EletroMobilidade
Transição para a Eletromobilidade nas Cidades Brasileiras

FINAL SURVEY REPORT

IDENTIFYING THE LEVEL OF KNOWLEDGE AROUND ELECTROMOBILITY AT THE END OF THE PROJECT

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FEDERATIVE REPUBLIC OF BRAZIL

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WORLD BANK

Senior Transport Economist

Ana Waksberg Guerrini

Transport Specialist Consultant

Aline Lang

Social Development Specialist

Gabriela Lima de Paula

Environmental Specialist Consultant

Márcia Noura Paes

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General coordinators

Ana Waksberg Guerrini – World Bank

Fernando Araldi – MDR

Alejandro Muñoz Muñoz – IABS

Content elaboration

Roberto Torquato – Logit

Rodrigo Laboissiere – Logit

Fernando Fleury – Almeida & Fleury

Lilian R. G. Moreira Pires – Mackenzie Presbyterian University

World Bank technical contributions

Ana Waksberg Guerrini – Senior Transport Economist

Aline Lang – Transport Specialist Consultant

Gabriela Lima de Paula – Social Development Specialist

Márcia Noura Paes – Environmental Specialist Consultan

Technical review

Fernando Araldi – MDR

Adriana Souza – IABS

Jady Medeiros – IABS

Anna Carollina Palmeira – IABS

Collaborators

Ana Nassar – ITDP Brasil

Beatriz Gomes Rodrigues – ITDP Brasil

Clarisse Cunha Linke – ITDP Brasil

Pedro Bastos – ITDP Brasil

Bernardo Baranda – ITDP Mexico

Gonzalo Peon – ITDP Mexico

Fernando Howat – Logit

Wagner Colombini Martins – Logit

Spelling and grammar review (English)

InPauta Comunicação

Editorial coordination

Mariana Resende – InPauta Comunicação

Graphic design and diagramming

Esa Gomes Magalhães – InPauta Comunicação

Bruno Silva Bastos – InPauta Comunicação

Final Survey Report identifying the level of knowledge around electromobility at the end of the project. Ministry of Regional Development - MDR and World Bank (authors). Clean Technology Fund - CTF (funder) - Brasília, 2022.

ISBN: 978-65-87999-50-0

54p.

1. Electromobility 2. Final Report 3. Level of knowledge. I. Ministry of Regional Development - MDR II. World Bank III. Clean Technology Fund - CTF

UDC: 629.3

SUMMARY

LIST OF ACRONYMS

AMC	Fortaleza Municipal Transit and Citizenship Authority
ANEEL	National Electric Energy Agency
ANTT	National Land Transportation Agency
BHTRANS	Belo Horizonte Transport and Transit Company
CEMIG-SIM	Electricity Distribution Company of Belo Horizonte
CTF	Clean Technology Fund
EPE	Energy Research Company
ETUFOR	Fortaleza Urban Transport Company
IABS	Brazilian Institute of Development and Sustainability
IPLANFOR	Fortaleza Planning Institute
ITDP	Transport and Development Policy Institute
MBA	Master in Business Administration
MCTI	Ministry of Science, Technology and Innovations
MDR	Ministry of Regional Development
ME	Ministry of Economy
MINFRA	Ministry of Infrastructure
MME	Ministry of Mines and Energy
N/R	No Answer
SCSP	Municipal Secretary of Conservation and Public Services of Fortaleza
SEUMA	Municipal Secretary of Urbanism and Environment of Fortaleza
SMMA	Belo Horizonte Secretary of the Environment

INTRODUCTION

This report corresponds to **Product 3 - Final survey report on knowledge assessment about electromobility at the end of the project (B.1.b)**. It presents the comparative results of initial and final surveys to assess the level of knowledge of those involved in the project around Electromobility.

The initial survey aimed to establish the baseline of knowledge about electromobility, and, at the end of the project, it was applied again as a final survey to consistently assess the degree of impact on improving the knowledge of the various actors on Electromobility.

This document begins with a presentation of the research method in Chapter 1, previously validated by the Project Coordination team. Then, in Chapter 2, the participating respondents are characterized, and, finally, in Chapter 3, the compiled results are presented systematically, facilitating the reading of collected data around the level of knowledge about Electromobility in the initial and final stages of the project.

1.

RESEARCH METHOD

This Chapter presents the main elements of the research method and instrument. Furthermore, it indicates basic definitions around the structuring of data collection, bringing, aspects related to communication and the form of presentation adopted throughout the process.

1.1 OBJECTIVES

The main objectives of the research are:

- Identify the current level of knowledge about electromobility among government officials at the federal level and in the cities chosen for the pilot projects;
- Measure the level of enhanced knowledge in technical, financial, and institutional arrangements;

1.2 TARGET AUDIENCE

During a meeting with the Project Coordination, the selection of participants at the federal level occurred. First came suggestions of possible stakeholders based on a previous identification of actors. In addition, as other key actors appeared while applying the surveys, additional participants incremented the list.

At the **federal level**, the target audience was the Ministry of Regional Development (MDR) team involved throughout the development of the study.

Participants from other ministries and entities that are involved in the topic of Electromobility were also considered, such as:

- Ministry of Mines and Energy (MME)
- Ministry of Infrastructure (MINFRA)
- Ministry of Science, Technology and Innovations (MCTI)

- Ministry of Economy (ME)
- Regulatory agencies (ANTT e ANEEL)
- Energy Research Company (EPE)

For **cities** that received the pilot projects, the target audience was the public transport management bodies and other secretariats involved in the project.

Given that structure and governance vary considerably between cities, a more precise definition of participants was necessary as part of planning the implementation of pilot projects. Thus, the identification of stakeholders was carried out separately, with each of the cities presented in the following table.

Table 1 – Survey participants from each of the pilot cities

Belo Horizonte	Fortaleza
• Members from the Belo Horizonte Transport and Transit Company (BHTRANS) • Members from the Belo Horizonte Secretary of the Environment (SMMA) • Members of the City Council • Members from the Electricity Distribution Company of Belo Horizonte (CEMIG-SIM) • Members of the Public Transport Operators • Members of the Civil Society	• Members from the Fortaleza Urban Transport Company (ETUFOR) • Members from the National Land Transportation Agency (AMC) • Members from the Fortaleza Planning Institute (IPLANFOR) • Members from the Municipal Department of Conservation and Public Services (SCSP) • Members from the Municipal Secretary of Urbanism and Environment of Fortaleza (SEUMA)

Source: own elaboration.

1.3 USE OF ONLINE QUESTIONNAIRES

For carrying out the survey, an online research tool was used, with all the necessary features to apply the proposed method, both in the data collection stage and in the research management and export of results.

1.4 WAY OF CONTACT AND SURVEY COMMUNICATION

The IABS and the Ministry of Regional Development (MDR) sent the research form to the participants through the project's institutional email.

The email presented the technical cooperation project with the Ministry of Regional Development (MDR), giving the research an official character to encourage the participation of the identified actors.

1.5 INVITATION MODEL SENT BY EMAIL

The following table presents the model used to disseminate the initial research. Since many of the guests were unaware of the project, it was necessary to include an introduction.

Subject: *Transition to Electromobility in Brazilian Cities Project – Initial Research*

Dear, (guest name)

We kindly invite you to participate in the initial survey within the scope of the "Transition to Electromobility in Brazilian Cities Project," resulting from a partnership between the World Bank and the Brazilian Institute for Development and Sustainability (IABS) with the Ministry of Regional Development (MDR) as the primary beneficiary.

The project aims to directly benefit public entities at all levels of government, given that its objectives focus on technical, financial, and institutional improvement. Besides, it supports implementing and monitoring pilot projects in Brazilian cities for electromobility transition. Furthermore, it will indirectly benefit several sectors, such as government agencies (state and municipal), users of collective public transport, bus operators, funders of electromobility projects, industry, utilities, and infrastructure related to electromobility, as well as the entire local population.

In the current stage, the development of analysis, structuring, and implementation of electromobility in public buses in Brazil covers the market diagnosis, legal structure, mapping of opportunities/barriers, and definition of actions required for implementation, besides analyzes related to the feasibility and application of pilot projects in two Brazilian cities. For the development of this activity, the Logit Engenharia Consultiva Ltda Consortium and the Institute for Transportation and Development Policy (ITDP).

This project aims for sustainable and efficient development for urban mobility and greener and more livable cities in Brazil.

How to participate

Access the Link: https://form.jotform.com/211796380340657, and answer the 16 self-assessment questions by the day [date defined as the research progresses]. This survey will not take more than 15 minutes of your time.

See the introduction for further instructions.

Your participation will be anonymous and highly relevant to an assessment of knowledge at all project stages.

In case you have any questions, please feel free to contact the project team at electromobilidade@iabs.org.br

Sincerely,

Transition to Electromobility in Brazilian Cities Project Team

Source: own elaboration.

1.6 INTRODUCTION TO THE QUESTIONNAIRE

Clarifications and instructions were included on the first page of the questionnaire. It introduces information necessary to understand the project and the survey to the respondents. Besides, it clarifies the objectives and the privacy policy. They are presented in the table below,

Introduction

Dear participant,

This research is part of developing the Transition to Electromobility in Brazilian Cities Project, designed in two stages. The first one identifies the participants' knowledge level, and the second stage, applied at the project's end, assesses how much knowledge the project brought to the actors involved.

This survey can be answered quickly, in up to 15 minutes. The following are initial information, instructions, and questions.

The project:

- This project results from the commitment in the Grant Agreement TF0A9650 between the World Bank and the Brazilian Institute of Development and Sustainability (IABS), with financial resources from the CTF - Clean Technology Fund.

- The Ministry of Regional Development is the primary beneficiary, supporting its implementation and safeguards alignment with government policies.

Research objectives:

- Identify whether the current level of knowledge about electromobility is sufficient for the implementation of electric bus projects.
- Measure the percentage of knowledge developed during the project.

Instructions:

- Assess your level of knowledge on each of the topics presented in the questionnaire. Consider the topic indicated in the statement of each question and the brief description included to exemplify the related knowledge.
- Deadline: the survey must be answered by the day [date defined as the survey progresses].

Privacy:

- Individual responses will not be published or shared with other project participants. Only the technical team will have access to evaluate the answers and generate a report with evaluations, for example, eventually grouped by gender, by city, or by the questions' topics.

Source: own elaboration.

1.7 RESPONDENTS' PROFILE

At the initial meeting, consultants, the World Bank, IABS, and the Ministry of Regional Development, discussed the identification and characterization of survey respondents to allow the analysis of existing knowledge according to different grouping methods.

The resulting recommendation, aimed at reducing any possible embarrassment and encouraging participation, was not to identify participants by name but only according to the following information:

- Representing company/entity/city: information that allows mapping knowledge levels at the federal and city levels.
- Institutional role and education: complements the mapping of the current knowledge level.
- Gender Identity: allows comparisons by gender.

Although the survey is not nominal and the respondent does not identify, to avoid embarrassment in revealing a low level of knowledge on some topics, the communication of the survey included some recommendations, which are:

- Clearly explain the purpose of the study;
- Explain that it is not appropriate to overestimate the level of knowledge in the initial stage, as the main objective is to assess the improvement over the course of the Project;
- Treat responses as confidential, not sharing participants' answers or evaluating their answers in a disaggregated manner;

1.8 TOPICS SELECTION

The knowledge and topics covered in this project can be considered diverse, comprehensive, and multidisciplinary. This diversity comes from covering subjects like the electric bus market, technical aspects of vehicles and the necessary infrastructure, business models, financing, and concession contracts for the bus operation, among others.

The selection of topics to be included came from a broad list built on an extensive literature review to identify the main opportunities for electromobility projects, barriers, and aspects to be defined in the projects.

Subsequently, priority topics had to follow some premises and objectives:

- Generating a list of up to 6 main topics so the knowledge search is not too extensive;
- Prioritization of topics considered most relevant for successful project implementation;
- Consideration of aspects related to different stages of the projects, such as planning, implementation, and operation;
- Consideration of more technical aspects, such as different technologies, and more strategic aspects of public policy.

This process resulted in a priority list of topics presented below that originated the questions of the survey:

1. Technical and operational aspects

- Buses technology
- Charging technology

- Infrastructure needed
- Autonomy
- Battery useful life
- Other possible uses for batteries at the end of their useful life
- Interoperability and charging

2. Institutional aspects

- Policies and normative instruments
- Inter-institutionality

3. Financial aspects

- System costs
- Concession Model and Financing method
- Tax breaks

4. Sustainability

- Impact of the diesel bus in the city
- Socioenvironmental benefits

5. Gender and inclusion

- Gender and Inclusion

6. General knowledge

- Experiences with electric buses in Brazil and Latin America

1.9 QUESTIONS' TYPE

The questions type presented to the participants resulted from meetings between the consultants and the teams of the World Bank, IABS, and the Ministry of Regional Development.

