



# CARBON PRICING:

what the business  
sector needs to know  
to position itself





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# Message from the president

**T**he Paris Agreement is a milestone that is inevitably leading us to a low-carbon economy. Even those countries most resistant to the climate change agenda – generally speaking, the largest emitters of greenhouse gases (GHG) – have made commitments and signaled paths to be followed. In this context, the mechanisms for carbon pricing stand out as important tools to achieve many goals, which especially favor Brazil.

Attuned to the future, more than 500 companies worldwide already take internal carbon pricing into consideration in their decision-making processes, and more than 700 others plan to do so by 2018, according to data from the Carbon Disclosure Project (CDP). However, not only does this practice need to become structural, but we also need to be able to set a global price to carbon.

With carbon pricing, carbon-intensive production technologies become more expensive and, consequently, it turns to be more advantageous to search for production methods that lead to the reduction of GHG emissions.

Since these are externalities, traditional economical and financial models are not capable of clearly capturing the impacts arisen from climate changes. Nonetheless, businesses have been forced to face new risk scenarios and obstacles that derive from several events related to climate change, for instance, a higher frequency of extreme phenomena such as tsunamis, hurricanes, tornados, sea level rise, droughts and floods, and so on.

The polluter-payer principle is key when it comes to carbon pricing, which means that who pollutes – but does not carry out internal mitigation measures – pays through taxes or buying market certificates.

There are basically two types of carbon pricing mechanisms: government taxes and carbon markets, the latter based on the allocation of certificates that


give the right to emit carbon and that are negotiated the same way as several financial products in worldwide secondary markets. However, this model requires highly complex structure and operation.

The study presented here deepens the discussion we started in partnership with CDP in the paper “Navegando por cenários de precificação de carbono” (Surfing carbon pricing scenarios), released in 2015. Following up with this project, which is now supported by We Mean Business, this study provides information on the characteristics of how this tool works. They are some directives that can guide companies’ decision-makers when building the basis of their new position in a world that is developing towards a green economy. We present a 360° view of several mechanisms that countries have been adopting worldwide. We have especially searched for experiences that can be reproduced in our country and that are related to our national context due to their characteristics.

We debate here where the business sector fits in the elaboration of pricing policies, the impact from companies, the opportunities presented and expected challenges.

By offering this paper, CEBDS, CDP and We Mean Business intend to influence corporate decision-makers’ strategy and planning towards a sustainable economy. Enjoy the reading!

  
Marina Grossi  
President of CEBDS

  
Nigel Topping  
CEO of We Mean Business

  
Juliana Lopes  
Director of Carbon Disclosure Project (CDP) Latin America

# What is CEBDS

**F**ounded in 1997, the Brazilian Business Council for Sustainable Development (CEBDS) is a civil association that is leading the business sector's efforts to implement sustainable development in Brazil, bringing together government, business and civil society.

CEBDS currently brings together around 70 important corporate groups in the country, with a combined revenue of 40% of GDP and responsible for more than one million direct jobs. CEBDS was the first institution in Brazil to discuss sustainability in terms of the concept of the Triple Bottom Line—which proposes that business action should be based on three key pillars: the economic, the social and the environmental. Besides, it is the country's representative of the World Business Council for Sustainable Development (WBCSD) network, the most important business sector entity in the world, with almost 60 national and regional councils in 36 countries, covering 22 industrial sectors and 200 multinational companies on all the continents of the globe. A pioneer in its field, CEBDS was responsible for the first Sustainability WHAT IS CEBDS Report in Brazil, in 1997, and, as of 2008, has helped to implement, in partnership with the FGV (Getúlio Vargas Foundation) and the WRI (World Resources Institute), the main tool for measuring greenhouse gas emissions, the GHG Protocol, in Brazil. The institution has represented its associates at all United Nations Party Conferences on Climate Change since 1998, and those on Biological Diversity, since 2000. It is also a member of the Sustainable Development Policy Commission and Agenda 21; the Genetic Heritage Management Council; the Brazilian Climate Change Forum; the Rio de Janeiro Climate Change Forum, the World Water Council and the National Sustainable Consumption Plan Steering Committee. At Rio+20, CEBDS launched Brazil Vision 2050, a forward-looking document that aims to present a vision of a sustainable future and the way to achieve it. This platform for dialogue with businesses and various sectors of society, built up throughout 2011 with the participation of more than 400 individuals and around 60 corporations, has provided a source of inspiration for the strategic planning of numerous companies in Brazil.

# What is CTClima?

**T**he Energy and Climate Change Working Group (CTClima) brings together major Brazilian companies around the aim of dealing with issues relating to energy and climate change and helping companies to explore new market opportunities and minimize risks arising from the process of climate change.

CTClima also follows and participates in the Conferences of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) and Federal Government and civil society forums.

REPRESENTATIVES (2015 - 2017):

President: Fernando Eliezer Figueiredo - Schneider Electric

Vice-president: David Canassa - Votorantim Participações

Coordinator: Lilia Caiado - CEBDS





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## LIST OF ACRONYMS

<b>AFOLU</b>	Agriculture, Forestry and Other Land Use
<b>BCA</b>	Border Carbon Adjustment
<b>B-PMR</b>	Business Partnership for Market Readiness
<b>BVRio</b>	Environmental Stock Exchange of Rio de Janeiro
<b>CCL</b>	Climate Change Levy
<b>CEBDS</b>	Brazilian Corporate Council for Sustainable Development
<b>CEO</b>	Chief Executive Officer
<b>CH<sub>3</sub></b>	Methane
<b>CIDE</b>	Contribution due to Intervention on Economic Domain
<b>CIM</b>	Inter-ministerial Committee on Climate Change
<b>COP</b>	Conference of the Parties
<b>CPLC</b>	Carbon Pricing Leadership Coalition
<b>EPC</b>	Platform Companies for Climate
<b>ETS</b>	Emissions Trading Scheme
<b>EU ETS</b>	European Union Emissions Trading Scheme
<b>USA</b>	United States of America
<b>FMASE</b>	Environment Forum of the Electric Sector
<b>GHG</b>	Greenhouse Gas
<b>GEF</b>	Global Environmental Facility
<b>GEx</b>	Executive Group Inter-ministerial Committee on Climate Change
<b>LPG</b>	Liquefied Petroleum Gas
<b>LNG</b>	Liquefied Natural Gas
<b>GtCO<sub>2</sub>e</b>	Giga ton of carbon dioxide equivalent
<b>GTI</b>	Inter-ministerial Workgroup on the Carbon Market
<b>GVCes</b>	Sustainability Study Center of Getúlio Vargas Foundation
<b>ICAP</b>	International Carbon Action Partnership
<b>ICO2</b>	BM&FBOVESPA's Carbon Efficient Index
<b>IEC</b>	Corporate Initiative on Climate
<b>IETA</b>	International Emissions Trading Association
<b>IKI</b>	International Climate Initiative
<b>iNDC</b>	Intended Nationally Determined Contribution
<b>IPCC</b>	Intergovernmental Panel on Climate Change

<b>ITMO</b>	International Transfer of Mitigation Outcomes
<b>LULUCF</b>	Land Use, Land-Use Change and Forestry
<b>MBRE</b>	Brazilian Market of Emission Reduction
<b>MCTI</b>	Ministry of Science, Technology and Innovation
<b>MDIC</b>	Ministry of Development, Industry and Foreign Trade
<b>CDM</b>	Clean Development Mechanism
<b>SDM</b>	Sustainable Development Mechanism
<b>MF</b>	Ministry of Economic Affairs
<b>MMA</b>	Ministry of the Environment
<b>MRP</b>	Market Readiness Proposal
<b>MRV</b>	Monitoring, Report and Verification
<b>N<sub>2</sub>O</b>	Nitrous Oxide
<b>NDC</b>	Nationally Determined Contribution
<b>NOK</b>	Norwegian Crown
<b>OECD</b>	Organization for Economic Cooperation and Development
<b>WTO</b>	World Trade Organization
<b>UN</b>	United Nations Organization
<b>R&amp;D</b>	Research and Development
<b>PFCs</b>	Poly fluorocarbohydrides
<b>GDP</b>	Gross Domestic Product
<b>PMR</b>	Partnership for Market Readiness
<b>PNMC</b>	National Policy on Climate Change
<b>UNEP</b>	United Nations Environment Program
<b>REDD</b>	Reduction of emissions by deforestation and degradation
<b>RGGI</b>	Regional Greenhouse Gas Initiative
<b>SCE</b>	EPC's Emission Trading System
<b>SF<sub>6</sub></b>	Sulphur Hexafluoride
<b>tCO<sub>2</sub></b>	Ton of carbon dioxide
<b>tCO<sub>2</sub>e</b>	Ton of carbon dioxide equivalent
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>WBCSD</b>	World Business Council for Sustainable Development
<b>WMB</b>	We Mean Business





# PRESENTATION

The study "Carbon Pricing: What the business sector needs to know to position itself" is an initiative of the Brazilian Corporate Council for Sustainable Development (CEBDS) and the CDP (formerly Carbon Disclosure Project), supported by We Mean Business. Its elaboration aims to offer to the Brazilian business sector relevant information on the functioning of carbon pricing mechanisms, favoring comprehension of the main challenges involved in the design and implementation of this type of instrument.

The objective of the development of this study was to assess how the business sector is inserted in the context of adopting carbon pricing policies. In this sense, the potential impacts of these mechanisms on the Brazilian companies and possible responses to the expected difficulties were assessed. It was also attempted to identify the opportunities which arise from this process, many of them being associated to the corporate sector's active participation in the elaboration of the policies.

The contents of this document were elaborated based on the review of international experiences and of updated literature on carbon pricing. Collaboration was also provided by key-areas of companies associated to CEBDS, obtained by means of a questionnaire on the expectations regarding a possible carbon pricing instrument in Brazil. Besides, valuable contribution was provided by representatives of ArcelorMittal, Braskem, CPFL Renováveis, ENGIE, Monsanto, Renova Energia, Vale and Votorantim, who participated in semi-structured interviews. However, it has to be pointed out that the opinions expressed in this document do not necessarily reflect the point of view of the companies interviewed or associated to CEBDS.

This study is organized in the following chapters: the **Executive Summary**, which presents the main conclusions of the study; a **contextualization** of the discussion about carbon pricing in Brazil; a **theoretical referential** on the types of carbon pricing instruments; the presentation of the **benefits and impacts** – aggregated and sectoral ones – of this type of instrument; and a discussion about **the perceptions of the business sector** regarding the perspectives of adopting a carbon pricing instrument, highlighting some topics with relevance for the Brazilian organizations. The final section presents some **recommendations** for the design and implementation of a carbon pricing instrument in Brazil, as well as for the national companies' positioning.

For collaborating with this study, we would like to give our thanks to *Carbon Pricing Leadership Coalition* and to Alexandre Kossoy, as well as to the companies which offered their contributions by means of interviews, answers to the questionnaire and presentation of comments throughout the period of elaboration of this assignment. We would also like to thank GVCes, FMASE, IETA, ICAP, Carbon Market Watch, We Mean Business and WBCSD for the support offered in the different phases of the study.

We hope that this study will be an additional resource for the Brazilian organizations in their efforts of defining the positioning to be taken regarding this unquestionable global trend: the adoption of carbon pricing instruments as one of the most important means to achieve GHG emission mitigation, creating opportunities and minimizing the risks associated to this transition.



# EXECUTIVE SUMMARY

**C**arbon pricing offers flexibility to the sectorial efforts to reduce greenhouse gas emissions (GHG), enabling mitigation targets to be achieved in a more cost-efficient way. Besides being a fundamental component in an effective and efficient mix of climate policies, carbon pricing presents itself to the private sector as an important tool for risk management and the development of competitive advantages in a world in transition to decarbonization.

**Carbon pricing is being adopted in the world in an accelerated manner. In the middle of 2016, there were already 64 international jurisdictions charging carbon taxes or operating emissions trading systems – corresponding to 13% of global GHG emissions. In Brazil, the issue has been considered as a climate policy instrument since at least 2011 and discussions regarding its design and implementation will reach a new level in 2017.**

Taxation, emissions trading systems and combinations of instruments have been broadly applied in different countries and subnational governments. According to the OECD, approximately 13% of global greenhouse gas emissions are currently covered by some pricing mechanism – i.e. coverage has tripled in comparison to a decade ago. Approximately 40 national jurisdictions and 24 cities, states and regions have already implemented this type of instrument, which represents an annual volume of 7 GtCO<sub>2</sub>e<sup>1</sup> subject to economic regulation (OECD, 2016).

With the conclusion of COP 21 and the adoption of the Paris Agreement in December 2015, the perspectives for carbon pricing policies were widened. Although the Agreement does not directly foresee the creation of a global price for carbon, the provisions established in Article 6 have the potential to increase international cooperation in favor of mitigation, via market mechanisms. For instance, it would be possible for the signatory Parties of the Agreement to achieve their targets by means of international transfer of emission reduction units.

The Nationally Determined Contributions (NDCs) of 101 countries indicate the interest in using economic instruments for achieving the respective targets. Furthermore, others point out the possibility of achieving more significant emission reductions than declared in the case that they gain access to international market mechanisms (EDF e IETA, 2016; World Bank, 2016). The Brazilian NDC is one among those which considered the use of market mechanisms, although there is no indication yet of how these instruments will be used. According to the text, the country reserves its position regarding the possibility of using the mechanisms to be established under the Paris Agreement.

Although the NDC does not describe how or if carbon will be priced in Brazil, studies for assessing possible configurations and impacts of carbon pricing instruments in the country have been considered by the Federal Government since at least 2011, when the country presented



The Nationally Determined Contributions (NDCs) of 101 countries indicate the interest in using economic instruments for achieving the respective targets.

<sup>1</sup> The carbon equivalent unit represents the standardization of greenhouse gases (GHG) in terms of carbon dioxide units, in a way that a total amount of emissions is calculated as the sum of emissions of all GHG expressed in one single unit. In order to perform that, the Global Warming Potential (GWP) of the other GHG in relation to the CO<sub>2</sub> (whose GWP is the base value, equal to 1) is adopted.



its application for the PMR, a program administered by the World Bank with the main objective of providing support in preparing and implementing carbon pricing instruments.

As of 2012, the feasibility and convenience studies regarding the adoption of a carbon pricing instrument in Brazil have been coordinated by the Department of Economic Policy of the Ministry of Economic Affairs and has concentrated on two fields: the development of a system for Monitoring, Reporting and Verification (MRV) of emissions; and the investigation of different configurations of carbon pricing instruments.

**“We should tax what we burn, not what we earn. This is the single most important policy change we can make (Al Gore)”**

**In the absence of economic instruments, the environmental and socioeconomic costs associated with GHG emissions are not captured by the market. With carbon pricing, a financial motivation is created for the companies and the consumers to reduce their emissions and for mitigation to follow the trajectory of the lowest aggregated cost to the economy. Pricing may take the form of carbon taxing or of an emissions trading system, whereby possible interactions between these mechanisms and instruments already existing are to be considered when being implemented.**

Carbon pricing has a solid foundation in economic theory. In the short term, increased control costs and the market loss of carbon-intensive products are inevitable consequences of the quantitative restrictions of GHG emissions, which are becoming increasingly necessary for climate change control. In this context, carbon pricing may reduce the economic cost of climate policies allowing for agents with lower abatement costs to contribute more to emission reduction efforts than agents with higher costs. Besides, pricing creates a stronger long-term incentive for environmental technology innovation than emission restriction policies such as command-and-control or technological standards.

Carbon pricing instruments may be of two different types: taxes or emission trading systems. In case of emission taxation, a price is determined to be paid per emission unit (in terms of carbon dioxide equivalent), so that the previously established aggregated emissions level is achieved. In the second type, the regulators create markets in which the agents interact in the purchase and sale negotiations of emission

allowances. This means that the regulator defines the emissions quantity permitted and allocates it among the regulated agents, allowing market interactions to define the carbon price.

In theory, without transaction costs and without uncertainty regarding emission reduction costs, the two types of instruments are equivalent. However, the reality is more complex and requires good comprehension of local circumstances in order to choose the most suitable and appropriately designed instrument. In any case, there are considerable challenges for both options, some of them shared by both – such as the case of sectorial scope definition, compensatory measures, implementation phases and use of the revenues obtained by pricing – and others which exclusively affect one of them. An important challenge which exclusively affects taxation is, for instance, the definition of the tax rate, whereas in the market system the definition of the criteria for emission rights allocation is at the center of the discussions.

The introduction of any new policy does not occur in a vacuum. Therefore, the suitable design of a pricing instrument requires deep knowledge of already existing policies and their instruments of implementation. In fact, the climate policy strongly interacts with many other sectorial instruments. When this interaction is complementary, the combination of instruments mutually strengthens the achievement of the policies' objectives. However, there is the risk that different policy instruments may adversely interfere with one another, mutually jeopardizing their objectives and creating perverse incentives.

However, two instruments may act together on the same emissions when directed at two different failures or market barriers. Carbon pricing, for instance, may be combined with energy efficiency standards or with energy substitution targets in order to correct behavioral or information asymmetry barriers. Additionally, the innovation's nature of positive externality will not be totally internalized solely by higher relative pollution prices and, therefore, direct subsidies to research and development should supplement emissions pricing.

Good institutional arrangements, which include knowledge, environmental, sectorial and fiscal capacities, are fundamental conditions for the implementation of successful economic instruments.

Thus, a stable regulatory framework, which can offer a consistent, believable and strong price signal for directing investment to clean technologies, is created. Good regulatory governance will thus ensure efficient transition to a low carbon economy.

**Besides the gains in efficiency regarding the achievement of the climate policy objectives, pricing instruments may also bring significant benefits to the economy by enabling the reduction of tax load distortions. However, production costs are directly or indirectly affected in the short term, which determines the importance of considering mechanisms to compensate possible losses in competitiveness. In general terms, studies have indicated the prevalence of positive economic impacts in international experiences. In Brazil, there are already estimates of socioeconomic effects of carbon pricing, in which the scenarios, assumptions and results achieved are very different.**

The introduction of carbon pricing instruments is an opportunity to promote an environmental tax reform, which enables the replacement of taxes levied on positive factors such as labor and consumption by the taxation of harm-causing factors, as in the case of GHG emissions. Other options for the destination of the revenues obtained include subsidies to initiatives to promote technological innovation (especially relevant for the development of less emission-intensive technologies) and the financing of social assistance programs (especially relevant to increase the adaptive capacity and the resilience of the populations which are most vulnerable to climate changes). Just as important as the design of carbon pricing instruments is the consideration of removing detrimental subsidies which oppose price incentives (as in the case of subsidies to diesel for cargo transport).

Pricing instruments affect the production costs, directly or indirectly. The degree of pass-through of these costs in the chain depends on the characteristics of the regulated sector, such as market power, installed capacity, technological flexibility and regulatory price restrictions. The pass-through of costs is, however, required to act in the demand and thus create long-term incentives. In the short term, however, there are concerns about competitiveness when competitors are not under the same carbon pricing regime, creating the risk of relocation of production activities towards economies or regions with more lenient emissions

restrictions, making the policy detrimental from the economic point of view and innocuous, from the environmental point of view. Therefore, special measures to compensate any loss of competitiveness should be considered.

As a rule, the greater the carbon intensity, the cost of mitigation, the competition (exposure to the external market) and the price elasticity of demand (that is, the sensitivity of the demand for the sector's products to price changes), the higher the impact of a pricing instrument on the profitability of a certain sector. However, in the medium and long term, negative impacts tend to be eliminated by technological innovation promoted by companies as a way to counter the potential profitability loss.

Thus, pricing instruments generate both positive and negative effects on the economy. Although it is not easy to verify the causality between these instruments and the observed economic effects, recent studies indicate the prevalence of positive economic impacts in international experiences. In the case of the European carbon market (EU ETS), with over ten years of operation, there were positive effects on production, employment and investment of regulated companies in relation to non-regulated ones. In comparison to non-regulated companies, companies covered by the ETS have increased their added value by 6%, their number of employed staff by 7.8%, investments by 26.7% and sales by 14.9% (MARIN et al., 2015). Effects on productivity and profit are of low magnitude, varying by country and more frequently observed on some energy-intensive sectors. Finally, the companies that innovated most demonstrated better performance. In experiences with carbon taxation, in turn, the magnitude of the impact is even less pronounced.

In recent years, some studies have tried to estimate the possible socioeconomic impacts caused by the adoption of different configurations of carbon pricing instruments in Brazil - both in an aggregated manner and from a sectorial point of view. A wide range of scenarios and assumptions have been employed - preponderantly by using computable general equilibrium models - and the results are, thus, assorted.

**The current moment is one of increased confidence in the carbon pricing as a global and irreversible trend. Thus, insofar as the adoption of carbon pricing instruments in Brazil becomes a more concrete possibility, it is important to seek an**



Although it is not easy to verify the causality between these instruments and the observed economic effects, recent studies indicate the prevalence of positive economic impacts in international experiences.

**alignment between the expectations of the corporate sectors and the objectives of the policies to be implemented. Issues such as the quality of the instrument design, possible impacts on competitiveness, MRV, engagement and internal prices for carbon deserve special attention from the corporate sector.**

In the world, the expectations of the corporate sector for the development of carbon pricing initiatives have undergone considerable changes since COP 21. In 2016, 82% of the GHG Market Sentiment Survey respondents (IETA, 2016) said they rely on the expansion of existing carbon markets, as a result of the Paris Agreement coming into force (as opposed to a percentage of 58% in 2015). The expectation of these respondents is that Brazil establishes an Emissions Trading System - ETS between 2020 and 2025. Most of the representatives of Brazilian companies, in turn, evaluate the possibility of adopting an emissions pricing instrument at a national level as "High" or "Very High". The vast majority of them believe that the year 2020 will mark the coming into force of this regulation.

The timing is very conducive to the deepening of discussions on carbon pricing in Brazil. An important milestone in the involvement of the corporate community in the co-creation of the pricing instruments that the country may adopt is the launch of the "Corporate Position on Carbon Pricing in Brazil" by the Climate Corporate Initiative (IEC) in October 2016. This document presents a number of suggestions and proposals from the corporate sector to the government, as well as a statement of commitment to this agenda from the entities represented.

From the review of international experiences and data collection conducted in this study, issues of special interest from the business sector concerning carbon pricing have been identified - considering both aspects of policy design and the positioning of companies regarding possible regulation. Among the main aspects to be considered in the implementation of the pricing mechanism, are the following ones:

**Decision on the type of instrument:** from the viewpoint of the corporate sector, contributions which ensure the quality of the instruments' design

- whatever they may be - assume a considerable significance. Discussions on the use of revenues from the instrument and on the fiscal neutrality of a tax on carbon are key points of the instrument's design and an essential agenda for discussions involving the corporate sector in the policy formulation.

#### **Competitiveness and costs:**

The impact that carbon pricing instruments may have on the costs of regulated companies contributes to increasing concerns about possible losses of competitiveness. In this sense, the consideration of the sectors most exposed to this risk should favor the provision of appropriate compensatory mechanisms. To do this, one must assess the level of energy intensity and the degree of each sector's exposure to international trade in each sector and agent potentially subject to regulation.

