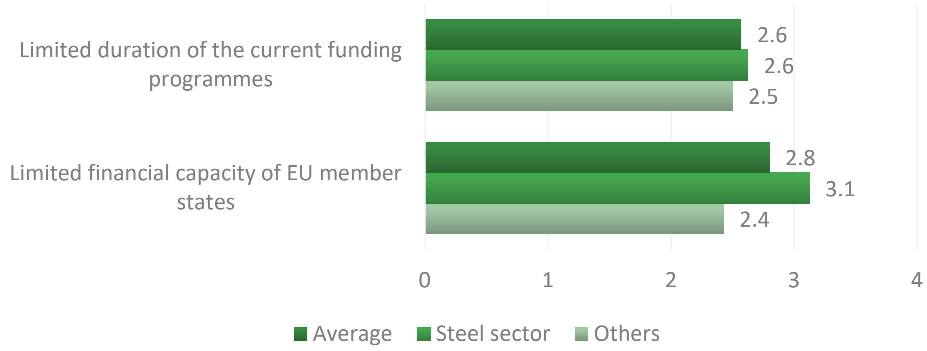


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that budget constraints at both EU and national level will further limit the effectiveness of public funding for low-carbon steel in the EU?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 108, the respondents believed to a high extent (2.8/4) that the limited financial capacity of EU Member States to invest in decarbonisation technologies tightens the budget constraints. Sector-wise, respondents from the steel industry agreed to a high extent (3.1/4) with this driver, while respondents from other sectors agreed to a lesser extent (2.4/4). The level of agreement of both steel and non-steel sector respondents with the other driver reducing the effectiveness of public funding, i.e. the limited duration of current funding programmes, was quite homogeneous, corresponding to 2.6/4 on average.

Figure 108: Drivers reducing the effectiveness of public funding for low-carbon steelmaking



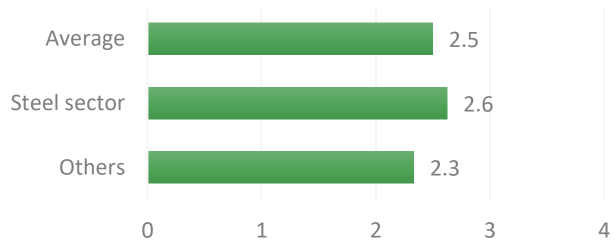
Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers will tighten the budget constraints and reduce public funding for low-carbon steelmaking technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

Operational problem FD3.2: funding gap for demonstration and deployment

As shown in Figure 109, the respondents acknowledged to a high extent (2.5/4) that the current funding gap for demonstration of low-carbon technologies would further limit the effectiveness of public funding for low-carbon steel in the EU (Figure 109). Across the sectors, respondents from the steel industry agreed with this problem to a higher extent than stakeholders from other sectors (2.6 and 2.3/4, respectively).

Figure 109: Current funding gap

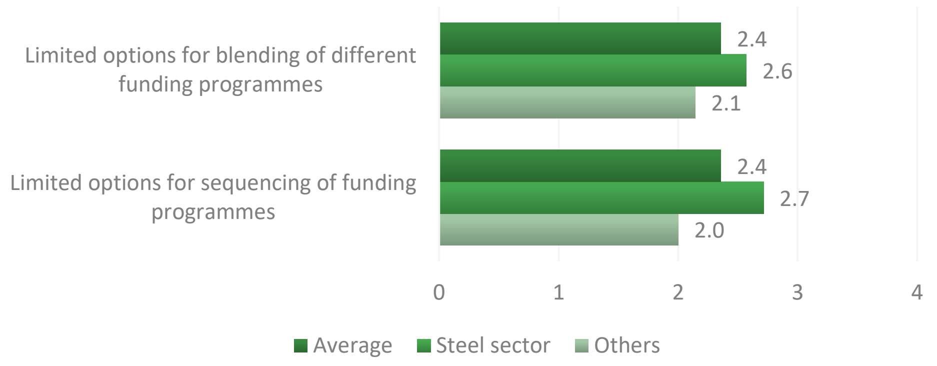


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the current funding gap for demonstration of low-carbon technologies will further limit the effectiveness of public funding for low-carbon steel in the EU?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

As shown in Figure 110, the stakeholders believed that the two drivers, i.e. limited options for blending and sequencing of different funding programmes, contribute to some extent (2.4/4) to increasing the current funding gap for demonstration of low-carbon technologies. Across the sectors, stakeholders from the steel industry agreed to a higher extent with the two drivers than stakeholders from other sectors.

Figure 110: The drivers increasing the current funding gap for demonstration of low-carbon technologies



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the drivers identified will increase the current funding gap for demonstration of low-carbon technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

One respondent from the steel sector provided additional considerations on limitations affecting public funding programmes for low-carbon steelmaking technologies, proposing moving from the Innovation Fund to the Just Transition Fund soon and at scale. This would ensure that the decarbonisation of the steel industry does not only support first innovative installations, but also the impacts of such transition on the whole steel industry. Furthermore, one respondent from a non-steel sector suggested establishing strong collaborations to reduce the overlaps in R&D&I efforts and funding, and ensure better synergies and more significant impacts. In addition, this stakeholder stated that R&D&I in low-carbon steelmaking technologies should be progressively phased out from public support and sequenced with other funding sources.

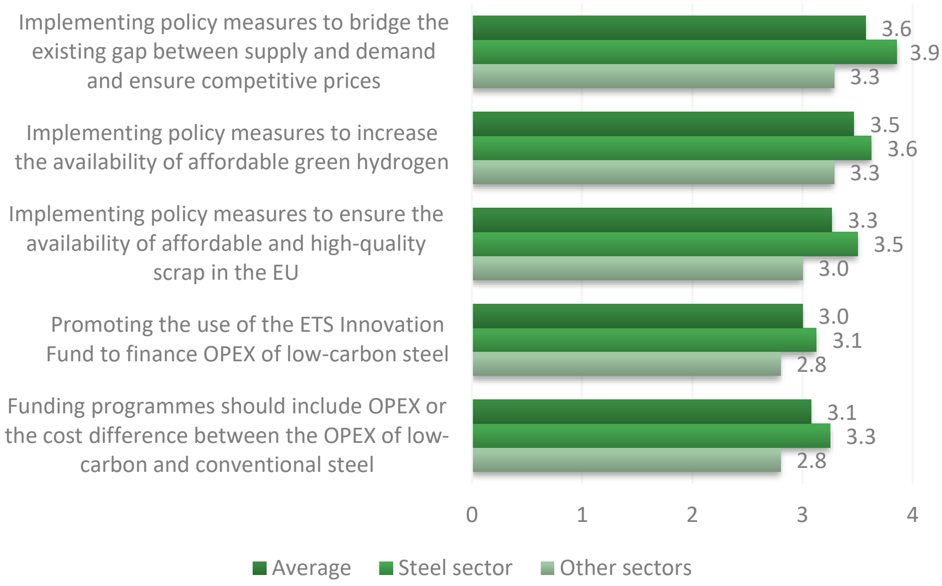
Other considerations on the general problem

One stakeholder from the steel sector shared additional considerations on the general problem, i.e. limited funding to decarbonise the EU steel industry, by providing additional statistics: for the transition towards low-carbon steelmaking, the steel industry probably needs € 1 B investments for 1 million steel production, on average.

Policy objectives and options

On average, consulted stakeholders believed that implementing policy measures to bridge the gap between supply and demand of renewable energy and ensure that RES-E is available at competitive prices is the option that would contribute the most (3.6/4) to reducing OPEX (Operational Objective FD1.1), with steel sector stakeholders supporting the option to the highest extent (3.9/4; Figure 111).

Figure 111: Policy options to reduce the OPEX

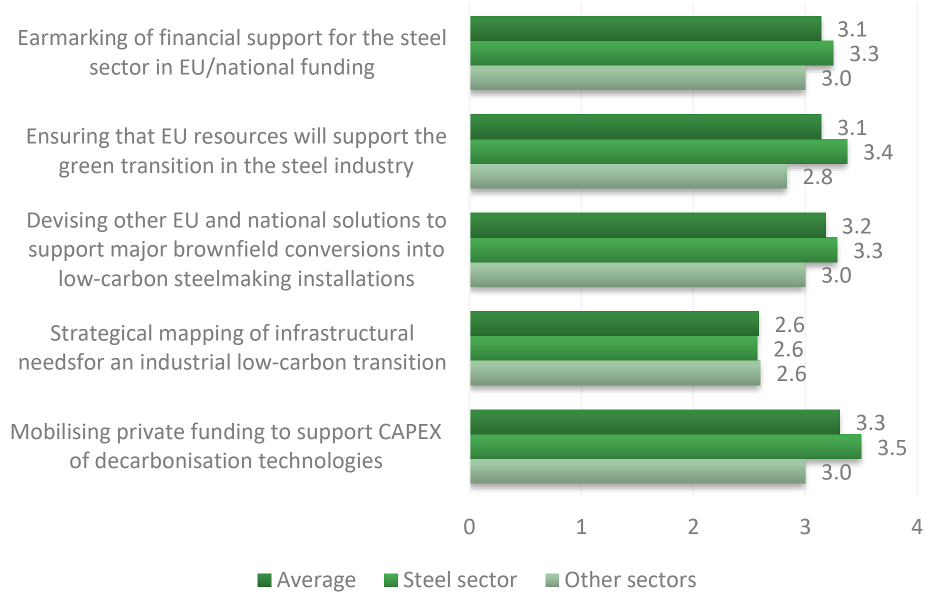


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Operational Objective FD1.1, i.e. reducing OPEX for low-carbon steelmaking and keeping it at a competitive level vis-à-vis OPEX for conventional steelmaking technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The stakeholders from both the steel and non-steel sectors supported the policy options proposed to achieve Operational Objective FD1.2 (ensuring public support for CAPEX) at least to some extent. The preferred solution was to mobilise private funding to support CAPEX (3.3/4), particularly among the stakeholders representing the steel sector (3.5/4; Figure 112).

Figure 112: Policy options to ensure public support for CAPEX

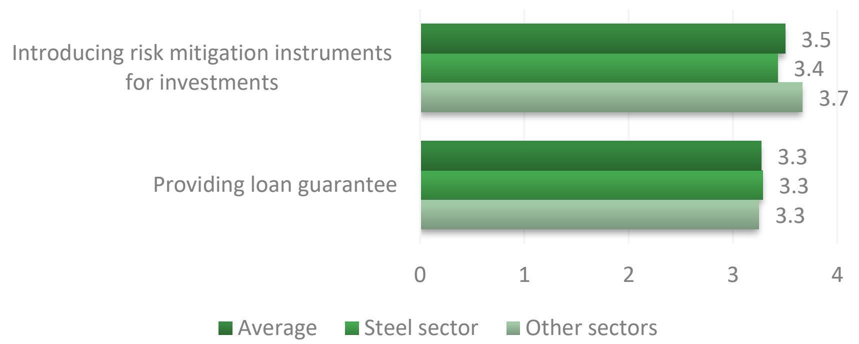


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Operational Objective FD1.2, i.e. ensuring public support for CAPEX in demonstration and early-stage commercialisation of decarbonisation technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The proposed policy options contributing to achieving Operational Objective FD2.1 (mitigating the innovation risks) received high to full support from consulted stakeholders. Stakeholders from non-steel sectors strongly preferred option FD2.1.1, i.e. introducing risk mitigation instruments for investments (3.7/4; Figure 113).