Initially, there was a joint assessment of the advantages and disadvantages of using open (discursive) or multiple-choice questions.

Open-ended surveys could be more challenging to answer and require more time and dedication from participants, which could become a

barrier to broader participation. Furthermore, the greater subjectivity needed for assessing responses to open-ended questions could make it challenging to measure standardized and uniform knowledge of research participants at the beginning and end of the project. Thus, it came to the option of multiple-choice questions.

The final survey form for participants' knowledge was also discussed: through the presentation of questions testing technical knowledge directly or demanding a declaration from the participant about the level of knowledge on each topic, with a self-assessment form.

It was decided to adopt the self-assessment format with a brief description of the expected knowledge on each topic to level the respondents' understanding. This process aimed to obtain more answers and avoid constraints.

Thus, self-assessment questions were developed, with responses on a 5-level *Likert* scale, where level 1 corresponds to no knowledge, and level 5 corresponds to excellent. The meaning of "excellent level" was considered as: "the respondent considers himself able to discuss the topic, defend best practices and make decisions based on this knowledge."

Thus, the assessment of the level of knowledge considered used the following scale:

- 1 – None
- 2 – Reasonable
- 3 – Good
- 4 – Very good
- 5 – Excellent

1.10 QUESTION SELECTION

Questions followed the selection of topics and types. Besides, a piece of brief information related accompanied each question.

The following table shows the wording of each selected question. Next, in Annex I, the complete questionnaire is presented.

Table 2 – Knowledge Level Assessment Questions

N	Question
1	**How would you describe your knowledge about the impacts of diesel buses in cities?** Diesel vehicles emit atmospheric pollutants, including particulate matter (PM), formed by soot and other solid or liquid particles in suspension, which harm health by causing cardiorespiratory problems.
2	**How would you describe your knowledge about the socio-environmental benefits of electric buses?** The benefits of electric buses are the reduction of exhaust emissions, greenhouse gases, and local pollutants, improving the air quality of cities. There is also noise reduction.
3	**How would you describe your knowledge of electric bus implementations in Brazil and Latin America?** In Brazil, there are experiences with electric buses in cities like São Paulo, Campinas, and Brasília, among others, and in Latin America, there are also essential experiences.
4	**How would you describe your knowledge of electric bus technologies?** Some technologies such as trolleybuses, battery electric buses, and others rely on fuel cells and hybrids with combustion engines.
5	**How would you describe your knowledge about battery electric bus charging technologies?** There are buses with plug-in charging and opportunity charging using pantograph or induction, with different infrastructure needs and operational characteristics.
6	**How would you describe your knowledge about the infrastructure needed to charge buses?** The infrastructure includes, for example, the electricity distribution network and equipment for charging.
7	**How would you describe your knowledge about the autonomy of battery electric buses?** Buses' autonomy varies according to the capacity of the batteries, the operating conditions (for example, relief, climate, road priority, and the way of driving), the regenerative braking system, and the opportunity to recharge other factors.
8	**How would you describe your knowledge about the need to standardize chargers to ensure interoperability?** There are different standards for chargers between manufacturers, and the lack of definition of standards can make interoperability difficult.
9	**How would you describe your knowledge about battery life?** Battery life depends on the number of usage cycles, timing, and operating and charging conditions.

N	Question
10	**How would you describe your knowledge about the possibility of other uses of batteries after their useful life in the vehicle?** After the battery life in buses (when it loses 80% of its original capacity, for example), it may be feasible to give the battery a second use or recycle it.
11	**How would you describe your knowledge about the importance of cooperation between different actors for implementing systems with electric buses?** Several government actors (municipal, state, federal), industry, development banks, operating companies, bus manufacturers, and the electric energy sector.
11.1	**Do you know any examples of cooperation between these actors?** *[Optional descriptive question.]*
12	**How would you describe your knowledge about the costs of system implementation and operation of electric buses?** Electric buses generally have higher acquisition and infrastructure costs and may have lower operating costs.
13	**How would you describe your knowledge of business models and financing options?** Some models seek to reduce risks for the operator and the public power and guarantee resources for acquiring assets.
14	**How would you describe your knowledge of tax incentives as a tool to accelerate the adoption of cleaner bus technologies?** National clean technology tax incentive policies can accelerate the implementation of clean transport systems.
15	**How would you describe your knowledge of policies and normative instruments to stimulate the technological transition?** Public and regulatory policies can stimulate the transition to technology for cleaner transport.
16	**How would you describe your knowledge of the importance of considering topics such as gender and social inclusion in implementing electromobility projects?** Some population groups present vulnerabilities, such as women, the elderly, children during early childhood, people with reduced mobility, black and/or low-income people, and residents of the periphery, who are more exposed to air pollution, and are more restricted in the access to the city and urban mobility.

Source: own elaboration.

1.11 STAGES AND APPLICATION

A aplicação da pesquisa para medição nível de conhecimento ocorre em 3 etapas:

- Stage 1 – Initial Research - at the beginning of the project;
- Stage 2 – Initial Research - at the beginning of the pilot projects;
- Stage 3 - Final Research - at the end of the project.

In Step 1, the survey was only destined for representatives of the Federal Government. In Stage 2, the form included the representatives of the cities of Belo Horizonte and Fortaleza before starting the activities related to the pilot projects.

In Stage 3, which took place after the last participatory activities of the project, the questionnaire was re-applied to representatives of the Federal Government and the pilot cities.

2.

RESPONDENTS CHARACTERISTICS

The following paragraphs introduce information on identifying the respondents in the 3 Stages after the initial and final surveys with representatives of the Federal Government and the Cities.

The survey had 63 respondents in the initial and 40 in the final. In the Federal sphere and in Belo Horizonte, there was a reduction in the number of respondents, while in Fortaleza, there was an increase in participation.

The following items detail these numbers of participants according to institutions, gender, position, and training, always considering the division of results between representatives of the Federal Government, Belo Horizonte, and representatives of Fortaleza.

2.1 RESPONDENTS BY INSTITUTION

The following table and figure show the number of respondents by institutions for the Federal Government, Belo Horizonte, and Fortaleza.

At the Federal level, the most significant participation was from ANEEL, with three respondents in both the initial and final surveys. The other institutions had more considerable involvement in the initial but reduced participation in the final survey.

In Belo Horizonte, the largest participation came from representatives of BHTRANS and SMMA. In Fortaleza, ETUFOR and SCSP participants were highly represented. In the case of ETUFOR, respondents also increased between the initial and final surveys.

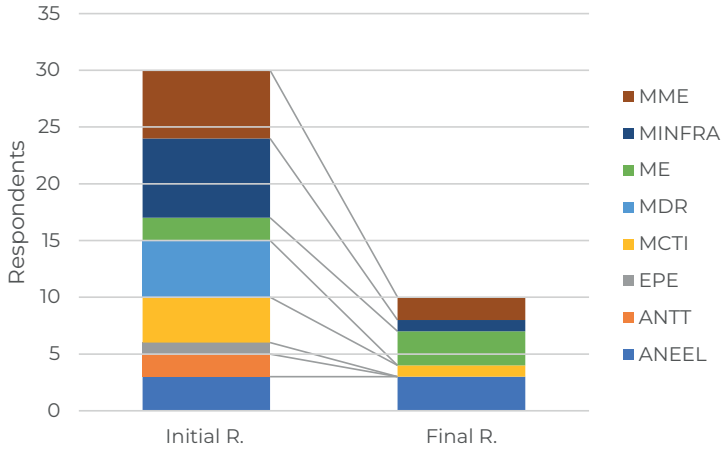
Table 3 – Respondents by institution

Institutions	Participants	
	Initial survey	Final survey
Federal Government	**30**	**10**
National Electric Energy Agency – ANEEL	3	3
National Land Transportation Agency – ANTT	2	0
Energy Research Company – EPE	1	0
Ministry of Science, Technology and Innovations - MCTI	4	1
Ministry of Regional Development – MDR	5	0
Ministry of Economy – ME	2	3
Ministry of Infrastructure – MINFRA	7	1
Ministry of Mines and Energy – MME	6	2
Belo Horizonte	**22**	**15**
Belo Horizonte Transport and Transit Company - BHTRANS	11	9
City Council	1	0
CEMIG-SIM – Electricity Distribution Company	2	0
Public Transport Operators	2	1
SMMA – Secretary of Environment	5	4
Civil Society	1	0
Unidentified Institution	0	1
Fortaleza	**11**	**15**
Fortaleza Municipal Transit and Citizenship Authority - AMC	0	1
Fortaleza Urban Transport Company - ETUFOR	9	10
Fortaleza Planning Institute - IPLANFOR	0	1
Municipal Department of Conservation and Public Services – SCSP	2	2
Municipal Secretary of Urbanism and Environment of Fortaleza - SEUMA	0	1

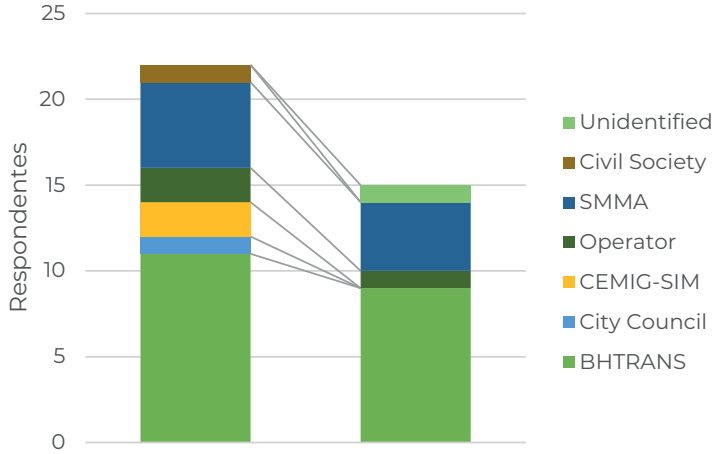
Source: own elaboration.

Figure 1 – Respondents by institution

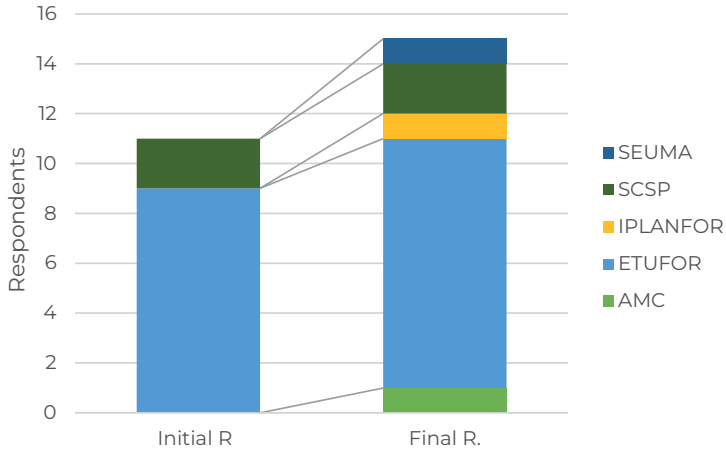
Federal Government Respondents



Respondents from Belo Horizonte



Respondents from Fortaleza



Source: own elaboration.

2.2 RESPONDENTS BY GENDER

One of the characterization questions was related to the gender with which the respondent identifies. The following table and figure show the number of respondents by gender.

The participation between genders in the research is not balanced. For example, in the Federal sphere, 80% of respondents identified as male, while in Belo Horizonte and Fortaleza cities, only 73%.

There is a maintenance of gender imbalance between the initial and final surveys. In the Federal Government and Belo Horizonte, there was also a reduction in women's participation, while in Fortaleza, there was a slight increase.

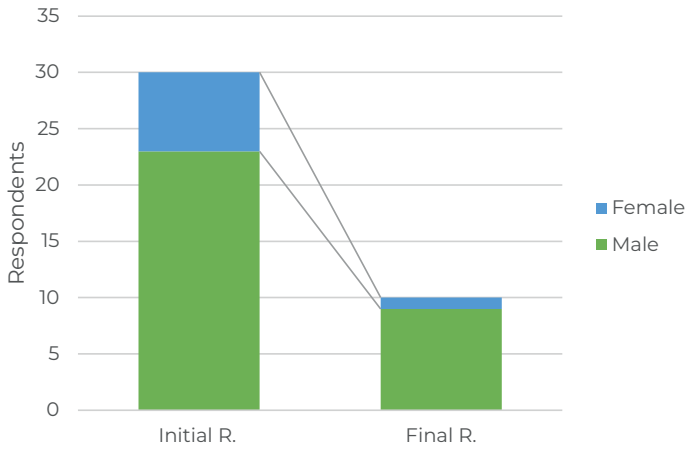
Table 4 – Respondents by gender

Gender	Participants	
	Initial Survey	Final Survey
Federal Government	**30**	**10**
Male	23	9
Female	7	1
Belo Horizonte	**22**	**15**
Male	16	11
Female	6	3
Not declared	0	1
Fortaleza	**11**	**15**
Male	9	10
Female	2	4
Not declared	0	1

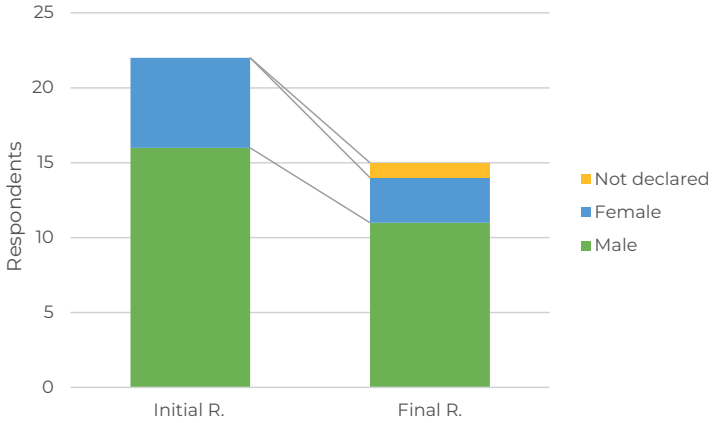
Source: own elaboration.