**MRV:** When it comes to emissions trading systems, the subject of the MRV assumes a core position. Its implementation involves an operational infrastructure that must have credibility with the government, participants



The timing is very conducive to the deepening of discussions on carbon pricing in Brazil.

and other stakeholders, as well as methodological consistency, transparency and data verification capability and information. The broad involvement of government and stakeholders is essential in drawing up guidelines, a process which should be coordinated by a body and staff competent on the subject.

**Engagement:** International experience shows that the engagement structured in different sectors of society is one of the key success factors in the pricing instrument implementation process. As the issue is politically sensitive and technically demanding, the broad, comprehensive, and early engagement of stakeholders is necessary to: create transparency around the process; increasing and maintaining public support; enjoying the wide range of available expertise; and fading out political conflicts.

**Internal carbon pricing:** The strategy of adopting internal carbon prices has been increasingly used by companies from various sectors to incorporate the carbon price variable in investment decisions. According to CDP (2016), 517 global corporations have already adopted the strategy of pricing carbon, besides the 732 who intend to do so in two years' time (by 2018).

## Recommendations

Experiences with carbon pricing confirm its positive long-term impacts on business growth and innovation. Also, they indicate that many of the effects on competitiveness were dealt with using special measures. In any case, it remains controversial to identify the ideal balance between a higher incentive of prices, exemptions and compensations.

Each economy that has implemented these systems has chosen the format that best accommodated, in political terms, risk expectations of loss of competitiveness and its mitigation goals for greenhouse gases. In all of them, it was possible to observe that this balance was adjusted with enhancement of price signals to the extent that the reliability of the system was being consolidated and the technological innovation was advanced.

In Brazil, any assessment of carbon pricing instruments type and design should consider the magnitude and temporality of mitigation targets that production sectors are subject to - as per the NDC. The higher this restriction, the greater the benefit in terms of efficiency and fairness of the application of price instruments.

Considering aspects such as the possibility of a tax reform, a tax instrument could be recommended for the Brazilian context, as long as the resulting revenue is used to reduce the overall tax burden of the economy - in particular on labor - and to finance technological innovation. The principle of tax neutrality is therefore a key element of discussions on carbon pricing in Brazil.

The option of creating a market, in turn, tends to focus on the industrial and energy generation sector, resulting in a lower revenue collection potential. As a joint measure, it would be necessary to apply taxes to sectors not regulated by the emissions market. On the other hand, an ETS would offer greater operational facility to include the options of Deforestation Emission Reduction projects and Forest Degradation credits (REDD) and of the Clean Development Mechanism (CDM) as *offset*, considering the low cost offer of these options in the country.

Whatever the instrument adopted, the effects of the indirect electricity costs would be lower than those observed in other economies, given the hydrous dominance and the high presence of biomass in the Brazilian energy matrix.

Moreover, there is evidence that there is a great potential of mitigation options with low cost in the production sector in Brazil, whether in the direct control of greenhouse gases or in the increase of energy efficiency. Possible financial and behavioral barriers to its adoption will have to be removed with credit incentives associated with targets and technological standards.

The resumption of economic and inclusive growth and the difficult international inclusion of the Brazilian economy make it relevant to consider protective mechanisms against leakage and loss of competitiveness. In this context, an early and detailed assessment of the direct and indirect costs of Brazil's climate policies will be crucial to design the format and scope of pricing instruments and their exemption and compensation mechanisms for the production sector and families' consumption.

The issue of regressive taxes - whether on small businesses, family agriculture or on low-income consumers - should also be considered and dimensioned. However, whatever the magnitude and the focus of the exemptions, ensuring the transition to a low-carbon economy will require them to be gradually reduced on the basis of objective and transparent criteria.

The consideration of complementary and counterproductive effects of other fiscal and sectorial instruments, and inefficiencies arising from double regulation or detrimental incentives, is essential for the design of an appropriate tool. Hence, it is necessary for Brazilian climate policy to establish credible and transparent climate governance, which enables the adoption of sectorial goals and instruments for control and pricing.

As one can see, there are important tasks and opportunities for the production sector to develop a leading role in Brazil's climate policies. In the context of international negotiations of the Climate Convention to guide the definition of national targets, the sector's efforts can be directed towards:

- I. expanding the discussion of the regulatory mechanisms of climate policy;
- II. developing principles and arrangements for the consolidation of climate governance;
- III. identifying the determinants of direct and indirect sector costs; and
- IV. performing comparative studies on exemptions and compensations mechanisms.

Considering the mitigation efforts that Brazil has committed to by signing the Paris Agreement, such initiatives become not only important, but especially urgent.

In addition, from the specific point of view of Brazilian companies, good preparation practices for the future adoption of carbon pricing instruments, based upon the experiences of companies already regulated (as the case studies conducted by PMR (PMR, 2015), assume a special relevance:

#### 1) The incorporation of the climate change issue in corporate strategy:

The definition of a competent technical team to guide climate actions of the company is an important step adopted in successful experiences. In addition to the formation of a team of experts, the dissemination

of the theme by the company favors the identification of risks and opportunities at all levels of the organization. The involvement and leadership of the CEO and the board of directors are fundamental to creating a culture that encourages the adoption and maintenance of carbon emission mitigation actions.

## **2) MRV of GHG emissions:**

According to the experience of the assessed companies, monitoring, reporting and verification of GHG emissions have played a key role in the preparation process for pricing carbon. After all, the development of the capacity to conduct GHG inventories allows the company to know the origin of their direct and indirect emissions and thus identify reduction opportunities.

## **3) Identification of risks and opportunities in future policies:**

Risks faced by the company may be reduced through the organization's engagement in the process of co-creation of the instruments. Taking advantage of the opportunities arising from the regulation, in turn, may be encouraged by the development of an internal cost-reduction curve and by the establishment of voluntary targets to reduce emissions.

## **4) Anticipated capability development:**

The company's participation in carbon pricing instrument simulations is a way to accustom the company's key area representatives to the type of decision that needs to be taken in regulatory scenarios. The involvement in the voluntary carbon market can also give the organization a greater familiarity with the methodologies, concepts and processes associated with this type of instrument.

## **5) Stakeholder engagement:**

From the company's point of view, assuming a leading role from the beginning of carbon pricing discussions can give greater credibility and reliability to the company in the corporate environment and before regulatory authorities. In addition, the collaborative work between companies, academic institutions, government bodies and non-governmental organizations, from the early stages of instrument design, can favor the development of a consensus on specific issues of pricing.

## **6) Internal carbon pricing:**

The establishment of internal prices for carbon - whether through shadow prices, fees and internal trade systems or implied prices - can be adopted in order to promote: the identification of opportunities and hidden risks in the company's operations and in its value chain; resource redirection for some of the intensive activities in GHG emissions; and encouraging investments in R&D, in order to develop more sustainable products, services and processes.





# CONTEXTUALIZATION

## **C**arbon pricing is a fundamental component for an efficient mix of climate change mitigation policies.

Carbon pricing consists of attributing a price, whether explicit or not, to the emissions of greenhouse gases of a specific installation, organization or jurisdiction. The designation of a monetary value to each emission unit of greenhouse gases (GHG), in tCO<sub>2</sub>e (tons of carbon dioxide equivalent), corresponds to sending a price signal to the decision-makers, discouraging the adoption of carbon-intensive technologies and stimulating the development of activities which imply reduction of GHG emissions.

The use of this type of instrument is based on the principle that the GHG emissions will exceed the desired levels should the market work without it. This is due to the fact that the environmental and socioeconomic costs associated to the emissions are an externality, i.e. they are not captured by the market. As there are no clearly defined propriety rights associated to the permission of GHG emissions (or to the right to an atmosphere with adequate GHG levels), there is no financial motivation for companies and consumers to reduce their emissions. This means, there are market-external costs – negative externalities – associated to pollution and which are not captured in the consumption and production activities. Consequently, the efficiency of the economy is reduced.

Carbon pricing is based on the principle that the polluter has to pay, which defines the responsibility and establishes the cost of the GHG emissions, internalizing the negative externality. This principle may be implemented by means of emission taxation – carbon levies and taxation – or by means of establishing an *Emissions Trading Scheme* (ETS).

By means of carbon pricing, the costs generated by the increase in greenhouse gas concentration in the atmosphere due to anthropic activities will be reflected by the market, directing investments to low carbon technologies and stimulating changes in behavior.

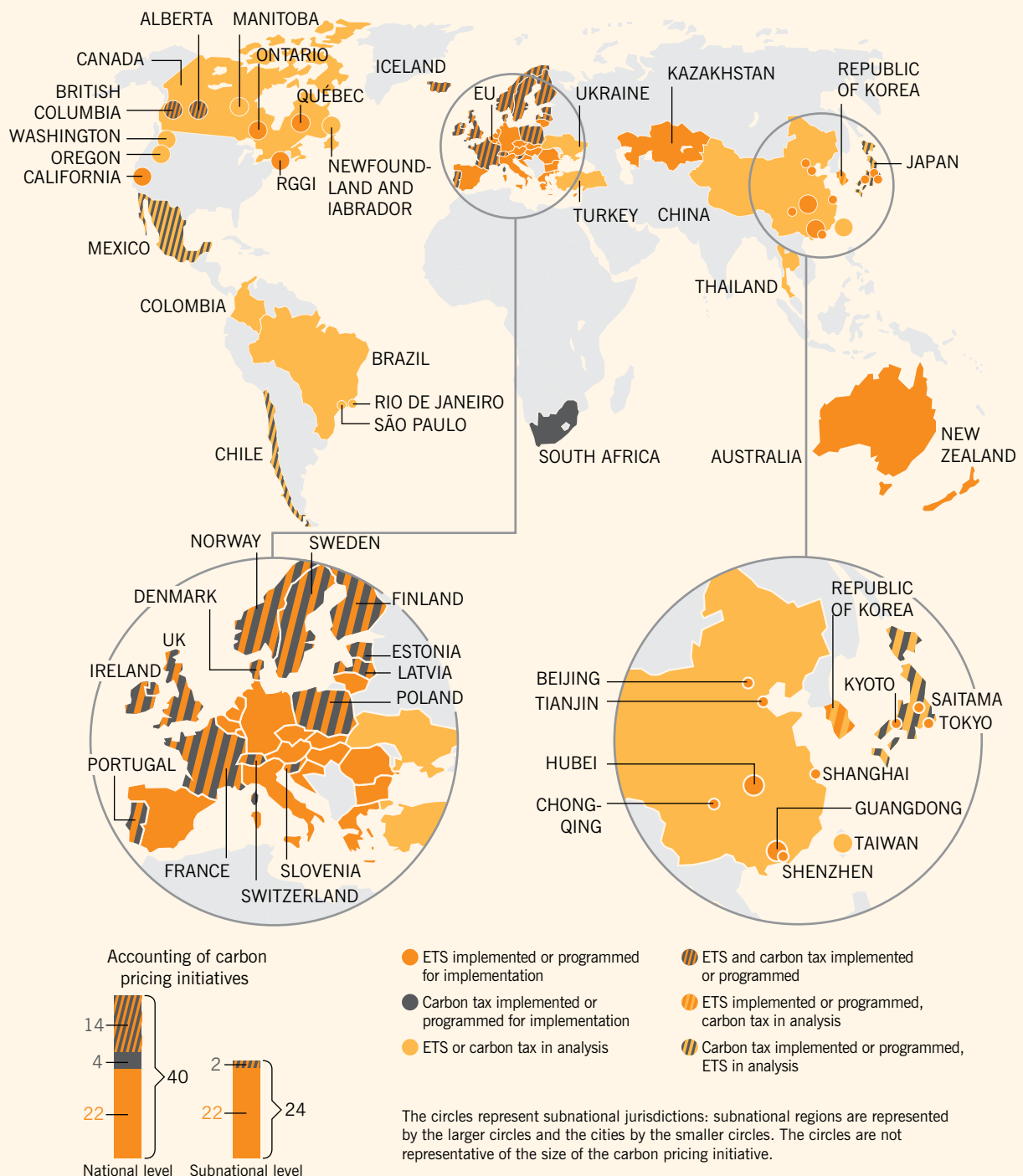
### **3.1 Carbon pricing in the world**

**The implementation of carbon pricing instruments as part of climatic policies has gained pace in the last few years. The expectations that the increase in these initiatives will occur in an exponential manner have become even higher as of 2015 when the Paris Climate Change Agreement was adopted.**

According to the Organization for Economic Cooperation and Development (OECD), approximately 13% of the global greenhouse emissions are currently covered by some pricing mechanism – a three times higher coverage than a decade ago. Approximately 40 national jurisdictions and 24 cities, states and regions have already implemented this type of instrument, which represents a volume of 7 giga tons of carbon dioxide equivalent (GtCO<sub>2</sub>e) submitted to economic regulation (OCDE, 2016). The distribution of the currently enforced carbon pricing instruments is presented in Figure 1 below (World Bank, 2016).



**Figure 1 – Enforced carbon pricing instruments or in the planning phase worldwide.**



Source: (World Bank, 2016)

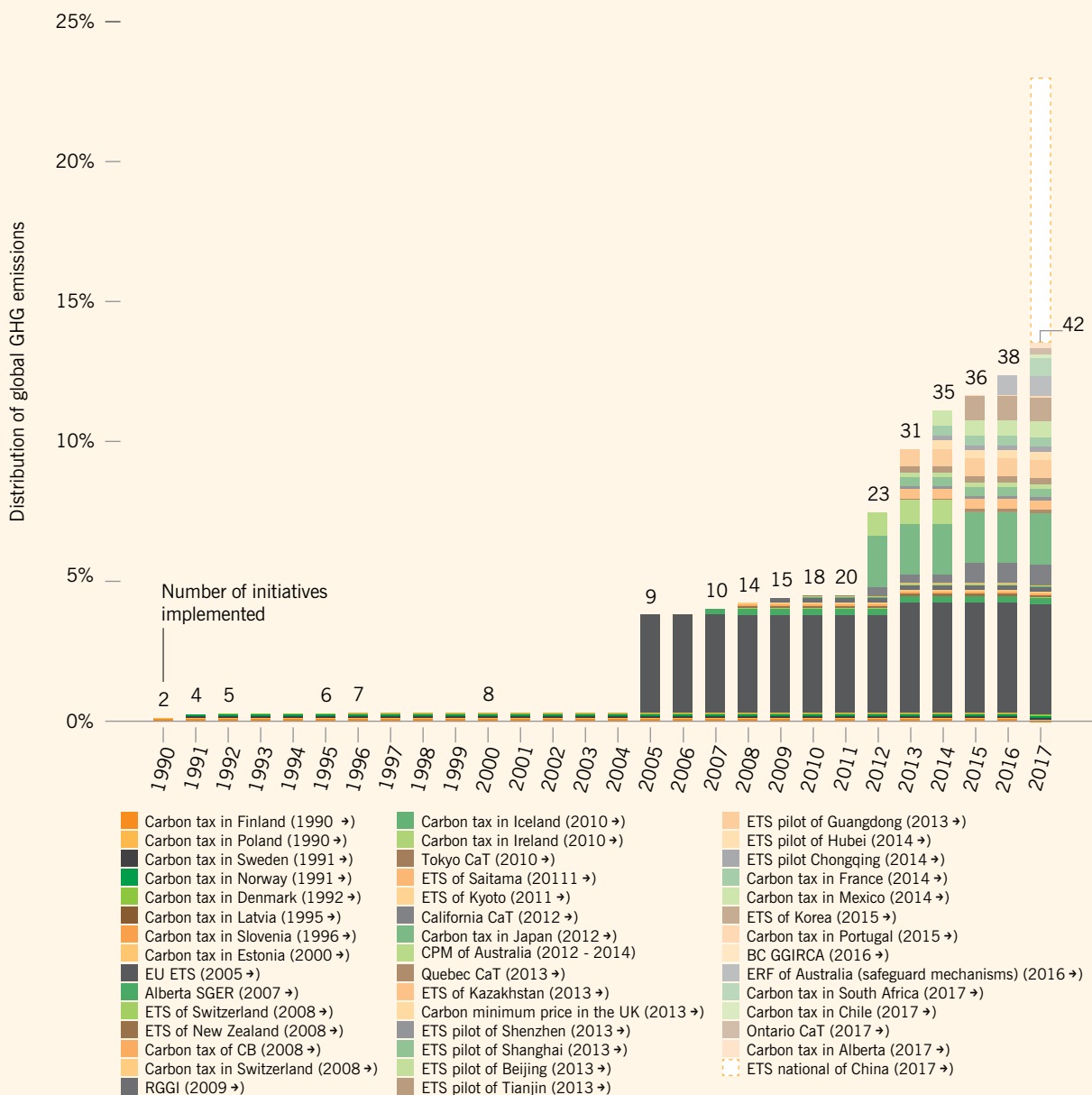
Among the more recent developments in terms of carbon pricing in the world may be mentioned: the beginning of ETS operations in South Korea in January 2015; the adoption of a carbon tax by Portugal, also in January 2015; the adoption of a price on the emissions of new liquefied natural gas plants (LNG) in British Columbia as of January 2016; and Australia's return

to the global carbon pricing scenario with the implementation of a safeguard mechanism which limits and prices the GHG emissions as of July 2016 (World Bank, 2016).

Figure 2 below presents the evolution of the carbon pricing initiatives in the world since 1990 when carbon taxes were adopted in Finland and in Poland. Three clear stages of international experience with this type of instrument can be clearly identified: the period 1990-2004, in which carbon pricing was limited to levying carbon taxes in European economies; the period 2005-2011, marked by the

beginning of the operation of the European Union Emissions Trading Scheme (EU ETS), the first cap-and-trade system in the world; and the period which started in 2012 and has extended up to these days, during which the ETS of California (as of 2012), the Australian experience (2012-2014) and the ETS of seven Chinese provinces (as of 2013 and 2014) were developed (World Bank, 2016).

**Figure 2 – Chronology of carbon pricing instruments in the world**



Note: Only the introduction or removal of an ETS or carbon tax is represented. The emissions are given in terms of distribution of global GHG emissions in 2012. Annual changes of global, regional, national and subnational GHG emissions were not represented in the chart. Data on the ETS coverage of Kyoto on the city-level were not available and the GGIRCA does not yet cover all types of emissions; their coverage is represented as zero. The information on the Chinese national ETS represents non official preceding estimates based on an announcement of the Chinese President made in September 2015.

Source: (World Bank, 2016).

For 2017 new relevant marks in the global scenario of carbon pricing policies are expected. The most important one is supposed to be the beginning of the nationwide ETS operation in China. It is forecast that thus the emissions covered by carbon pricing initiatives will achieve a level between 20% and 25% of global emissions. (World Bank, 2016).

### 3.2 Carbon pricing in the Paris Climate Change Agreement and in the NDCs

**With the conclusion of the 21<sup>st</sup> Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) and the formulation of the Paris Climate Change Agreement in December 2015, the perspectives for carbon pricing policies have been widened.**

The Paris Climate Change Agreement, which aims to strengthen the global reaction to the threat caused by climate changes, has established an ambitious objective: limiting the increase in global average temperature to a level well below 2°C in relation to preindustrial levels, with the indication of efforts to make sure that the limit of 1.5°C be not exceeded – given that this would reduce the risks and impacts of climate change significantly.

The Paris Climate Change Agreement establishes the bases for international cooperation around the climate issue as of 2020 by means of adoption of national commitments – the Nationally Determined Contributions (NDCs)<sup>1</sup> – submitted by the majority of the Parties to the UNFCCC prior to the COP 21 in the form of intended Nationally Determined Contributions (INDCs). The Agreement establishes that these domestic contributions progress a long its period of enforcement and that they reflect the Convention's principles of "common responsibilities; however, differentiated" and of "respective capacities".

As the total amount of the already intended efforts by means of the NDCs is not sufficient to achieve the objective of the Agreement, the success of future mitigation policies will be assessed in accordance with the countries' capacity of achieving an emission reduction superior to the one already presented by means of the NDCs. This, in its turn, will depend on the design quality of the mitigation policies implemented by the Parties and on the capacity of stimulating additional emission abatement by the economic agents.

It shall be highlighted that 101 NDCs – submitted by Parties which together account for 58% of global GHG emissions – indicate the interest in using carbon market instruments to achieve the respective targets. Furthermore, others point out the possibility of achieving higher emission reductions than declared if they have access to international market mechanisms (EDF e IETA, 2016; World Bank, 2016).

Although the Paris Climate Change Agreement does not directly foresee the creation of a global carbon price, some of its provisions have the



The inclusion of Article 6 in the Agreement, considered as an unexpected result of the COP 21 negotiations, presents important implications for carbon pricing.

potential of increasing international cooperation for mitigation through market mechanisms. The inclusion of Article 6 in the Agreement, considered as an unexpected result of the COP 21 negotiations, presents important implications for carbon pricing, as detailed in Chart 1 below.

<sup>1</sup> On, November 4, 2016, when the Paris Agreement came into force, the INDCs became NDCs.

**Chart 1 – Carbon pricing in the Paris Agreement**

PARIS AGREEMENT ARTICLE	IMPLICATIONS FOR CARBON PRICING
Article 6, paragraph 1	The Parties may cooperate on a voluntary basis in order to achieve more ambitious targets in their mitigation efforts.
Article 6, paragraph 2	The Parties may achieve their emission reduction targets by means of <i>internationally transferred mitigation outcomes</i> – ITMOs), provided these transfers contribute to promoting sustainable development and comply with the accounting principles approved of by the Convention.
Article 6, paragraph 3	No Party is obliged to use international transfers in order to achieve its mitigation commitments.
Article 6, paragraph 4	A new GHG mitigation and sustainable development promotion mechanism is created which is called “ <i>Sustainable Development Mechanism</i> (SDM). It is expected that the mechanism will facilitate the participation of public and private bodies in the emission reduction efforts. The structure of the mechanism, the types of activities being covered and the means of implementation have not been defined, yet; however, it is believed that it may favor the trading of ITMOs in the context of the NDCs.
Article 6, paragraph 5	In order to avoid double counting, the emission reductions resulting from the mechanism stated in paragraph 4 may not be used by more than one Party to prove compliance with their NDCs.
Article 6, paragraph 8	It is acknowledged the importance of non economic mechanisms for the Parties’ implementation of NDCs in a coordinated and effective manner.
Article 13	A framework is established in order to increase the transparency of each country’s contributions, including the need for periodically presenting national GHG emission inventories, elaborated based on methods accepted by the <i>Intergovernmental Panel on Climate Change</i> (IPCC), and information which permits assessment of the progress achieved in the implementation of NDCs.

Source: Elaborated based on EDF e IETA (2016), Zwick (2015) and World Bank (2016).

#### BOX 1 :: Carbon Pricing Leadership Coalition

It was also at the COP 21 where the *Carbon Pricing Leadership Coalition (CPLC)* was launched, one of the action platforms for the conception and implementation of pricing instruments which contribute to achieving the emission reduction targets. The Coalition is voluntarily joined by more than twenty governments and more than ninety corporations, organizations of the civil society and institutional investors.

The main objective of the CPLP is to identify and promote the adoption of transparent, efficient and fair pricing instruments which ensure competitiveness and stimulate the creation of jobs and technological innovation. It is believed that the implementation of efficient pricing policies as part of the national climate plans will be able to increase production capacity and speed up the pace of transition to sustainable economy.