Figure 113: Policy options to mitigate the innovation risks

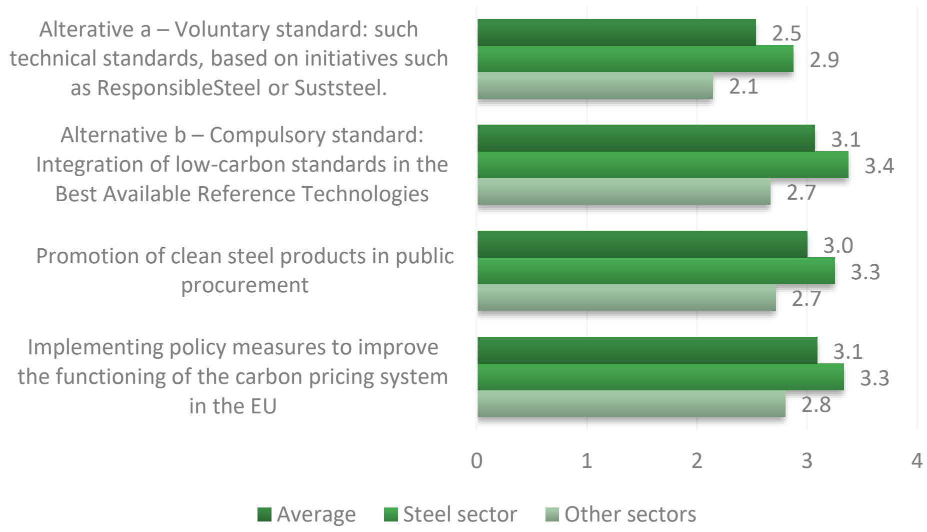


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Operational Objective FD2.1, i.e. mitigating the innovation risks?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

On average, stakeholders from the steel sector supported the options proposed to achieve Operational Objective FD2.2 (creating a market for low-carbon steel) more than stakeholders from non-steel sectors. The preferred solutions were: i) introducing compulsory standards (3.1/4); and ii) implementing policy measures to improve the functioning of the carbon pricing system (3.1/4; Figure 114).

Figure 114: Policy options to create a market for low carbon steel

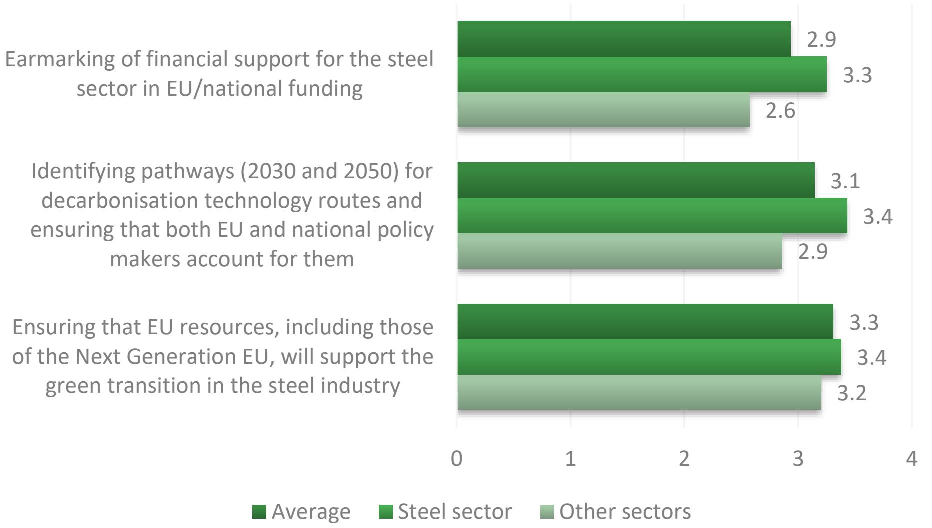


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Operational Objective FD2.2, i.e. creating a market for low-carbon steel?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

On average, the policy options proposed to achieve the objective of securing EU and national financial support (Operational Objective FD3.1) received high support from all the stakeholders. The preferred option was ensuring that EU resources will support the green transition in the steel industry (3.3/4). Identifying clear pathways for 2030 and 2050 for decarbonisation technology routes and ensuring that these pathways are taken into account at EU and national level was also recognised by steel sector stakeholders as the most relevant solution together with the above-mentioned one (Figure 115).

Figure 115: Policy options to secure EU and national financial support

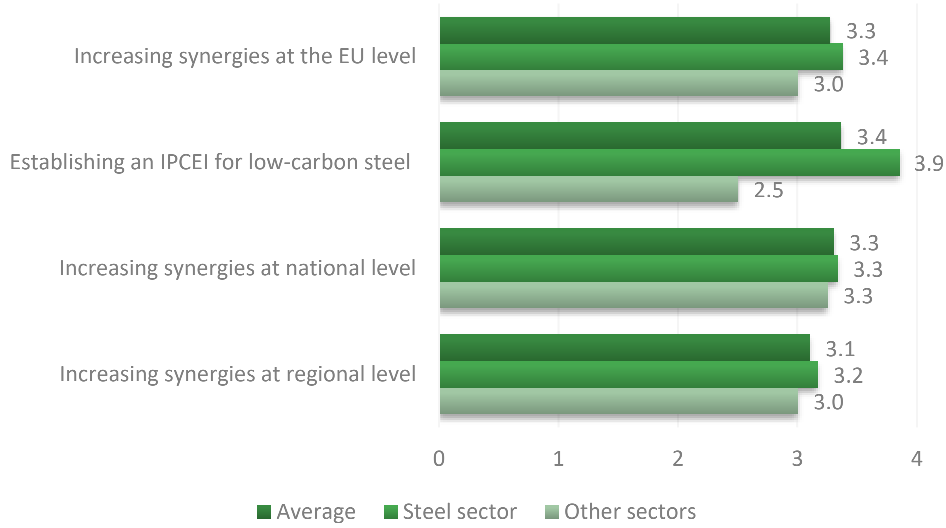


Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Operational Objective FD3.1, i.e. securing EU and national financial support for the decarbonisation of the steel sector?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

The proposed policy options contributing to achieving Operational Objective FD3.2 (closing the funding gap between the research, demonstration and deployment phases for decarbonisation technologies) received high support from both steel and non-steel stakeholders. The preferred option was to establish an IPCEI for low-carbon steel (3.4/4), with steel sector stakeholders expressing full support (3.9/4). Increasing synergies at EU level and national level are also recognised as important options by the stakeholders (3.3/4), while increasing synergies at regional level received a slightly lower consensus (3.1/4; Figure 116).

Figure 116: Policy options to close the funding gap



Note: the figure presents stakeholders' answers to the question "To what extent do you believe that the proposed policy solutions can contribute to achieving Operational Objective FD3.2, i.e. closing the funding gap between the research, demonstration and deployment phases for decarbonisation technologies?". The answers have been converted to a scale from 0 to 4: not at all (0), to a limited extent (1), to some extent (2), to a high extent (3) and to the fullest extent (4).

Source: authors' own composition on survey results.

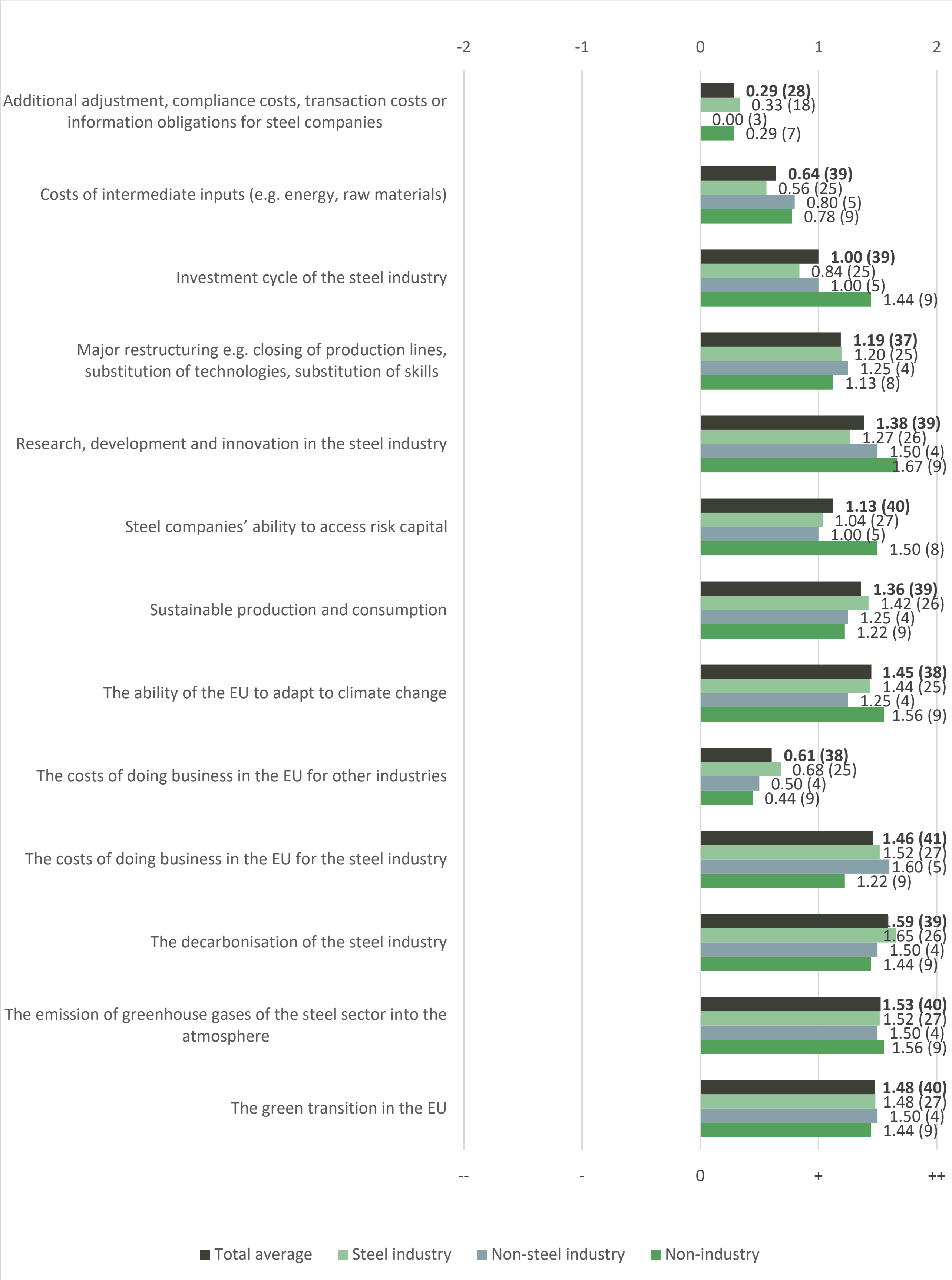
Stakeholders agreed that the proposed set of policy options extensively covers different dimensions of the funding problems associated with the decarbonisation of the EU steel industry. No additional policy option was suggested by the respondents in the context of the survey. However, the need to assess the expected impacts of the Clean Steel Partnership and, more specifically, to create sufficient synergies between Horizon Europe (HEU) and the Research Fund for Coal and Steel (RFSC) was emphasised by some stakeholders in the follow-up interviews

Impacts of options

Impacts of option FD1: promoting the use of EU funding programmes to finance OPEX of low-carbon steel

As shown in Figure 117, the option of promoting the use of EU funding programmes to finance OPEX of low-carbon steel would generate the highest positive impact on the decarbonisation of the steel industry, recording the highest total score on average (1.59 in a range from -2 to 2).