Figure 2 – Respondents by gender

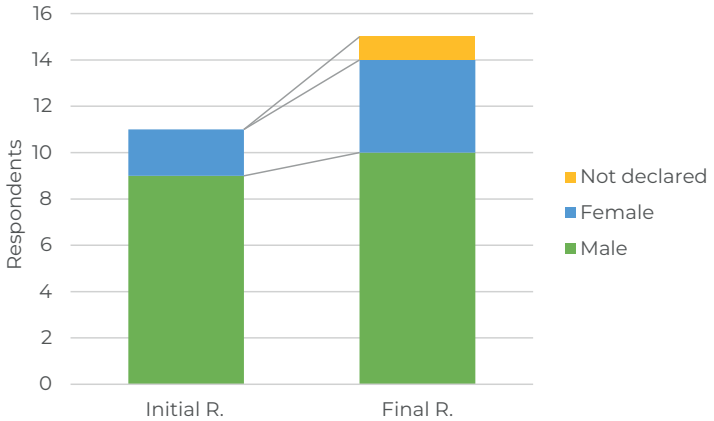
Federal Government Respondents



Respondents from Belo Horizonte



Respondents from Fortaleza



Source own elaboration.

2.3 RESPONDENTS BY JOB POSITION

Among the questions selected, one allowed the identification of participants' institutional roles. The following table and figure show the number of respondents by job position.

Table 5 – Respondents by job position

Job position	Participants	
	Initial Survey	Final Survey
Federal Government	**30**	**10**
Analyst	4	0
Advisor	2	0
Assistant	0	1
Head of Division	1	0
Coordinator	8	2
Director	5	3
Engineer	0	1
Specialist	3	3
Researcher	1	0
Under secretary	2	0
Technologist	2	0
No answer	2	0
Belo Horizonte	**22**	**15**
Analyst	3	7
Architect	2	1
Advisor	2	0
Director	1	1
Engineer	3	1
Manager	5	4
Not identified	1	0
Superintendent	1	0
Supervisor	4	1

Job position	Participants	
	Initial Survey	Final Survey
Fortaleza	**11**	**15**
Analyst	0	1
Architect	1	0
Advisor	1	2
Assistant	1	0
Head of Division	1	2
Chief of Operations	1	0
Coordinator	3	4
Manager	1	1
President	1	0
Executive Secretary	0	1
Superintendent	0	1
Technician	0	2
Vice president	1	1

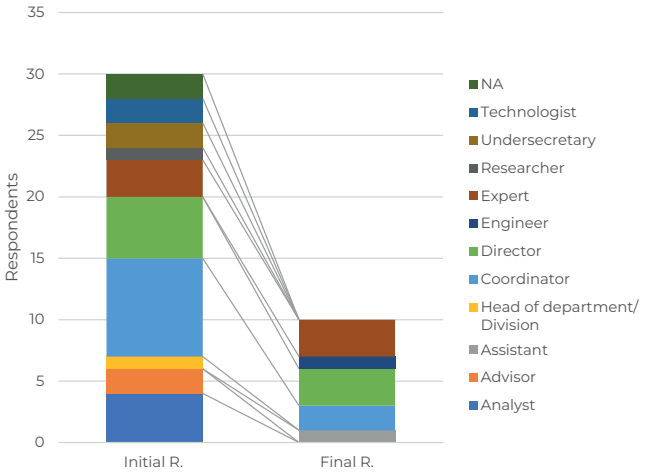
Source: own elaboration.

From the figure below, one can note there was a change in the participants' profile between the initial and final surveys, besides the reduction in number.

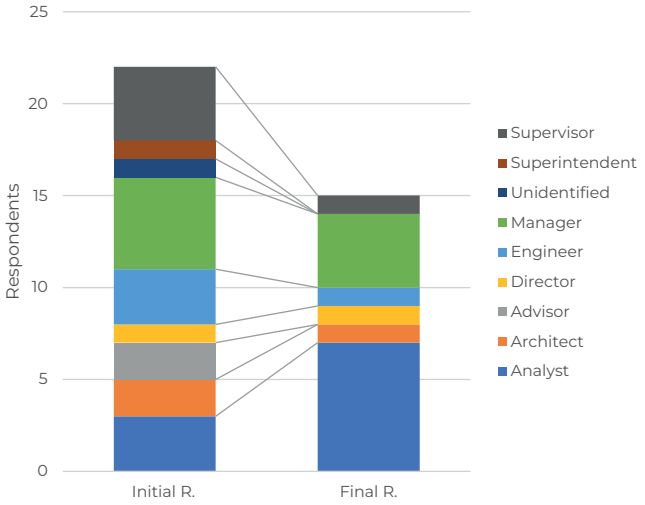
This profile change indicates that the final survey participants were not the same as the initial survey respondents. For example, in Belo Horizonte, there was an increase in the participation of Analysts, although the total number of respondents had decreased. In Fortaleza, responses from some positions were observed only in the initial survey, although absolute participation was higher in the final survey.

Figure 3 – Respondents by job position

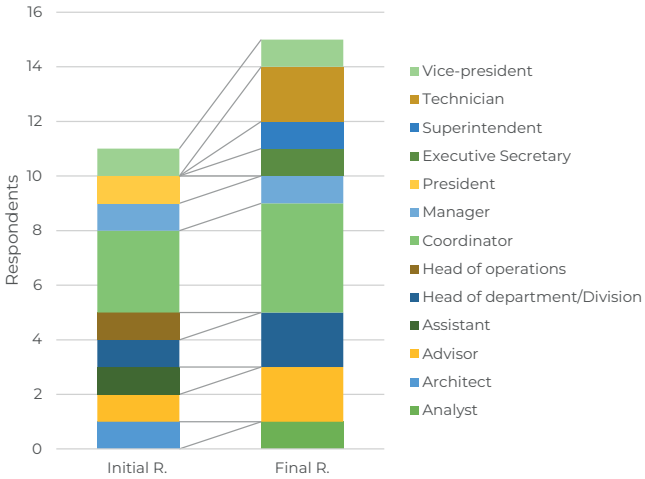
Federal Government Respondents



Respondents from Belo Horizonte



Respondents from Fortaleza



Source: own elaboration.

2.4 RESPONDENTS BY LEVEL OF EDUCATION

The questionnaire has characterization questions related to the training of respondents. Participants with postgraduate degrees were divided according to the type of education: specialization, master's (including MBAs), or Ph.D.

The following tables and figures present the distribution of respondents by level and area of training. It is possible to observe that 80% of the respondents from the Federal Government and 59% of the respondents from Belo Horizonte have a graduate degree. In Fortaleza, the percentage of postgraduates participating was 35%.

This perspective can also observe the same change in participants' profiles mentioned in the previous item.

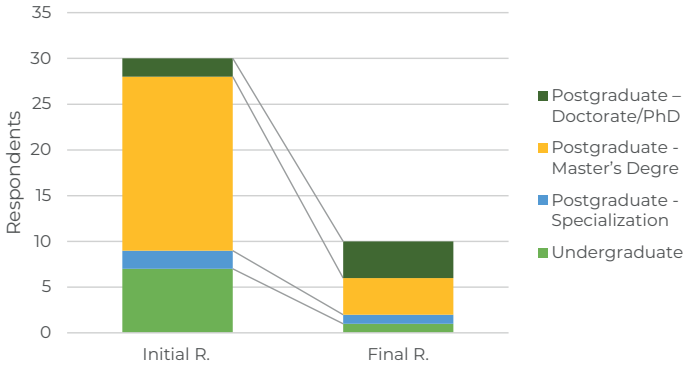
Table 6 – Respondents by level of education

Education level	Participants	
	Initial Survey	Final Survey
Federal Government	**30**	**10**
Higher education	7	1
Postgraduate – Specialization	2	1
Postgraduate - Master's	19	4
Postgraduate – Doctorate	2	4
Belo Horizonte	**22**	**15**
Higher education	9	6
Postgraduate - Specialization	6	5
Postgraduate - Master's	5	2
Postgraduate – Doctorate	2	2
Fortaleza	**11**	**15**
High school	1	0
Technical education	0	1
Higher education	6	9
Postgraduate - Specialization	3	5
Postgraduate - Master's	1	0

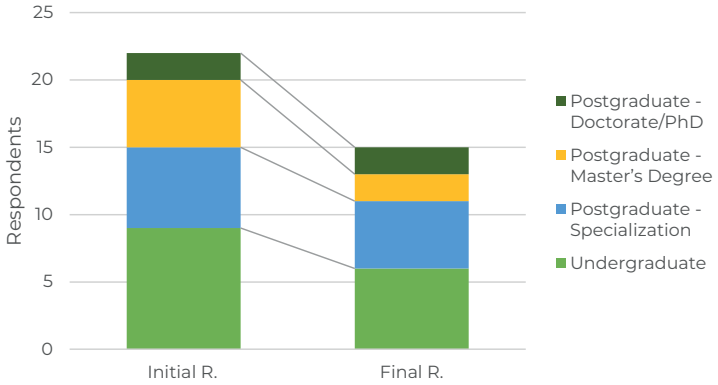
Source: own elaboration.

Figure 4: Respondents by education level

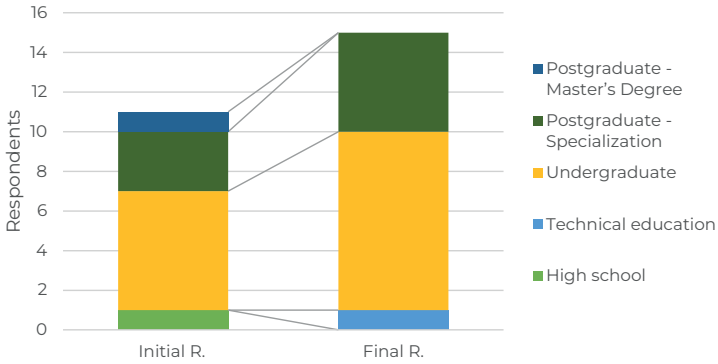
Federal Government Respondents



Respondents from Belo Horizonte



Respondents from Fortaleza



Source: own elaboration.

3.

COMPARATIVE ANALYSIS OF RESULTS

The knowledge level results for the different topics compose this chapter. The results are presented according to 2 cuts. The first one shows the total number of respondents from each sphere (Federal Government, Belo Horizonte, and Fortaleza) under the 16 topics considered. The second considers the response of all spheres but divides the results by gender.

The following graphs and tables only present the topic of the questions asked. However, they simplify the visualization and analysis. The first ANNEX - Questionnaire - at the end of this document presents the complete question form.

3.1 GENERAL CONSIDERATIONS

It is essential to highlight that, as described in Chapter 2 - Characterization of the respondents, there was a significant change in the characteristics of the research participants between the initial and final application. That is, there was a change in the people who participated in the two surveys, which may have directly impacted the consistency of the analyzed results.

This research protects the participants' personal information, which makes it impossible to link or verify the changes in the responses recorded. Therefore, it only is possible among those who participated in the two proposed moments.

Therefore, the change in profiles between the initial and final surveys may reflect final respondents with a knowledge profile different from those who participated in the initial survey.

In addition, since it is a qualitative research, it depends on the participants'

judgment about the level of existing knowledge on each topic. Thus, the results are subject to possible distortions of participants' perceptions of the topics presented.

It is possible that, by not knowing a specific topic in detail, an individual may judge that the level of knowledge around the subject after learning more about it is higher than it is. The increased expertise acquired around a topic can determine how much the person knows.

These issues must be considered when evaluating the results presented in the following items.

3.2 RESULTS BY TOPIC

This item presents the results for each topic included in the initial and final surveys. Initially, the general results are presented, referring to all participants. Next, we introduce the participants' cutouts from the spheres involved: the Federal Government and the pilot cities.