### 3.3 The Brazilian NDC and the national regulatory framework

The Brazilian NDC, presented at the United Nations General Assembly in September 2015, establishes the commitment to a 37% reduction in national GHG emissions by 2025 (equivalent to the emission of 1,346 million tCO<sub>2</sub>e) and of 43% by 2030 (equivalent to the emission of 1,208 million tCO<sub>2</sub>e), based on the levels registered in 2005. The period covered by the Brazilian NDC is from 2020 and its implementation will occur in consecutive five-year-cycles (BRASIL, 2015). Thus, these cycles will result in a mitigation commitment in the year of 2025 and in an indicative contribution for 2030, for the purpose of predictability of the economic agents.

The Brazilian NDC is one among those which considered the use of market mechanisms, which makes Brazil together with China and India one of the largest GHG emitters to declare this possibility in their national contribution (World Bank, 2016). However, in the case of Brazil it has not yet been indicated how these instruments will be used. According to the NDC text, the country safeguards its position regarding its possibility of using the mechanisms which may be established under the Paris Agreement. Besides, the transfer of units derived from mitigation results achieved in the Brazilian territory will be subject to prior and formal approval by the Federal Government<sup>2</sup>.

The Paris Climate Change Agreement was signed by former President Dilma Rousseff on 22 April 2016 and approved by the Brazilian Federal Senate on 12 September. The ratification instrument was deposited with the United Nations General Secretary on 21 September, during the 71<sup>st</sup> United Nations General Assembly. The deposit of the ratification instrument also marks the date on which the Brazilian commitment leaves the field of intention and becomes its *Nationally Determined Contribution* (NDC).

On 5 October 2016, the two targets for the Paris Agreement to be enforced were achieved: the ratification of the instrument by at least 55 countries – this target had already been achieved at the end of September 2016 – and the coverage of at least 55% of the global greenhouse emissions by the ratifying countries together. Thus, the Agreement will be enforced on 4 November 2016 (UNFCCC, 2016).

### 3.4 The situation of the carbon pricing discussions in Brazil

Currently in Brazil the National Policy on Climate Change (PNMC in the Portuguese acronym) is the main regulatory mark regarding the climate issue. It was instituted in 2009 by Law No. 12.187/2009

<sup>2</sup> It shall be pointed out that the use of units coming from the mitigation results achieved in the Brazilian territory which were acquired by means of instruments not established under the Convention, the Kyoto Protocol or the Paris Agreement will not be acknowledged by the Brazilian Government (BRAZIL 2015a).

and officializes Brazil's voluntary commitment to UNFCCC at COP 15, held in Copenhagen in 2009. This policy is aimed at reducing the anthropic GHG emissions on a level between 36.1% and 38.9% of the emissions projected for 2020, besides the stimulus to the development of the Brazilian Emission Reduction Market (MBRE in the Portuguese acronym).

#### BOX 2 - Subnational carbon market policies

In Brazil, the states of São Paulo and Rio de Janeiro have announced their intention of establishing subnational emission trading markets. The State of São Paulo, pioneer in the adoption of a subnational climate change policy, disclosed in 2012 the existence of plans to establish an emission trading market on the state level. However, these plans have been suspended since 2014.

The State of Rio de Janeiro, in its turn, announced during the Rio+20 Conference in 2012 the launch of an emission trading system which would start to operate at the beginning of 2013. This instrument would cover industries from the cement, chemical and petrochemical sectors. However, its implementation has been postponed for an undetermined period of time.

Source: ICAP (2016).

Economic Policy of the Ministry of Economic Affairs (SPE/MF).

The study of institutionalization of an information system on GHG emissions was carried out by the ad-hoc workgroup on Emission Registry, instituted in 2013 with the objective of elaborating technical recommendations for the creation of the National System for Emission Registry and Removals by Drains on the lowest accounting organizational level possible. Besides these recommendations, the Workgroup promoted the empowerment of the teams of the Federal Government and of the States regarding the theme, having concluded its activities still in 2013.

Currently a project is being developed financed by the *International Climate Initiative* (IKI) of the German Ministry for the Environment (BMUB) for feeding the Registry with GHG emission data of industrial installations in Brazil. It is expected that the creation of the capacity of measurement, report and emission verification by the Brazilian productive sector be one of the bases for defining future mitigation instruments.

The PNMC governance is task of the Inter-ministerial Committee on Climate Change (CIM in the Portuguese acronym) and its Executive Group (GEx), which has ad-hoc workgroups for the discussion of specific themes. At the end of 2011, by means of a Decree of the Economic Affairs Ministry, was instituted the Inter-ministerial Workgroup (GTI) on Carbon Market with the objective of analyzing the viability and the requirements for the MBRE (Brazilian Reduction Emission Market) implementation. The GTI on Carbon Market elaborated a report on the potential and the cost-effectiveness of market instruments for emission reduction in the segments included in the PNMC. The GTI referred to was concluded in 2012, as foreseen in the governmental decree.

Once the activities of the Inter-ministerial Workgroup on Carbon Market had been finished, the feasibility study and the assessment of the convenience of adopting a carbon pricing instrument in Brazil began to focus on two points: the creation of the capacity to gather data on emissions; and the analysis of the impact of possible carbon pricing instruments. The discussions have been conducted since then by the Department of

With regards to the assessment of the impact of pricing instruments shall be highlighted the investigations carried out in the field of PMR – *Partnership for Market Readiness*, an initiative administered by the World Bank for the preparation of carbon market policies in different developing countries (Box 3). By means of the PMR, studies for assessment of possible configurations and impacts of carbon pricing instruments in Brazil have been developed since 2011, when the country presented its application for the program.



### BOX 3 - Partnership for Market Readiness (PMR)

Simultaneously, the PMR is a forum for collective innovation and a fund for offering support to countries preparing and implementing climate policies, among which are the carbon pricing instruments, with the objective of providing scale to the global mitigation efforts. The initiative joins 35 countries and subnational jurisdictions, among which are some of the biggest global GHG emitters, as for instance China, India (as **Implementation Countries**, which receive financing and technical assistance) and the United States (in the condition of **Contributing Participant**, who provides financial resources to the PMR Fund).

The activities of the PMR are focused on the **National Programs (Country Programs)**, by means of which the Implementation Countries receive financing for the adoption of carbon pricing pilot instruments or for preparation of other components which support the implementation of such instruments. The PMR also includes complementary programs, such as the **Technical Work Program**, which promotes the dissemination of knowledge and experiences in market mechanisms for climate change mitigation, and the **Policies Analysis Work Program**, which offers support for defining the post-2020 national mitigation scenarios and for identifying the cost-effective policies, among which are the carbon pricing instruments.

Source: PMR (2016)

Brazil's participation in PMR started with a preparatory phase during which two studies ordered by the Ministry of Economic Affairs were carried out: the first one consisted of the assessment of the economic impact of adopting a carbon pricing instrument by means of a computable general equilibrium (CGE) model. The second study comprised a review of international experiences in carbon taxation, exploring, from the legal point of view, possible configurations for a carbon tax in Brazil.

Once the studies of the preparatory phase had been concluded, Brazil prepared its *Market Readiness Proposal* (MRP), which was presented at the PMR Meeting in 2014. This Proposal, approved of in the same year, presents a plan for the PMR implementation phase in Brazil<sup>3</sup>.

There are three components of the PMR implementation phase in Brazil: 1) Sectoral studies to inform the policy design and modeling - carbon taxation and ETS for the agricultural sector, the energy sector (production of fuels and generation

of electricity) and the industrial sector, represented by seven subsectors (aluminum, lime, cement, steelworks, paper and pulp, chemical, and glass). 2) work of modeling the economic impacts of carbon pricing; and 3) commitment and *capacity-building*, which includes carrying out mobilization seminars and technical workshops in economic modeling.

The studies carried out in the PMR implementation phase will give origin to a *White Paper* with proposals of carbon pricing policies destined for providing guidance to the decision-making process regarding the national mitigation actions in the post-2020 period. In this phase, the central questions which have been tried to answer are: (i) would it be convenient and feasible for the country to incorporate a carbon pricing instrument to the PNMC framework after 2020? If so, (ii) which would be the best instrument to introduce a price for carbon in Brazil: the regulation of prices (by means of taxation), the regulation of the quantity of emissions (by means of a permission trading system) or a combination of both instruments?

Also with the objective of assessing the economic effects of carbon pricing instruments, it shall be highlighted the project "Green Tax Policy in Brazil",

<sup>3</sup> It shall be considered that in spite of composing the "implementation" phase, the projects referred to still largely correspond to exploratory studies regarding the options of pricing instruments in Brazil.



An increase in the Economic Dominium Intervention Contribution levied on fossil fuels would have moderately negative impacts on the growth rates of the GDP (-2% in 2030) and on the employment level (-0,7% in 2030), besides promoting a reduction of 1.5% in GHG emissions of road transport.

financed by the Embassy of the United Kingdom and which comprised two phases. In the first one, developed by the Center of Sustainability Studies of Getúlio Vargas Foundation (GVCes), the objective was compiling the existing tools for assessing the tax policy in terms of its impacts on the climate changes. Besides that, the aim was also providing an analysis of the national environmental policies, climate changes and solid residues aimed at identifying the arguments in favor of adopting a taxation model which ensures promotion of sustainability and which is not unbearable for the production sector.

The study referred to was concluded with recommendations for adopting a Green Tax Policy in Brazil, among which are: the option for an approach compatible with the national plans of sustainable development and with national long-term policies; the prioritization of offering incentives in comparison to over-taxation measures; the prior assessment of the instruments available in terms of their economic impacts and political and distribution implications; the tax neutrality, so that increases in taxation of emission-causing activities are compensated by tax incentives for cleaner activities; the concession of subsidies and tax exemptions for sectors which comply with the environmental standards; the reduction in subsidies for emission-causing activities.

For the second phase of the project “Green Tax Policy in Brazil” *Cambridge Econometrics* was in charge of. The phase consisted in the application of a macro-econometric model (E3-Brazil, elaborated in collaboration with the Ministry of Economic Affairs and the Embassy of the United Kingdom in Brazil) to capture the impact of the tax policy on the economic performance, the energy consumption and the potential of job creation in Brazil. The preliminary conclusions of the study, publicly available, indicate that an increase in the Economic Dominium Intervention Contribution (CIDE in the Portuguese acronym) levied on fossil fuels (increase of R\$0.22/liter of gasoline and R\$0.15/liter of diesel) would have moderately negative impacts on the growth rates of the GDP (-2% in 2030) and on the employment level (-0,7% in 2030), besides promoting a reduction of 1.5% in GHG emissions of road transport (POLLITT, 2015).

It has to be mentioned, still in this context, the project “Options of greenhouse gases emission mitigation in key-sectors of Brazil”, financed by *Global Environmental Facility* (GEF) through the United Nations Environment Program (UNEP) and developed under the coordination

of the Ministry of Science, Technology and Innovation (MCTI) between 2012 and 2015. The central objective of the project was strengthening the technical capacity of the Brazilian Government for implementing mitigation actions referring to GHG in key-sectors of the Brazilian economy – industry, energy, transport, private households and services, LULUCF (*Land Use, Land-Use Change and Forestry*), waste management and other inter-sectoral alternatives.

For that purpose there were selected experts able to produce more recent and integrated estimates for emission forecasts in a baseline scenario, and also able to identify the sectoral mitigation potentials and marginal abatement costs curves in specific sectors. The forecasts were carried out for the periods 2012-2035 and 2035-2050, considering three different scenarios: a) Reference Scenario (or baseline), b) Low Carbon Scenario, and c) Low Carbon Scenario with Innovation. With this study was carried out, for the first time, an integrated analysis of the different mitigation options in Brazil, considering the non-additivity of these options with their consequent economic and social implications (UNEP, 2012).





# CARBON PRICING INSTRUMENTS

## 4.1 Carbon pricing in the mix of climate policies

### Carbon pricing may reduce the economic cost of climate policies.

In the short term, the main effects of climate change mitigation policies faced by the productive sector are the increasing costs of control and loss of market of the “polluting” products (i.e., more intensive in GHG emissions). These are inevitable consequences of quantitative restrictions of greenhouse gas emissions. In the long term, for its turn, these effects may become positive as reflection of the ascension of less polluting technologies and with increase in productivity.

The environmental regulators usually apply control instruments to induce the agents to conformity with the environmental management targets. For that purpose, they define individual emission standards or individual technology standards compatible with the environmental standards which define the environmental quality levels. Thus, all the polluting agents are limited to the same emission level or use of determined environmental resources.

It may seem equitable that all agents face the same quantitative emission restrictions, but this uniformity is more costly to the society. If instead of applying equal emission standards the regulation began to charge an equal price from all agents for each pollution unit generated – i.e. if it increased the relative price of pollution – the individual control levels or the use of environmental resources by each agent would be different.

Thus, the agents with lower abatement costs would achieve a higher level of pollution control than the agents with higher costs. Facing higher relative pollution prices, all the private agents will have to choose between paying for what they pollute and reducing the pollution caused. The most rational reason, from the economic point of view, would be to reduce pollution to the point in which the marginal cost of control<sup>1</sup> is lower than the price of pollution and pay for pollution from this point onwards. In this situation, the control trajectory would follow the path of the lowest cost among the agents and, therefore, of the lowest aggregated cost for the economy.

Furthermore, pricing creates competitive advantages for the agents who effectively control pollution as those who control spend less on the controlled pollution unit than the price of pollution; whereas those who do not control are obliged to pay the price for not controlled pollution. Thus, the agents who control have lower overall control costs.

Furthermore, pricing creates a stronger dynamic incentive for innovative environmental technology as the polluters will continue to be interested in adopting cleaner production forms in order to reduce their pollution cost. All in all, it is more efficient to have the same unit price for



It may seem equitable that all agents face the same quantitative emission restrictions, but this uniformity is more costly to the society.

all the emission sources, thus ensuring equality of incentives and encouraging cost-effective reductions and innovation.

For the reasons set forth, the economic literature suggests the application of price instruments as the quickest and cheapest form to promote transition to a low carbon economy<sup>2</sup>.

<sup>1</sup> Marginal cost of control or abatement is the economic cost (investment, operation and maintenance) of the actions and practices which reduce the emissions. The economic theory makes use of the marginal concept to demonstrate how these costs evolve in the way the control level increases (the first cost derivative in relation to the quantity controlled).

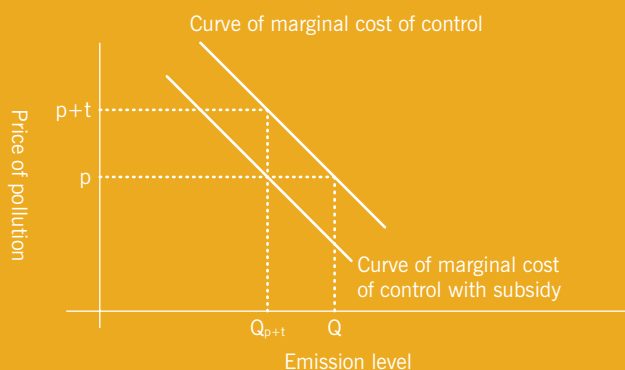
<sup>2</sup> The basic bibliography for the development of the conceptual and theoretical part are Chapters 3 and 15 of the IPCC/AR5/WGIII report (IPCC, 2014).

#### BOX 4 - Is it possible to achieve the pollution control target by means of subsidies instead of prices?

Check in the chart below the curve of marginal cost of control of an economy prior to the climate policy. This curve represents how much the economic agents are willing to reduce their emissions in response to pollution pricing. At the moment, the environmental policy imposes standards and other control mechanisms so that its costs signalize a price  $p$  for pollution. Thus, the emission level finds an equilibrium in  $Q_p$ .

With taxation of greenhouse gas emissions via an increase in price  $t$ , as shown in the chart below, the emission level is reduced from  $Q_p$  to  $Q_{p+t}$ .

In the market creation system, instead of establishing taxation with price  $t$ , the quantity of emissions  $Q_{p+t}$  is distributed among the economic agents being free to negotiate them among themselves. Thus, the price of equilibrium of the emission licenses exchanges would be  $(p + t)$ , i.e. generating the same surcharge  $t$  of the taxation. This demonstrates the equivalence of the price instruments and the market instruments in the absence of transaction costs and uncertainty (SEROA DA MOTTA, 2008).



In the short term, this surcharge  $t$  of taxation or of the market will increase the production costs and will consequently cause negative economic impacts. In the long term, however, this price incentive will induce to innovation in cleaner and more efficient technologies in pollution control. Thus, the curve of marginal cost of control would point downwards and for society reducing its emissions would become cheaper.

However, there is the intuition that these short-term losses could be avoided with the creation of subsidies. If instead of charging a surcharge  $t$  the economic agents received subsidies  $s$  equivalent to  $t$ , the curve of marginal cost of control would also point downwards, as shown in the chart above, and the emission level at the current price  $p$  would also result in a drop in emissions to  $Q_{p+t}$ , in the same way as in the case of taxation.

The creation of subsidies may be a tempting solution due to the gains obtained in the short term. However, in the long term this solution leads to increasing tax costs and dynamic inefficiency by reducing incentives for technological innovation. This is due, in the first place, to the fact that the subsidies meet restrictions of tax capacity – as all the companies which entered into the market would be entitled to these subsidies, turning the tax account permanent and increasing. Thus, instead of the principle of the “polluter is to pay”, we would have in this case the principle of “the taxpayer is to pay”. In the second place, the option of higher emissions in order to receive higher subsidies would become profitable for the company – reducing drastically the incentive for pollution reducing innovations. In the end, a company which is not profitable under a pricing policy may become profitable under a policy of subsidies.

## 4.2 Types of carbon pricing instruments

**Pricing instruments may be applied in form of duties or by means of market creation.**

Whichever environmental policy is applied, it establishes the overall emission limit for a specific period. This limit is generally defined in relation to some *baseline*, as for instance the reduction of a percentage in the emission level in a given year – as in the Brazilian NDC.

**In the case of taxation of emissions, a price to be paid per emission unit is determined so that the previously established aggregated emission level is achieved.** This is done in such a way that the sum of the pollution reductions achieved by each polluter results in the new desired aggregated control level. Thus, ideally the price reflected in the environmental taxation shall be based on functions of cost control of the regulated agents. For each pollution price, the regulator would identify the associated controlled quantity.

Instead of price regulation, **the regulators could create markets in which the agents interact in purchase and sale negotiations of negotiable emission rights.** As these rights are negotiable among the agents, a market will be created which will define the transaction prices for these rights. In this case, the initial restriction is quantitative, and not caused by the price. Thus, **the maximum quantity of emissions desired for the entire economy is distributed among the agents (*cap*), allowing them to trade the emission licenses within these limits (*allowances*).** For this purpose, the regulator would define a rule of allocation of these licenses among the economic agents – which may be done, for instance, by means of gratuitous distribution of part of these permissions and sale of the other ones by means of auctions.

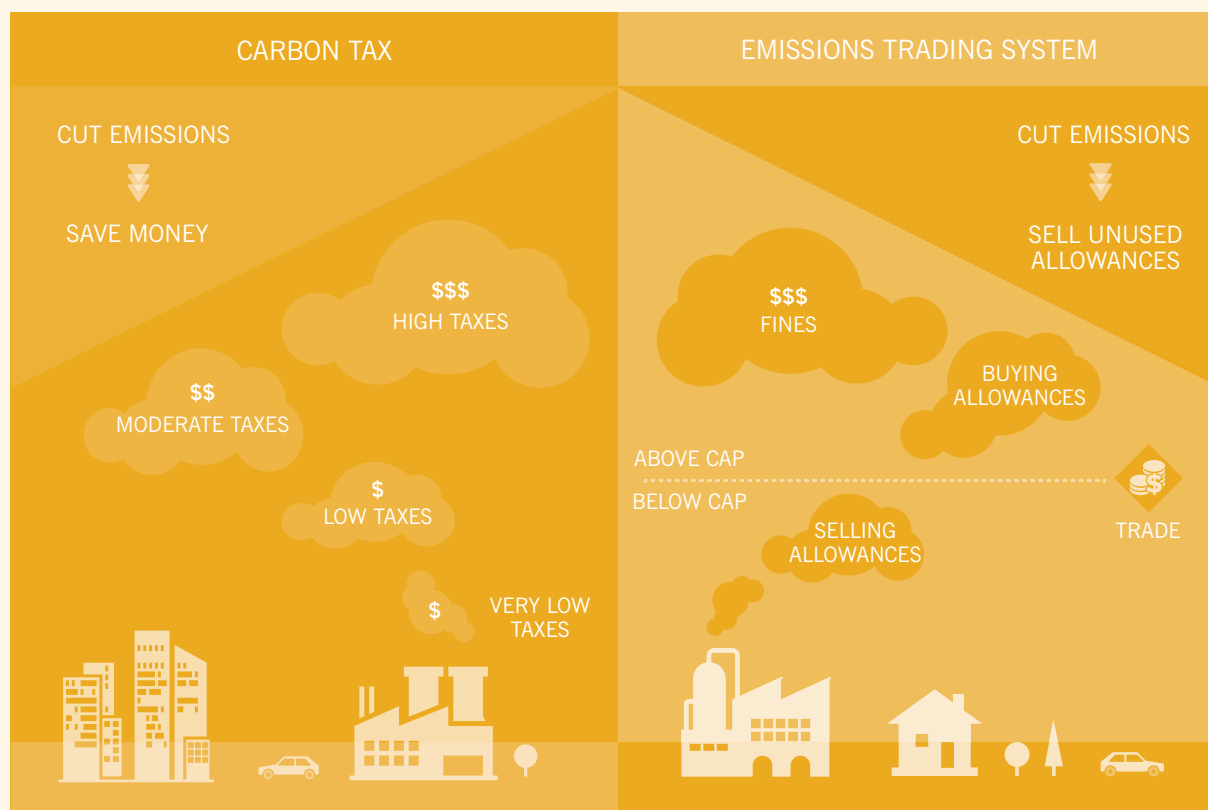
Whether gratuitous or negotiated in auctions, the licenses will reflect a cost of opportunity, i.e. the value of alternative use in the installations of their holder which will be set in the market transactions. As a consequence, the problem of the company's cost minimization is the same in any allocation system and, therefore, the efficiency will be the same, leading to the same price of equilibrium. However, gratuitous allocation may cause distribution problems as it privileges with higher chances of selling licenses those who received a larger proportion of their emission needs and/or who have higher control costs. Auctions do not have these distribution effects as in this allocation system the purchase

prices of the revenues reflect each agent's marginal cost of control. Besides, auctions generate tax revenues for the governments which could be recycled in the economy – reducing a duty or even financing investments into clean technologies.

National markets may be connected to other markets. They may also accept the acquisition of credits or *offsets* of emission reductions from jurisdictions without market, but which define and sell emission rights under the Climate Convention – such as the Clean Development Mechanism (CDM) and the emission reductions from deforestation and forest degradation (REDD). Although operationally the incorporation of these credits and *offsets* into market systems is easier, the regulation of the taxation may also create exemptions for the acquisition of these assets. Anyway, generally it is necessary to limit the use of these mechanisms in order to ensure incentives to technological innovation – as it was done for instance in the EU ETS.