Figure 117: Impacts of promoting the use of EU funding programmes to finance OPEX of low-carbon steel



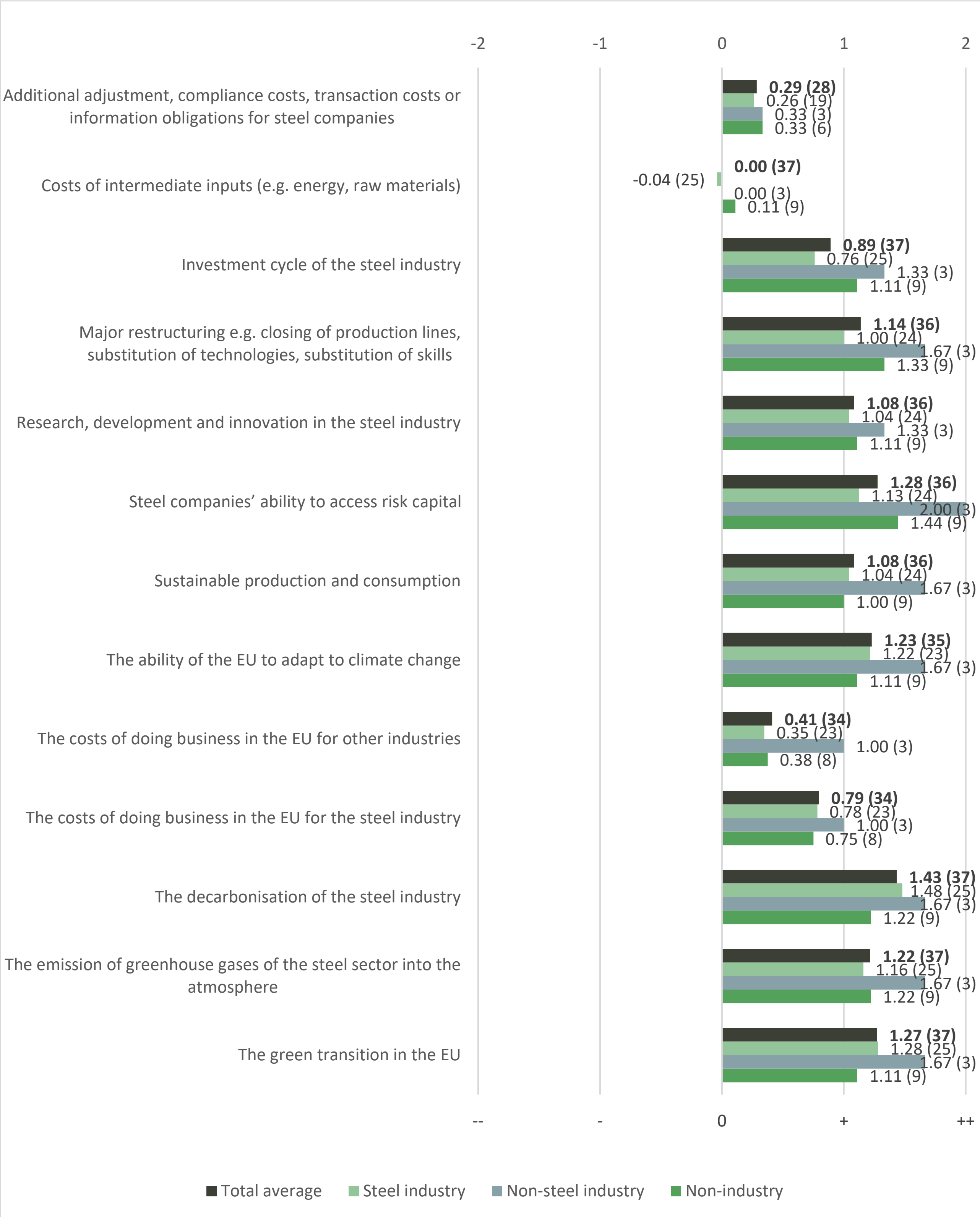
Note: the figure presents stakeholders' answers to question FD.IA.1, i.e. "What impact would option FD1 (promoting the use of EU funding programmes to finance OPEX of low-carbon steel) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD2: mobilising private funding to support CAPEX of decarbonisation technologies

According to the respondents, the option of mobilising private funding to support CAPEX of decarbonisation technologies would generate the highest impact on the decarbonisation of the steel industry (Figure 118), recording the highest total score on average (1.43 in a range from -2 to 2).

Figure 118: Impacts mobilising private funding to support CAPEX of decarbonisation technologies



Note: the figure presents stakeholders' answers to question FD.IA.2, i.e. "What impact would option FD2 (mobilising private funding to support CAPEX of decarbonisation technologies) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive

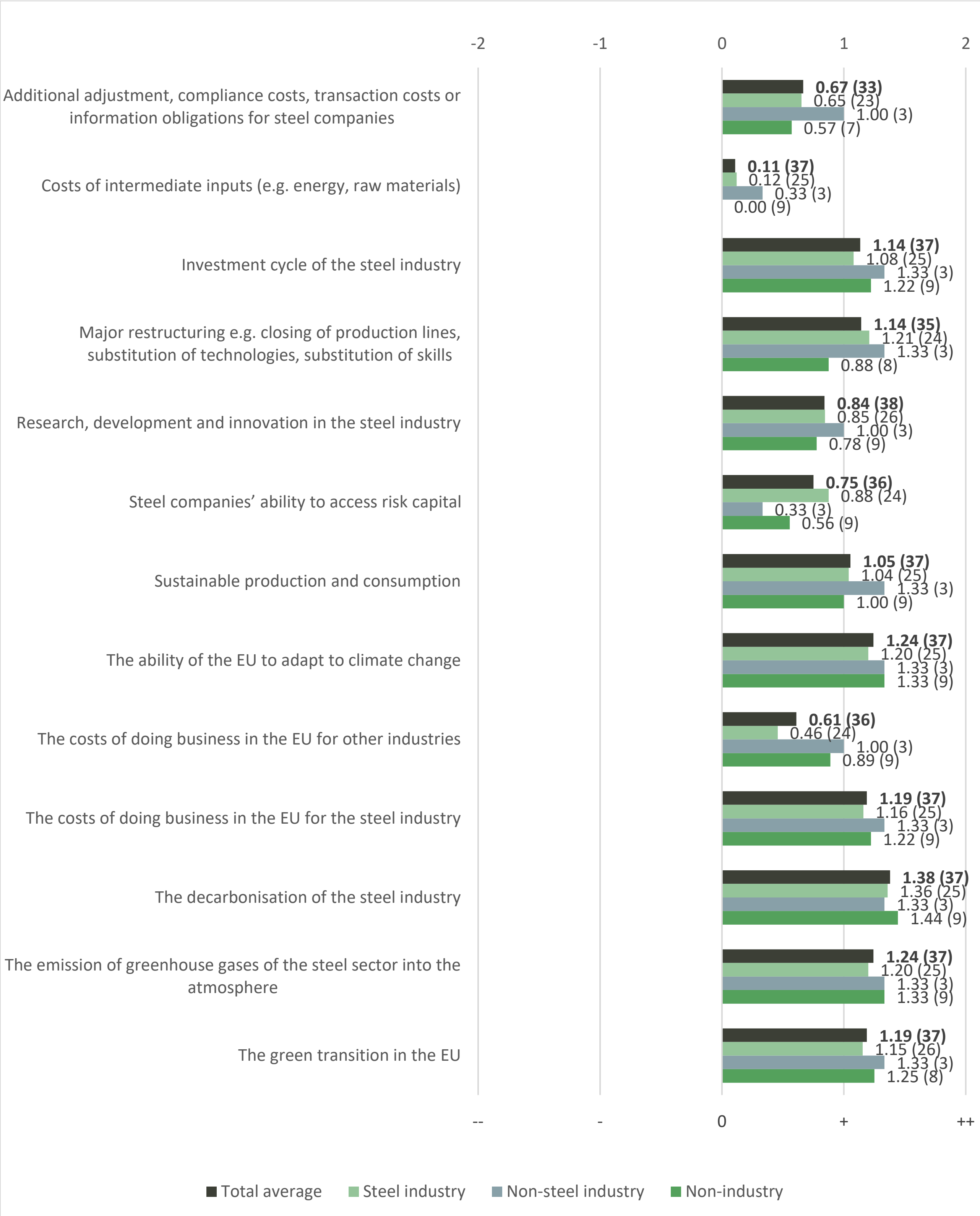
(+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD3: ensuring public support for CAPEX beyond direct public funding, e.g. through accelerated depreciation or tax abatements

As shown in Figure 119, the option of ensuring public support for CAPEX beyond direct public funding, e.g. through accelerated depreciation or tax abatements, would generate the highest impact on the decarbonisation of the steel industry, recording the highest total score on average (1.38 in a range from -2 to 2).