The results are presented through the frequencies of each of the possible levels of answers for the knowledge assessment: (1) None; (2) Reasonable; (3) Good; (4) Very good; and (5) Excellent.

Each level's frequency took into account the initial survey, from the beginning and the final survey, from the end of the project.

The results presentation is carried out through a figure and table for each topic with the total number of participants and the groupings with the Federal Government, Belo Horizonte, and Fortaleza respondents.

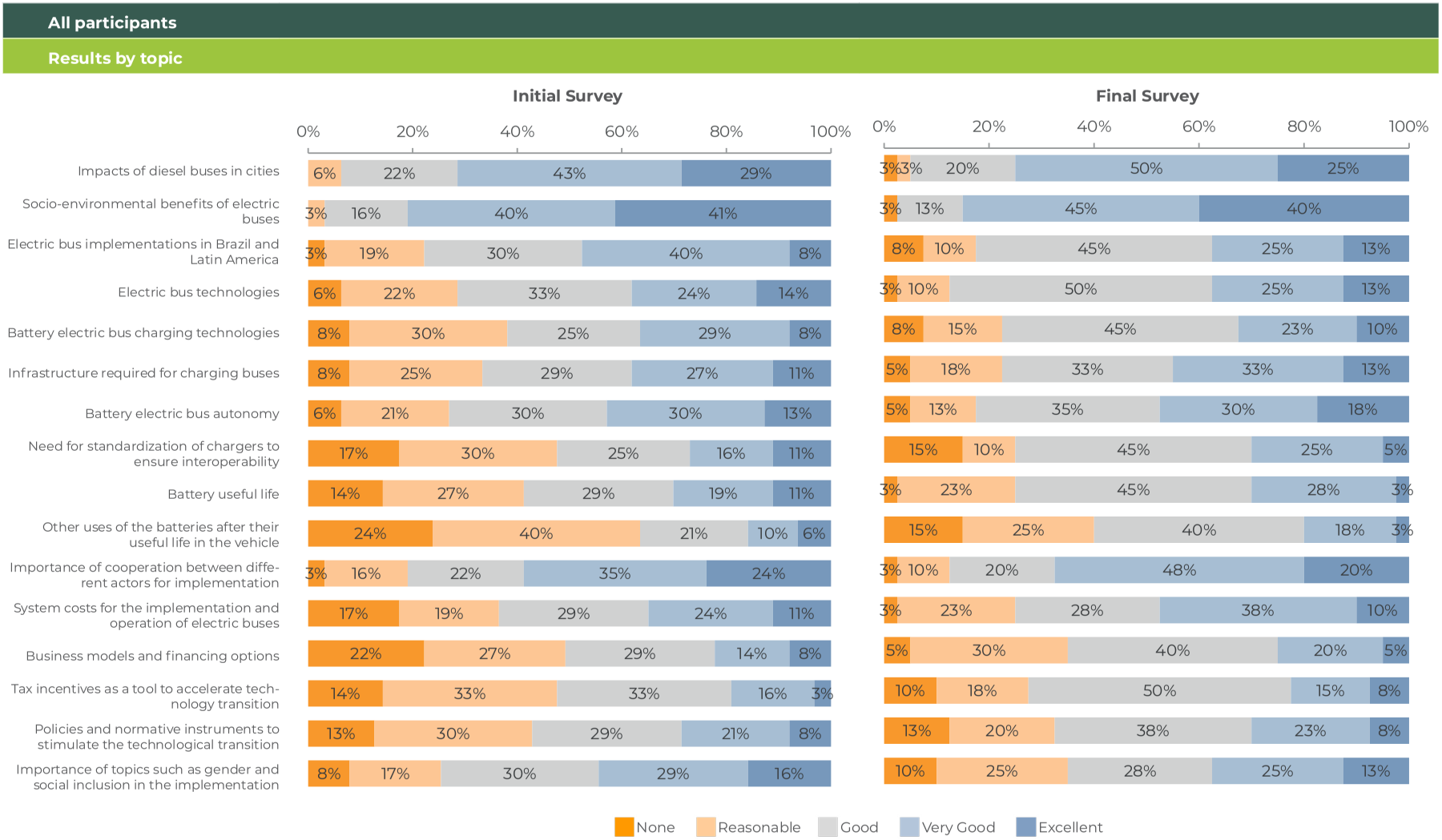
The figures contain two graphs. The distribution of responses obtained in the initial survey appears on the left, and the final survey on the right.

The tables present the numerical values represented in the graphs and the difference in frequencies observed for each level of knowledge between the initial and final research. Differences between frequencies were calculated by subtracting the frequency observed in the initial survey from the frequency observed in the final survey:

In the tables, positive differences are represented in shades of green and negative differences in shades of red to facilitate visualization.

After this figures and tables presentation, a brief discussion of the results is introduced, topic by topic.

Figure 5 – Results by topic – All participants



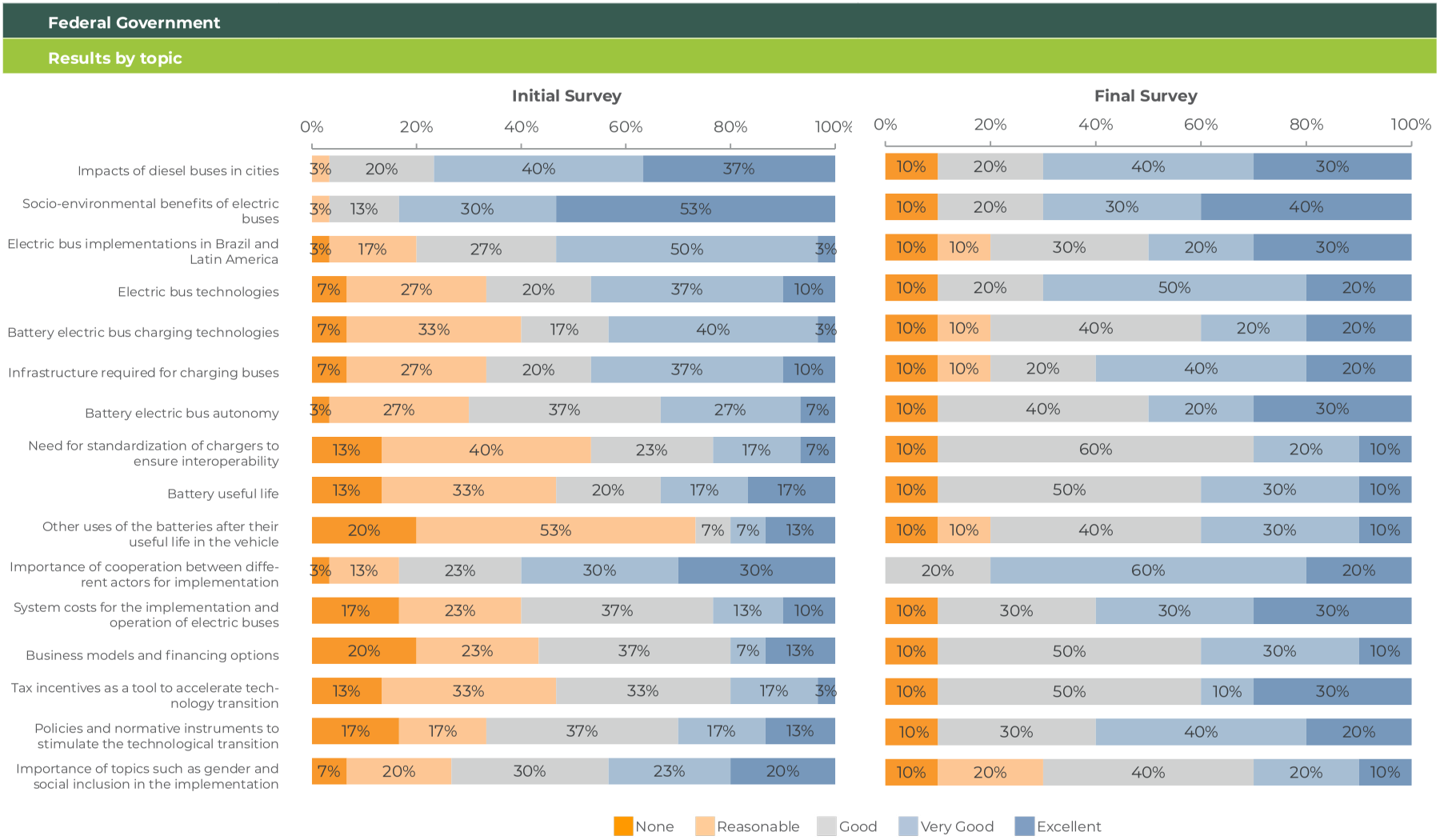
Source: own elaboration.

Table 7 – Results by topic – All Participants

	Initial Survey					Final Survey									
	None	Reasonable	Good	Very Good	Excellent	None		Reasonable		Good		Very Good		Excellent	
	Frequency					Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.
Impacts of diesel buses in cities	0,0%	8,3%	25,0%	37,5%	29,2%	3,3%	3,3%	3,3%	-5,0%	23,3%	-1,7%	50,0%	12,5%	20,0%	-9,2%
Socio-environmental benefits of electric buses	0,0%	2,1%	14,6%	39,6%	43,8%	3,3%	3,3%	0,0%	-2,1%	10,0%	-4,6%	50,0%	10,4%	36,7%	-7,1%
Electric bus implementations in Brazil and Latin America	2,1%	20,8%	29,2%	39,6%	8,3%	6,7%	4,6%	13,3%	-7,5%	36,7%	7,5%	26,7%	-12,9%	16,7%	8,3%
Electric bus technologies	2,1%	20,8%	35,4%	25,0%	16,7%	3,3%	1,3%	6,7%	-14,2%	46,7%	11,3%	30,0%	5,0%	13,3%	-3,3%
Battery electric bus charging technologies	6,3%	25,0%	29,2%	31,3%	8,3%	6,7%	0,4%	13,3%	-11,7%	40,0%	10,8%	26,7%	-4,6%	13,3%	5,0%
Infrastructure required for charging buses	4,2%	25,0%	29,2%	29,2%	12,5%	3,3%	-0,8%	13,3%	-11,7%	36,7%	7,5%	33,3%	4,2%	13,3%	0,8%
Battery electric bus autonomy	4,2%	20,8%	31,3%	29,2%	14,6%	6,7%	2,5%	10,0%	-10,8%	33,3%	2,1%	33,3%	4,2%	16,7%	2,1%
Need for standardization of chargers to ensure interoperability	14,6%	25,0%	29,2%	16,7%	14,6%	16,7%	2,1%	6,7%	-18,3%	43,3%	14,2%	26,7%	10,0%	6,7%	-7,9%
Battery useful life	8,3%	27,1%	29,2%	22,9%	12,5%	3,3%	-5,0%	20,0%	-7,1%	40,0%	10,8%	33,3%	10,4%	3,3%	-9,2%
Other uses of the batteries after their useful life in the vehicle	16,7%	39,6%	25,0%	10,4%	8,3%	13,3%	-3,3%	20,0%	-19,6%	40,0%	15,0%	23,3%	12,9%	3,3%	-5,0%
Importance of cooperation between different actors for implementation	2,1%	16,7%	25,0%	31,3%	25,0%	3,3%	1,3%	10,0%	-6,7%	20,0%	-5,0%	53,3%	22,1%	13,3%	-11,7%
System costs for the implementation and operation of electric buses	12,5%	22,9%	27,1%	27,1%	10,4%	3,3%	-9,2%	23,3%	0,4%	20,0%	-7,1%	40,0%	12,9%	13,3%	2,9%
Business models and financing options	16,7%	27,1%	29,2%	18,8%	8,3%	6,7%	-10,0%	26,7%	-0,4%	33,3%	4,2%	26,7%	7,9%	6,7%	-1,7%
Tax incentives as a tool to accelerate technology transition	12,5%	35,4%	31,3%	16,7%	4,2%	6,7%	-5,8%	16,7%	-18,8%	50,0%	18,8%	16,7%	0,0%	10,0%	5,8%
Policies and normative instruments to stimulate the technological transition	12,5%	33,3%	25,0%	20,8%	8,3%	10,0%	-2,5%	16,7%	-16,7%	40,0%	15,0%	26,7%	5,8%	6,7%	-1,7%
Importance of topics such as gender and social inclusion in the implementation	10,4%	16,7%	31,3%	25,0%	16,7%	13,3%	2,9%	26,7%	10,0%	26,7%	-4,6%	23,3%	-1,7%	10,0%	-6,7%

Source: own elaboration.