A comparison between the two types of pricing instruments – carbon taxes and emission trading systems – is presented in Figure 3 below.

**Figure 3 - Representation of the functioning of carbon taxation and of emission trading systems**



Source: Own elaboration based on WMB (2016).

A description of some of the main carbon pricing instruments enforced in the world – Norway and United Kingdom, regarding carbon taxes, and EU ETS and RGGI (*Regional Greenhouse Gas Initiative*), regarding emission trading systems – is presented in Boxes 5 and 6 below.



National markets  
may be connected to  
other markets.

## BOX 5 - International Experiences with the use of carbon taxes

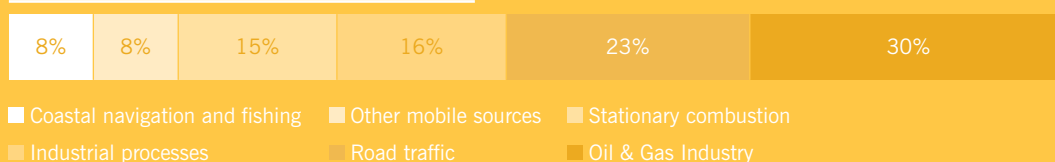
### NORWAY

CO<sub>2</sub> taxation was introduced in 1991 on the consumption of gasoline, diesel oil, mineral oil and on the sector of *offshore* petrol. The tax is part of Norway's special consumption tax regime regarding fossil fuels, which also includes a tax on energy and a tax on SO<sub>2</sub>. The taxes are annually reviewed and result from political negotiations.

#### Gases covered by the tax

CO<sub>2</sub>, N<sub>2</sub>O e PFCs

#### Emissions of the covered sectors (2014)



#### Tax rates (2012)

Vary in accordance with the energy product:

- NOK 101 (EUR 13,7)/tCO<sub>2</sub> (heavy fuel oil);
- NOK 225 (EUR 30,5)/ tCO<sub>2</sub> (natural gas, oil for heating);
- NOK 384 (52,1 euros)/ tCO<sub>2</sub> (gasoline).

#### GHG reduction targets

Reduction in CO<sub>2</sub> emissions coming from the oil industry and promotion of low carbon technologies in the sector. Norway has assumed the commitment to become carbon-neutral by 2050.

#### Estimate of covered emissions (2013)

75.2%

#### Results achieved

Between 1990 and 2001, carbon tax contributed to a reduction in emissions on land by just 1.5%, and in the total amount of emissions by just 2.3%. The energy intensity was reduced by 7.2%, though, contributing to an 11% decrease in CO<sub>2</sub> emissions. However, it was observed a 30% reduction in energy intensity in the private households, due to the more efficient use of gasoline, which reflects changes in the consumers' choice of their vehicle as a result of fuel prices.

In the same period, the tax was considered as efficient in the reduction in CO<sub>2</sub> emissions per production unit, which registered a drop of approximately 22%.

Source: Dahan et al. (2015); Withana (2013).

## UNITED KINGDOM

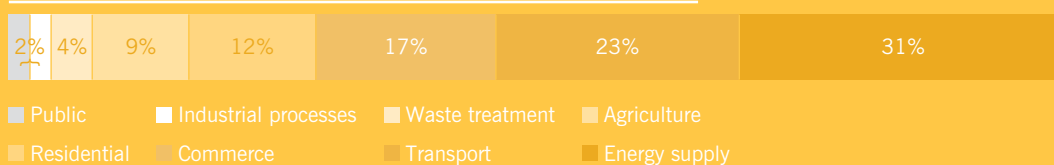
The Climate Change Levy (CCL) was introduced in 2001 and is applied to electricity, natural gas and other fossil fuels, such as liquefied petroleum gas (LPG), coke and semi-coke of coal used by industries, companies and the public sector. The main objective of CCL is promoting changes in the companies' behavior regarding their GHG emissions.

As of April 2013, the CCL includes the 'Carbon Price Floor' (CPF), a tax on fossil fuels used for generating electricity – which were previously exempted from the CCL. The taxes take into consideration the average carbon content of the fossil fuel and have the objective to maintain an explicit price for carbon emissions, thus stimulating investment into clean technologies.

### Gases covered by the tax

CO<sub>2</sub>

### Emissions of the sectors covered, excluded LULUCF (2014)



### Tax rate (2012)

In March 2014, the government froze the rates:

- £18/tCO<sub>2</sub> of 01 April 2016 to 31 March 2020.
- £18.08/tCO<sub>2</sub> in the fiscal year 2015-2016.

### GHG reduction targets

- 2008 – 2012: 23% below the GHG levels of 1990;
- 2013 - 2017: 29% below the GHG levels of 1990;
- 2018 – 2022: 25% below the GHG levels from 1990 to 2020;
- 2023 – 2027: 50% below the GHG levels from 1900 to 2025.

### Estimate of emissions covered (2013)

35.4%

Sources: United Kingdom (2016); Dahan et al. (2015); Withana (2013); Waycarbon, Ludovino Lopes Advogados and Climate Focus (2014).

## BOX 6 - International Experiences with emissions trading systems

### THE EUROPEAN UNION EMISSIONS TRADING SYSTEM (EU ETS)

The EU ETS is the first major GHG negotiation system in the world and represents the central pillar of the European Union's climate change policy. The system started its operations in 2005 and contemplates more than 11,000 installations in 31 countries (28 member-states of the EU, as well as Norway, Iceland and Liechtenstein).

#### Gases covered by the tax

CO<sub>2</sub>, N<sub>2</sub>O and PFCs

#### Sectoral participation in the total amount of emissions covered (2012)



#### Permissions allocation method

Auction and free distribution of licenses.

#### Average price of the permissions

- In 2014: € 6/tCO<sub>2</sub> (US \$ 7/tCO<sub>2</sub>);
- In August 2015: € 8/tCO<sub>2</sub> (US \$9/tCO<sub>2</sub>).
- By 2020: 20% below the GHG levels of 1990;
- By 2030: at least 40% below the GHG levels of 1990;
- By 2050: the leaders of the EU committed themselves to reducing the GHG emissions by 80-95% below the levels of 1990.

#### Emissions reduction target

##### Evolution of the cap.

Phases 1 and 2 (2005-2012): The European ETS resulted from the aggregation of the National Plans of each member-state, with decentralized limits.

Phase 3 (2013-2020): Single limit on EU level for stationary sources: 2.084 MtCO<sub>2</sub>e in 2013, which will annually be reduced by a constant factor of linear reduction (actually 1.74% of the average point of the limit of phase 2). Limit of the aviation sector for the period from 2013 to 2020: 210 MtCO<sub>2</sub>e/year (will not diminish).

Phase 4 (2021-2030): In accordance with the proposal of the EU ETS review, the annual linear reduction factor will be changed from 1.74% to 2.2% as of 2021. The linear reduction factor does not have a suspension clause and, thus, the emissions limit will continue to diminish after 2030.

Source: ICAP (2016).



## REGIONAL GREENHOUSE GAS INITIATIVE (RGGI)

The RGGI is the first mandatory GHG ETS in the United States. The participating states are: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.

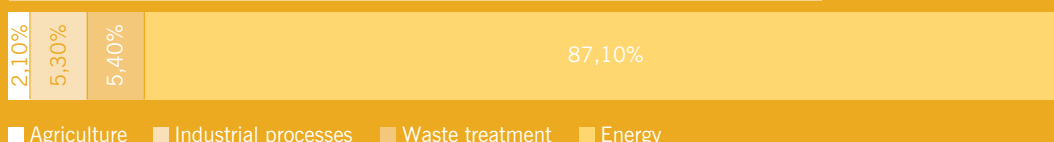
The development and implementation of the RGGI are supported by RGGI Inc., a not profit-oriented cooperation, but each participating state has its own legal and/or regulatory authority.

The first period of program compliance was from 01 January 2009 to 31 December 2011. As foreseen in the original Agreement Memorial signed by the participating states, a program review was carried out in 2012.

### Gases covered by the tax

CO<sub>2</sub>, only.

### Sectoral participation in the total amount of emissions covered (2012)



### Permissions allocation method

Auctioning.

### Average price of the permissions

- In 2015: € 5.48/tCO<sub>2</sub> (US \$ 6/tCO<sub>2</sub>);
- In 2016: € 7.31/tCO<sub>2</sub> (US \$8/tCO<sub>2</sub>).
- In 2017: € 9.14/tCO<sub>2</sub> (US \$10/tCO<sub>2</sub>).

### Emissions reduction target

- By 2020: the participating states committed themselves to a regional reduction target above 50% in relation to the GHG levels of 2005.

### Evolution of the cap

The original cap remained stable at 149.7 MtCO<sub>2</sub> (165 million American tons) in the period from 2009 to 2014, with an annual reduction factor of 2.5% from 2015 to 2018.

By 2012, the RGGI achieved a reduction of more than 40% in emissions in relation to the original limit and, due to this reduction in emissions, the states diminished the limit to 91 M American tons in 2014, as part of the 2012 program review.

Source: ICAP (2016).

## 4.3 Equivalence of the instruments

**Without transaction costs and uncertainty in the marginal costs of control, the two types of instruments generate the same cost-effectivity gains.**

It shall be noticed that both in taxation and in market creation the regulations require the estimate of the aggregated curves of marginal costs of control of environmental damage of the agents regulated. This measurement, in its turn, is generally unprecise, keeping in mind the limited availability of the information required. Thus, the regulator is uncertain regarding the question of how the agents and the environmental damages would react, respectively, to pollution price and quantity regulations.

When this uncertainty regarding the control costs trajectory is higher than the uncertainty regarding the trajectory of the damages, i.e. the costs may increase much faster with pollution than the damages, taxation would then be more appropriate as the loss with price variations (volatility) in market systems would not compensate the possible mistakes in achieving the targets and, therefore, it would be recommended to adopt periodic price adjustments via taxation in order to achieve the targets. In the opposite case – small variations in the control quantities generate much more abrupt variations in damages than in costs – it would be more efficient to use quantitative controls as those which are adopted in the market creation instruments.

All in all, the adoption of duties is preferable if the cost of uncertainty is relatively higher in the abrupt pollution price variations; otherwise, the market solution is preferable if the cost of uncertainty is relatively lower in the abrupt variations of damages<sup>3</sup>.

It shall be pointed out that the possibility of using hybrid systems in which price controls are adopted within a market system in order to reduce the volatility of the negotiated values has become more feasible as the international experience has shown. An example is given by the creation of minimum and maximum price references (lower limit and upper limit for prices practiced in the market, as those adopted in California, in Quebec and in the RGGI). Another possibility, adopted in the EU ETS, would be to maintain a licenses reserve which would be sold and purchased in order to ensure price stability (*Market Stability Reserve*).

**Regarding taxation, the largest political challenge is in defining the tax rate, whereas in the market system this challenge is met in the distribution question of the emission rights allocation criterion – although without consequence in the system efficiency.** However, the transaction cost in taxation is lower than in the market system as contrary to the markets, where the economic agents have to discover prices and sign contracts, the administrative cost of taxation is initially lower as it uses the institutional fiscal capacity already existing.

<sup>3</sup> However, if the uncertainty of prices and damages are negatively correlated, the market solution may be better.



Regarding taxation, the largest political challenge is in defining the tax rate.

Therefore, the existing market experiences do not include sectors which involve a large number of economic agents, which would generate the need for a high frequency of licenses transactions (as it is the case of the transport and agriculture and livestock sectors). Thus, market systems tend to have their scope concentrated on the industry and the energy sector.

Consequently, taxation instruments may be adopted together with market systems to cover the sectors which would initially be excluded from the regulation. This configuration and combination of instruments has strongly been influenced by political economy factors in which the participation and the power of influence of the regulated agents and of the regulators end up determining choices dictated not only by technical questions (see Box 7).

### BOX 7 - The political economy of pricing

*"If you drive a car I'll tax the street.*

*If you try to sit I'll tax your seat.*

*If you get too cold I'll tax the heat.*

*If you take a walk I'll tax your feet.*

*Taxman, George Harrison*

Although the quantitative restriction of emissions is the central issue of the economic impacts of the environmental policies, the design of the price instruments ends up attracting to its sphere the whole controversy of the climate policies debate.

Taxation – even equivalent in terms of efficiency and cost to the creation of markets, and with lower transaction costs – usually meets with the biggest political challenges. Some environmentalist groups are concerned about the possibility of this instrument generating excessive emissions as the quantity of emissions allowed is not fixed. The companies, in their turn, may be afraid of losing the opportunity of making use of the advantages of a market system with gratuitous allocations. Beyond any doubt, for the political representatives it is preferable to avoid the accusation of being favorable to an increase in taxes.

Other barriers linked to the political economy may arise from legal and institutional aspects. Constitutional barriers as those existing in Brazil may create obstacles to creating new duties. On the other hand, the existing institutional capacity may present greater familiarity with taxation than with market creation mechanisms.

There are also perception conflicts regarding exemptions and compensations. When instruments for taxation or for auctions of licenses are adopted, there is strong pressure by the regulated agents for financing mechanisms which return the revenues by means of credit subsidies and compensations to the regulated agents.

The non-governmental environmental organizations and experts, in their turn, consider as crucial the elimination, even if gradual, of the special treatment offered to energy-intensive industries as this would reduce the incentives to innovation. Besides, this differentiation would reduce the collection of revenues which could be used to reduce the tax load on work and, as a consequence, increase job offers. Finally, it would allow abnormal profits in the sale of licenses to the benefited sectors. For instance criticism of the European Commission for excessive concern with competitiveness, which facilitates being captured by the pressure groups of large corporations.

The experience of the EU ETS well reflects the controversy. Studies demonstrate that the benefits of revenues from auctions and the reduction in tax expenditure with compensations by far exceed the costs of loss of competitiveness due to leakages (FTI CONSULTING; COMPASS LEXECON, 2014; BUSHNELL; CHONG; MANSUR, 2013; ELLERMAN; BUCHNER; CARRARO, 2007).

On the other hand, the regulated agents, including the large corporations, have combatted, for instance, the new measures of Phase III of the EU ETS, which foresees a gradual increase in auctions for the allocation of emission licenses and that the possible gratuitous allocation follows an emission reference level based on the emissions of the plants which are included in the 10% layer of least carbon intensity (*benchmarks*). They also create a price regulation mechanism which would be licenses reserve (*Market Stability Reserve*) and an Innovation

Fund which allocates licenses in accordance with the technological performance (ETU; ESA 2016; CEPI, 2015). The productive sector, particularly the industrial sector, is explicitly in favor of gratuitous allocations and rejects their being defined by very stringent referent criteria. Furthermore, they consider that the price regulation effect is unnecessary and that the allocation by the Innovation Fund is complementary and not restrictive. Finally, they request total compensation of the indirect costs of the price increase in electricity and raw materials whose consumption has increased with the substitution of fossil fuels.

In the United Kingdom, in its turn, the industrial sector has accused the national climate policy of “double regulation” as they have to pay for emissions via EU ETS and also via the CO<sub>2</sub> taxes adopted by the country concomitantly.

All in all, these political and institutional barriers affect the design of pricing instruments and end up throwing into shade the aspects of efficiency and equity of the instruments. On the other hand, by bringing these sectoral concerns and perceptions together in a compatible manner it is possible to forge a pricing system which is politically feasible and believable.

## 4.4 Interaction of instruments

### Climate policy strongly interacts with other sectoral instruments.

To the extent in which the climate policy encompasses the entire economy, it interacts with a series of other instruments in the fiscal, energy, environmental, transport, trade, technology, agricultural and social policy areas. These interactions may have determinant impacts on the success of the climate policy, in general terms, and on the development of carbon price schemes, in particular (SORRELL; SIJM, 2003; ACHTNICHT et al., 2015).

When this interaction is complementary, the combination of instruments mutually strengthens the achievement of the objectives of the policies which interact. However, there is also the risk that different policy instruments may adversely interfere one upon the other, mutually jeopardizing their objectives and, as a consequence, creating incentives which are perverse to the climate policy.

In order to determine if the interaction may be judged as benefic, neutral or counterproductive, a careful exam of its nature and of its consequences is required. For this purpose, the objectives of each instrument are to be assessed and to the extent in which they strengthen or not the conflict between each other, the

scope and the operation of each instrument after the interaction are to be analyzed. As well as the sectors, the jurisdictions and the emission sources which are directly or indirectly affected by each instrument - and how they will react to the incentives after the interaction - are to be taken into consideration.

There are interactions sometimes perceived as “double regulation” when the same emission source is affected by two different instruments. This leads to double payment for reduction of the same GHG emission unit. However, these double payments may be combined in order to ensure a common aggregated objective. Furthermore, as already discussed before, two instruments may act together on the same emissions provided they are directed at two different failures or market barriers. Carbon pricing, for instance, may be combined with energy efficiency standards or energy substitution targets in order to correct behavioral barriers or of information asymmetry. In addition, the nature of positive externality of the innovation will not be totally internalized with higher relative prices and, therefore, they need direct subsidies for research and development (see Box 7).

Perverse incentives, in their turn - as, for instance, subsidies to fossil energy or to deforestation - reduce, or even eliminate, the climate policy incentives. Thus, the adjustments of this type of interaction are to have priority in the design of the carbon pricing instruments.

## 4.5 Institutional arrangement

**Good regulatory governance ensures an efficient transition towards a low carbon economy.**

The implementation of economic instruments depends on a legal and institutional framework which includes knowledge and environmental, sectoral and fiscal capacities. In this way, a stable regulatory framework is created which offers a consistent, credible and strong signal to direct investments into clean technologies. This regulatory framework will require participation, predictability, flexibility and monitoring (MANN, 2009; PERTHUIS; TROTIGNON, 2015).

Support and acceptance of carbon pricing will strongly depend on the efforts, from the beginning of the regulatory process, of participation and communication with the affected interested parties regarding logics, the empowerment criteria, the desired results and the *trade-offs* of sectoral and social costs and benefits.

The predictability of the carbon price trajectory promotes an organized transition to a low carbon economy over time, providing new innovative business opportunities. It may also contribute to the stability of the revenues and their destination.

If on one hand a gradually increasing carbon price creates adequate political incentives, on the other hand, it produces more emissions in the short term than an initially higher price. This is the so called “*green paradox*” – see Box 5.

Whereas predictability is essential to support the long-term investment decisions, there is also the need for offering flexibility to the price adjustments in order to manage the exogenous shocks for the purpose of ensuring the system’s credibility and reliability.

Finally, monitoring and regular follow-up of the national and sectoral carbon budgets are crucial to reducing uncertainties. In the case of markets, there is the need for establishing an emission register in order to avoid double counting. For taxation it will be necessary to have transparency in the tax account adjustments and the application of resources.

Thus, carbon pricing requires an autonomous and transparent governance structure in order to avoid deviations resulting both from the influence and the interests of the regulated agents and from the changes of government or political opportunism.

This will only be possible if the climate policy regulation itself adopts a governance structure similar to that of other regulated sectors (for instance, electric energy and communications) in which market failures are regulated. In these sectors there is a ministerial body responsible for the definition of legislative bill initiatives of the regulatory framework, as well as its follow-up, counting with the assistance of an inter-ministerial council which allows for the alignment of sectoral policies and instruments.

The implementation of this regulatory framework would be executed by an autonomous agency, a special semi-public body outside the intervention of the Executive Power, which would be responsible for



The predictability of the carbon price trajectory promotes an organized transition to a low carbon economy.

achieving the objectives of the regulatory frameworks with mandates for the Directors and a budget not subject to curtailment.

This body, besides supervising the implementation of the national climate policy, would act (i) in the articulation between the federal initiatives and the different other state initiatives in the field of greenhouse gas emissions regulation which operate with other price or control instruments; (ii) in the collection and distribution of resources or in emission right auctions; and (iii) in registration, monitoring and verification (SEROA DA MOTTA, 2015).

As seen in the sections above, it may be affirmed that the decisions on the institutional arrangement represent just part of the phases involved in designing a carbon pricing instrument. Thus, Chart 2 below describes some of the central decisions which are to be taken by the policy-makers in defining the design of a carbon pricing instrument – whether a tax or an ETS.

**Chart 2 - Central elements for designing a carbon tax and an ETS**

TAX
<ul style="list-style-type: none"> <li>• <b>Definition of the sectoral scope:</b> This corresponds to the selection of the sectors which will be regulated by the tax, generally being those which consume substantial quantities of fossil fuels;</li> <li>• <b>Establishment of a calculation base and tax rate:</b> In general, the rate is calculated based on the CO<sub>2</sub> emissions expected per unit of fuel burnt, using specific emission factors for each fuel. This means that the real rate charged per unit of fuel varies in accordance with its carbon content, and which, therefore, is charged “per ton of CO<sub>2</sub> emission”. The rates may also vary for sectors which are more or less GHG emitters, for instance. The objective of the rate determines its value, whereby the highest ones usually are aimed at stimulating changes in the consumers’ behavior. The lowest ones, in their turn, have tax objectives or even the objective of creating revenues for a climate change or low carbon technologies fund. Besides, some fiscal carbon policies foresee plans of gradual increase in the rate, allowing that the bodies covered get financially and technologically adapted.</li> <li>• <b>Concession of discounts and exemptions:</b> The discounts or exemptions of rates tend to be granted to the sectors which are most exposed to international competition and to those which are already regulated by some emissions trading regime. They may be transitional, in order to allow that the companies get adapted to the new tax, or permanent, avoiding the loss of competitiveness in some sectors of the industry.</li> <li>• <b>Use of revenues:</b> There is large variation in the final destination of the revenues in countries in which the tax has already been implemented. In some cases, the revenues are recycled to the taxpayers, destined to the most vulnerable sectors, to the adverse effects of taxation, or forwarded to financing environmental measures. In other cases, they are directed to the state treasury, where they may be used for income tax reductions or be invested in sectors such as education and health care.</li> <li>• <b>Legal and institutional framework:</b> The implemented policy has to be transparent and concise in order to be well accepted by the sectors affected by the taxation, as well as by the population. Frequently, the introduction of a tax implies a comprehensive reform of the environmental policies and/or the tax system as a whole, which has not proven to be a big challenge in countries with strong institutional capacity for taxation.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Scope definition:</b> It establishes the sectors subject to regulation, such as industry, the energy sector, civil construction and transport. Besides, it determines the GHG included in the policy (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>, NF<sub>3</sub>), the regulation points (<i>upstream</i> – in which regulation affects the production/commercialization point of the emission-causing fuel - or <i>downstream</i> – in which regulation affects the body or installation which is responsible for the GHG emission into the atmosphere), the installations regulated and the criteria for their inclusion in the coverage of the instrument.</li> <li>• <b>Definition of cap:</b> The <i>cap</i> will be established based on the emission data – historic or projected ones – of the sectors covered by the system. Obtaining these data, in their turn, may follow a <i>Top-Down</i> or a <i>Bottom-Up</i> approach. The <i>cap</i> shall reflect the level of ambition of the emissions reduction target which is intended to be achieved, taking into consideration possible <i>trade-offs</i> between the ambition level of the <i>cap</i> and the regulation costs. Finally, it is necessary to define the trajectory to be followed by the <i>cap</i>, which may evolve in accordance with absolute terms or of intensity.</li> <li>• <b>Allocation of permissions:</b> The permissions may be allocated gratuitously (in accordance with <i>grandfathering</i> criteria in which they are distributed in accordance with the regulated bodies’ historic emissions, or <i>benchmarking</i>, in which the distribution is carried out based on reference indexes for the sector) or sold in auctions. Besides, the design of the instrument shall foresee how the regulation of new participants will be considered, the closure of installations and the removals of GHG emissions</li> </ul>

- **Decision on the use of *offsets*:** If *offsets* of sectors not covered by ETS and/or credits coming from emission reductions achieved in other jurisdictions are accepted, the sectors, gases and eligible activities shall be delimited beforehand. Besides, the limit for the use of *offsets* shall be established and it has to be determined if these credits will be coming from a proper *offset* program or from already existing programs – such as the MDL.
- **Decision on temporary flexibility:** It is necessary to define if the permissions of a determined installation which were not used in a *compliance* phase of the ETS may be used in future periods (*banking*) and if permissions of future phases may be used beforehand (*borrowing*), as well as the rules of these flexibility mechanisms. As a matter of course, the periods of *compliance* of the instrument are to be well established.
- **Promotion of price predictability:** It shall be foreseen the criteria and methods for intervention on prices in case they achieve very low or very high levels which make the adequate functioning of the system impossible. The intervention instrument has to be outlined.
- **Compliance guarantee and supervision:** In order to ensure the efficacy of an emissions market, their report is to be made in a clear and regulated manner. The definition of how the ETS registration will work and how the regulation of the market will be is fundamental, as well as the form how fulfillment of the regulation will be ensured.
- **Stakeholders' commitment, communication and capacity-building:** Besides identifying the main *stakeholders*, their interests and concerns, it is necessary to outline which will be the strategies to get them committed. Another essential issue is defining which will be the approach for the empowerment of the agents involved, considering the complexity of an ETS-type system.
- **Consideration of the interconnection of markets:** The delimitation of the strategy for the connection of the ETS with other markets, whether on the national or the regional level, shall be made beforehand. Finally, the design of the system shall be elaborated taking into consideration the need of future compatibility of the systems, as well as the definition of the partner markets and the type of interconnection to be established.
- **Implementation, assessment and betterment:** A feasible schedule for the implementation of the system is to be established, as well as the scope of the subsequent reviews. Finally, the forms of assessment of performance and of the impacts of the emissions trading system are to be foreseen.