Figure 119: Impacts of ensuring public support for CAPEX beyond direct public funding, e.g. through accelerated depreciation or tax abatements



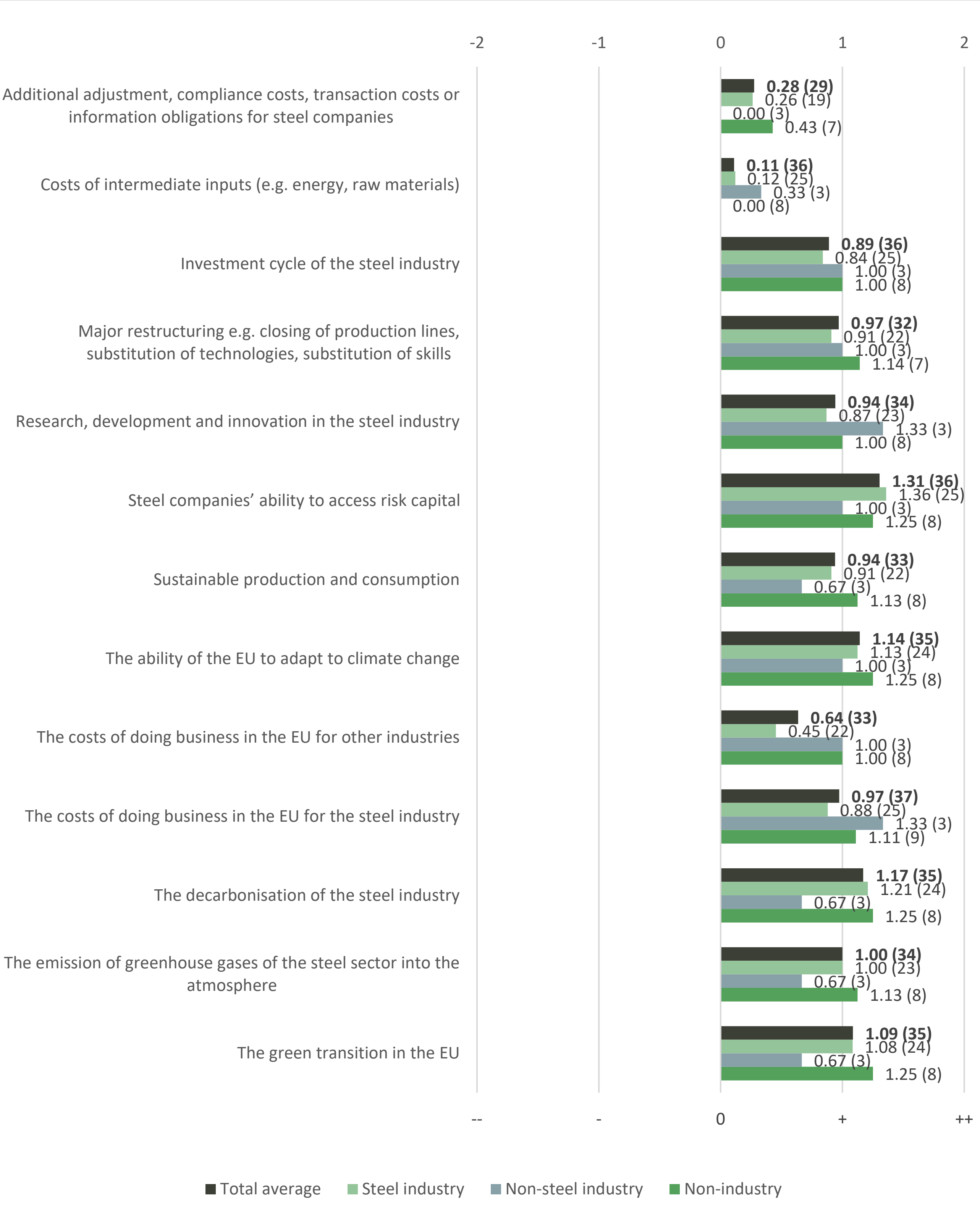
Note: the figure presents stakeholders' answers to question FD.IA.3, i.e. "What impact would option FD3 (ensuring public support for CAPEX beyond direct public funding, e.g. through accelerated depreciation or tax abatements) have on...?". Respondents provided their best estimate based on the following scale: very *negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.*

Source: authors' own composition on survey results.

Impacts of option FD4: introducing risk mitigation and loan guarantee instruments for investments in decarbonisation technologies

Figure 120 shows that, according to the respondents, the option of introducing risk mitigation and loan guarantee instruments for investments in decarbonisation technologies would generate the highest impact on steel companies' ability to access risk capital, recording the highest total score on average (1.31 in a range from -2 to 2).

Figure 120: Impacts of introducing risk mitigation and loan guarantee instruments for investments in decarbonisation technologies



Note: the figure presents stakeholders' answers to question FD.IA.4, i.e. "What impact would option FD4 (introducing risk mitigation and loan guarantee instruments for investments in decarbonisation technologies) have on...?". Respondents provided their best estimate based on the following scale: very negative (--),

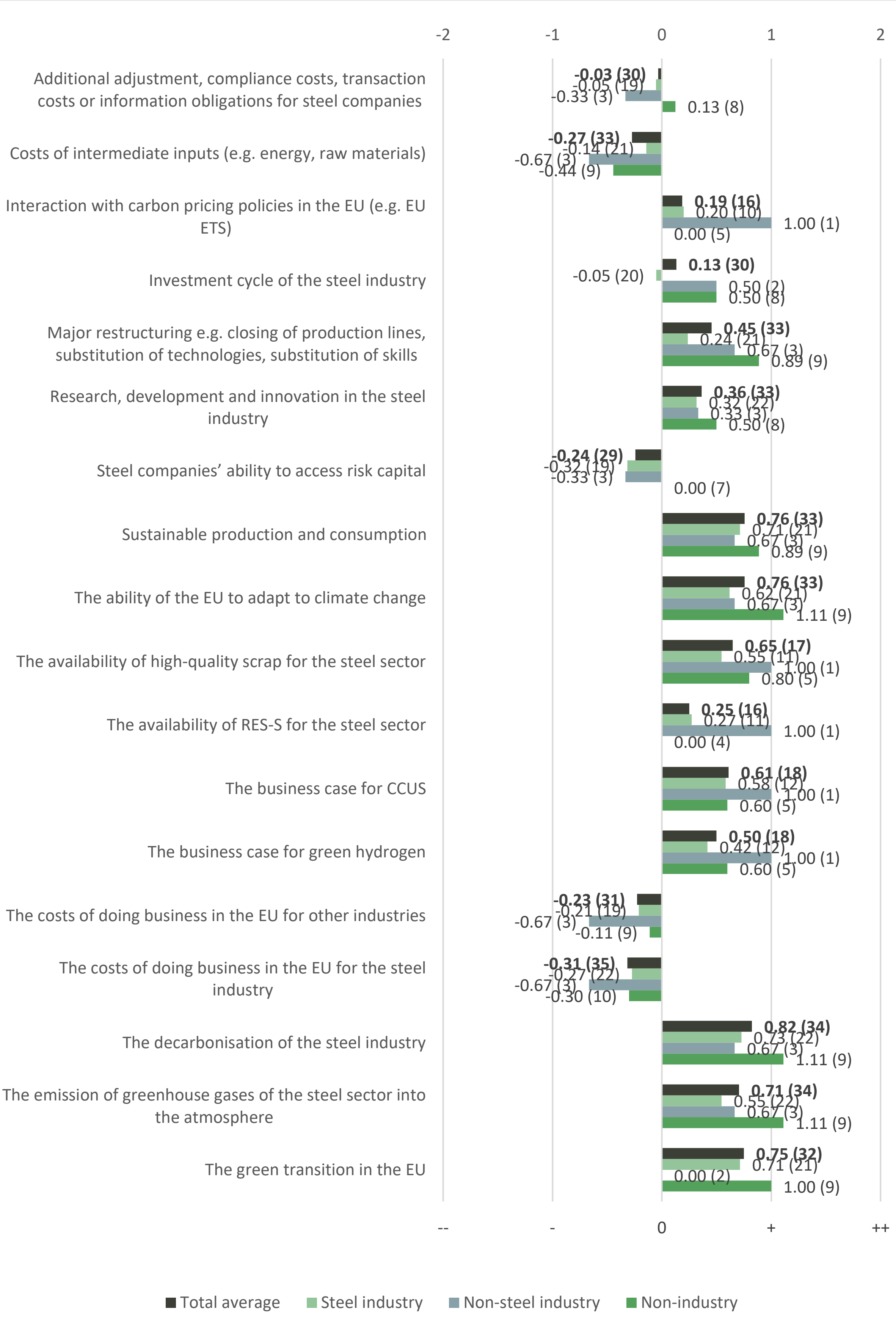
negative (-), neutral (0), positive (+) or very positive (++).The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD5: introducing a compulsory standard - integration of low-carbon standards in the Best Available Techniques Reference

As shown in Figure 121, respondents believed that the option of introducing a compulsory standard, namely the integration of low-carbon standards in the Best Available Techniques Reference, would generate the highest positive impact on the decarbonisation of the steel industry (total average score of 0.82 in a range from -2 to 2). The same option would generate the highest negative impact on the cost of doing business in the EU for the steel industry (total average score of -0.31 in a range from -2 to 2).

Figure 121: Impacts of introducing a compulsory standard - integration of low-carbon standards in the Best Available Techniques Reference



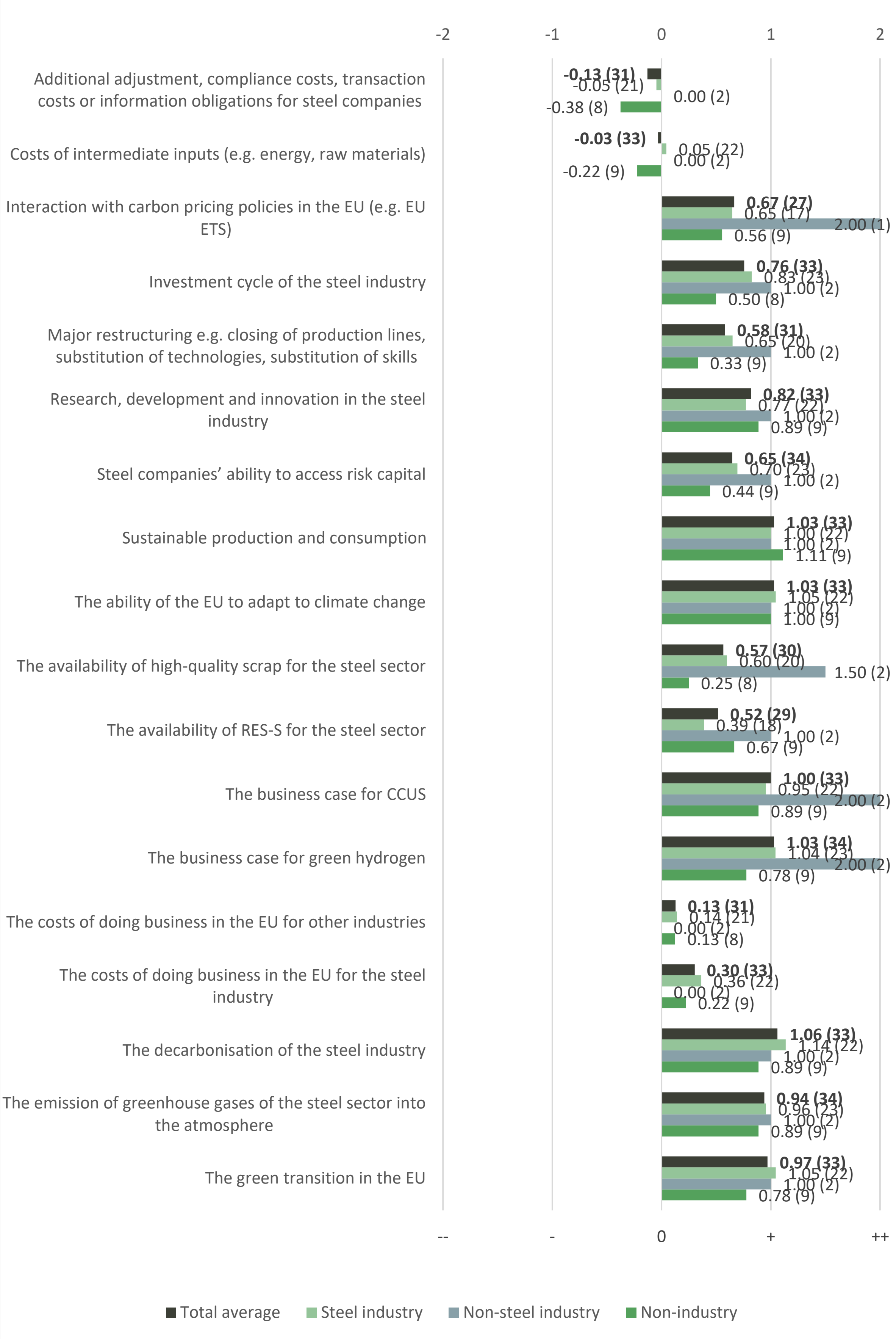
Note: the figure presents stakeholders' answers to question FD.IA.5, i.e. "What impact would option FD5 (introducing a compulsory standard - integration of low-carbon standards in the Best Available Techniques Reference) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD6: promoting low-carbon steel products in public procurement