Figure 6 – Results by topic – Federal Government



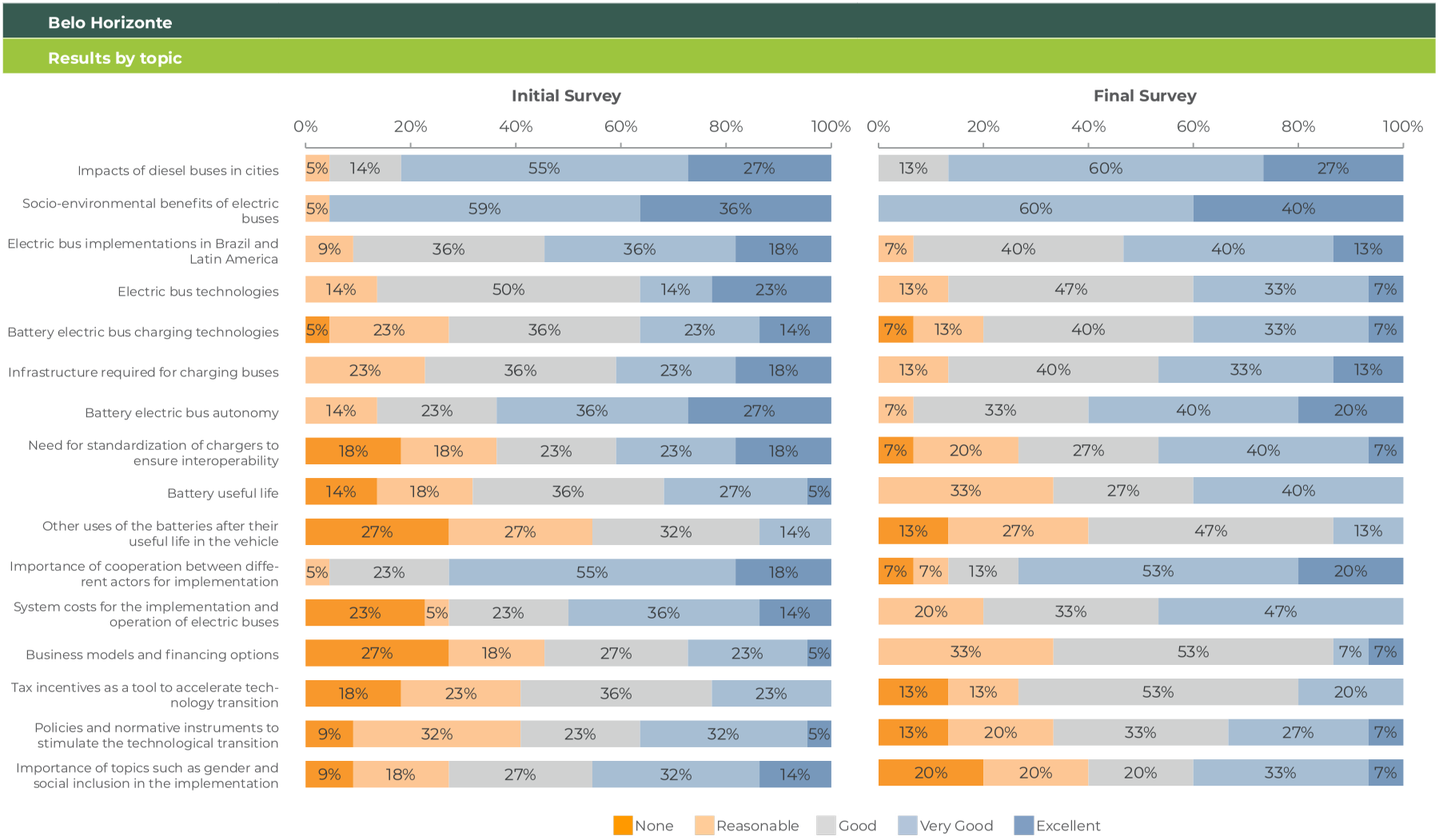
Source: own elaboration

Table 8 – Results by topic – Federal Government

	Initial Survey					Final Survey									
	None	Reasonable	Good	Very Good	Excellent	None		Reasonable		Good		Very Good		Excellent	
	Frequency					Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.
Impacts of diesel buses in cities	0,0%	3,3%	20,0%	40,0%	36,7%	10,0%	10,0%	0,0%	-3,3%	20,0%	0,0%	40,0%	0,0%	30,0%	-6,7%
Socio-environmental benefits of electric buses	0,0%	3,3%	13,3%	30,0%	53,3%	10,0%	10,0%	0,0%	-3,3%	20,0%	6,7%	30,0%	0,0%	40,0%	-13,3%
Electric bus implementations in Brazil and Latin America	3,3%	16,7%	26,7%	50,0%	3,3%	10,0%	6,7%	10,0%	-6,7%	30,0%	3,3%	20,0%	-30,0%	30,0%	26,7%
Electric bus technologies	6,7%	26,7%	20,0%	36,7%	10,0%	10,0%	3,3%	0,0%	-26,7%	20,0%	0,0%	50,0%	13,3%	20,0%	10,0%
Battery electric bus charging technologies	6,7%	33,3%	16,7%	40,0%	3,3%	10,0%	3,3%	10,0%	-23,3%	40,0%	23,3%	20,0%	-20,0%	20,0%	16,7%
Infrastructure required for charging buses	6,7%	26,7%	20,0%	36,7%	10,0%	10,0%	3,3%	10,0%	-16,7%	20,0%	0,0%	40,0%	3,3%	20,0%	10,0%
Battery electric bus autonomy	3,3%	26,7%	36,7%	26,7%	6,7%	10,0%	6,7%	0,0%	-26,7%	40,0%	3,3%	20,0%	-6,7%	30,0%	23,3%
Need for standardization of chargers to ensure interoperability	13,3%	40,0%	23,3%	16,7%	6,7%	10,0%	-3,3%	0,0%	-40,0%	60,0%	36,7%	20,0%	3,3%	10,0%	3,3%
Battery useful life	13,3%	33,3%	20,0%	16,7%	16,7%	10,0%	-3,3%	0,0%	-33,3%	50,0%	30,0%	30,0%	13,3%	10,0%	-6,7%
Other uses of the batteries after their useful life in the vehicle	20,0%	53,3%	6,7%	6,7%	13,3%	10,0%	-10,0%	10,0%	-43,3%	40,0%	33,3%	30,0%	23,3%	10,0%	-3,3%
Importance of cooperation between different actors for implementation	3,3%	13,3%	23,3%	30,0%	30,0%	0,0%	-3,3%	0,0%	-13,3%	20,0%	-3,3%	60,0%	30,0%	20,0%	-10,0%
System costs for the implementation and operation of electric buses	16,7%	23,3%	36,7%	13,3%	10,0%	10,0%	-6,7%	0,0%	-23,3%	30,0%	-6,7%	30,0%	16,7%	30,0%	20,0%
Business models and financing options	20,0%	23,3%	36,7%	6,7%	13,3%	10,0%	-10,0%	0,0%	-23,3%	50,0%	13,3%	30,0%	23,3%	10,0%	-3,3%
Tax incentives as a tool to accelerate technology transition	13,3%	33,3%	33,3%	16,7%	3,3%	10,0%	-3,3%	0,0%	-33,3%	50,0%	16,7%	10,0%	-6,7%	30,0%	26,7%
Policies and normative instruments to stimulate the technological transition	16,7%	16,7%	36,7%	16,7%	13,3%	10,0%	-6,7%	0,0%	-16,7%	30,0%	-6,7%	40,0%	23,3%	20,0%	6,7%
Importance of topics such as gender and social inclusion in the implementation	6,7%	20,0%	30,0%	23,3%	20,0%	10,0%	3,3%	20,0%	0,0%	40,0%	10,0%	20,0%	-3,3%	10,0%	-10,0%

Source: own elaboration.

Figure 7 – Results by topic – Belo Horizonte



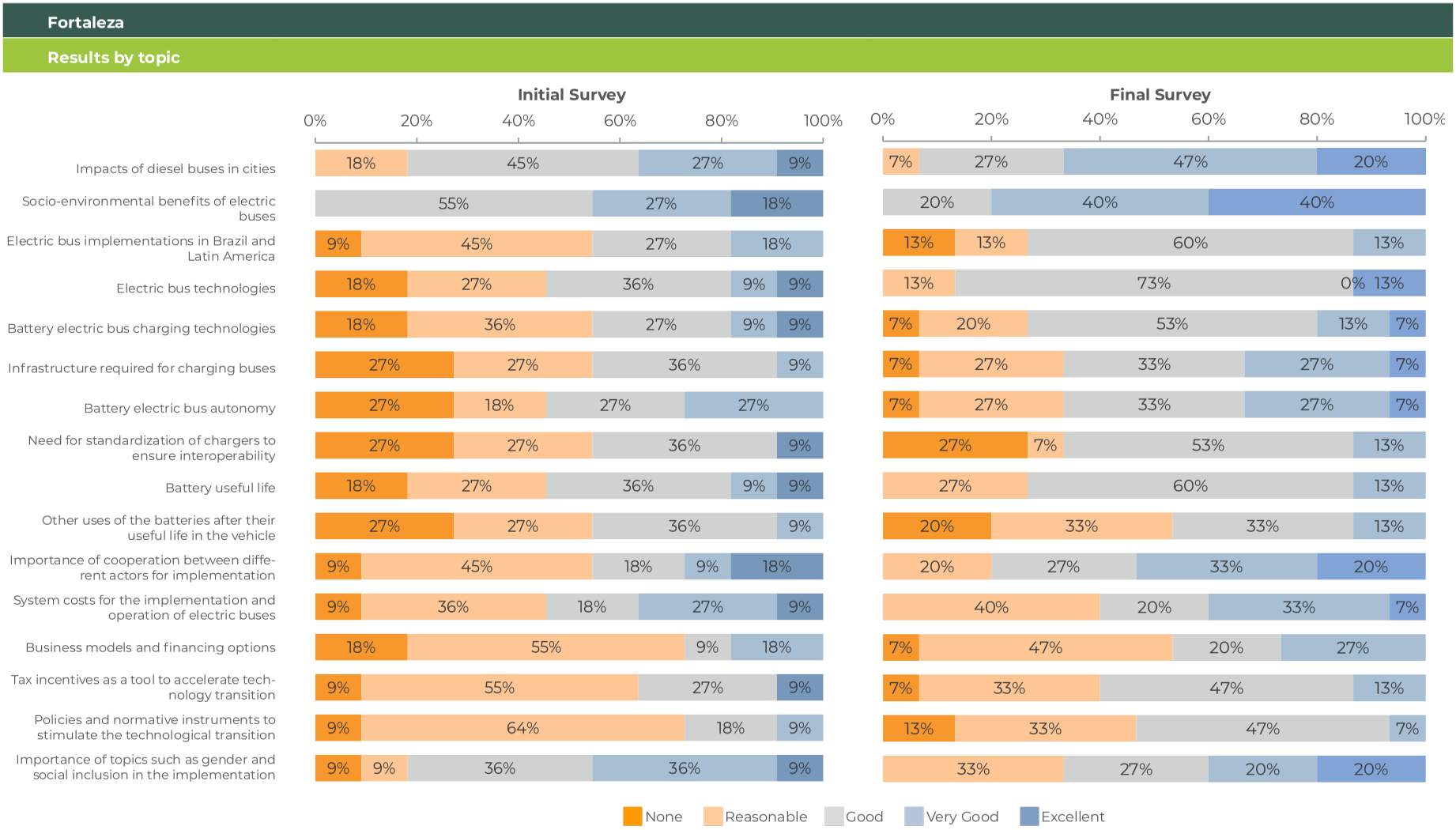
Source: own elaboration.