Source: Own elaboration based on WayCarbon, Ludovino Lopes Advogados and Climate Focus (2014), PMR and ICAP (2016).







# EFFECTS OF PRICING: BENEFITS, IMPACTS AND POSSIBLE RESPONSES

The international literature supplies enough evidence of the definition and implementation phases of instruments which attribute prices to greenhouse gas emissions. Thus, the experience of the main mechanisms enforced in the world – among them the EU ETS (European Union Emissions Trading System) and the systems adopted in British Columbia, California, Australia, Chile, Mexico, France, Scandinavian countries and China – offers valuable information for jurisdiction which are in the preparation process for adopting these economic instruments.

## 5.1 Socioeconomic benefits of the pricing instruments

Besides the gains in efficiency, pricing instruments also permit to reduce tax load distortions of the economy.

Besides emission reductions, there is another social benefit – a double dividend - if the revenues obtained with environment pricing permit the reduction of another duty or finance already existing expenditures.

In this way an environmental tax reform is initiated. As a matter of course, such recycling would only produce a second dividend if the tax or expenditure replaced generated more allocative distortions in the economy than the environment pricing. Therefore, the possibility of a double dividend will depend on the tax structure and on the expenditures of each economy. In the case of carbon pricing – which predominantly affects energy which is fundamental for the entire economy – the more attractive substitution would be in relation to taxes which are levied on labor, which usually present relatively higher costs in all the sectors of the economy.

The revenues achieved by the pricing instruments may also be used for financing social assistance programs, in order to increase the resilience and adaptive capacity of the neediest populations. The resources potentially collected with carbon pricing at around USD20.00/tCO<sub>2</sub>e are equivalent in amount to the current expenditures on social assistance, indicating that recycling, even if partial for this purpose, has an expressive social impact (HALLEGATTE et al., 2016). When the economic instrument contributes to reduction in inequality, it not only reduces emissions and stimulates economic growth, but it is said to have achieved a triple dividend.

However, such a change of the fiscal paradigm is not a trivial question. Its success depends on the interaction and combination of several other policies which affect pollution prices (effects of political interaction) and the capacity of the tax system to make adjustments. In some cases, the barriers of the market and of behavior (which generate inertia, divided incentives and information asymmetry) are also to be removed and the addition of control instruments becomes necessary (as, for instance, in the case of energy efficiency) – see Box 5.

As important as the design of carbon pricing instruments shall be the consideration of removing perverse subsidies which are opposed to pricing incentives. As example there may be mentioned those offered



The resources potentially collected with carbon pricing at around USD20.00/tCO<sub>2</sub>e are equivalent in amount to the current expenditures on social assistance.

to fossil fuels or to infrastructure and activities which generate the intensification of consumption of these fuels. There also may be mentioned the subsidies

and activities which stimulate deforestation and those which promote the generation of solid residues and of effluents.

#### BOX 8 - Integration of pricing instruments

The use of pricing instruments in climate policies requires complementarity with other instruments. In the same way that creation of a price is a better solution for a negative externality – as the GHG emissions, for instance –, the establishment of a subsidy is recommended for a positive externality – as for instance technological innovation. This is due to the fact that the economic agents tend to reduce their expenditures on innovation – as they are investment risks – and the opportunity that some benefit from the innovations carried out by others (spillover effect).

The incentives to innovation via price lose impetus when the fossil energy industry reacts to the higher relative price of its fuels trying to reduce production costs. As this strategy will have to be implemented via innovation, given its market scale, the fossil energy industry will compete for human resources in a much more favorable manner than the clean energy sectors. Consequently, it will impose higher risk and uncertainty on the development of clean technologies. Therefore, the climate policies shall include, besides prices for emissions, subsidies to innovation of clean technologies, so that there are two different sources of externalities. This subsidy differs, for instance, from the subsidy for generation of clean energy which primarily has the objective of generating economies of scale.

Furthermore, the reaction of the fossil energy industry to the increase in the relative price may be the acceleration of the exploitation of these resources, to the extent in which the declining tendency of its prices is perceived. That means, it increases the extraction volume in order to use the revenues in investments in the financial markets which may offer higher yields. This situation is called “green paradox”, which follows the known Hotelling rule for the extraction of not renewable resources.

On the other hand, the reduction of the fossil energy prices by increase in offer or by reduction in cost of its use through higher technological efficiency may generate an indirect increase in demand, known as “rebound effect”.

Although some practices and technologies which generate significant gains in energy efficiency present a high return rate at modest costs, there is evidence that despite that fact they are not broadly adopted, the so called energy efficiency gap. This situation is explained by barriers related to financing the changes, by the transaction costs which include losses of the networks of knowledge or qualitative attributes related to the replaced technology, besides costs of empowerment for handling the new technology and even the barriers to the changes in the internal structure, to the culture and managerial strategies. That means, asymmetric information and behavioral factors may represent market failures for the implantation of technological changes. These informational and behavioral barriers are also observed in the adoption of low carbon technologies in agriculture and cattle growing which, although they are more profitable, are not totally disseminated.

For these reasons, besides the subsidies to innovation, climate policies additionally have to adopt control instruments, such as clean energy targets or efficiency standards in order to mitigate these reverse effects described above.

## 5.2 Carbon pricing instruments economic impacts

### International experiences with carbon pricing show positive economic impacts.

The climate policies economic impacts fall on the scale of production, employment, and investment, as well as profitability and productivity performance indicators.

As already discussed above, several studies show that the economic impacts of the greenhouse gases emission target limits in Brazil would be greatly reduced if price instruments are applied. Studies assessing the international experience involving taxation and carbon market indicate that the negative economic impacts are not significant, and using said instruments also yields positive effects<sup>1</sup>.

The EU ETS case - a more region wide carbon pricing experience with a greater time-span ETS - allows the impacts of this type of policy to be more accurately examined. Although pricing has caused the electricity price to increase (between 20 and 100%), as well as the diesel and gasoline price (over 50%), a performance analysis of companies before and after the pricing policy was adopted generally shows that the EU ETS positively affected production, employment, and investment in regulated companies - although a small reduction in employment levels has been observed in some countries.

The effects on productivity and income in the EU ETS are ambiguous; some studies show positive changes, some show negative changes. However, the energy-intensive sectors - which received a generous amount of free allowances - managed to earn significant profits from selling those permissions, and the stock market positively evaluated that privileged situation of regulated companies with strong license sales positions (OESTREICH; TSIKAS, 2015). A recent study finds that, despite a little impact on productivity and profit, the EU ETS significantly fostered the growth of regulated companies when compared to non-regulated companies (see Box 9).

<sup>1</sup> The EU ETS impact assessment is based on several studies, such as, (ELLERMAN; BUCHNER; CARRARO, 2007) (MARIN; PELLEGRIN; MARINO, 2015) (ELLERMANN; MARCANTONINI; ZAKLAN, 2016), (KLEMETSEN; ROSENDAHL; JAKOBSEN, 2016), (WAGNER et al., 2014), (LAING et al. 2014) (LISE; SIJM; HOBBS, 2010), (KENBER; HAUGEN; COBB, 2009), (CEPS, 2005) and (OBERNDORFER; RENNINGS; SAHIN, 2006).

The most innovative companies in the ten years of the EU ETS have shown better performance than the others. In fact, the EU ETS is deemed responsible for a 10% increase on low-carbon technologies patent registration in regulated companies. Energy efficiency, in turn, improved 20%, despite the modest economic growth over the past ten years (CALEL; DECHEZLEPRETRE, 2016; BUSHNELL; CHONG; MANSUR, 2013).

There is consensus that, in addition to the innovation factor, the economic recession that began in 2008 also contributed to the sharp drop in transaction prices of licenses in the EU ETS. Together with free and generous allocation to energy-intensive sectors, it helped to reduce the control cost, thus contributing to favorable pricing effects.

Experiments involving taxation on carbon - whose regional scopes are lower than the EU ETS - show even lower impact magnitudes. This type of taxation lies predominantly on fossil energy sources, which concentrate carbon emissions. Traditionally, the energy tax logic has been adopted for tax collection purposes and, in some cases, to reduce dependence on imports (as it was initially, for example, the case of Pro-Alcohol in Brazil).

Environmental considerations associated with this type of instrument only appear at the end of the 1980s. One of the first initiatives in this direction was the one that favored unleaded fuel (gasoline) in Europe and the United States through a tax rebate. There were other experiences to reduce local gas emissions, but isolated ones.

Currently, there are numerous initiatives related to energy taxation for CO<sub>2</sub> emission control. In some cases, in the Scandinavian countries particularly, such taxation makes-up a green tax reform, in which the additional revenue from raising taxes on the CO<sub>2</sub> content of energy sources is used to deduce the conventional tax burden, labor taxes specially. Also in Germany the carbon tax is used as fiscal adjustment measure.<sup>2</sup>

Usually, part of the tax collection is also intended to finance activities that contribute to achieving climate policy goals. For example, all revenue raised in the UK, Ireland, and Denmark is directed to finance the

<sup>2</sup> The carbon assessment evaluation is based on (WITHANA, 2013), (BOWEN, 2011), (SPECK, 2008), (ANDERSEN; EKINS, 2009) and (EUROSTAT, 2003).

regulated agents' spending in mitigation and innovation. In the United States, in turn, a clean transport plan, which will help meet the country's carbon reduction target, was announced by President Barack Obama in February 2016. Approximately one third of the investment required - corresponding to a total of US\$ 300 billion over the next ten years - would come from a US\$ 10 tax charged per oil barrel.

Therefore, the taxation experiences have had to reconcile revenue targets with the mitigation incentive, as the higher the tax, the greater the incentive for the regulated companies to adopt mitigation practices and technologies, with consequent less tax collection.

It is noteworthy that, as the main tax experiences were implemented in Europe, the CO2 taxes coexist with the EU ETS in most cases. This instruments coexistence is due to pricing scope expansion in sectors that the carbon market do not cover, tax reform, or even mitigation or adaptation activities funding.

That taxation usually does not fall on all uses, users, or sectors, and comes with numerous tax exemptions and reductions to mitigate competitiveness effects (see Box 7). Almost all of them, however, have a temporal dimension of gradual increase in rates and the tax sector scope, with smaller a smaller window for special treatments.

Due to exemptions granted to the industry, those taxes have regressive effects, as they will be ultimately levied on automotive fuels and heating mainly, particularly households ones, more than on burning fuel for energy generation. Therefore, an analysis of those experiences in the OECD indicates that there is no strong evidence of significant economic impacts, nor that this levy has had a major contribution to emission reduction. For example, the energy rising costs would be only 5 to 10%, while the impact on prices would be 1% tops.

Effects on innovation were not marked as well, although British Columbia - the first province in Canada to establish a greenhouse gas emissions restriction and to adopt the carbon pricing policy - records clean technology investments twice higher than in the rest of Canada, which reflects an almost 50% increase in technology sector sales in the region.

Currently, these taxes correspond to an income around 2-5% only within the total revenues, although this share is less than 1% in the UK and almost 8% in the Netherlands. Although modest, those revenues make the economy tax base to shift. These tax collection effects on market instruments, such as the EU ETS, only happen when emission allowance auctions, instead of free allocations, are adopted.



the higher the tax, the greater the incentive for the regulated companies to adopt mitigation practices and technologies.

#### BOX 9 - EU ETS economic impacts

Based on a broad European Community company panel, Marin et al. (2015) conducted the latest study on the EU ETS effective economic impact on all participating countries. This study adopted econometric analysis strategies that allowed to isolate – with better accuracy compared to previous studies – the effects of the EU ETS on performance differences between carbon pricing system regulated companies and non-regulated companies. The results indicate significant positive effects: when compared to non-regulated companies, the regulated companies increased the value added in 6% in the period, with the number of employees increasing by 7.8%; investments by 26.7%; and sales by 14.9%.

No effect was observed on average wages and labor productivity. Only modest negative effects on overall productivity (1.6 to 2.4%), on profit (1.5%), and a drop of 0.4-0.5% in return on investment. It means that the effects on scale indicators are high and positive, while performance indicators are not very significant.

It shows that, when facing an imposed greenhouse gas reduction target, companies in the European Community would already have higher costs and, consequently, loss of competitiveness. With the EU ETS, however, although some productivity and profit loss still persists, the regulated companies was stimulated when compared to non-regulated companies growth.

In short, experiments with carbon pricing confirm their long-term positive impact on business growth and innovation, and many of the effects on competitiveness were faced with special treatments. Anyway, identifying the ideal balance between higher incentive rates, exemptions, and compensations remains controversial.

Each economy that has implemented those systems choose the format that would politically accommodate best those competitiveness loss risk expectations and the greenhouse gas mitigation targets. And all of them showed that said balance was being adjusted with stronger price signals, to the extent that the system's reliability was being developed and the technological innovation was being consolidated.

### 5.3 Estimated impact of climate policy scenarios in Brazil

**In recent years, some studies have tried to estimate the socioeconomic impacts of the adoption of a carbon pricing instrument in Brazil, either from an aggregate or a sectoral point of view.**

Some of these studies adopt computable general equilibrium models. Through these models, a price is defined for carbon and the model calculates the level of resulting emissions, or vice versa: a limit on emissions is set and the model calculates the equilibrium carbon price. Whatever the option, impacts are noticed on macroeconomic aggregates or sector variables resulting from the economy's adjustment process to a new equilibrium point. Generally speaking, the impact of introducing a pricing tool in the economy brings adverse effects on macroeconomic



the carbon price  
is an instrument  
to achieve the  
mitigation goals  
in a more cost-  
effective manner.

aggregates, as it implies a restriction or an additional cost to the economy, but on a smaller scale than those expected when command-and-control policies are simulated in the same models, i.e., the imposition of mandatory limits. This is because the carbon price, as already discussed, is only an instrument to achieve the mitigation goals in a more cost-effective manner - that is,



with lower economic cost. In short, it is the quantitative restriction of emissions arising from impacts that the pricing tends to reverse in the medium and long term.

The general equilibrium models also allow simulating the impacts of different options for recycling the revenue collected by the government with the pricing instrument, either being a tax or an allowance distribution revenue. Examples of revenue recycling include direct transfers to households, subsidies for specific sectors, and reduction of other taxes. Depending on the way these funds raised are injected back into the economy, the positive effects of recycling may exceed the negative impacts caused by the introduction of emission restrictions, resulting in a net positive impact on the economy. As the main objective of the pricing tool is environmental (reducing emissions) to this second benefit.

The first assessment of the macroeconomic effects of introducing a carbon price in the Brazilian economy, carried out under the PMR, was made through the computable general equilibrium model BeGreen (Brazilian Energy and GHG Emissions General Equilibrium Model). Faced with the hypothetical target of a 15% reduction of emissions in 2030 compared to a baseline scenario, the main macroeconomic aggregates performance was estimated. The selection of the sectors covered by that policy coincided with the sector coverage of the Industry Plan (chemicals, cement, other non-metallic products, steel and steel products, pulp and paper, aluminum products), to which were added the extraction, production, and oil and gas refining industries (BRASIL, 2015b).

The study simulated three scenarios: 1) Command-and-control policy: a 15% reduction target was imposed on selected sectors, considering the baseline scenario in 2030 without carbon pricing instruments; 2) Cap-and-trade: a carbon pricing instrument was adopted through the free distribution of GHG emission allowances for selected sectors, with an imposed reduction target of 15% of emissions considering the baseline scenario for 2030; and 3) Carbon Tax: adopting an instrument equivalent to a tax on the carbon emissions of selected sectors, thus recycling revenues to households. The tax rate was calculated annually, so that emissions accumulated in 2030 corresponded to a reduction of 15% when compared to the baseline scenario (increasing from R\$ 24/tCO<sub>2</sub>e in 2015 to R\$ 150/tCO<sub>2</sub>e in 2030). Finally, an additional hybrid scenario was simulated by combining policies 2 and 3: a carbon tax was considered for the period 2015-2020 with revenues recycling for households; and for the period between 2021 and 2030, the policy considered involved emission allowances tradable among sectors.

The simulation results were summarized and made publicly available by means of two rates: cost-effectiveness (ratio between the percentage change of GHG emissions and GDP percentage change against the baseline scenario) and cost-equity (ratio between the percentage change of GHG emissions and the percentage change in Gini Index of population deciles yields in relation to baseline). Carbon pricing policies proved more cost-effective, as expected, than command-and-control policies, and Policy 3 was the more cost-effective and cost-fair, as shown in Table 1 below.

**Table 1 - Results of macroeconomic study conducted during the PMR Brazil preparation stage**

VARIABLE	POLICY 1	POLICY 2	POLICY 3
% Variation in Gini index	-0.2	-0.2	-5.5
% Variation in total emissions	-7.0	-4.7	-4.2
Cost-effectiveness: % Variation in Emissions/% GDP growth	2.38	3.44	5.32
Cost-equity: % Change in Gini Index /% Change in emissions	0.03	0.04	1.32

Source: Brazil (2014).

The study reinforces the conclusion that carbon pricing policy design - particularly in terms of instrument's revenue recycling options - has different macroeconomic and sectorial impacts. In fact, instrument design choices seem to be more decisive for its efficiency than the choice between different types of instrument (taxation or cap-and-trade).

The Begreen general equilibrium computable model was also used by Magalhães, Domingues and Hewings (2015) to estimate the impact of an emissions reduction target imposed to the Brazilian economic sectors (specifically GHG emissions from energy use and production activity). The emission reduction is achieved through setting of a price for GHG emissions - which, in practical terms, is a carbon taxation.

The results obtained by Magalhães, Domingues, and Hewings (2015) consist of variations in relation to a

baseline scenario, considering the Brazilian economy trajectory if there were no emission restriction policies. Three policy scenarios are simulated for different constraint levels (reduction of 5, 10, 15, 20, and 25% of emissions): 1) emission limits and a carbon tax; 2) emission limits and carbon tax with endogenous technological progress hypothesis (which allows companies to reduce emissions through technological innovations, thus avoiding taxation); and 3) emission limits and carbon tax with revenues collected recycled as households subsidies. The third scenario considers three different forms of recycling: subsidizing consumption, direct transferring to the entire population, direct transferring to the poorest households. The results of a 5% emission restriction simulation in the three scenarios are shown in Table 2 below.

**Table 2 – Results of Magalhães, Domingues, Hewings (2015)**

VARIABLE	SCENARIO 1	SCENARIO 2	SCENARIO 3		
			RECYCLING THROUGH SUBSIDIZING CONSUMPTION	RECYCLING THROUGH INCOME	RECYCLING THROUGH INCOME OF POOREST HOUSEHOLDS
Actual GDP	-0.65	-0.46	-0.59	-0.64	-0.65
Employment	-0.57	-0.40	-0.51	-0.57	-0.58
Carbon price in 2030 (R\$/ tCO <sub>2</sub> e)	15	10	15	14	14
GDP/Emissions reduction	0.13	0.09	0.12	0.13	0.13

Source: Magalhães; Domingues; Hewings, 2015.





negative economic impacts can be minimized through policies that promote technological innovation and through practices that redistribute revenues from tax.

The table shows that Scenario 2 - which considers technological progress - allows achieving a 5% reduction target at the lowest economic and social cost: a reduction of 0.46% of the GDP and 0.4% of the employment level against a baseline scenario. In scenarios that lack technological progress, the recycling of tax revenues through subsidizing consumption seems to be the most cost-effective configuration.

The study indicates that negative economic impacts can be minimized through policies that promote technological innovation and through practices that redistribute revenues from tax. In a technological progress scenario, the goal of reducing 25% of emissions by 2030 is achieved at the lowest cost possible (-5.1% of GDP in 2030, compared to a loss of 8.93% of GDP in the baseline scenario of lack of technological progress).

Besides the BeGreen, other general equilibrium models were used to estimate the effects of carbon pricing on the macroeconomic aggregates. Wills and Lefevre (2012), for example, assess the economic impact of a carbon tax in Brazil using the IMACLIM-S BR computable general equilibrium model. In this model, the political scenario is simulated through a carbon price that is added to the energy prices paid by interim and/or final consumers. A first set of simulations considered a carbon tax of R\$ 200/tCO<sub>2</sub>e. The authors say that, as a result, the way in which the tax incomes are used is a decisive factor for the economic growth rate, the unemployment rate, and the public debt level.

Silva and Gurgel (2010), in turn, used an EPPA (Emissions Prediction and Policy Analysis) model of the MIT (Massachusetts Institute of Technology) to estimate the carbon emission tax impact on the Brazilian economy. For the 2015-2050 period, the authors simulated an initial carbon price of US\$ tCO<sub>2</sub>e, with a consequent 52.17% reduction of emissions and a GDP decrease of approximately 6.08% in 2050, against a reference scenario. Adopting emission reduction measures would, therefore, change the country's growth line trajectory, with little significant effect on GDP during the first years of the policy. According to the authors, the policy's effectiveness in its final years of effectiveness (reduction of 45.8% and 52.17% of emissions in 2045 and 2050 respectively) is due to the carbon price gradual increase – an annual growth of 4%.