Figure 122 shows that the option of promoting low-carbon steel products in public procurement would generate the highest positive impact on the decarbonisation of the steel industry (total average score of 1.06 in a range from -2 to 2). According to non-industry respondents, however, the same option would generate a negative impact in terms of additional adjustment, compliance costs, transaction costs or information obligations for steel companies (scoring -0.38 in a range from -2 to 2).

Figure 122: Impacts of promoting low-carbon steel products in public procurement



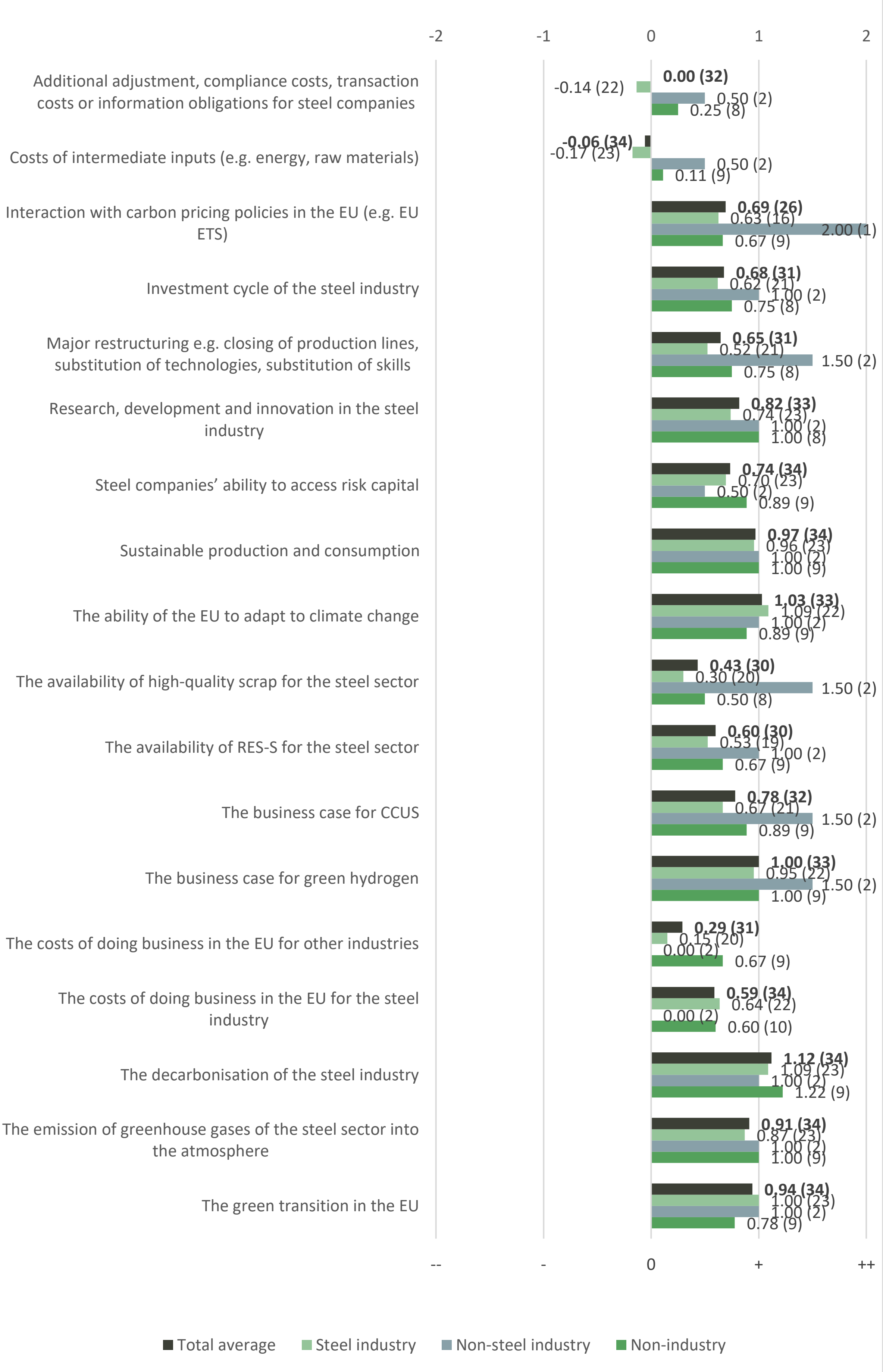
Note: the figure presents stakeholders' answers to question FD.IA.6, i.e. "What impact would option FD6 (promoting low-carbon steel products in public procurement) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD7: developing a green label for low-carbon steel

According to the respondents, the option of developing a green label for low-carbon steel would generate the highest impact on the decarbonisation of the steel industry (Figure 123), recording the highest total score on average (1.12 in a range from -2 to 2).

Figure 123: Impacts of developing a green label for low-carbon steel


-2
-1
0
1
2
Additional adjustment, compliance costs, transaction costs or information obligations for steel companies
0.00 (32)
-0.14 (22)
0.50 (2)
0.25 (8)
Costs of intermediate inputs (e.g. energy, raw materials)
-0.06 (34)
-0.17 (23)
0.50 (2)
0.11 (9)
Interaction with carbon pricing policies in the EU (e.g. EU ETS)
0.69 (26)
0.63 (16)
2.00 (1)
0.67 (9)
Investment cycle of the steel industry
0.68 (31)
0.62 (21)
1.00 (2)
0.75 (8)
Major restructuring e.g. closing of production lines, substitution of technologies, substitution of skills
0.65 (31)
0.52 (21)
1.50 (2)
0.75 (8)
Research, development and innovation in the steel industry
0.82 (33)
0.74 (23)
1.00 (2)
1.00 (8)
Steel companies' ability to access risk capital
0.74 (34)
0.70 (23)
0.50 (2)
0.89 (9)
Sustainable production and consumption
0.97 (34)
0.96 (23)
1.00 (2)
1.00 (9)
The ability of the EU to adapt to climate change
1.03 (33)
1.09 (22)
1.00 (2)
0.89 (9)
The availability of high-quality scrap for the steel sector
0.43 (30)
0.30 (20)
1.50 (2)
0.50 (8)
The availability of RES-S for the steel sector
0.60 (30)
0.53 (19)
1.00 (2)
0.67 (9)
The business case for CCUS
0.78 (32)
0.67 (21)
1.50 (2)
0.89 (9)
The business case for green hydrogen
1.00 (33)
0.95 (22)
1.50 (2)
1.00 (9)
The costs of doing business in the EU for other industries
0.29 (31)
0.15 (20)
0.00 (2)
0.67 (9)
The costs of doing business in the EU for the steel industry
0.59 (34)
0.64 (22)
0.00 (2)
0.60 (10)
The decarbonisation of the steel industry
1.12 (34)
1.09 (23)
1.00 (2)
1.22 (9)
The emission of greenhouse gases of the steel sector into the atmosphere
0.91 (34)
0.87 (23)
1.00 (2)
1.00 (9)
The green transition in the EU
0.94 (34)
1.00 (23)
1.00 (2)
0.78 (9)
--
-
0
+
++
Total average
Steel industry
Non-steel industry
Non-industry

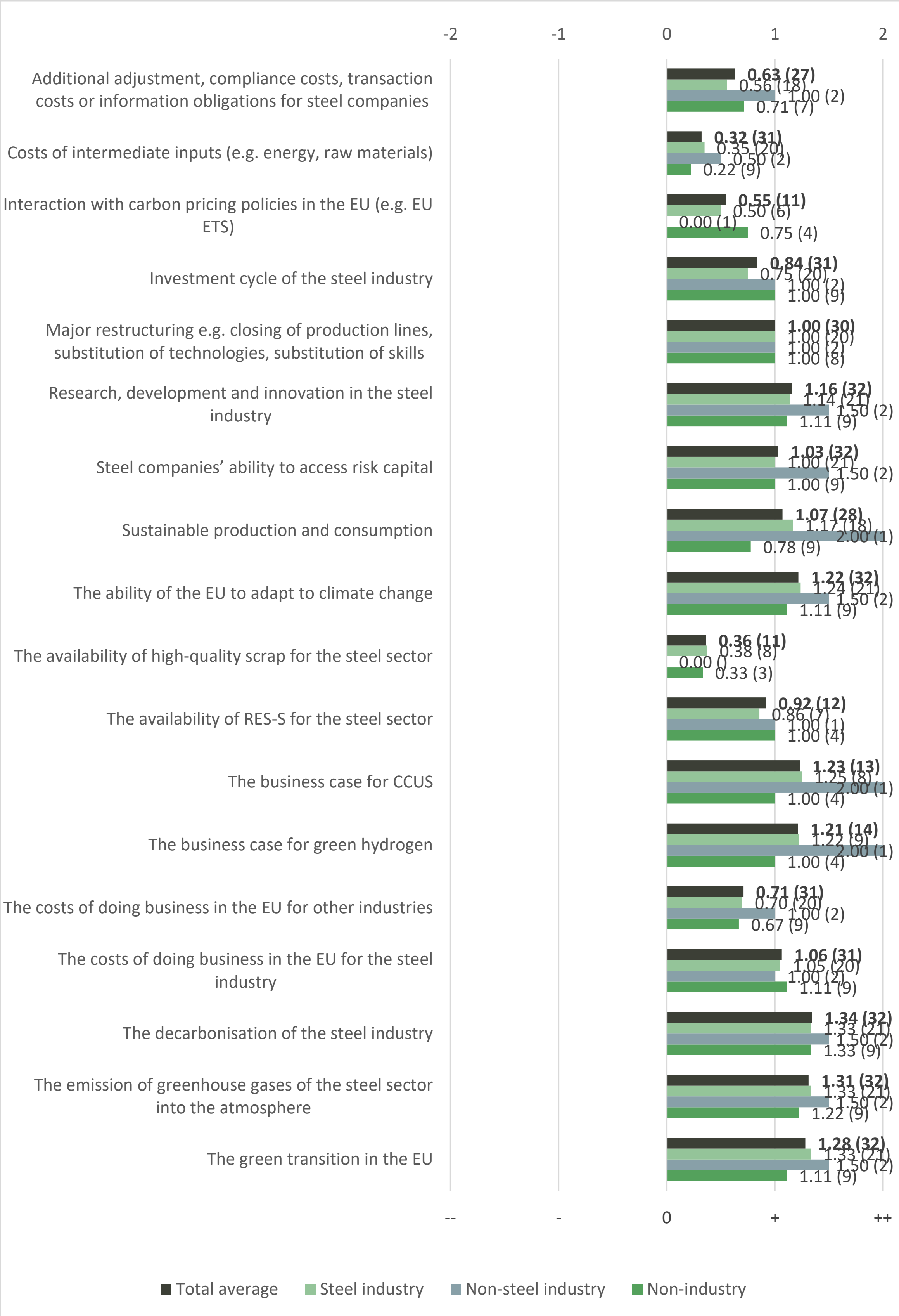
Note: the figure presents stakeholders' answers to question FD.IA.7, i.e. "What impact would option FD7 (developing a green label for low-carbon steel) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD8: ensuring that EU resources, including those of Next Generation EU, will support the green transition in the steel industry