Table 9 – Results by topic – Belo Horizonte

	Initial Survey					Final Survey									
	Excellent	None	Reasonable	Good	Very Good	Excellent		Razoável		Bom		Muito bom		Excelente	
	Frequency					Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.
Impacts of diesel buses in cities	0,0%	4,5%	13,6%	54,5%	27,3%	0,0%	0,0%	0,0%	-4,5%	13,3%	-0,3%	60,0%	5,5%	26,7%	-0,6%
Socio-environmental benefits of electric buses	0,0%	4,5%	0,0%	59,1%	36,4%	0,0%	0,0%	0,0%	-4,5%	0,0%	0,0%	60,0%	0,9%	40,0%	3,6%
Electric bus implementations in Brazil and Latin America	0,0%	9,1%	36,4%	36,4%	18,2%	0,0%	0,0%	6,7%	-2,4%	40,0%	3,6%	40,0%	3,6%	13,3%	-4,8%
Electric bus technologies	0,0%	13,6%	50,0%	13,6%	22,7%	0,0%	0,0%	13,3%	-0,3%	46,7%	-3,3%	33,3%	19,7%	6,7%	-16,1%
Battery electric bus charging technologies	4,5%	22,7%	36,4%	22,7%	13,6%	6,7%	2,1%	13,3%	-9,4%	40,0%	3,6%	33,3%	10,6%	6,7%	-7,0%
Infrastructure required for charging buses	0,0%	22,7%	36,4%	22,7%	18,2%	0,0%	0,0%	13,3%	-9,4%	40,0%	3,6%	33,3%	10,6%	13,3%	-4,8%
Battery electric bus autonomy	0,0%	13,6%	22,7%	36,4%	27,3%	0,0%	0,0%	6,7%	-7,0%	33,3%	10,6%	40,0%	3,6%	20,0%	-7,3%
Need for standardization of chargers to ensure interoperability	18,2%	18,2%	22,7%	22,7%	18,2%	6,7%	-11,5%	20,0%	1,8%	26,7%	3,9%	40,0%	17,3%	6,7%	-11,5%
Battery useful life	13,6%	18,2%	36,4%	27,3%	4,5%	0,0%	-13,6%	33,3%	15,2%	26,7%	-9,7%	40,0%	12,7%	0,0%	-4,5%
Other uses of the batteries after their useful life in the vehicle	27,3%	27,3%	31,8%	13,6%	0,0%	13,3%	-13,9%	26,7%	-0,6%	46,7%	14,8%	13,3%	-0,3%	0,0%	0,0%
Importance of cooperation between different actors for implementation	0,0%	4,5%	22,7%	54,5%	18,2%	6,7%	6,7%	6,7%	2,1%	13,3%	-9,4%	53,3%	-1,2%	20,0%	1,8%
System costs for the implementation and operation of electric buses	22,7%	4,5%	22,7%	36,4%	13,6%	0,0%	-22,7%	20,0%	15,5%	33,3%	10,6%	46,7%	10,3%	0,0%	-13,6%
Business models and financing options	27,3%	18,2%	27,3%	22,7%	4,5%	0,0%	-27,3%	33,3%	15,2%	53,3%	26,1%	6,7%	-16,1%	6,7%	2,1%
Tax incentives as a tool to accelerate technology transition	18,2%	22,7%	36,4%	22,7%	0,0%	13,3%	-4,8%	13,3%	-9,4%	53,3%	17,0%	20,0%	-2,7%	0,0%	0,0%
Políticas e instrumentos normativos para estimular a transição tecnológica	9,1%	31,8%	22,7%	31,8%	4,5%	13,3%	4,2%	20,0%	-11,8%	33,3%	10,6%	26,7%	-5,2%	6,7%	2,1%
Importância de temas como gênero e inclusão social na implementação	9,1%	18,2%	27,3%	31,8%	13,6%	20,0%	10,9%	20,0%	1,8%	20,0%	-7,3%	33,3%	1,5%	6,7%	-7,0%

Source: own elaboration.

Figure 8 – Results by topic – Fortaleza



Source: own elaboration.

Table 10 – Results by topic – Fortaleza

	Initial Survey					Final Survey									
	None	Reasonable	Good	Very Good	Excellent	None		Reasonable		Good		Very Good		Excellent	
	Frequency					Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.
Impacts of diesel buses in cities	0,0%	18,2%	45,5%	27,3%	9,1%	0,0%	0,0%	6,7%	-11,5%	26,7%	-18,8%	46,7%	19,4%	20,0%	10,9%
Socio-environmental benefits of electric buses	0,0%	0,0%	54,5%	27,3%	18,2%	0,0%	0,0%	0,0%	0,0%	20,0%	-34,5%	40,0%	12,7%	40,0%	21,8%
Electric bus implementations in Brazil and Latin America	9,1%	45,5%	27,3%	18,2%	0,0%	13,3%	4,2%	13,3%	-32,1%	60,0%	32,7%	13,3%	-4,8%	0,0%	0,0%
Electric bus technologies	18,2%	27,3%	36,4%	9,1%	9,1%	0,0%	-18,2%	13,3%	-13,9%	73,3%	37,0%	0,0%	-9,1%	13,3%	4,2%
Battery electric bus charging technologies	18,2%	36,4%	27,3%	9,1%	9,1%	6,7%	-11,5%	20,0%	-16,4%	53,3%	26,1%	13,3%	4,2%	6,7%	-2,4%
Infrastructure required for charging buses	27,3%	27,3%	36,4%	9,1%	0,0%	6,7%	-20,6%	26,7%	-0,6%	33,3%	-3,0%	26,7%	17,6%	6,7%	6,7%
Battery electric bus autonomy	27,3%	18,2%	27,3%	27,3%	0,0%	6,7%	-20,6%	26,7%	8,5%	33,3%	6,1%	26,7%	-0,6%	6,7%	6,7%
Need for standardization of chargers to ensure interoperability	27,3%	27,3%	36,4%	0,0%	9,1%	26,7%	-0,6%	6,7%	-20,6%	53,3%	17,0%	13,3%	13,3%	0,0%	-9,1%
Battery useful life	18,2%	27,3%	36,4%	9,1%	9,1%	0,0%	-18,2%	26,7%	-0,6%	60,0%	23,6%	13,3%	4,2%	0,0%	-9,1%
Other uses of the batteries after their useful life in the vehicle	27,3%	27,3%	36,4%	9,1%	0,0%	20,0%	-7,3%	33,3%	6,1%	33,3%	-3,0%	13,3%	4,2%	0,0%	0,0%
Importance of cooperation between different actors for implementation	9,1%	45,5%	18,2%	9,1%	18,2%	0,0%	-9,1%	20,0%	-25,5%	26,7%	8,5%	33,3%	24,2%	20,0%	1,8%
System costs for the implementation and operation of electric buses	9,1%	36,4%	18,2%	27,3%	9,1%	0,0%	-9,1%	40,0%	3,6%	20,0%	1,8%	33,3%	6,1%	6,7%	-2,4%
Business models and financing options	18,2%	54,5%	9,1%	18,2%	0,0%	6,7%	-11,5%	46,7%	-7,9%	20,0%	10,9%	26,7%	8,5%	0,0%	0,0%
Tax incentives as a tool to accelerate technology transition	9,1%	54,5%	27,3%	0,0%	9,1%	6,7%	-2,4%	33,3%	-21,2%	46,7%	19,4%	13,3%	13,3%	0,0%	-9,1%
Policies and normative instruments to stimulate the technological transition	9,1%	63,6%	18,2%	9,1%	0,0%	13,3%	4,2%	33,3%	-30,3%	46,7%	28,5%	6,7%	-2,4%	0,0%	0,0%
Importância de temas como gênero e inclusão social na implementação	9,1%	9,1%	36,4%	36,4%	9,1%	0,0%	-9,1%	33,3%	24,2%	26,7%	-9,7%	20,0%	-16,4%	20,0%	10,9%

Source: own elaboration.

3.2.1 Impacts of diesel buses in cities

In the initial survey, the participants already indicated good topic knowledge. Of all the participants, about 94% stated that they had a level of expertise from “Good” to “Excellent.” This same percentage remained during the final survey, but with a higher frequency of responses at the “Very good” level and slightly lower at the “Good” and “Excellent” levels.

For Federal Government participants, these levels changed from 97% to 90% in Belo Horizonte, 95% to 100%, and in Fortaleza, 82% to 93%.

One can observe the most significant evolution in this last group. “Excellent” level frequency increased from 9% to 20%, and “Reasonable” level frequency decreased from 18% to 7%.

3.2.2 Socio-environmental benefits of electric buses

Regarding socio-environmental benefits, the pooled analysis of all participants also shows there was already a declared higher level of knowledge before the start of the project. Around 94% indicated having a level of knowledge from “Good” to “Excellent,” a percentage that remained in the final survey.

The cut of participants from the Federal Government shows that the frequencies’ sum mentioned above changed from 97% to 90%. On the contrary, in Belo Horizonte, there was an increase from 95% to 100%.

In Fortaleza, the two highest levels accounted for 45% of responses in the initial survey, increasing to 80% in the final survey.

3.2.3 Implementations of electric buses in Brazil and Latin America

For the third topic, there was a reduction in the frequencies of general responses for the two lowest levels, “None” and “Reasonable,” from 22% to 18%. The highest level, “Excellent,” goes from 8% in the initial stage to 13% in the final.

Among Federal Government participants, responses to the “Excellent” level ranged from 3% to 30%. In Belo Horizonte, the increase recorded was related to the “Good” and “Very good” levels, ranging from 36% to 40%%.

In Fortaleza, considering the two upper levels, there was an increase in response frequencies from about 45% in the initial survey to 73% in the final survey.

3.2.4 Electric bus technologies

The response frequency from all participants for the top three levels increased from 72% in the initial survey to 87% in the final survey. The “Good” level showed the most significant increase, ranging from 33% to 50%.

Among Federal Government participants, these levels increased from 67% in the initial survey to 90% in the final survey. On the contrary, in Belo Horizonte, considering the sum of the three levels, there was almost no change and, in Fortaleza, the lowest level, "None," had its response frequency reduced from 18% to 0%, and the "Reasonable" level also decreased from 27% to 13%.

3.2.5 Battery electric bus charging technologies

When considering the three upper levels, the frequencies of responses from all participants increased from 52% in the initial survey to 77% in the final survey. The level that showed the higher frequency increase was "Good," ranging from 25% to 45%.

Among Federal Government participants, the "Good" level decreased from 33% to 10%, and the "Excellent" level increased from 3% to 20%. In Belo Horizonte, the "Reasonable" level frequency decreased from 23% to 13%, while "Good" and "Very good" levels increased from 36% and 23% in the initial survey to 40% and 33% in the final survey.

In Fortaleza, the lowest level, "None," had its response frequency reduced from 18% to 7%, and "Reasonable" decreased from 36% to 20%.

3.2.6 Infrastructure required for charging buses

Regarding the infrastructure necessary for charging electric buses, considering the three highest levels, there was an increase in the frequencies of responses from 67% to 79%.

In the Federal Government, the frequency of the "Excellent" level has doubled, increasing from 10% to 20%. On the other hand, Belo Horizonte did not register responses to the "None" level in any survey, and the "Reasonable" level decreased from 23% in the initial survey to 13% in the final survey.

In Fortaleza, the topic is among those who received the highest response frequency at the "None" level in the initial survey, 27%. In the final survey, the value dropped to 7%. The highest level, "Excellent," with no responses in the initial survey, was recorded by 7% of respondents in the final survey.

3.2.7 Autonomy of battery electric buses

The frequencies of "None" or "Reasonable" responses to the topic decreased from 27% to 18% between the initial and final surveys. Among Federal Government respondents, this figure dropped from 30% to 10% in Belo Horizonte, 14% to 7%, and Fortaleza, 45% to 34%.

It is essential to highlight that the topic was central to all the technical discussions and still appears to be a critical topic within the Transition to Electromobility discussions. The technology is still developing, and local applications are just beginning. The available knowledge on the topic is

expected to grow significantly from the monitoring and expansion of electric bus projects in Brazil and Latin America during the following years.

3.2.8 Need for standardization of chargers to ensure interoperability

Among all respondents, the “Good” level demonstrated a frequency increase, from 25% to 45%, while the “Reasonable” level decreased from 30% to 10%.

Among Federal Government participants, when considering the two lower levels, there was a reduction in the frequency of responses from 53% in the initial survey to 10% in the final survey. In Belo Horizonte, for the same levels, the frequencies recorded went from 36% to 27%, and in Fortaleza, from 54% to 34%.

3.2.9 Battery useful life

The results on the battery life topic were similar to the previous one. Among all respondents, the “Good” level frequency increased, from 29% to 45%, while the “None” level decreased from 14% to 3%.

Among Federal Government participants, when considering the two lower levels, there was a reduction in the frequency of responses from 46% in the initial survey to 10% in the final survey. In Belo Horizonte, the frequency registered for the “None” level was 14% to 0%, and in Fortaleza 18% to 0%.

3.2.10 Other uses for batteries after their useful life in the vehicle

This topic reached 24% of “None” among all respondents, the highest frequency for the initial survey, and 15% in the final survey.

Among Federal Government participants, the sum of the two lower levels stood out in the initial survey with 73% of the responses and reached 20% in the final survey. A decrease was also observed among participants from Belo Horizonte, from 54% in the initial survey to 40%. Fortaleza’s “None” level dropped from 27% to 20%. The “Excellent” level increased from 9% to 13%.

3.2.11 Importance of cooperation between different actors for implementation

In the initial survey, the participants indicated they had good knowledge of the subject. Of all participants, about 81% stated that they had a level of knowledge from “Good” to “Excellent.” This same percentage increased to 87% in the final survey.

Among Federal Government participants, the frequencies of these levels changed from 84% to 100%, and in Fortaleza, from 46% to 80%. In Belo

Horizonte, this sum recorded a decrease, but the frequencies of "Excellent" level responses increased from 18% to 20%.

Thus, it is essential to consider the observations recorded at the beginning of this chapter regarding perception variation in the level of knowledge.

3.2.12 System costs for the implementation and operation of electric buses

Among all respondents, the "Very good" level increased, from 24% to 38%, while the "None" level decreased from 17% to 3%.

Among Federal Government participants, when considering the two lower levels, there was a reduction in the frequency of responses from 40% in the initial survey to 10% in the final survey. In Belo Horizonte, the frequencies recorded for the "None" level went from 23% to 0%, and in Fortaleza, from 9% to 0%.