The Chart below shows an overview of selected studies to estimate the socioeconomic aggregate effects of carbon pricing instruments in Brazil.

**Chart 3 - Summary of studies that estimated the economic impact of carbon pricing instruments in Brazil**

STUDY	GOALS	METHODOLOGY	INSTRUMENT/ MODELED SCENARIO
Economic and Social implications of GHG Emissions Mitigation Scenarios in Brazil by 2030. IES-Brasil, 2015.	<ul style="list-style-type: none"> <li>› Check the mitigation actions impact on macroeconomic and social indicators (such as GDP, inflation, employment, and income distribution), their costs, and the relevant emission reduction level.</li> <li>› Test scenarios with a global carbon tax on emissions from fossil fuels burn.</li> </ul>	<p>The results from Message, Leap, and Blum mathematical models were used to feed the IMACLIM-BR hybrid Computable General Equilibrium model.</p> <p>The GHE emissions were grouped into five sectors: Agriculture, Forestry, and Other Land Use (AFOLU); Energy; Industry; Waste; Transport.</p> <p>High economic growth rates were considered.</p>	MA1: Mitigation measures without carbon tax
			MA1 + T: Mitigation measures with carbon tax
			MA2: A more ambitious set of mitigation measures without a carbon tax
			MA2 + T: More ambitious mitigation measures with carbon tax
Social and economic impacts of carbon tax in Brazil. INSTITUTO ESCOLHAS, 2015.	Assess the carbon tax impacts with and without tax neutrality, to be obtained through Pis-Cofins simplification.	Social, economic, and environmental impacts of the proposed Carbon Tax were estimated through an Hybrid Input-Output Matrix for 2011. The matrix was built with the National Accounts Systems (IBGE) and the National Energy Balance (EPE) data.	Scenario 1a: A tax assessed on fossil fuels burns at US\$ 10/tCO <sub>2</sub> e
			Scenario 1b: A tax assessed on fossil fuels burns at US\$ 50/tCO <sub>2</sub> e
			Scenario 2: A tax assessed on fossil fuels burns at US\$ 35.68/tCO <sub>2</sub> e with Pis-Cofins simplification.
A Low Carbon Economy in Brazil: Policy Alternatives, Costs of Reducing Greenhouse Gas Emissions and Impacts on Households. MAGALHÃES; DOMINGUES; HEWINGS, 2015.	Evaluate price-induced emission reduction policies (such as a carbon tax) and their impact on the economy and welfare.	<p>Computable general equilibrium model (GHG), the BeGreen (Brazilian Energy and Greenhouse Gas Emissions General Equilibrium Model).</p> <p>The model's structure is recursive and dynamic, and is divided into two modules: a model specific to the energy sector, and an environmental model.</p>	Scenario 1: Emission restrictions and carbon tax
			Scenario 2: Emissions restrictions and a carbon tax, with endogenous technological progress hypothesis
			Scenario 3: Emissions restrictions and carbon tax with collected revenues recycled as subsidies to households.

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Regarding the reference scenario (Governmental Plan Scenario - GPS):

- › GDP growth of 3.91%.
- › Unemployment rate reduction of 6.2%.
- › General price index increase of 39.75% due to higher wages.
- › Investment rate drop of 5.29% due to the industry's loss of competitiveness related to general price index increase.

A tax of US\$ 20/ tCO<sub>2</sub>e causes a GDP reduction of 0.17% compared to the GPS.

Regarding the reference scenario (Governmental Plan Scenario - GPS):

- › GDP growth of 3.98%.
- › Unemployment rate reduction of 19.54%.
- › General price index increase of 76.40%.
- › Investment rate drop of 12%.

› A tax of US\$ 100/ tCO<sub>2</sub>e causes a GDP reduction of 1.48% compared to the GPS.

- Highest decreases in unemployment rate, as labor hiring is fostered.
- The trade balance is higher than in the GPS, due to the smaller carbon footprint in the production of energy-intensive goods and increased industrial competitiveness.

A US\$ 10/tCO<sub>2</sub>e rate yields a GDP drop (0.19%) and an employment rate drop (0.21%). The collection of indirect taxes increases by R\$ 8.9 billion.

With a rate of US\$ 50/tCO<sub>2</sub>e, the GDP would drop 0.94%, and the employment rate would drop 1.03%. The collection of indirect taxes increases by almost R\$ 44 billion.

With a fee of US\$ 35.68/tCO<sub>2</sub>e and Pis-Cofins simplification, the impact on GDP (0.47%), employment level (0.53%), and wages (0.41%) would be positive. The estimated drop in government revenue was approximately R\$ 37.4 billion (on number of Dec/2011).

With a carbon price of R\$ 15 t/ CO<sub>2</sub>e in 2030, the estimates show a drop in actual GDP (-0.65%), employment level (-0.57%), exports (-1.69 %), and imports (-0.11%).\*

In this scenario, the carbon price in 2030 would be R\$ 10/tCO<sub>2</sub>e, with an estimated drop in actual GDP (-0.46%), employment level (-0.40%), exports (- 1.24%), and imports (-0.12%).

#### Recycling through subsidizing consumption:

A carbon price of R\$ 15 t/CO<sub>2</sub>e in 2030 would bring a drop in actual GDP (-0.59%), employment level, (-0.51%) and exports (-1.91%) . There would be an increase in imports (0.24%).\*

#### Recycling through income:

With a carbon price of R\$ 14 t/CO<sub>2</sub>e in 2030, the estimates show a drop in actual GDP (-0.64%), employment level (-0.57%), and exports (-1.91% ), with an increase in imports (0.01%).\*

#### Recycling through income of poorest households:

A carbon price of R\$ 14 t/CO<sub>2</sub>e in 2030 would bring a drop in actual GDP (-0.65%), employment level, (-0.58%) and exports (-1.79%) . Imports, on the other hand, would increase (0.01%) as in recycling through income.\*

\* The results mentioned refer to a 5% restriction of emissions. Other simulations were carried out in Magalhães et al. (2015).

STUDY	GOALS	METHODOLOGY	INSTRUMENT/ MODELED SCENARIO
Carbon emission tax impact on the Brazilian economy. SILVA; GURGEL, 2010.	Estimate the economic impacts resulting from a climate change mitigation policy.	EPPA Model (MIT). This is a multi-region, dynamic-recursive general equilibrium model, which represents both the world economy and the specifics of the Brazilian economy.	Initial carbon price of US\$ 20/tCO <sub>2</sub> e, with 4% annual growth (2015-2050).
The impact of a carbon tax over the Brazilian economy in 2030 - IMACLIM: The GHG model hybrid approach. WILLS; LEFEVRE, 2012.	Analyze the carbon tax impact over the Brazilian economy.	Hybrid general equilibrium model IMACLIM BR-S, developed by the authors according to a hybrid input-output matrix for 2005.	Implementing a carbon price, which should initially be R\$ 200/tCO <sub>2</sub> e, and added to energy prices paid by interim and/or final consumers.
Economic evaluation of public policies aiming the reduction of greenhouse gas emissions in Brazil. FERREIRA FILHO; ROCHA, 2008.	Assess the impact of different types of carbon taxes on the economy.	A inter-regional, bottom-up general equilibrium static model was used. The model was derived from the Australian MMRF-GREEN model, and calibrated according to the Brazilian economy.	CARB TAX05: A R\$ 10/tCO <sub>2</sub> e carbon tax assessed on fossil fuels only. CARBTAXAT: A R\$ 10/tCO <sub>2</sub> e carbon tax assessed on non-fossil fuels only. CARBTAX05x: A combination of the above scenarios, keeping the tax rate in R\$ 10/tCO <sub>2</sub> e.

Source: Construction according to different authors.

## 5.4 Climate policies sectoral impacts

The climate policies sectoral impact is directly related to the emission reduction level that each policy assigns to each sector. That level will indicate the degree of effort required to have the emissions reduced. Industry characteristics, however, as well as control instruments, may or may not mitigate that impact. Generally speaking, the instrument's sectoral impact would be as high as:

- The sector's carbon intensity: the carbon intensity is given by the volume of emissions (in tCO<sub>2</sub>e) per unit produced; hence, it is a relative emission level indicator and, therefore, of the mitigation effort also.
- The sector's marginal mitigation cost: the marginal mitigation cost varies according to sector, and may vary amongst emitters in a same sector, according to the type of technology used. Therefore, those costs may vary regardless of the carbon intensity.

- The sector's demand price elasticity: markets where the demand is very elastic to price variations do not allow that emission reduction additional cost to be passed-through to the final consumer. Therefore, in such cases, the profitability loss will be higher.
- The sector's degree of competition: the degree of competition depends not only on demand price elasticity, but also on the number of producers in the market. Sectors whose companies face international competition, for example, have even less options for passing-through.

**In short, a pricing instrument impact on the profitability of a given sector is as high as the carbon intensity, the marginal cost control, the competition (exposure to foreign markets), and the demand price elasticity.**

One should notice that that, in the medium and long term, those impacts tend to be eliminated by technological innovation that businesses adopt to counter the potential profit loss. Therefore, the

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- 52.17% emissions reduction and a GDP drop of approximately 6.08% in 2050;
- The largest GHG emission reductions are from the most carbon-intensive sectors.

The determining factor in the economic growth rate, the unemployment rate, and the government debt level is the way in which the tax incomes are used.

A US\$ 10/tCO<sub>2</sub>e rate yields a drop in GDP (-0.32%), employment rate (-0.45%), exports (-2.77%), and imports (-0.45%).

A US\$ 10/tCO<sub>2</sub>e rate yields a drop in employment rate (-0.80%), and imports (-0.35%). On the other hand, there is an increase in exports (6.14%), but GDP remains constant.

A tax rate of R\$ 10/tCO<sub>2</sub>e combining both sectors leads to a drop in GDP (-0.39%), employment level (-1.03%), and imports (-0.83%). Regarding exports, there is an increase of 2.39%.

higher the sector's research and development capacity, the lower the impact, as several carbon pricing experience studies have shown. By accelerating technological innovation process, the carbon pricing instruments may potentially preserve, even improve, the regulated companies' performance. Experiments with pricing instruments also show how they can be used to mitigate the short-term impacts, either by sector's emission allocation criteria or tax exemption (see Box 10).

In Brazil, studies that tried to estimate the climate policy scenarios' possible effects can evaluate those characteristics' interaction impact. The results depend on the model parameters selected, which are estimates, despite being realistic. Thus, they do not consider, e.g., the variation between plants in a same sector.

Among the studies that have estimated the sectoral impacts of carbon pricing instruments in Brazil, Rathmann et al. (2010), Castro, and Seroa da Motta (2013), as well as IES-Brazil (2015), stand out.

#### 5.4.1 Rathmann et al. (2010): benefits and challenges of a cap-and-trade in the industrial sector

Rathmann et al. (2010) used the national input-output matrix to calculate the impact of a cap-and-trade system on the industrial sector



the most affected segments would be cement, refining, pig iron and steel, ferroalloys, and non-ferrous metals. Mineral extraction, pulp and paper, and chemicals sectors would be little affected.

in Brazil. The study works with goals from 2015 and aims to reach 2030 with the emissions level of 2008. Two options were considered to mitigate the policy's impact, which are: free distribution of certificates, and granting tax incentives for investments in low carbon technologies. The study concludes that the sectors that emit more, in absolute terms, will not be the most affected. Rather, the loss of competitiveness would be associated with the sectors exposure to foreign trade. The results show that the most affected segments would be, in this order: cement, refining, pig iron and steel, ferroalloys, and non-ferrous metals. On the other hand, mineral extraction, pulp and paper, and chemicals sectors would be little affected – they would be, however, greatly capable of transmitting impacts to other activities.

#### **5.4.2 Castro and Seroa da Motta (2013): effectiveness and distribution effects of a carbon market in Brazil**

Castro and Seroa da Motta (2013) also simulated a carbon market for the Brazilian industrial sector, in order to understand what would be the effects of efficiency and distribution of a greenhouse gas emission mitigation target.<sup>3</sup> To this end, they simulated two scenarios, namely: (I) A symmetrical scenario; and (II) a protective scenario. In both cases, they used an aggregate target of 30% for the industrial sector. In the (I) symmetrical scenario, all regulated sectors have the same target of 30% emission reduction. In (II) protectionist scenario, the total reduction of 30% is maintained, but the allocation tends to protect sectors with higher marginal mitigation cost, to which lower targets at 30% are assigned.

As shown in Table 3, it is noticed at first that the market instrument enables a significant reduction in the mitigation policy total cost: between 78 and 82% in relation to costs in the absence of market. The creation of a market, therefore, yields large efficiency gains in mitigation targets achievement; after all, all sectors had significant cost reductions in both market scenarios.

<sup>3</sup> One should notice that the results of this study depend crucially on the sector's marginal mitigation cost curves used, transaction costs excluded. Additionally, the model used was limited to industry scope and, therefore, did not consider other mitigation options – such as land use and deforestation control, whose costs are lower – or transactions with international markets.

**Table 3 – Castro and Seroa da Motta (2013) study results**

SCENARIOS	SCENARIO I - SYMMETRICAL (IDENTICAL SECTOR TARGETS)			SCENARIO II - PROTECTIONIST (DIFFERENT SECTOR TARGETS)		
SECTORS	SECTOR TARGETS (%)	TOTAL COST WITHOUT EMISSION PRICING (IN US\$ MILLIONS)	TOTAL COST WITH EMISSION PRICING (IN US\$ MILLIONS)	SECTOR TARGETS (%)	TOTAL COST WITHOUT EMISSION PRICING (IN US\$ MILLIONS)	TOTAL COST WITH EMISSION PRICING (IN US\$ MILLIONS)
Beverages and food	30	-2974	-14667	22	-4408	-19001
Pulp and paper	30	19663	-104	21	-2705	-2948
Textile	30	386	300	20	117	-154
Nonferrous	30	13012	13012	22	7191	7191
Chemicals	30	48639	15097	24	23976	7368
Ceramic	30	1	-24456	23	-1836	-31161
Mining	30	15370	8635	22	6005	3380
Cement	30	2827	2827	22	-598	-3610
Steel	30	20892	13475	37	201534	64165
Refining	30	165161	49109	25	130746	41295
Ferroalloys	30	2327	-623	21	1480	-2965
Total	30	285304	62605	30	361502	63560

Source: Castro and Seroa da Motta (2013).

According to Table 3, one may also notice that using a market mechanism would make possible for the food and beverage, pulp and paper, ceramics, cement, and ferroalloy sectors to meet their goals with negative costs in both scenarios.

In the (I) Symmetrical Scenario, only 20% of the certificates would be traded in the market. That market would have basically three sectors demanding permissions – Refining, Chemicals, and Nonferrous – and three sectors offering permissions - Ceramics, Steel, and Food and Beverages. Therefore, net revenues from the market would amount US\$ 76 billion total over 20 years. Of that total, the Ceramics sector would represent about 44% of revenues, followed by Steel, with 28%, and Food and Beverages, with 20%. The market-generated economies, in turn, would amount to US\$ 176 billion in the same period, as follows: Refining with 66%; Chemicals with 20%, and Pulp and Paper with 11%. Therefore, one may notice that the savings are considerably larger than the revenues generated. The total cost of this market would be US\$ 62 billion a year, compared to US\$ 285 billion if the sector had to achieve all that target internally.

In the (II) Protectionist Scenario, only the steel industry – with high reduction and low marginal control costs – had a target higher than the symmetrical scenario target (its target was increased from 30% to 37%). The other sectors, in turn, had their targets reduced. Therefore, in this scenario, Steel subsidizes the reduction in other sectors. By definition, the equilibrium price, the quantity reduced, and the mitigation measures are the same as in the previous scenario. However, there is a change in certificates flows. In this scenario, there is a small decrease in market transactions,



which now correspond to 18% of total certificates. Net revenues from the certificates sales are also reduced to US\$ 52 billion in the period.

In that scenario, the sectors that proffer permissions are: Ceramics (over 50% of offers), Food and Beverages (about 30%), and Ferroalloy (9%). On the demand side, the Steel sector exceeds Refining and becomes the largest permission acquirer, with an approximately 38% market share (compared to 35% of Refining). The other 27% are divided amongst Nonferrous, Chemicals, and Mining sectors.

The savings in that scenario are even greater than those achieved in Scenario (I). This is basically due to the large increase in cost without market in the Steel sector, as other sectors have reduced their costs without market with reduction of targets. Therefore, the savings from that policy reach US\$ 285 billion in 20 years. In Scenario (II), the total costs are US\$ 62 billion, the same as Scenario (I); costs without market, however, increased by 27% in relation to Scenario (I).

Thus, one can see that protectionist policies can be used both to penalize and benefit sectors. In the case of the policy proposed by Castro and Seroa da Motta (2013), the market-related savings in both scenarios are higher than the costs and revenues related to the emission restriction policy. In the second scenario, the targets are reduced in all sectors – except Steel, whose target is now higher than in the other sectors. This type of analysis, as well as other studies about impact on employment, income, and competitiveness, needs to be undertaken before a policy scope is designed, with differentiation of sectorial obligations.

### 5.4.3 IES-Brazil: Mitigation scenarios' social and economic implications

The socioeconomic effects of adopting different GHG emissions mitigation actions in Brazil by 2030 – both in aggregate and sectoral scopes – were also considered in the IES-Brazil (2015) project. The GHG emission levels were estimated, as well as their economic impact in a reference scenario (Government Plan Scenario – GPS, which considers the implementation of mitigation measures already agreed by the government and being implemented at the time of the study) and four alternative scenarios: two additional mitigation scenarios (MA1 and MA2, which consider other measures than those provided for in the GPS, with MA2 being more ambitious than MA1); and variations of those two scenarios, in which the mitigation measures are complemented by a global adoption of a carbon tax on fossil fuel burning (MA1+T and MA2+T). While in MA1+T the tax level is US\$ 20/tCO<sub>2</sub>e, that level in MA2+T is US\$ 100/tCO<sub>2</sub>e.

The study concluded that the economic impact of adopting additional mitigation measures together with a carbon tax depends on the rate level: at US\$ 20/tCO<sub>2</sub>e, the estimated GDP is 0.17% lower than in the GPS scenario. At US\$ 100/tCO<sub>2</sub>e, on the other hand, the GDP reduction in relation to the baseline scenario is around 1.48%. Also, higher taxation levels are associated with larger falls in unemployment levels, which is explained by the assumption that, according to the model used, the revenue from tax collection is used to relieve the regulated sectors' payroll, thus stimulating hiring.



It should be noted that the study was based on the premise that the carbon tax would abide by the fiscal neutrality principle: the tax collection revenue would be used to offset the same amount of labor costs by shifting taxation on labor wage to the fossil fuel burning. Additionally, the simulation considered that all other countries would adopt a carbon tax similar to the tax applied in Brazil. For this reason, there would be no impact in terms of international competitiveness.

In the most ambitious scenario of additional mitigation with taxation, the trade ledger balance is substantially higher than in the baseline scenario. This is due to the carbon footprint reduction in

the energy-intensive goods production (steel, non-ferrous metals, pulp and paper, chemicals, and others) and increased competitiveness of domestic industry associated with that effect.

As the mitigation measures identified in the study were organized in sectoral groups, the IES-Brasil results may contribute to understanding the sectoral impacts of carbon pricing instruments in Brazil. Those groups were: (i) Industry, (ii) Energy, (iii) Agriculture, Forestry and Land Use (AFOLU), (iv) Waste, and (v) Transport. Graph 1 below summarizes the GHG contribution (MtCO<sub>2</sub>e) per sector in 2030, for different simulated scenarios. The scenarios in which a carbon tax is considered are in red.

**Graph 1 – GHG emissions in 2030 by sector (in Mt CO<sub>2</sub>e).**



Source: IES-Brasil (2015).

One can note that all mitigation scenarios are associated with lower GHG emissions when compared with the GPS. Regarding the scenarios with carbon tax (MA1+T and MA2+T), the tax in the energy sector (supply and demand) and in the waste sector is linked to the same emissions of corresponding mitigation scenarios without tax (MA1 and MA2). As to the transport sector, the carbon tax resulted in lower CO<sub>2</sub>e emissions. This behavior is also observed when the tax is included in the higher mitigation cost scenario (MA2) for the AFOLU sector. In the industry sector, the inclusion of a carbon tax is associated with increased CO<sub>2</sub>e emissions. This behavior will be explained later. The study did not include detailed reviews of the relationship between carbon tax inclusion and emission changes in other sectors. It is important to note that Graph 1 shows absolute values, and does not represent the carbon intensity (CO<sub>2</sub>e/production unit) of each activity.

The industry analysis considered the emissions associated with energy use and industrial processes, especially in the Cement and Steel sectors, which lead the emissions of greenhouse gases in the Brazilian industry. For the cement industry, the scenarios with the adoption of carbon taxes had the highest GHG emission reductions compared to the baseline scenario (CPG) as shown in Table 4 below. This is due to the reduced activity in the economy caused by the presence of a carbon tax.

**Table 4 – Comparison between the Cement sector GHG emissions in different scenarios and the baseline scenario (GPS).**

SCENARIO	MA1	MA1+T	MA2	MA2+T
EMISSIONS COMPARED TO GPS IN 2030	- 4.8%	- 5.2%	- 8.5%	- 10.2%

Source: IES-Brasil, 2015.

Generally speaking, reduced emissions, when compared to the baseline scenario, result from increased thermal and co-processing efficiency.

Regarding the steel industry, the scenarios with carbon tax led to greater competitiveness of domestic steel in the international market due to lower CO<sub>2</sub> emissions per tonne of steel produced. Consequently, we expect further growth of the sector in these scenarios, leading to less net imports of steel in Brazil. As a consequence, the country should become a net steel exporter by 2030.

In terms of absolute emissions, the increase in production associated with the sector growth exceeds the energy efficiency gains, and that explains the higher emissions of the Industry sector for the scenarios with carbon tax, as shown in Graph 1. When compared with the baseline scenario, however, MA1+T is the only one with increased emissions, and is associated with 1.9% more emissions than the GPS. As noted above, these values represent the absolute emissions, with the strong possibility of increase in the MA1+T scenario associated with a lower carbon intensity when compared to the GPS, due to mitigation measures. MA2+T, in turn, had higher emissions only when

compared to the MA2 scenario. The reduced emissions resulting from increased use of charcoal in this scenario are mitigated by the increased emissions associated with that higher steel production in the scenario with carbon tax. When compared to the GPS, however, MA2+T shows 31.9% less emissions. Table 5 below shows a comparison between emissions from different scenarios with the base scenario.

**Table 5 – Comparison between the Steel sector GHG emissions in the different scenarios and the baseline scenario (GPS).**

SCENARIO	MA1	MA1+T	MA2	MA2+T
EMISSIONS COMPARED TO GPS IN 2030	- 4.4%	+ 1.9%	- 41.1%	- 31.9%

Source: IES-Brasil (2015).

## 5.5 Compensatory mechanisms

**Any national climate policy will require some type of special treatment to compensate losses in competitiveness.**

**The control costs directly affect the production costs when controls are carried out by the regulated agent, or indirectly when they affect the prices in the upstream supply chain.** In the case of the current-intensive industry, for instance, the indirect costs via energy consumption may be higher than the control costs of residual emissions.