Figure 124 shows that the option of ensuring that EU resources, including those of Next Generation EU, will support the green transition in the steel industry would generate the highest positive impact on the decarbonisation of the steel industry, recording the highest total score on average (1.34 in a range from -2 to 2).

Figure 124: Impacts of ensuring that EU resources, including those of Next Generation EU, will support the green transition in the steel industry



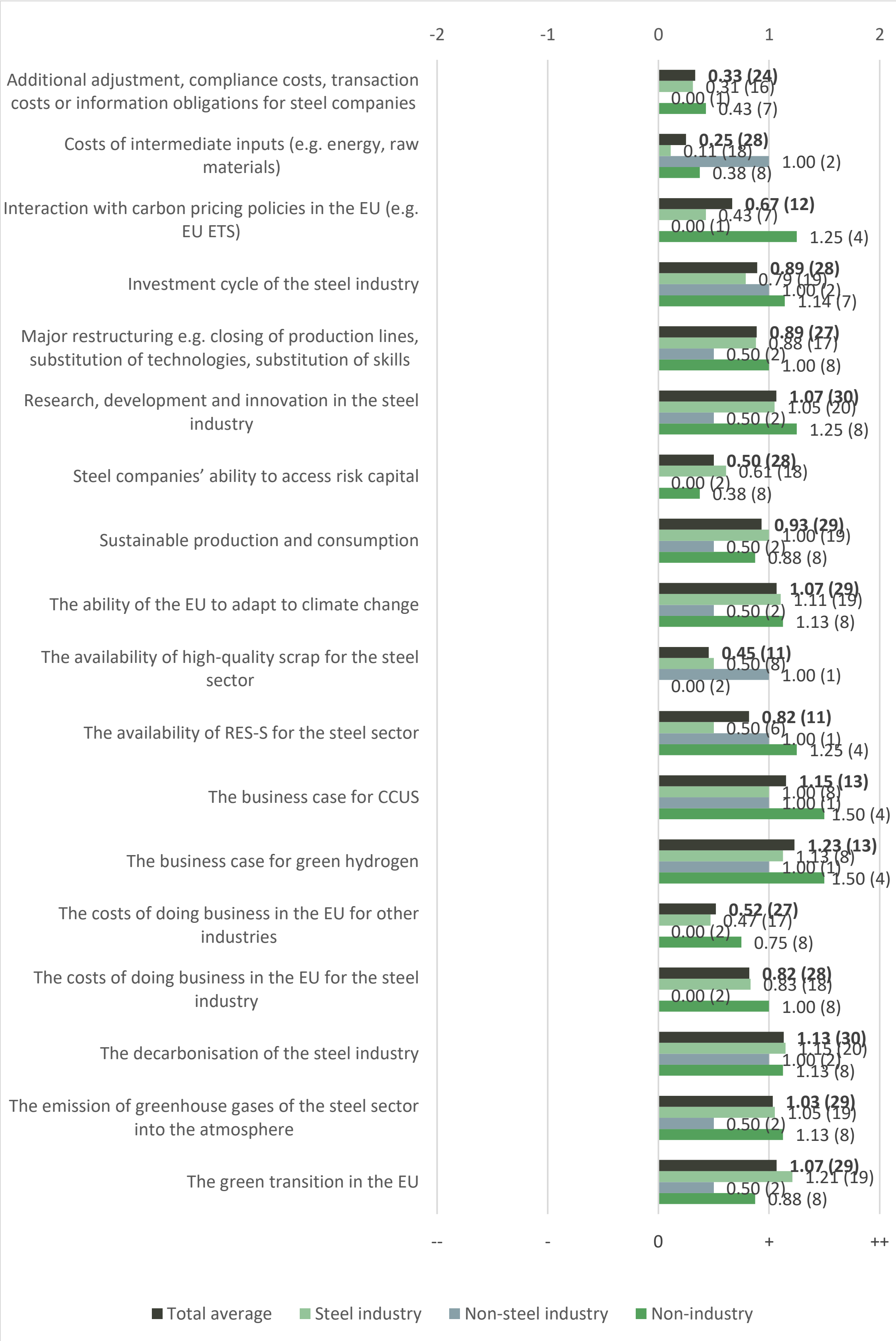
Note: the figure presents stakeholders' answers to question FD.IA.8, i.e. "What impact would option FD8 (ensuring that EU resources, including those of Next Generation EU, will support the green transition in the steel industry) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD9: identifying pathways (2030 and 2050) for decarbonisation technology routes and ensuring that both EU and national policymakers account for them

According to the respondents, the option of identifying pathways (2030 and 2050) for decarbonisation technology routes and ensuring that both EU and national policymakers account for them would generate the highest impact on the business case for green hydrogen (Figure 125), recording the highest total score on average (1.23 in a range from -2 to 2).

Figure 125: Impacts of Identifying pathways (2030 and 2050) for decarbonisation technology routes and ensuring that both EU and national policymakers take them into account



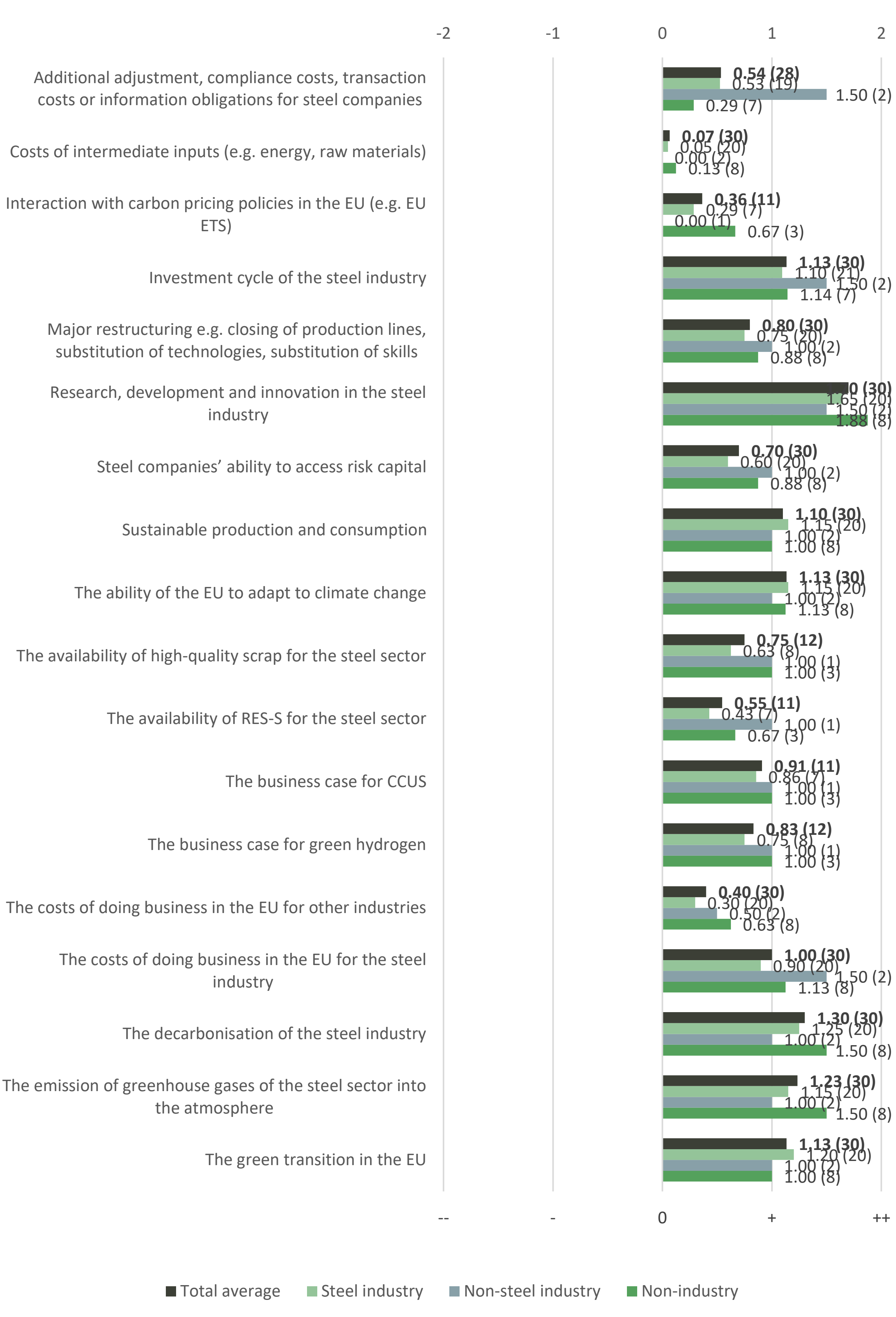
Note: the figure presents stakeholders' answers to question FD.IA.9, i.e. "What impact would option FD9 (identifying pathways (2030 and 2050) for decarbonisation technology routes and ensuring that both EU and national policymakers take them into account) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD10: creating synergies in EU level funding via the Clean Steel Partnership

As shown in Figure 126, the option of creating synergies in EU level funding via the Clean Steel Partnership would generate the highest positive impact on R&D&I in the steel industry, recording the highest total score on average (1.70 in a range from -2 to 2).