3.2.13 Business models and financing options

Business modeling and financing was another topic that stood out during the technical discussions regarding the development of pilot projects. Among all participants, the topic registered the highest frequency of responses with "None" in the initial survey when it reached 22%. However, this frequency reached only 5% in the final survey.

Among Federal Government participants, when considering the two lower levels, frequencies reduced from 43% in the initial survey to 10% in the final survey.

In Belo Horizonte, the "None" level recorded 27% of responses in the initial survey and was not recorded in the final survey. In Fortaleza, there was also a reduction to the "None" level, from 18% to 7%.

3.2.14 Tax incentives as a tool to accelerate the technological transition

The topic registered a reduction in the frequencies of general responses to the two lower levels, "None" and "Reasonable." In the initial survey, they appeared in 47% of the answers against 28% in the final survey. In the Federal Government, the reduction was from 46% to 10%, Belo Horizonte from 41% to 26%, and Fortaleza from 64% to 40%.

3.2.15 Policies and normative instruments to stimulate the technological transition

For this topic, all answers' frequency under the two lowest levels, "None" and "Reasonable," decreased from about 43% to 33%. On the other hand, the "Very good" level increased from 21% in the initial survey to 23% in the final survey.

Among Federal Government participants, the responses at the “Excellent” level ranged from 13% to 20%. In Belo Horizonte, “Good” and “Excellent” levels increased, ranging from 23% and 5% to 33% and 7%.

In Fortaleza, considering the two lower levels, there was a reduction in the frequency of responses from 73% in the initial survey to 46% in the final survey.

3.2.16 Importance of topics such as gender and social inclusion in the implementation

The topic on the importance of gender issues was different than expected. All participants’ responses under the two lower levels increased between the initial and final surveys, from 25% to 35%.

Among Federal Government participants, the increase was less significant. It went from 27% to 30%. In Belo Horizonte, there was an increase from 27% to 40%, and in Fortaleza, 18% to 33%. In the case of Fortaleza, the response record at the “None” level decreased from 9% to 0%.

Given the general comments presented at the beginning of this chapter, it is also essential to consider the perception evolution of the knowledge level between the two surveys.

3.3 RESULTS BY GENDER

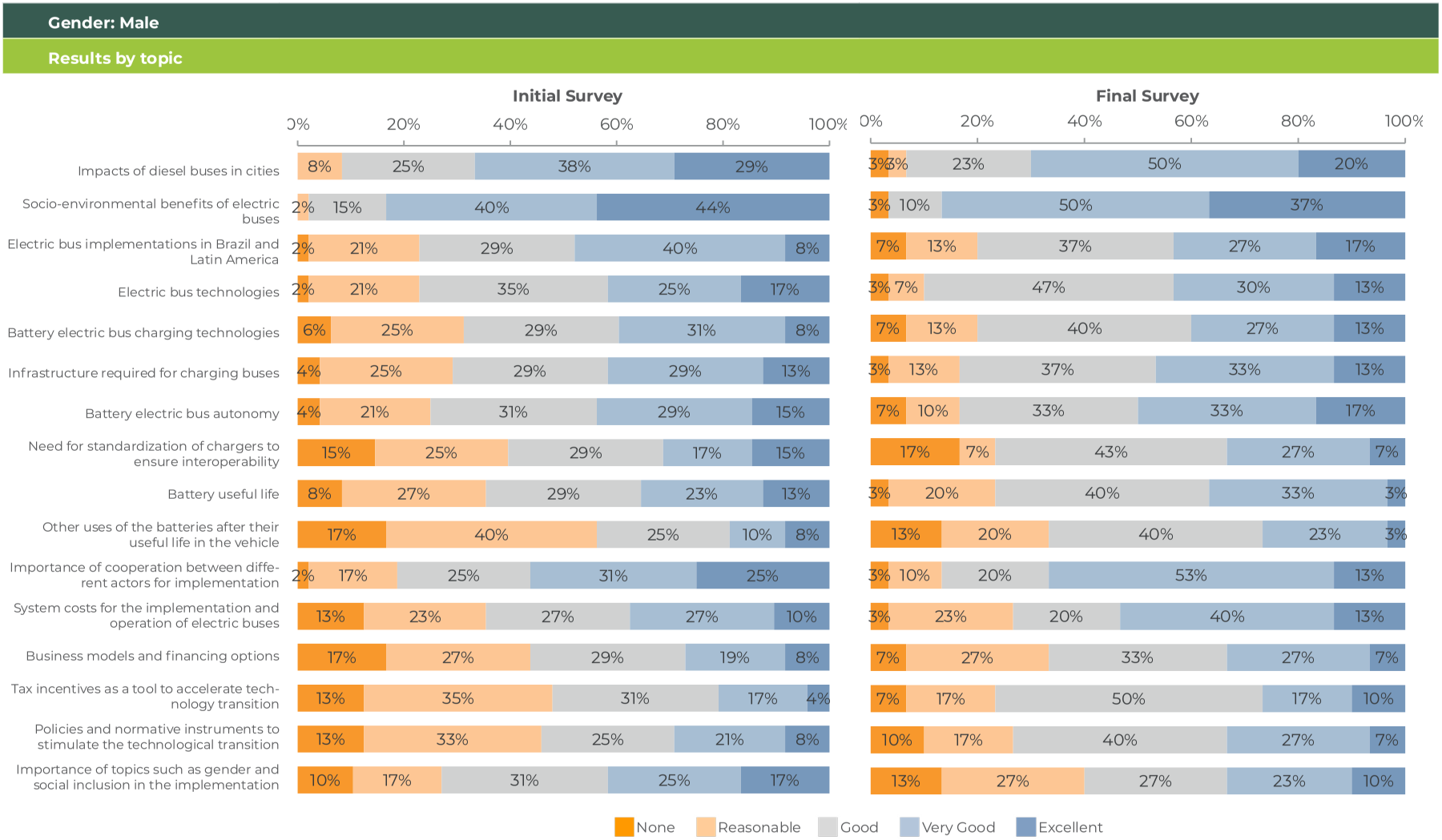
Finally, this item presents an analysis of the results according to the gender of the respondents. The Federal Government, Belo Horizonte, and Fortaleza responses were divided by gender for this grouping.

The presentation of the results follows the format from the previous section, through the frequencies of each of the levels of answers for knowledge assessment: (1) None; (2) Reasonable; (3) Good; (4) Very good; and (5) Excellent.

A different figure and a table present the group of respondents of each gender. The figures contain two graphs, the distribution of responses obtained in the initial survey is shown on the left, and the final survey on the right. The tables present the numerical values represented in the graphs and the difference in frequencies observed for each level of knowledge between the initial and final research. Positive differences are in shades of green and negative differences are in shades of red to facilitate visualization.

After the presentation of figures and tables, a brief discussion of the observed results is presented.

Figure 9 – Results for male participants



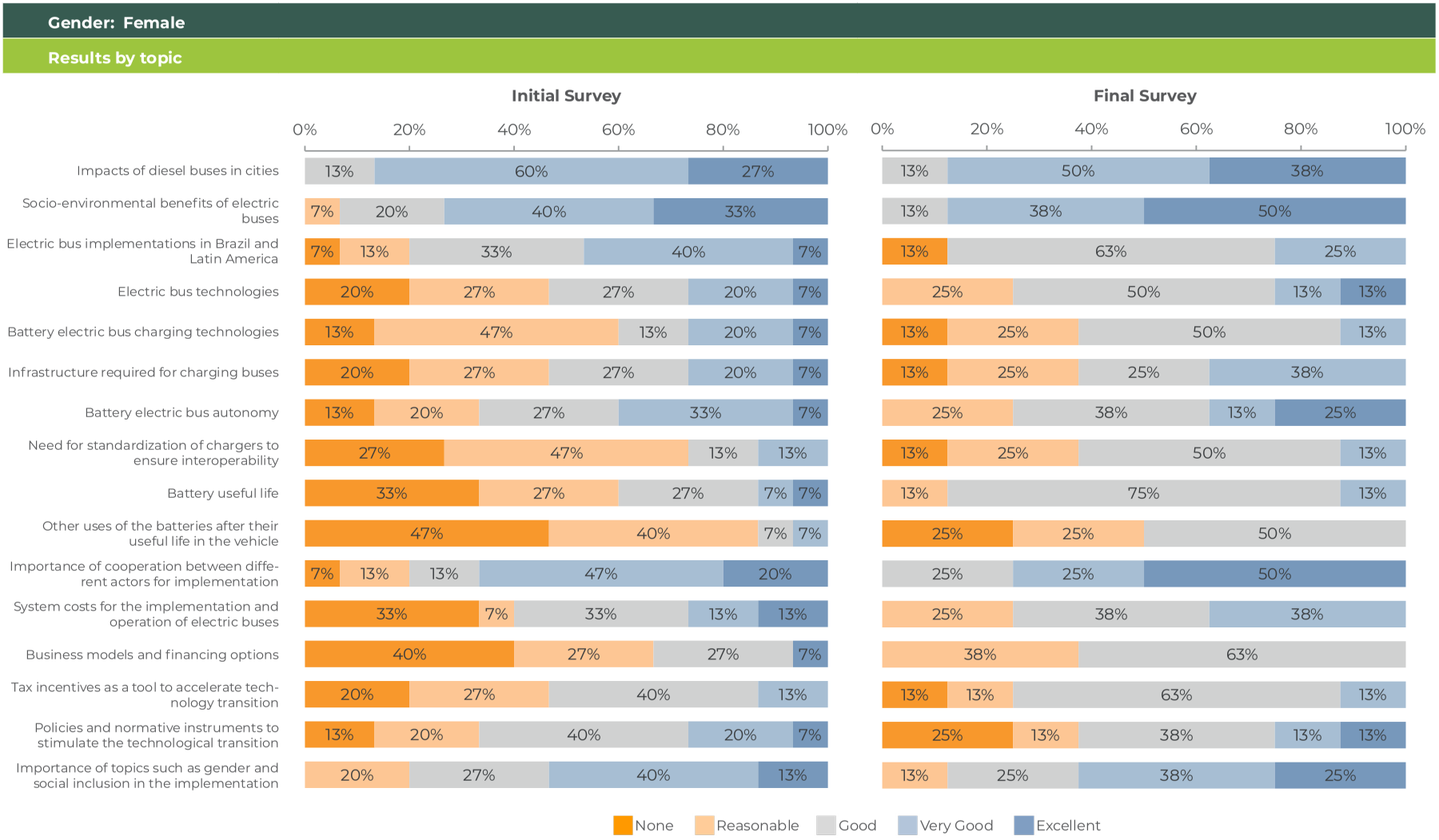
Source: own elaboration.

Tabla 11 – Results for male participants

	Initial Survey					Final Survey									
	None	Reasonable	Good	Very Good	Excellent	None		Reasonable		Good		Very Good		Excellent	
	Frequency					Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.
Impacts of diesel buses in cities	0,0%	8,3%	25,0%	37,5%	29,2%	3,3%	3,3%	3,3%	-5,0%	23,3%	-1,7%	50,0%	12,5%	20,0%	-9,2%
Socio-environmental benefits of electric buses	0,0%	2,1%	14,6%	39,6%	43,8%	3,3%	3,3%	0,0%	-2,1%	10,0%	-4,6%	50,0%	10,4%	36,7%	-7,1%
Electric bus implementations in Brazil and Latin America	2,1%	20,8%	29,2%	39,6%	8,3%	6,7%	4,6%	13,3%	-7,5%	36,7%	7,5%	26,7%	-12,9%	16,7%	8,3%
Electric bus technologies	2,1%	20,8%	35,4%	25,0%	16,7%	3,3%	1,3%	6,7%	-14,2%	46,7%	11,3%	30,0%	5,0%	13,3%	-3,3%
Battery electric bus charging technologies	6,3%	25,0%	29,2%	31,3%	8,3%	6,7%	0,4%	13,3%	-11,7%	40,0%	10,8%	26,7%	-4,6%	13,3%	5,0%
Infrastructure required for charging buses	4,2%	25,0%	29,2%	29,2%	12,5%	3,3%	-0,8%	13,3%	-11,7%	36,7%	7,5%	33,3%	4,2%	13,3%	0,8%
Battery electric bus autonomy	4,2%	20,8%	31,3%	29,2%	14,6%	6,7%	2,5%	10,0%	-10,8%	33,3%	2,1%	33,3%	4,2%	16,7%	2,1%
Need for standardization of chargers to ensure interoperability	14,6%	25,0%	29,2%	16,7%	14,6%	16,7%	2,1%	6,7%	-18,3%	43,3%	14,2%	26,7%	10,0%	6,7%	-7,9%
Battery useful life	8,3%	27,1%	29,2%	22,9%	12,5%	3,3%	-5,0%	20,0%	-7,1%	40,0%	10,8%	33,3%	10,4%	3,3%	-9,2%
Other uses of the batteries after their useful life in the vehicle	16,7%	39,6%	25,0%	10,4%	8,3%	13,3%	-3,3%	20,0%	-19,6%	40,0%	15,0%	23,3%	12,9%	3,3%	-5,0%
Importance of cooperation between different actors for implementation	2,1%	16,7%	25,0%	31,3%	25,0%	3,3%	1,3%	10,0%	-6,7%	20,0%	-5,0%	53,3%	22,1%	13,3%	-11,7%
System costs for the implementation and operation of electric buses	12,5%	22,9%	27,1%	27,1%	10,4%	3,3%	-9,2%	23,3%	0,4%	20,0%	-7,1%	40,0%	12,9%	13,3%	2,9%
Modelos de negócio e formas de financiamento	16,7%	27,1%	29,2%	18,8%	8,3%	6,7%	-10,0%	26,7%	-0,4%	33,3%	4,2%	26,7%	7,9%	6,7%	-1,7%
Incentivos fiscais como ferramenta para acelerar transição tecnológica	12,5%	35,4%	31,3%	16,7%	4,2%	6,7%	-5,8%	16,7%	-18,8%	50,0%	18,8%	16,7%	0,0%	10,0%	5,8%
Políticas e instrumentos normativos para estimular a transição tecnológica	12,5%	33,3%	25,0%	20,8%	8,3%	10,0%	-2,5%	16,7%	-16,7%	40,0%	15,0%	26,7%	5,8%	6,7%	-1,7%
Importância de temas como gênero e inclusão social na implementação	10,4%	16,7%	31,3%	25,0%	16,7%	13,3%	2,9%	26,7%	10,0%	26,7%	-4,6%	23,3%	-1,7%	10,0%	-6,7%

Source: own elaboration.