The degree of cost pass-through in the supply chain depends on the structure of the regulated market sector, given by dimensions such as market power (degree of oligopoly), installed capacity (or free capacity) and technological flexibility (possibilities of substitution of inputs and factors), besides regulatory restrictions in the control (tariff review rule) and price discrimination (peak prices).

The cost pass-through, when carried out in a competitive environment, is necessary to induce the reaction from the demand side and, therefore, create the incentives for the less carbon-intensive sectors and promote the innovation which, in the long term, will create benefits and not costs. However, concerns about competitiveness arise when production and/or other costs relatively differ from the competitors who are outside the reach of the same pricing regime and, therefore, create the risk of reallocation of activities.

In the case of climate policies, the term “leakage” is defined as any increase in GHG emissions due to reallocation of productive activities towards economies or regions with more lenient emission restrictions. Additionally to the loss of competitiveness, this behavior negatively impacts the environmental integrity of climate policies. Thus, competitiveness and leakages are intimately linked and follow, to a great extent, the same mechanisms. For instance, the production movement in the short term would be the result of the loss of its competitiveness, causing a leakage. These reallocations generate losses of products and jobs and, furthermore, may generate aggregated demand effects

(production, investment and employment) and macroeconomic effects (inflation and exchange rate and interest rate).

In this perspective, the carbon pricing policies usually adopt, especially in the moment of their introduction:

- (i) Special treatments of emission restrictions in the main sectors with a strong inclination to leakages, with the use of subsidies and reduction in carbon tax rates, or in the case of markets with a more generous and gratuitous distribution of licenses;
- (ii) Commercial barriers to maintain the treatment equivalent to imports which are not produced in a climate regulatory environment equivalent to the domestic production environment.

Both in the international taxation experiences and in the carbon market experiences there is extensive use of exemptions, reductions and compensation mechanisms. In the case of taxation, partial and total exemptions are offered, besides subsidies to innovation. In the case of markets, this compensation would be carried out through gratuitous allocations of emission rights, and, besides, these would be defined based on more generous limits. Additionally, there may be tax compensations for indirect effects via the cost of the consumed energy (see Box 10).

These exemptions are generally guided towards the most affected agents and gradually reduced over time, benefitting energy-intensive sectors which operate in the highly competitive international market. A gradual approach assumes the existence of short-term restrictions on the industry's production potential, whereas in the long term the companies may decide where to invest in expansion with new technological standard. In the European case, for instance, there is evidence that the effects of climate policies on competitiveness would be stronger due to the energy-intensity factor in production than due to exposure to foreign trade.

However, the pricing effectiveness – i.e., its capacity of promoting a reduction in emissions and technological innovation – is limited by such protectionist measures. Therefore, it is preferable that partial exemptions be adopted together with a previously communicated reductions schedule with objective review criteria. Furthermore, it is important that conditionalities to these exemptions be created, such as voluntary agreements and adoption of technological standards.

The magnitude and the allocation of exemptions and compensations have not been object of consensus between the regulated parties and the regulators; furthermore, these mechanisms have strongly been criticized for supposedly protecting large corporations (see Box 10). In addition, these measures are currently being discussed by the World Trade Organization (WTO) as they may be interpreted as an implicit form of subsidy.

Equally controversial are the trade barriers known as “border carbon adjustment” (BCA). These barriers consist of application of a tax – or of the requirement of the equivalent purchase of carbon emission licenses – in import operations. Discounts may also be applied to exports from



even if in a moderate way, locational impacts associated to environmental regulation exist and vary a lot in accordance with the sectoral characteristics.

a market which adopts this type of mechanism (SEROA DA MOTTA, 2010; BÖHRINGER; FISCHER; ROSENDAHL, 2010). In this case, the concerns are the creation of “pollution paradises”, regions or economies which do not have the same emission restrictions, which allows them to attract regulated companies from other jurisdictions. In the case of GHG emissions, the pollution paradises are especially troublesome as the direct effects of the emissions are not perceived locally as in other types of pollution. Recent studies present evidence that, even if in a moderate way, locational impacts associated to environmental regulation exist and vary a lot in accordance with the sectoral characteristics. Besides mitigating leakages, another objective of these barriers is to exert certain pressure on other not regulated jurisdictions to make them adopt the same emission restrictions.

The WTO rules permit the adoption of barriers which are linked to protection of natural resources provided two conditions are complied with. Firstly, a quite clear connection is to be established between the declared objective of the environmental policy and the respective border measures. Secondly, the measure cannot be a “means of arbitrary or unjustifiable discrimination” or a “disguised restriction to international trade”. However, there are initiatives in the WTO which turn these adjustments justifiable as the effects of climate change cross borders. Furthermore, the argument goes that their application would be in accordance with the WTO rules provided they do not exert discrimination in favor of domestic producers or to favor imports from certain countries to the detriment of others. In this way, both the special treatments of exemptions and the restrictions should have a not discriminatory character between domestic production and imports.

However, it is acknowledged that there are two big challenges in the implementation of border adjustment measures. The first one is how to evidence a clear justification for border measures in terms of carbon leakage and losses of competitiveness. The second one is how to determine a fair “price” to be applied on imported products to align their costs to the internal costs.

#### BOX 10 - Criteria for exemptions and compensations

The EU ETS developed quantitative and qualitative criteria to assess the increase in costs and the trade intensity of the regulated sectors in order to identify with their help which sectors would be benefitted by gratuitous allocations and compensations (FTI CONSULTING; COMPASS LEXECON, 2014; SARTOR, 2013; WOODERS; COSBEY, 2010). In accordance with the quantitative criteria, a sector is considered as having sufficient exposure for the occurrence of carbon leakage if it passes through at least one of the three criteria below:

1. Carbon cost: the increase in production costs exceeds 30%, as proportion of the aggregate value.
2. Trade intensity: trade intensity exceeds 30%.
3. Combination of the carbon cost and trade intensity: if the control costs increase by at least 5% of the aggregated value of the sector and the international trade intensity of the sector exceeds 10%.

In the qualitative criteria, in their turn, the analysis is sectoral and identifies (i) the extension to which it is possible to reduce the emission levels or the electric energy consumption; (ii) the competitive structure of the market, the current and the projected one, for cost through-pass; and (iii) the profit margins as long-term investment indicator or of re-localization decisions.

Based on these criteria, 164 sectors were selected, whereby only five based on qualitative criteria and the large majority in accordance with the criteria of trade intensity. The selected sectors were the energy-intensive ones, which together generated 95% of the total amount of industrial emissions. The industrial plants in the selected sectors would receive gratuitous licenses and obtain financial compensation to cover the increases in electricity costs resulting from the ETS.

In the experiences with taxation of CO<sub>2</sub> from the energy sources, the selection of the sectors benefitted by exemptions and compensations is made by defining a limit for the impact on energy costs, which tends to be determined between 5 and 10% of the aggregated value. With these limits, the exemptions or reductions tend to benefit a large part of the energy-intensive industry and, therefore, a large part of the revenues is generated via residential consumption (WITHANA et al. 2013; ANDERSEN; EKINS, 2009).



# THE BUSINESS PERSPECTIVE

**A**s the adoption of carbon pricing instruments in Brazil becomes a more concrete possibility, it is important to seek alignment between the expectations of the business sector and the objectives of the policies to be implemented.

From the economic perspective, carbon pricing is the most efficient way to promote the mitigation of GHG emissions, and results in significant gains when compared to scenarios in which the mitigation is achieved solely through command-and-control policies. When assessed from the perspective of a given organization, however, the initial impacts of pricing will vary and will depend on the regulated company's specifics – as already discussed in previous sections, such as mitigation costs, level of exposure to international trade, and level of energy-intensity of the production

In order to ensure the most appropriate responses to regulatory developments within carbon pricing measures, the national companies have to know the benefits and potential impacts of this type of instrument in the course of their business activities. A review of the international literature shows advantages and disadvantages that companies already operating in regulated markets encountered when designing and adapting their activities to a carbon pricing environment.

**Chart 4 - Carbon pricing benefits and challenges from the business sector's perspective**

BENEFITS	CHALLENGES
<p><b><i>Market trends anticipation</i></b></p> <p>A growing number of companies have created expectations around stricter emission reduction, with higher carbon price. Those expectations make them anxious about being prepared and well positioned in the market. Additionally, those companies find in sustainability a good alternative to mitigate business risks.</p>	<p><b><i>Increase in company's costs</i></b></p> <p>Some initial effects of carbon taxation are increased costs. Several companies that have joined the EU ETS claimed that the carbon price is too low to foster technological innovation and, therefore, it is necessary to pass-through part of the cost to customers – who, in turn, are not always willing to pay more.</p>
<p><b><i>It enables more efficient processes and cleaner technologies</i></b></p> <p>It is believed that the carbon pricing in British Columbia has led to increased investment in new and cleaner technologies and, consequently, greater energy efficiency. The same argument is used by companies in countries that have joined the EU ETS and, moreover, claim a consequent reduction in costs.</p>	<p><b><i>Legislation complexity</i></b></p> <p>A frequent concern of regulated companies is the statutory complexity and red tape involving the carbon pricing implementation.</p> <p>In Mexico, for example, some companies argue that existing rules and evaluation criteria have yet to be fully developed, and that the lack of clarity requires a legislation refinement.</p>
<p><b><i>Meeting the needs of more sophisticated corporate clients and portfolio diversification</i></b></p> <p>There has been a growing demand from consumers for more eco-efficient processes and products. In order to remain competitive, companies have to adapt to this reality. Moreover, there are several public bids that demand more sustainable practices.</p>	<p><b><i>Uncertainties about the future</i></b></p> <p>Several governments and companies report difficulties in planning when it comes to future climate policies and next steps to be taken. According to surveys, the industrial sector is the most subject to risks, and the energy sector was the one that has attracted more incentives historically.</p>

Source: Prepared based on Salmond, Tansey, Bumpus (2011); Waycarbon; Ludovino Lopes Advogados; Climate Focus (2015) and CISL (2015).



## 6.1 Carbon pricing general perspectives from a business point of view

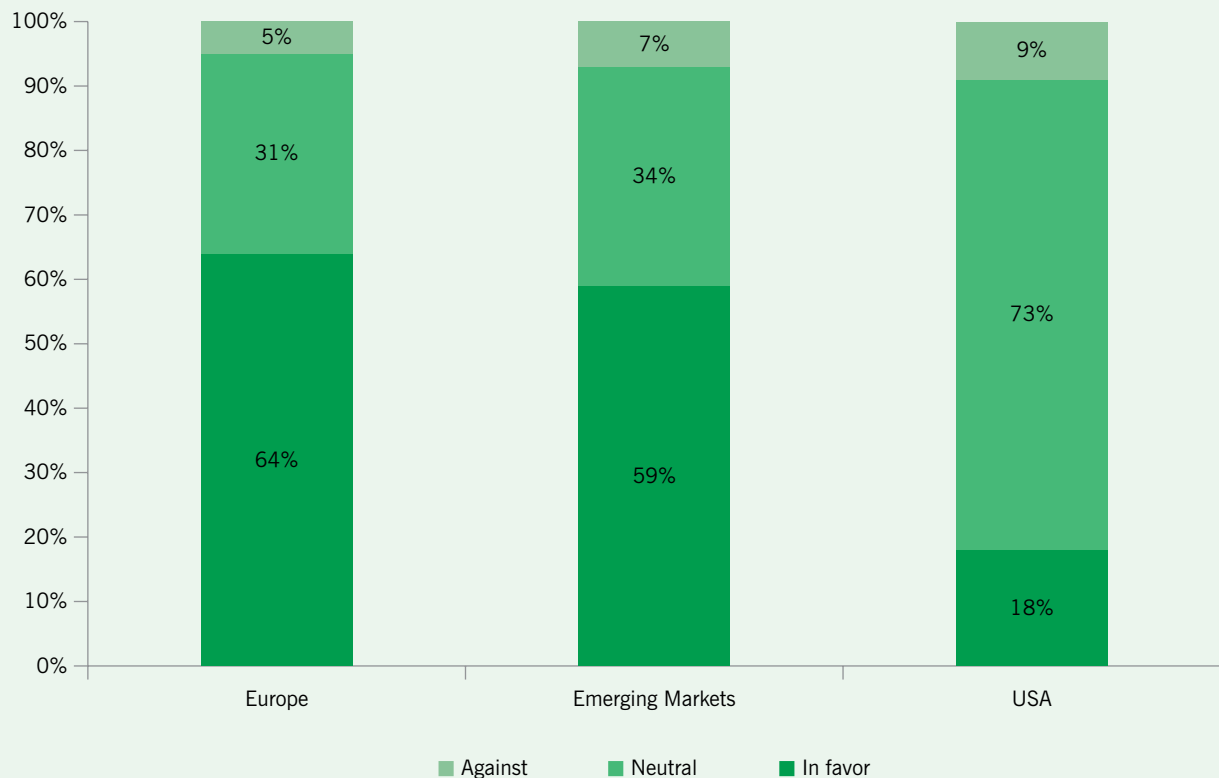
The GHG Market Sentiment Survey 2016, a study by IETA with 146 representatives of several organizations from around the world – most from already regulated markets such as Europe and some US states – shows significant changes in business sector expectations on carbon pricing development initiatives after the COP 21, with 82% of respondents relying on the expansion of existing carbon markets as a result of the Paris Agreement coming into effectiveness. Furthermore, national and subnational ETSs are considered to be the factor that should exercise greater role in the expansion of those markets (IETA, 2016).

The respondents expect Brazil, followed by countries as Chile, Japan, Mexico, and South Africa, to

implement an ETS between 2020 and 2025. In addition, the survey shows that, for most consultees, initiatives as PMR and CPLC will play an important role in the carbon pricing advancement in the world in the next five years (IETA, 2016).

A study by EY conducted before COP 21 in 2015 reinforces the IETA's conclusions (2016). 54% of more than 100 executives from Europe, USA, and emerging markets said they believe carbon pricing is the most effective means for CGE reduction, while 48% of respondents being favorable to this type of instrument. 45% of companies, in turn, considered themselves neutral in relation to this topic. Although there is a significant difference between the general answers' standard and the standard observed in the US (where the vast majority of respondents claimed to be neutral to carbon pricing), the proportion of companies considered openly contrary to the carbon price is low in all markets assessed (see Chart).

**Graph 2 - Position of companies in relation to introducing carbon pricing policies in their home countries.**



Source: EY (2015).

For most companies, therefore, the most important issue is no longer just related to the regulatory framework possibly evolving into carbon pricing. The primary question now concerns when these policies will be adopted in each country. Thus, while the subject is still surrounded by uncertainties, companies from different sectors are already mobilizing to improve their emission monitoring and control systems, and to identify domestic mitigation actions.

It is not surprising, therefore, that dozens of investors and highly energy-intensive companies express their support for carbon pricing. In June 2015, e.g., six major companies in the oil and gas industry sent a letter to the UN and governments in order to claim clear, stable, ambitious, long-term regulatory frameworks, with carbon pricing as a key element (UNFCCC, 2016).

In short, it appears from recent developments – as evidenced by the GHG Market Sentiment Survey (IETA, 2016) and the EY Study (2015) – that the present moment is a moment of confidence in carbon pricing as a global and an irreversible trend.

## 6.2 Brazilian business sector's expectations

In survey carried out amongst representatives of national companies, through a questionnaire that assessed the business perception on carbon pricing instruments in Brazil, some clear trends were observed: most companies evaluate as “High” or “Very High” the possibility of Brazil coming to adopt an emissions pricing instrument at the national level. Moreover, the vast majority of those representatives believes that the year 2020 will be marked by this regulation entering into force.

In terms of instrument's design and its potential impact on costs and competitiveness, however, most respondents said companies have not yet undertaken a thorough assessment on the subject. It was noted, however, that many of these companies prefer ETS-type instruments instead of carbon taxation. Furthermore, the following elements stand out amongst those elements considered desirable in a future regulation: price control (maximum and minimum values for permits prices in an ETS scenario); connection with international markets (also in the case of an ETS); tax collection revenues returning as investment in R&D involving low-carbon technologies; and creation of an

independent regulatory agency to be responsible for the pricing system.

Also considering the results of the survey made as part of that study, one of the most significant responses concerns the business community involvement in the issue of carbon pricing in Brazil. The vast majority of companies surveyed considers important the productive sector to lead the discussions on this topic from the beginning. Consistent with that finding, the “Business Position on Carbon Pricing in Brazil” launched by the Climate Business Initiative – IEC (*Iniciativa Empresarial em Clima*), in October 2016, is an important milestone for the business community involvement in co-creating pricing instruments in Brazil.

The IEC is represented by the Ethos Institute, CEBDS, CDP, GVces, UN's Global Compact Network Brazil, and Envolverde, and brings together companies that are active in climate change issues. One of its main objectives is to align topics and agendas for initiatives that promote the economy's decarbonisation with the lowest cost possible for society. It believes that carbon pricing can be an efficient and effective alternative to reduce GHG emissions and promote economic growth.

The “Business Position on Carbon Pricing in Brazil” presents the perspectives implementing a carbon pricing mechanism in the country, as well as suggestions and proposals to the government and a declaration of commitment from entities it represents. Additionally, it states a preference for an emissions trading system, assuming that the instrument would be more effective economically, and allow the international integration with other systems.

Amongst the main perspectives presented, some say that the implementation should take place gradually and interactively; there should be a permanent communication channel between economic and social players; and companies should be guided throughout the process. Another aspiration is that the instrument's tax neutrality should be ensured, in order to avoid fiscal burden on taxpayers. It means that, alongside the pricing mechanism in place, there must be, e.g., exemption from other taxes, subsidies, and other tax benefits.

The proposals delivered to the government request it to take the leading role in building a consistent pricing strategy, identifying gaps in implementation, and proposing plans for the most appropriate actions. Moreover, the expectations regard a harmonization of



the carbon pricing issues of particular interest to the business sector were identified, considering aspects of both policy design and companies position in relation to a possible regulation.

tax incentives and subsidies, as well as a commitment to the timetable mentioned in the document (with strategy structured by the end of 2018 and respective implementation as of early 2020).

Finally, the IEC has its commitments, such as disseminating good practices, stimulating cooperation across the business sector, and acting as spokesperson for the environmental, social, and economic use of carbon pricing mechanisms.

### **6.3 Business sector's points of interest regarding carbon pricing in Brazil**

Based on a review of international experiences and the collection of data in previous stages of the study, the carbon pricing issues of particular interest to the business sector were identified – considering aspects of both policy design and companies position in relation to a possible regulation. Follows a brief discussion on those points.

#### **6.3.1 Decision on the type of instrument**

The growing interest in the carbon pricing debate in Brazil is unquestionable. Based on information already available on this type of instrument – shared by companies already operating in a regulated environment and, in some cases, widely disseminated by multilateral organizations, non-governmental organizations and research institutes – and internal initiatives, leaders and representatives of large companies' key areas already have been able to provide answers for future regulations and dissemination of good practices.

However, there are debate qualification possibilities that could benefit domestic companies. In this sense, one of the central points of the debate concerns the type of instrument adopted: taxation, ETS, or combinations of both. It is natural that certain types of instruments are judged, in principle, as preferred by certain companies. After all, every class of economic instrument available is associated with advantages and specific risks to which certain organizations and sectors may be particularly sensitive. The following chart, e.g., presents a comparison of specific attributes of carbon pricing instrument types.

**Chart 5 - Comparison between types of carbon pricing instruments according to specific attributes**

<b>Reducing emissions</b>	It contributes to GHG emission reduction. However, in order to achieve a pre-established cap, it must be based on known curves of marginal reduction cost in regulated sectors.	It contributes to GHG emission reduction to the cap limit.
<b>Fostering technological innovation</b>	It fosters investors and entrepreneurs to develop new low-carbon technologies.	It can provide incentives for the development of low-carbon technologies, especially in systems where the cap is strict enough to support a price that fosters the reduction of emissions and the marketing of unused licenses.
<b>Generating government revenue</b>	<p>If a tax is selected, the revenue may be allocated to fostering the country's energy efficiency, or to make energy more affordable to low-income families. Other destinations may be granted, as investments in health, education, or urban infrastructure maintenance.</p> <p>A study by Stavins (2008) estimates that a tax of US\$ 10/tCO<sub>2</sub>e generates revenues of US\$ 50 billion/year in the US.</p>	Revenues will be created only if emission permits are auctioned. The same uses mentioned for taxes may be observed.
<b>Carbon price volatility</b>	A carbon tax provides stable carbon prices, so that producers and businessmen can make investment decisions without uncertainty as to changes in regulatory costs.	There is a great fear amongst entrepreneurs regarding fluctuations in market price. There are mechanisms, however, that contribute to reducing volatility, like permit borrowing and banking.
<b>Price lower or higher than expected</b>	If the tax is too low, many companies will prefer to pay it instead of reducing emissions. On the other hand, if the tax is too high, there will be impact on profits and employment.	If the permits are cheaper than expected, either because the cap is not ambitious or due to a financial crisis in which there is a reduction of emissions due to decreased production, there will be no incentive for reductions beyond the target emissions. However, if the price is too high, the productive sector may be discontent and press for emission limit flexibility, thus endangering the environmental integrity of the instrument.
<b>Emission limit</b>	As there is emission volume fluctuation in this system, it is not certain that the emission limit will be achieved.	The emissions market sets a limit for emissions, and permits are distributed to issue up to the target set. Therefore, this system provides certainty as to the environmental benefits resulting from its implementation.
<b>System's structural complexity</b>	This system stands out for its simple implementation and enforcement, especially in countries with strong institutional capacity for taxation. When the implementation is more immediate, it is believed that a carbon tax will be able to reduce emissions more quickly.	There has been a greater complexity of emissions trading, since it is necessary have emission limits established, determine the type of permits distribution, and create a regulatory agency. Additionally, VAT and cyber fraud mechanisms were verified, such as phishing, between 2008 and 2011 (ECA, 2015).

<b>Emission reduction costs distribution</b>	With a tax, there will be an initial high cost for industries for each ton of GHG emitted, with possible imbalance in trade balance.	Initially, permits can be distributed for free (“grandfathering”), meaning lower costs for industries in the early stages of implementation of the instrument.
<b>Economic benefits for businesses</b>	Usually, and even temporarily, the government deducts other taxes from business, which are then taxed by emissions, thus avoiding the loss of competitiveness while they replace the existing technology with a cleaner one.	Companies that can achieve the emission reduction targets can sell surplus allowances to those that do not achieve it, thus generating profits.
<b>Flexibility</b>	A tax on carbon is defined previously. If not well designed, i.e., if underestimated or overestimated, there will be a strong reaction from companies, with a consequent loss of acceptance.	In this system, the carbon price is further defined by the market, which is able to identify which technologies are most appropriate and which should be implemented in order to generate greater cost-efficiency.

Source: Prepared from multiple authors.

In Brazil, it is possible to identify, to a certain extent, an inclination to defending carbon pricing instruments through emissions trading to the detriment of carbon taxation instruments. In fact, there is a concern about creating a fiscal instrument that may deviates from its original purpose, i.e., promoting a cost-effective GHG emission mitigation, thus becoming a simple means of additional taxation. It is legitimate concern, and should be discussed broadly by society.