Figure 126: Impacts of creating synergies in EU level funding via the Clean Steel Partnership



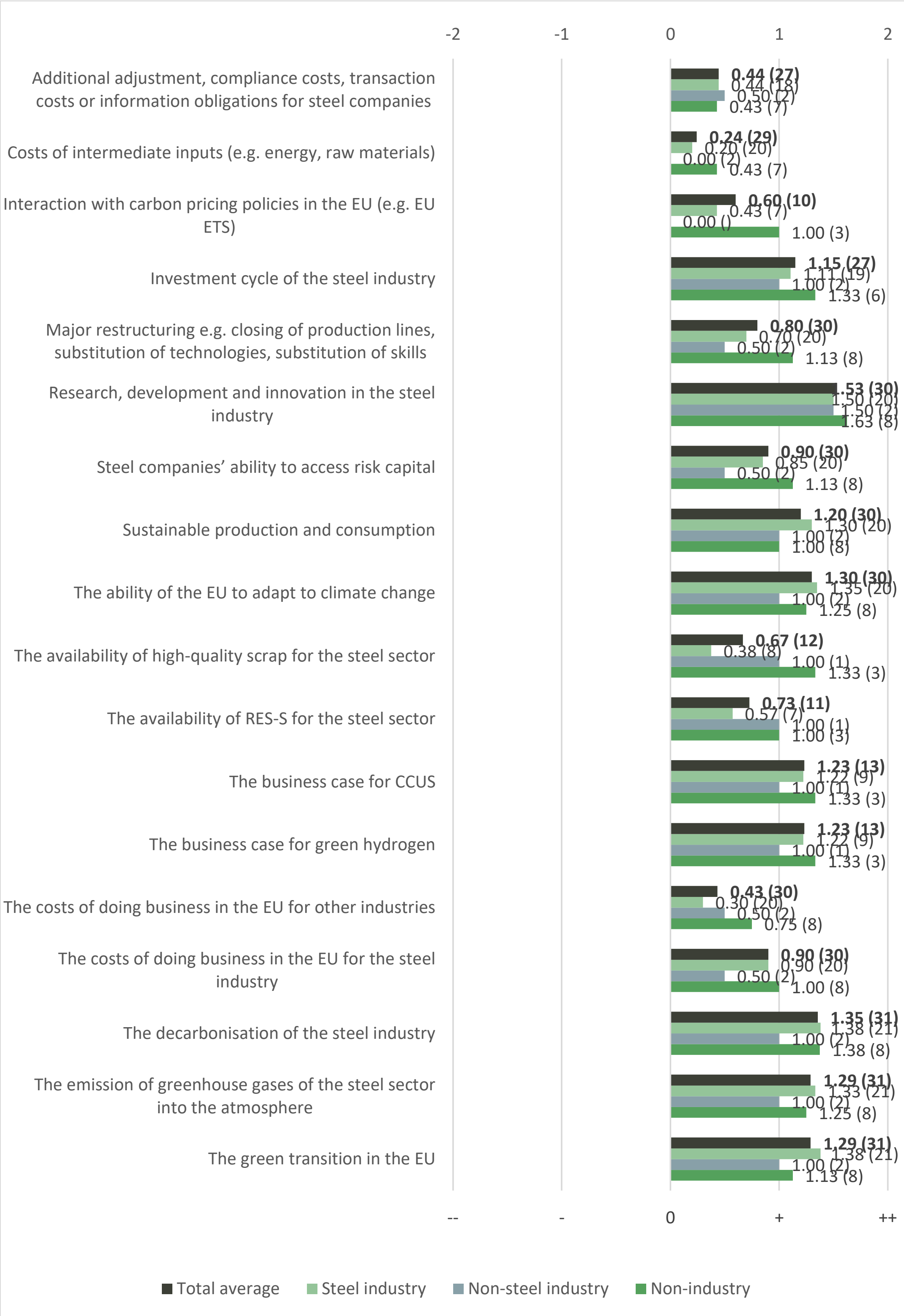
Note: the figure presents stakeholders' answers to question FD.IA.10, i.e. "What impact would option FD10 (creating synergies in EU level funding via the Clean Steel Partnership) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

Source: authors' own composition on survey results.

Impacts of option FD11: creating additional synergies in EU level funding via blending and sequencing of different opportunities

According to the respondents, the option of creating additional synergies in EU level funding via blending and sequencing of different opportunities would generate the highest impact on R&D&I in the steel industry (Figure 127), recording the highest total score on average (1.53 in a range from -2 to 2).

Figure 127: Impacts of creating additional synergies in EU level funding via blending and sequencing of different opportunities



Note: the figure presents stakeholders' answers to question FD.IA.11, i.e. "What impact would option FD11 (creating additional synergies in EU level funding via blending and sequencing of different opportunities) have on...?". Respondents provided their best estimate based on the following scale: very negative (--), negative (-), neutral (0), positive (+) or very positive (++). The answers have then been converted to the following scale: -2, -1, 0, 1 and 2, respectively.

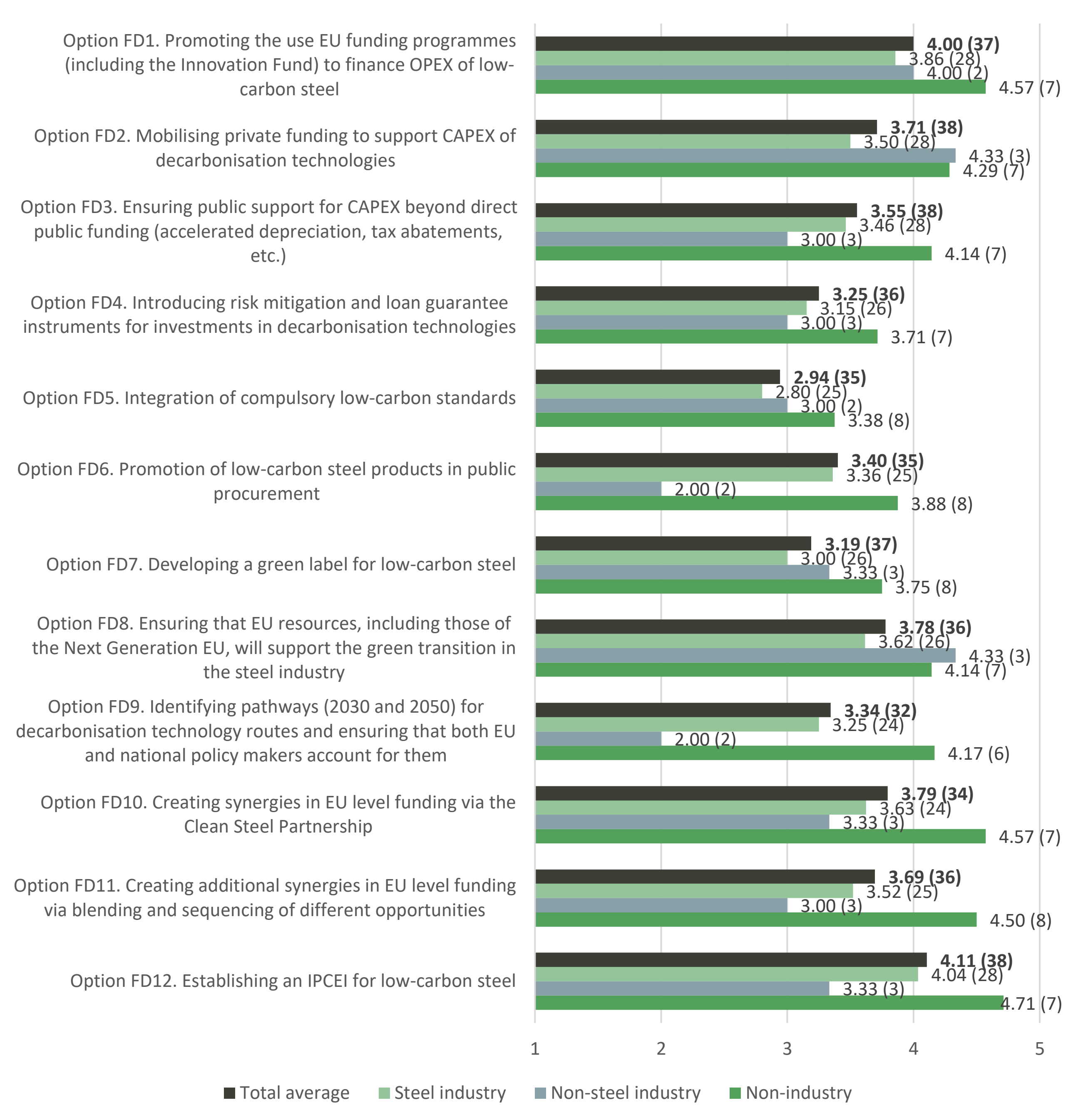
Source: authors' own composition on survey results.

Comparison of options

Effectiveness

Figure 128 shows that, according to the survey, the option of establishing an IPCEI for low-carbon steel is the one recording the highest total score on average (4.11/5) when the options are assessed on their ability to help ensure sufficient funding to develop and deploy low-carbon steelmaking technologies in the EU.

Figure 128: Comparison of the effectiveness of the policy options – Funding



Note: the figure presents stakeholders' answers to question FD.COMP.1, i.e. "Would the policy options listed in the table below help ensure sufficient funding to develop and deploy low-carbon steelmaking technologies in the EU?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