Figure 10 – Results for female participants



Source: own elaboration.

Table 12 – Results for female participants

	Initial Survey					Final Survey									
	Excellent	None	Reasonable	Good	Very Good	Excellent		Razoável		Bom		Muito bom		Excelente	
	Frequency					Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.	Freq.	Diff.
Impacts of diesel buses in cities	0,0%	0,0%	13,3%	60,0%	26,7%	0,0%	0,0%	0,0%	0,0%	12,5%	-0,8%	50,0%	-10,0%	37,5%	10,8%
Socio-environmental benefits of electric buses	0,0%	6,7%	20,0%	40,0%	33,3%	0,0%	0,0%	0,0%	-6,7%	12,5%	-7,5%	37,5%	-2,5%	50,0%	16,7%
Electric bus implementations in Brazil and Latin America	6,7%	13,3%	33,3%	40,0%	6,7%	12,5%	5,8%	0,0%	-13,3%	62,5%	29,2%	25,0%	-15,0%	0,0%	-6,7%
Electric bus technologies	20,0%	26,7%	26,7%	20,0%	6,7%	0,0%	-20,0%	25,0%	-1,7%	50,0%	23,3%	12,5%	-7,5%	12,5%	5,8%
Battery electric bus charging technologies	13,3%	46,7%	13,3%	20,0%	6,7%	12,5%	-0,8%	25,0%	-21,7%	50,0%	36,7%	12,5%	-7,5%	0,0%	-6,7%
Infrastructure required for charging buses	20,0%	26,7%	26,7%	20,0%	6,7%	12,5%	-7,5%	25,0%	-1,7%	25,0%	-1,7%	37,5%	17,5%	0,0%	-6,7%
Battery electric bus autonomy	13,3%	20,0%	26,7%	33,3%	6,7%	0,0%	-13,3%	25,0%	5,0%	37,5%	10,8%	12,5%	-20,8%	25,0%	18,3%
Need for standardization of chargers to ensure interoperability	26,7%	46,7%	13,3%	13,3%	0,0%	12,5%	-14,2%	25,0%	-21,7%	50,0%	36,7%	12,5%	-0,8%	0,0%	0,0%
Battery useful life	33,3%	26,7%	26,7%	6,7%	6,7%	0,0%	-33,3%	12,5%	-14,2%	75,0%	48,3%	12,5%	5,8%	0,0%	-6,7%
Other uses of the batteries after their useful life in the vehicle	46,7%	40,0%	6,7%	6,7%	0,0%	25,0%	-21,7%	25,0%	-15,0%	50,0%	43,3%	0,0%	-6,7%	0,0%	0,0%
Importance of cooperation between different actors for implementation	6,7%	13,3%	13,3%	46,7%	20,0%	0,0%	-6,7%	0,0%	-13,3%	25,0%	11,7%	25,0%	-21,7%	50,0%	30,0%
System costs for the implementation and operation of electric buses	33,3%	6,7%	33,3%	13,3%	13,3%	0,0%	-33,3%	25,0%	18,3%	37,5%	4,2%	37,5%	24,2%	0,0%	-13,3%
Business models and financing options	40,0%	26,7%	26,7%	0,0%	6,7%	0,0%	-40,0%	37,5%	10,8%	62,5%	35,8%	0,0%	0,0%	0,0%	-6,7%
Tax incentives as a tool to accelerate technology transition	20,0%	26,7%	40,0%	13,3%	0,0%	12,5%	-7,5%	12,5%	-14,2%	62,5%	22,5%	12,5%	-0,8%	0,0%	0,0%
Policies and normative instruments to stimulate the technological transition	13,3%	20,0%	40,0%	20,0%	6,7%	25,0%	11,7%	12,5%	-7,5%	37,5%	-2,5%	12,5%	-7,5%	12,5%	5,8%
Importance of topics such as gender and social inclusion in the implementation	0,0%	20,0%	26,7%	40,0%	13,3%	0,0%	0,0%	12,5%	-7,5%	25,0%	-1,7%	37,5%	-2,5%	25,0%	11,7%

Source: own elaboration.

Before analyzing the results, it is crucial to make some considerations. First, among the participants of the Federal Government, a reduction in the participation of women was observed. While in the initial survey, seven women (23.3% of the total) registered, in the final survey, only one woman (10% of the total participants) registered.

On the other hand, among participants from Fortaleza, there was an increase in the participation of total respondents between the initial and final surveys, demonstrating the team's engagement. Moreover, with the rise in the number of participants, there was also a doubling in the number of women (2 women in the initial survey vs. four women in the final survey), while the number of men increased by only 10% (9 males in the initial survey vs. ten males in the survey Final).

Based on the results presented, it can be seen that the responses recorded in the initial survey indicate, in general, a lower level of knowledge among female participants than among male participants. For example, among the 16 topics considered, only 3 had a frequency of the "None" level equal to or greater than 15% among male participants. Among women, this number rises to 8 topics.

Among the two topics that registered the lowest level of knowledge declared in the initial survey, "Possibility of other uses of batteries after their useful life in the vehicle" and "Business models and forms of financing," the level "None" registered respective percentages: 17% and 17% among male participants. Among women, the percentages for the same topics were higher, 47% and 40%, respectively.

As for the records of the higher level "Excellent," among men, seven topics registered frequencies equal to or greater than 15%. Among women, this occurred in only 3 of the 16 topics. For the topic "Socio-environmental benefits of electric buses," with the highest frequency of "Excellent" answers, the male audience represented 44% and female participants 33%.

In the final survey, the number of topics with a "None" level frequency equal to or greater than 15% dropped from 3 to just one. Among women, the change was from 8 to 2 topics only. Regarding the "Excellent" level record among men, the difference went from 7 to 4 topics with a frequency equal to or greater than 15%, registering a slight decrease between the two surveys. On the other hand, among female respondents, there was an increase from 3 to 5 topics, as opposed to men.

Regarding the topics with the lowest level of knowledge initially declared, "Possibility of other uses of batteries after their useful life in the vehicle" and "Business models and financing options," it is also possible to establish a comparison between genders to illustrate the differences. Considering the sum of the frequencies of the two lower levels, "None" and "Reasonable," male respondents declared a change of 57% and 44% to values of 33% and 34%, respectively. Among female participants, the values for

this cutoff decreased from 87% and 67% to 50% and 38%, respectively. However, among the female respondents, there was still a decrease in the “None” level on the topic “Business models and financing options” of 40% for no record.

Among women, 9 of the 16 topics presented did not present records for the level of knowledge “None” in the final survey, which did not happen among the responses of male participants in any of the topics considered.

4.

ANNEX I QUESTIONNAIRE

The questionnaire used is available in an online form. The model used is presented below as a reference.

Part 1: Personal information questions

- Do you represent the Federal Government or any city? Which one?
- Institution: Reply with the name of the organization, entity, body, and/or department you represent.
- What gender do you identify with?
- Position: Indicate the name of the position/function in the organization, entity, body, and/or department that it represents
- Training: Describe training level and area. For example, Higher Education in Engineering, Master's in Law, etc.

Part 2: Questions to assess the level of knowledge

N	**Assess your level of knowledge for the topics below** *Consider the scale where 1 represents no knowledge, and 5 represents excellent, in which you already consider yourself able to discuss the topic, defend best practices and make informed decisions.	1 - None 2 - Reasonable 3 - Good 4 – Very Good 5 - Excellent
1	**How would you describe your knowledge about the impacts of diesel buses in cities?** Diesel vehicles emit atmospheric pollutants, including particulate matter (PM), formed by soot and other solid or liquid particles in suspension, which harm health by causing cardiorespiratory problems.	
2	**What is your level of knowledge about the socio-environmental benefits of electric buses?** The benefits of electric buses are the reduction of exhaust emissions, greenhouse gases, and local pollutants, improving the air quality of cities. There is also noise reduction.	
3	**How would you describe your knowledge of electric bus implementations in Brazil and Latin America?** In Brazil, there are experiences with electric buses in cities like São Paulo, Campinas, and Brasília, among others. In Latin America, there are also relevant experiences.	
4	**How would you describe your knowledge of electric bus technologies?** Some technologies such as trolleybuses, battery electric buses, and others rely on fuel cells and hybrids with combustion engines.	
5	**How would you describe your knowledge about battery electric bus charging technologies?** There are buses with plug-in charging and opportunity charging using pantograph or induction, with different infrastructure needs and operational characteristics.	
6	**How would you describe your knowledge about the infrastructure needed to charge buses?** The infrastructure includes, for example, the electricity distribution network and equipment for charging.	
7	**How would you describe your knowledge about the autonomy of battery electric buses?** The autonomy of the buses vary according to the capacity of the batteries, the operating conditions (for example, relief, climate, road priority, and the way of driving), the regenerative braking system, and the opportunity to recharge, among other factors.	

N	**Assess your level of knowledge for the topics below** *Consider the scale where 1 represents no knowledge, and 5 represents excellent, in which you already consider yourself able to discuss the topic, defend best practices and make informed decisions.	1 - None 2 - Reasonable 3 - Good 4 – Very Good 5 - Excellent
8	**How would you describe your knowledge about the need to standardize chargers to ensure interoperability?** There are different standards for chargers between manufacturers, and the lack of definition of standards can make interoperability difficult.	
9	**What is your level of knowledge about battery life?** Battery life depends on the number of usage cycles, timing, and operating and charging conditions.	
10	**How would you describe your knowledge about the possibility of other uses of batteries after their useful life in the vehicle?** After the battery life for bus use (when the capacity reaches less than 80% of its original one, for example), it may gain a second use, or it might be possible to recycle it.	
11	**How would you describe your knowledge about the importance of cooperation between different actors for implementing systems with electric buses?** Consider government actors (municipal, state, federal), industry, development banks, operating companies, bus manufacturers, and the electric energy sector, among others.	
11.1	**Do you know any examples of cooperation between these actors?** *[Optional descriptive question.]*	
12	**How would you describe your knowledge about the costs of system implementation and operation of electric buses?** Electric buses generally have higher acquisition and infrastructure costs and may have lower operating costs.	
13	**How would you describe your knowledge of business models and financing options?** Some models seek to reduce risks for the operator and the public power and guarantee resources for acquiring assets.	
14	**What is your knowledge about tax incentives as a tool to accelerate the adoption of cleaner bus technologies?** National clean technology tax incentive policies can accelerate the implementation of clean transport systems.	

N	**Assess your level of knowledge for the topics below** *Consider the scale where 1 represents no knowledge, and 5 represents excellent, in which you already consider yourself able to discuss the topic, defend best practices and make informed decisions.	1 - None 2 - Reasonable 3 - Good 4 – Very Good 5 - Excellent
15	**How would you describe your knowledge about policies and normative instruments to stimulate the technological transition?** Public and regulatory policies can stimulate the transition to technology for cleaner transport.	
16	**How would you describe your knowledge of the importance of considering topics such as gender and social inclusion in implementing electromobility projects?** Some population groups present vulnerabilities, such as women, the elderly, children during early childhood, people with reduced mobility, black and/or low-income people, and residents of the periphery, who are more exposed to air pollution and are more restricted in the access to the city and urban mobility.	

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