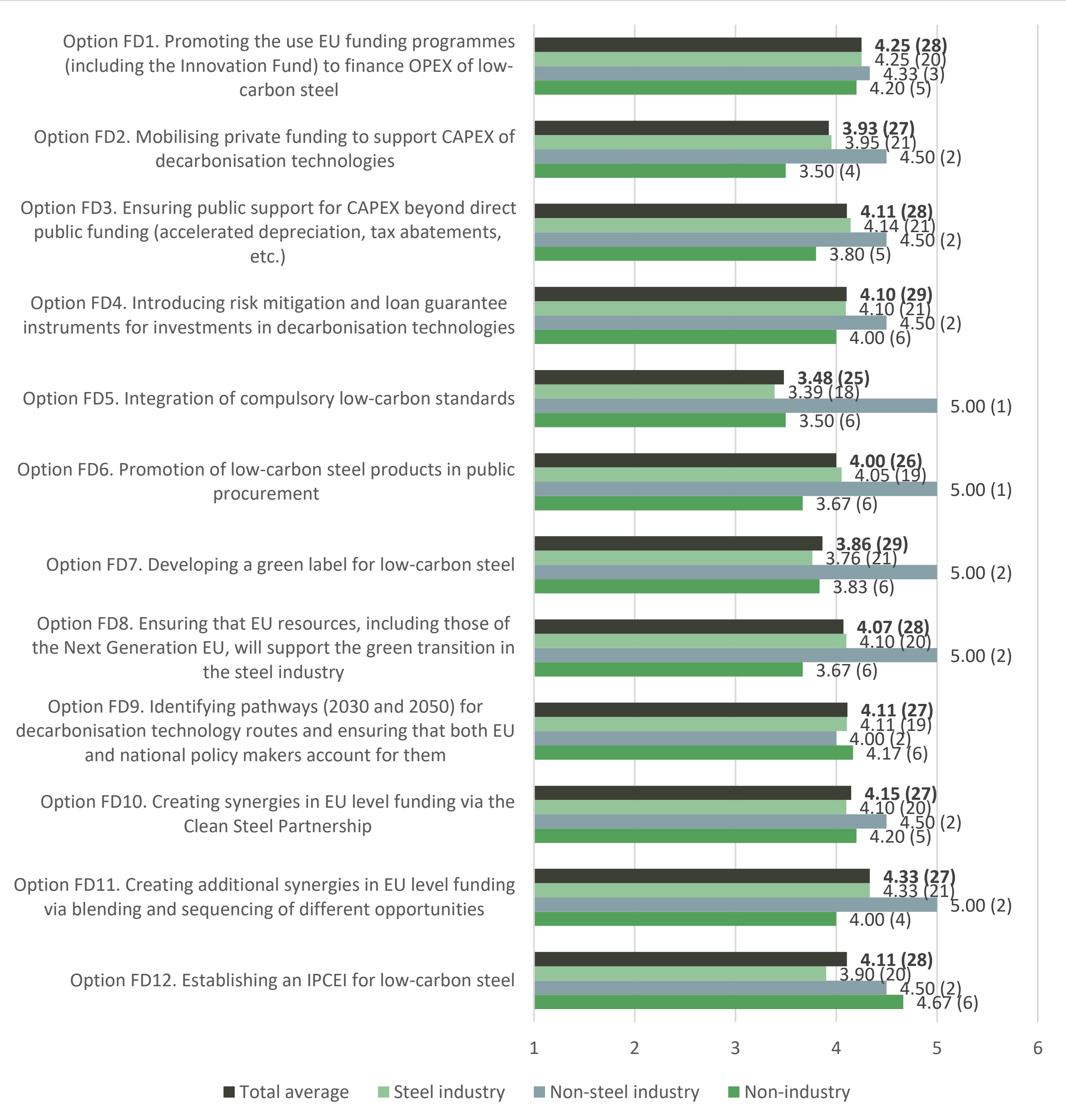
Source: authors' own composition on survey results.

Coherence

As shown in Figure 129, the option of creating additional synergies in EU level funding via blending and sequencing of different opportunities is the one recording the highest total score on average

(4.33/5) when the options are assessed on their coherence with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.).

Figure 129: Comparison of the coherence of the policy options – Funding



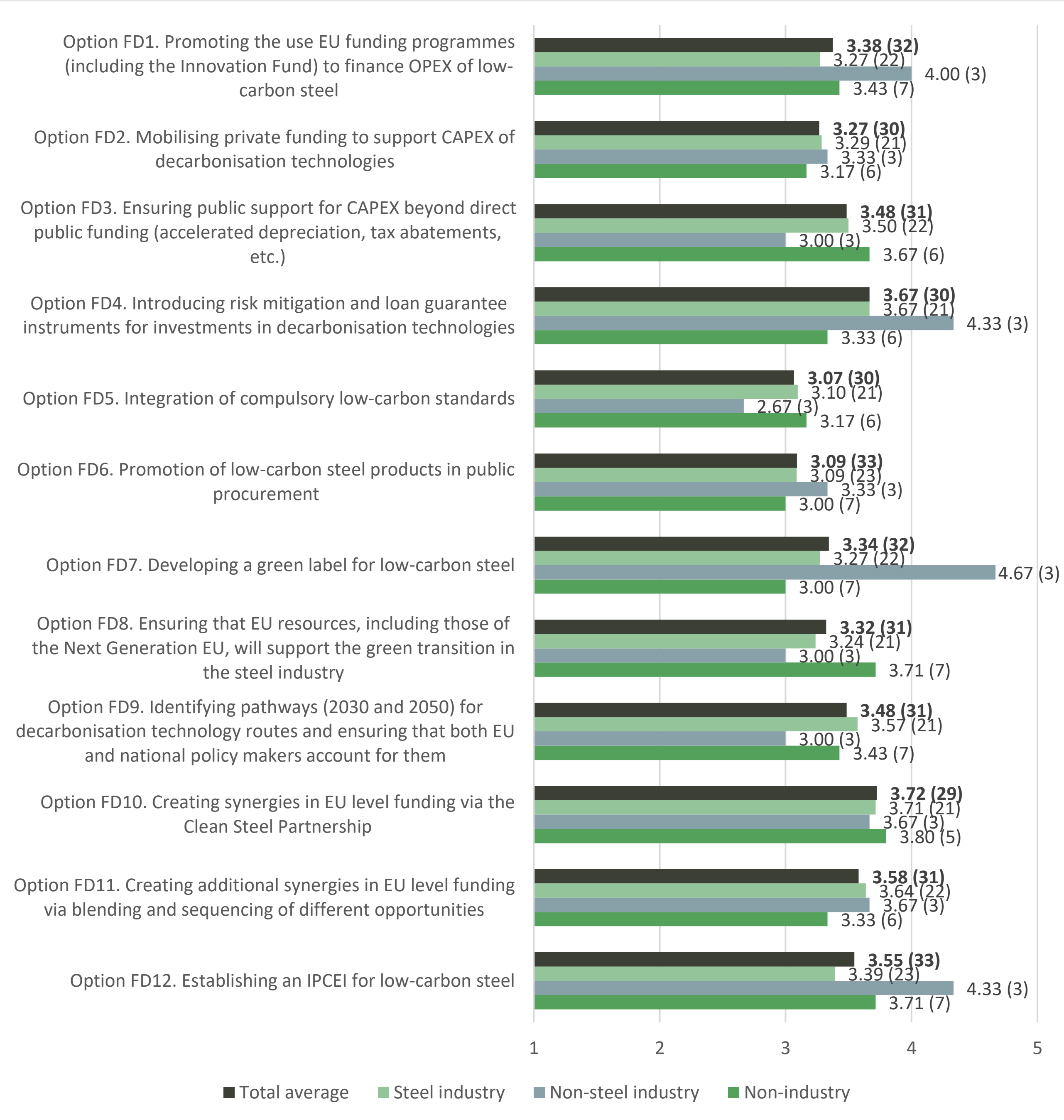
Note: the figure presents stakeholders' answers to question FD.COMP.2, i.e. "Are the policy options listed in the table below coherent with other relevant EU initiatives in the field (e.g. the European Green Deal, the 2030 climate and energy framework, the 2050 long-term strategy, the Clean Energy for all Europeans package, etc.?". Respondents provided their best assessment based on the following scale: not at all (1), to a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.

Source: authors' own composition on survey results.

Feasibility

According to the survey, the option of creating synergies in EU level funding via the Clean Steel Partnership is the one recording the highest total score on average (3.72/5) when the options are assessed on the possibility to receive enough support from EU and national policymakers to be properly implemented (Figure 130).

Figure 130: Comparison of the feasibility of the policy options – Funding



Note: the figure presents stakeholders' answers to question FD.COMP.3, i.e. "Do you expect that the policy options listed in the table below will receive enough support from EU and national policymakers to be properly implemented?". Respondents provided their best assessment based on the following scale: not at all (1), to *a limited extent (2), to some extent (3), to a high extent (4) or to the fullest extent (5). They selected DK/NO when they did not know or had no opinion.*

Source: authors' own composition on survey results.

Summary of stakeholder feedback - Funding

The stakeholders participating in the consultation shared similar views on the magnitude and mechanism of the impacts of the proposed policy options in every area (economic and competitiveness, environmental, etc.). For convenience, in this report we distinguished between technology-push options (FD1-FD4), demand-pull options (FD5-FD7), playing field/synergy options (FD8-FD12).

Technology-push options: Options FD1-4 received similar level of support.

Stakeholders highly regard option FD1 (Promoting the use EU funding programmes) but pointed out that OPEX and CAPEX (see option FD2 - Mobilising private funding to support CAPEX of decarbonisation technologies) should always be considered together from the business viewpoint. Few stakeholders stressed that at present the EU Steel industry cannot use private funding to carry higher OPEX. Therefore, the sector needs support to plan new long-lasting investment decisions and OPEX support at least in this transition phase is a key instrument enabling the transition towards green steel. However, some stakeholders argued that the ETS Innovation Fund would be better suited for supporting CAPEX than OPEX. According to this, they also support Option FD3 (Ensuring public support for CAPEX beyond direct public funding) as it supports CAPEX via state aid. Finally, they agreed that with Option FD4 (Introducing risk mitigation and loan guarantee instruments for investments in decarbonisation technologies) there would be a considerable boost in investments in the steel sector.

Demand-pull options: Options FD5-7 are some of the favourite options among many stakeholders.

The Integration of compulsory low-carbon standards received support from the stakeholders proposed in Option FD5, can incentivize the adoption of green technologies and result in emissions reductions while preserving the competitiveness of domestic steel manufacturers. Integrating low-emission standards with BAT will force producers to introduce new technologies. However, some argue that this may also delay new investments, which will become more expensive, limiting the magnitude of the impact of the measure. Initially, this solution will introduce additional inconvenience of doing business in the steel sector, because the implementation of BAT. On the other hand, it will positively affect all environmental aspects of steel production. The introduction of EU standards can also help to overcome green washing. The introduction of standards can be supported by promoting carbon-neutral steel production via public procurement with Option FD6, which is a powerful leverage for disseminating new technologies in steel production. This measure will allow governments to set an example in reaching carbon neutrality. However, according to stakeholders, the impact fully depends on the definition of low carbon steel products. Finally, Option FD7 (Developing a green label for low-carbon steel) is among the favourite options as it supports a market for low-carbon-steel. This measure will push for a clearer definition of what green steel actually is or should be. A 'green label' can have the strongest impact on the technology scenario supporting decarbonisation, influence the access to risk capital and become an enabler of other positive impacts. This action is also necessary in levelling the chances of green steel in competition with conventional steel and to encourage producers to stay in the EU, switching to hydrogen technologies.

Playing field/synergy options: Options FD8-12 advocate for solutions to reform the sector, levelling the playing field.

With respect to Option FD8 (Ensuring that EU resources, including those of the Next Generation EU, will support the green transition in the steel industry), stakeholders shared similar considerations to those of options 1-4 on funding. While distributing additional resources to greening the steel industry, the EC should also promote with Option FD9 (Identifying pathways (2030 and 2050) for decarbonisation technology routes and ensuring that both EU and national policy makers account for them) the identification of the milestones, the timing and the relevant value chains involved. This aspect, together with a clear definition of what green steel actually should be, was regarded as a cross-cutting prerequisite for other initiatives.

Synergies of funding also play an important part. This process has started with the Clean Steel Partnership (see Option FD10 - Creating synergies in EU level funding via the Clean Steel Partnership), which will increase the level of collaboration between different companies, resulting in more efficient use of funding. This will lead to increased success in decarbonisation efforts and lower the required funding budget thanks to synergies. The CSP and IPCEIs are seen as potentially important as a lever for the deployment of the technologies across Europe.

Conclusion