However, beyond the simple debate on the type of instrument to be implemented, claims and contributions to ensure the quality of the instruments design – whatever they are – are considerably relevant. The discussion on the use of revenues from the instrument and the fiscal neutrality of a carbon tax, for example, are key points of the instrument design and an essential agenda of discussions involving the business sector in policy formulation. If addressed properly, these points may increase an attractive tax instrument in Brazil – especially if accounting for the costs and complexity associated with administration of an ETS, which are generally higher.

As discussed in the Instruments Equivalence section, both instruments, in theory, are associated with the same efficiencies and cost-effectiveness. Although, in practical terms, specific difficulties and risks may emerge in a tax or an ETS implementation process, there is no evidence of a single type of instrument that may be preferable, in all circumstances and in any jurisdiction, over others. Anyway, there are successful experiences and lessons learned related to both types of instruments.

What the international experience tells, however, it is that national and sectoral specificities must not be neglected when designing a carbon pricing instrument. While emissions trading systems are generally more suited to industry and power generation sectors, other sectors may benefit more from a taxation instrument (EY, 2015). In this sense, the coexistence of cap-and-trade schemes and carbon taxes as part of the same policy mix has become, in fact, a feasible and effective strategy for dealing with sectoral specificities.

As already discussed, hybrid instruments configured by combining tax characteristics and emission trading systems have become alternatives to approaches based on single instruments: the price uncertainty associated with an ETS can be minimized, for example, by setting minimum and maximum prices, thus ensuring a certain level of confidence in a long-term price signal. There is also evidence of taxes incorporating flexible mechanisms – as in Mexico, where the carbon tax provides for the use of offsets. Finally, a carbon tax may be used as a transitional instrument to evolve later to more complex institutional arrangements of an ETS.

### 6.3.2 Competitiveness and cost

The potential impact of carbon pricing instruments may have on regulated companies' cost contributes, of course, to increased concerns about a possible loss of competitiveness of sectors subject to regulation. Because of its importance, this issue has been subjected to investigations in several fronts, especially when considering the example

of economies that have already implemented the GHG emission pricing.

When measured in aggregate, the competitiveness of an economy can be understood as the result of a number of structural factors, including the macroeconomic environment, the commercial framework, openness to trade and investment, labor qualifications, the ability to innovate, and labor market regulations (ADAMS, 1997). Competitiveness at sectoral level, in turn, must be dissociated from national competitiveness, given the diversity assumed by these factors in different sectors of an economy (and even within a single sector), which allows economic agents to respond differently to a same regulation (ARLINGHAUS, 2015).

Evidences available in regulated economies show that, although with a cost increase, companies that start to pay for their emissions do not necessarily experience negative impacts on their competitiveness. This finding stems from the fact that competitiveness is not only related to production costs and reduced energy, but above all to the development of products with higher added value and increased efficiency of processes and services.

Chart 6 below shows an effect relationship, in terms of competitiveness, observed by European companies as a result of carbon pricing policies in effect in that continent - the EU ETS and national carbon taxes.

Chart 6 -Carbon pricing effects on business competitiveness in Europe

CAP-AND-TRADE – EU ETS	
Industry	There is no evidence that the EU ETS has reduced employment, turnover, and exports of German companies surveyed (PETRICK; WAGNER, 2014).
	No impact was detected on cement, iron, and steel. According to the authors, the EU ETS has not affected the employment level in energy companies, but there was an increase in costs in that sector (CHAN LI; ZHANG, 2013).
	No impacts were noted on value, profit margin, and employment level in the following sectors: non-metal mineral products, electricity, paper, metals, coke, and refined petroleum products (ABRELL, FAYE, ZACHMANN, 2011).
	In a survey conducted in Germany in mining, electricity, energy, pulp and paper, coke, and oil sectors, no negative impacts were detected on the companies' revenue and employment level (ANGER; OBERNDORFER, 2008).
	According to Reinaud (2008), a negative correlation was identified between CO2 price and net imports in the aluminum sector. Still, no structural breaks was noted in the import volume after the EU ETS was introduced.
Power generation	Twenty-two publicly traded companies in the European Union's energy industry believe that an increase in the EU ETS permits price is related to the increase in the price of their shares. Investors expect higher profits if the acceptance of carbon markets increases (VEITH; WERNER; ZIMMERMANN, 2009).
	In Germany and France, the largest electricity prices are related to the higher prices of carbon (KIRAT; AHAMADA, 2011).
	As to several Swiss companies, they did not detect any significant effect on the growth of their productivity levels after the EU ETS was implemented (JARAITÉ; MARIA, 2012).



## TAXES

## Industry

There were no significant effects on energy expenditure, employment, and total productivity after the Climate Change Levy (CCL) was implemented in the UK (Martin, of Preux & Wagner, 2014 (CPLC, 2016).

An analysis of the three years following the CCL implementation (2001) shows negative impacts on energy-intensive sectors. No impact was detected, however, on employment, gross product, or total productivity (MARTIN; PREUX; WAGNER, 2014).

Regarding energy taxes levied in Germany, no strong negative or positive impact on the industrial sector was detected (FLUES; LUTZ, 2015).

According to the Ministry of Finance of British Columbia, the carbon tax has produced and will continue to produce a small negative impact on GDP. Furthermore, the industries that emit more are most affected, such as in the cement and oil and gas refining industries (BRITISH COLUMBIA, 2016).

According to the Carbon Pricing Leadership Coalition Executive Report (2016), countries such as Norway, Sweden, Switzerland, and France did not observe any adverse effects of the carbon tax on industry or on economic growth.

## Agriculture

In British Columbia, there were no significant effects on agriculture or on gross exports. In the few cases where significant impacts were detected, there was an increase in exports and a decrease in imports (RIVERS, SCHÄUFELE, 2014).

## Power generation

The increased carbon tax in Sweden encouraged the replacement of electrical or oil boilers with biomass boilers. One of the consequences of the increasing demand for biomass cogeneration has been the development of more efficient forests extraction techniques and more efficient heating technologies in the country (SIMS. et al., 2007).

According to a study by the OECD Nuclear Energy Agency, the gas power generation and nuclear power generation, between 2005 and 2010, showed higher competitiveness compared to coal-fired plants, after the carbon taxes were implemented (KEPPLER; MARCANTONINI, 2011).

Source: based on multiple authors.

However, almost all of the evidence available about effects of carbon pricing on competitiveness is related to developed countries – where the use of economic instruments in environmental policy is more widespread. According to the OECD, the increasing legislation concerning the environment in these countries – where technology is also more advanced – is directly related to increased innovation and hence the competitiveness gains. The same cannot be said for developing countries, in which the barriers to information and innovation are larger and may result in loss of productivity and competitiveness. In this case, the transfer of technologies and resources and capacity building are crucial factors to manage the transition to a low-carbon economy (World Bank, 2016).

Still, as outlined in previous sections of the study, considerations involving pricing instruments, in its design stage, about sectors most exposed to the risk of loss of competitiveness should encourage the provision

of appropriate compensatory mechanisms. In that sense, the level of energy intensity and the degree of exposure to international trade of each sector and agent potentially subject to regulation should be assessed.

Compensation mechanisms such as exemptions – in the case of taxation – and free distribution of permits in the early stages of an ETS, discussed in the previous section of the guide, are amongst the instrument design options that can help to minimize any pricing impact on sectoral competitiveness. Other options include phased implementation and recycling of revenues to compensate the most affected sectors.

Although they may have limited initial capacity to reduce emissions, a phased instruments implementation may help with the transition from a context of no carbon pricing policy to a scenario in which a price is associated with GHG emissions. The gradual character can apply to different elements of instrument design, like carbon price and sectoral coverage (as in Finland,

where the tax applied initially on emissions from the energy sector came to cover the transport sector in subsequent steps).

### 6.3.3 Monitoring, reporting, and verification/ Creating internal capabilities

Monitoring, Reporting, and Verification (MRV) are the basic infrastructure elements required to monitor performance and make an emissions market operational.

**Monitoring** (or measurement) is already a reality in many organizations in Brazil, which accomplish it through annual GHG inventories, a fundamental practice for the company to know and manage its direct and indirect emissions, e.g., by identifying reduction opportunities. Companies that already have such capability are leading the emission regulating and carbon pricing scenario.

**Report** (or inform) is the presentation of emissions inventory, which may include data, measurements, and associated analysis. In Brazil, there is already a degree of engagement in voluntary reporting of emissions from the Brazilian private sector, in initiatives such as the Brazilian GHG Protocol Program, the Carbon Efficient Index (ICO2 BM & FBovespa), the CDP in Brazil, among others. This engagement is often encouraged by external pressures – investors, access to finance, image gains with consumers, etc. A highlight amongst those initiatives is the Public Register of Emissions, a platform used for disclosure of corporate GHG inventories of participants in the Brazilian GHG Program. It is currently the largest database of corporate inventories in Latin America. In 2015, 136 companies disclosed their inventories through the platform.

The GHG inventory **Verification** aims to ensure the input data reliability, emission factors used, and other related information. This practice, often conducted by a third party, is already adopted by several Brazilian companies that mind the accuracy of their calculations and reports. Underscoring the main Brazilian initiative in the voluntary field, the Brazilian GHG Protocol Program encourages the verification of emissions by third parties for its member companies, awarding a “Gold Seal” for those that comply with it. In order to conduct a check, you must have accredited and trained companies. In some cases, this approach may be different. For example, in some cases (different jurisdictions with other regulations) one can perform a self-check or a verification may be carried by program administrators (either systematic or random).

Although there are no national rules on monitoring, reporting, and verification, some subnational initiatives are already in place. Mainly in the states of Rio de Janeiro and São Paulo, where there is a requirement for monitoring, verification, and reporting GHG inventories for some sectors of the economy. In Minas Gerais state, there is the Public Register of Emissions (which is voluntary). Such initiatives are gaining maturity and may contribute with experience when building national guidelines.

The MRV issue takes central position when it comes to emission trading systems. Its implementation involves an operational infrastructure





## The extensive involvement of government and stakeholders is essential for preparing guidelines.

that lacks credibility with the government, participants, and other stakeholders, methodological consistency, transparency, and data and information verification capability. The extensive involvement of government and stakeholders is essential for preparing guidelines, and the process coordination should be carried out by a body and staff that are competent in the field.

Anticipating a pricing instrument to be adopted, in order to ensure its integrity, the greater the number of companies that monitor, publicly report, and verify their emissions right now, the better the quality of information available to regulatory authorities when establishing an emissions baseline. Similarly, the business sector should pay attention to the development of internal capacity on the subject, which may be achieved through courses and seminars, and even acting in the voluntary carbon markets or simulations, like the Emissions Trading System of the Empresas Pelo Clima platform (see box 11).

### BOX 11 – Emissions Trading System - Empresas pelo Clima

The Empresas Pelo Clima (EPC) platform is an initiative of the Sustainability Center of the Getulio Vargas Foundation (GVCes), which aims to encourage and work with the Brazilian businesses in the transition to a low carbon economy. The EPC activities include awareness of companies on issues related to climate, as well as relevant risks and opportunities. Among its actions, since 2013, there is the simulation of a cap-and-trade greenhouse gas (GHG) emissions market – the Emissions Trading System – SCE (*Sistema de Comércio de Emissões*) This system provides the business sector with practical experience of market mechanism operation.

Transactions occur with fictitious financial resources in the trading platform of the Rio Environmental Stock Exchange (BVRio), which is EPC partner in this initiative. In 2015, 23 companies took part in the simulation. Amongst the numerous results, it has contributed to the creation of GHG emission records in participating companies – reinforcing the importance of a robust management of GHG emissions data – and the engagement of financial areas of companies in decisions on market mechanisms.

The active participation of companies is critical to the simulation success, allowing system adjustments and improvements. In addition to preparing for a possible market mechanism focused on emission control, the results discussion improves the practical and theoretical knowledge and allows companies to be able to contribute to the debate on the subject in Brazil and internationally.

Source: Based on GVCes (2016).

### 6.3.4 Engagement

International experience shows that engagement structured in different segments of society is one of the key success factors in the pricing instrument implementation process. As the issue is politically and technically sensitive, a broad, comprehensive, early stakeholder engagement becomes necessary to create transparency about the process; to raise and maintain public support; to enjoy the wide range of available expertise; and mitigate political conflicts.

We selected the following success factors recommended by participants of a technical workshop conducted by PMR with the theme “Lessons



the greater the number of companies that monitor, publicly report, and verify their emissions right now, the better the quality of information available to regulatory authorities when establishing an emissions baseline.

Learned on engagement and communication with stakeholders” (PMR, 2015), which are of special interest to the Brazilian case.

- Disseminate knowledge on the fundamentals of pricing instruments. Note in particular that the burden is the result of achieving emissions reduction targets, and that the pricing instrument actually provides cost-effectively achievement. The opposition is often related to climate change policy itself and not the pricing tool, making it important to separate them from each other as much as possible. Communicate effectively about the instrument benefits for society (e.g. because the form of recycling revenues) helps in building trust.
- Similarly, communicate effectively about the policy objectives, the different configuration options, and what are the expected implications. Well prepared impact assessments help to prepare the ground for discussions. It is also important to keep the issue of mitigation to climate change high on the agenda, as the public opinion is volatile and varies according to specific events. When addressing the press release, do it directly and clearly to minimize the chance of misunderstandings.
- The stakeholder consultation should be frequent and take advantage of various formats. Meetings should promote open and intense dialogue, involving a wide range of participants, from all levels, including civil society and media. As there is no single approach for all segments of society, try to anticipate the needs and pains of each stakeholder profile. Manage the stakeholders expectations from the beginning, since there is

no way to please everyone involved, and have a strategy to work for those who are never satisfied.

- Seek intelligent ways of carrying out consultations, making use of electronic platforms for information dissemination, and allow multiple opportunities for feedback.
- Share responsibilities and resources between public and private sector (the costs can be reduced if the public sector provides public infrastructure and stakeholders bear their own expenses). In Germany, for example, the first discussions about the EU-ETS led to a specific organization that operates separately from the government, engaging different levels of government, political parties, trade unions and productive associations, NGOs, etc., in regular meetings, plenary sessions, and working groups, around a range of technical and political challenges related to the establishment of an emission allowances market.
- Keep in mind that adopting new policies often implies distribution issues, and that it may be a good idea to bring winners and losers for a structured engagement in which they will have the opportunity to listen to each other. The support of leaders amongst stakeholders is key in convincing the others.

Finally, it is important to recognize and promote existing engagement infrastructures such as the Brazilian Forum on Climate Change and several private initiatives that have shown interest in contributing to the discussions on the format of a carbon pricing instrument in Brazil, as evidenced, for example, by the “Business Position on Carbon Pricing in Brazil” (see section 6.2).

### 6.3.5 Internal carbon pricing

The strategy of adopting internal carbon pricing has been used increasingly by companies from various sectors to incorporate a carbon price variable in investment decisions.

According to the CDP report based on reports from companies around the world, 517 global corporations have adopted the carbon pricing strategy in 2016, in addition to 732 companies that intended to adopt it within two years, i.e., by 2018. Collectively, the number of companies in these two groups grew more than 22% compared to 2015, which reinforces the conclusion that the number of companies engaged in assigning costs to impacts generated by the increase in greenhouse gas emissions tend to grow in the next years, especially when considering the number of companies that declare themselves favorable to adopting a global price for carbon (CDP, 2016).

In Brazil, the increase in the number of companies that adopt an internal carbon pricing was 74%, making the country to stand out as one of the regions with the greatest breakthrough in carbon pricing over the previous year. This growth shows that, even in the absence of a definitive policy on the matter, the private sector has been preparing for the future scenario (CDP, 2016).

Globally, the representativeness of companies engaged with carbon pricing varies by sector, as shown by the percentages in Table 6.

**Table 6: Representativeness of companies that practice carbon pricing per sector.**

SECTOR	COMPANIES THAT PRACTICE CARBON PRICING INTERNALLY (%)
Utilities	63
Energy	52
Telecommunication Services	40
Materials	35
Financial	31
Information Technology	25
Basic Consumer Goods	24
Industrial	23
Discretionary Consume	22
Health	19

Source: CDP, 2016.

94% of companies that publicly stated they use internal prices for carbon are based in countries where regulations already exist, or regulations are in the planning stage or under consideration in the national or subnational level. The prices charged by companies vary from US\$ 1/tCO<sub>2</sub>e and US\$ 800/tCO<sub>2</sub>e, reported by only 30% of companies (CDP, 2016). As assessed by (World Bank, 2016), the fact

that some organizations will adopt domestic prices for carbon higher than the prices actually charged in the markets in which they operate indicates that their strategy has been limited to the use of pricing as a risk management tool in order to assess the potential impact of carbon pricing initiatives. Furthermore, they have priced their GHG emissions in order to explore cost-cutting options and generate additional revenue opportunities by fostering innovation.

According to a study done by Ernst & Young in 2015 (EY 2015), the internal carbon pricing should be understood as part of a decarbonisation movement undertaken by the business sector, which includes, as most common measures, the industry benchmarking, investment in low carbon technologies, definition of corporate goals to reduce emissions, commitment to consuming energy from renewable sources, and offsetting emissions. Among those organizations that have implemented an internal carbon price, the main reason identified by the study is, in fact, compliance with regulatory requirements of the market in which they operate. Voluntary pricing, either for alignment with the company's strategy and values to standardize processes in all markets in which they operate, or even for a better understanding of the impact that future emissions regulations could have on business, is also seen as motivation for internal carbon pricing.

In line with EY study (2015), the companies reposting to CDP (2016) showed that carbon pricing has contributed to the achievement of emissions reduction targets, reallocation of resources in low-carbon activities, definition of R&D investments needed to develop new products and low carbon services, and revealed hidden risks and opportunities in the company's operation and value chain. In this context, the incorporation of carbon pricing in business strategy increased in 2016 when compared to 2015 (CDP, 2016).



# RECOMMENDATIONS

## 7.1 Key points for discussions on pricing instruments in Brazil

The study Carbon Pricing: What the corporate sector needs to know to position itself tried to address important points for the transition to a context GHG emission regulations in Brazil via pricing instrument. Some elements to be mentioned are: designing and implementing a GHG data management system for MRV; creating GHG data recording systems; designing offset programs; establishing sectoral benchmarks; and modeling policies that allow the assessment of possible impacts on competitiveness.

A list of key points considered for discussions on the shape of a carbon pricing instrument in Brazil then follows:

1. Before any assessment on the type and design of a carbon pricing instrument to be adopted in Brazil, one has to know the magnitude and temporality of mitigation goals that productive sectors in Brazil will have to achieve – expressed, in principle, in the Brazilian NDC. The higher that restriction, the greater the benefit in terms of efficiency and fairness of the application of price instruments.
2. Considering aspects such as the scope (sectoral coverage), possibility of tax reform, and lower administrative costs, the tax instrument would be recommendable, provided that the resulting revenue would be used to reduce the overall tax burden of the economy, particularly on labor, finance, and technological innovation. The principle of tax neutrality is, therefore, a key element of discussions on carbon pricing in Brazil.
3. A market creation option would tend to be concentrated in the industrial and power generation sectors, with potential for revenue collection – particularly if considered the unique profile of GHG emissions in Brazil, where the AFOLU component has great relevance. Moreover, as a joint measure, the assessment of taxes would be necessary in other sectors not regulated by the emissions market. On the other hand, an ETS would greater facilitate the operation to include REDD and CDM as offset. Even if this possibility is limited and/or temporary, and as in the EU ETS, there is a low cost offer for these options in the country, which could significantly reduce the emission mitigation costs in the short term.
4. There is plenty of evidence that there is great potential for mitigation options with low cost in the productive sector in Brazil, either by directly controlling the greenhouse gases or increasing energy efficiency. Possible financial and behavioral barriers will have to be removed with credit incentives associated with targets and technological standards.
5. Whatever the instrument adopted, the effects of indirect electricity costs would be lower than those observed in the other economies, given the hydric dominance and the high presence of biomass in the Brazilian energy matrix. However, despite the potential for wind and solar power cost reduction, the matrix margin expansion in the form of thermal sources may increase these costs. Also, the possible expansion of biomass use may increase the overhead and promote the exploitation of forest land.
6. Even with the consequent reduction of dynamic effects in the development of technological innovations and the tax effects of recycling tax revenues or emission rights auctions, the resumption of economic and inclusive growth and the difficult international insertion of the Brazilian economy will require protective mechanisms against deviations and loss of competitiveness.
7. An early and detailed assessment of the direct and indirect costs of Brazil's climate policies will be crucial to design the format and scope of pricing instruments and exemption and compensation mechanisms for the productive sector and household consumption. As with the mitigation targets, an appraisal of these costs is required prior to selecting an instrument.
8. Similarly, whatever the instrument selected, the issue of regressivity – whether small businesses, family farms, or low-income consumers – should also be considered and dimensioned. However, whatever the magnitude and focus of said exemptions, ensuring the transition to a low carbon economy will require them to be reduced gradually according to objective and transparent criteria.
9. This assessment has also to consider any complementary and counterproductive effect of other fiscal and sectoral instruments and, therefore, has to identify inefficiencies resulting from double regulation or perverse incentives. As this is, perhaps, the most complex and

controversial task from the political and institutional standpoint, the Brazilian climate policy has started by establishing a credible and transparent climate governance, enabling sectoral goals and control and pricing instruments. Only then the intersectoral regulatory harmonization efforts will be possible.

10. So, there are important tasks and opportunities for the productive sector to develop a role in Brazil's climate policies. During the international negotiations of the Climate Convention that guide the national targets, the sector efforts can be directed to:
  - (i) expand the discussion on regulatory mechanisms for climate policy;
  - (ii) develop principles and arrangements for climate governance consolidation;
  - (iii) identify direct and indirect cost determinants in sectors; and
  - (iv) carry out comparative studies on exemption and compensation mechanisms.

In all these efforts, it will be crucial to include (i) all productive sectors and finance, including employers' and workers' organizations; (ii) policy makers of the Executive, Legislative, and Judicial branches; (iii) environmental non-governmental organizations; and (iv) academia and research centers.

Considering the mitigation efforts to which Brazil is committed according to the Paris Agreement, such initiatives are not only important, but especially urgent.

#### BOX 12 – FASTER Principles for Successful Carbon Pricing

FASTER Principles for Successful Carbon Pricing, jointly prepared by OECD and the World Bank, synthesize the desirable attributes of an instrument that assigns price to GHG emissions. They are:

- **Fairness:** carbon pricing policies should reflect the payer-polluter principle, and contribute to the equitable distribution of costs and benefits, thus preventing vulnerable groups from being affected disproportionately.
- **Alignment of Policies and Objectives:** carbon pricing policies are part of a wider and coherent set of measures, which should promote innovation, removal of institutional barriers, and encourage low-carbon alternatives .
- **Stability and Predictability:** the political framework of which the carbon pricing policies are an integral part must be stable and provide a strong price signal and increasing intensity of investments.
- **Transparency:** carbon pricing policies must have a clear design and implementation, including monitoring systems and regular communication with relevant stakeholders.
- **Efficiency and Cost-Effectiveness:** carbon pricing policies must improve economic efficiency and reduce the GHG emission mitigation costs, providing flexibility for regulated entities and improving the allocation of resources from savings.
- **Reliability and Environmental Integrity:** carbon pricing policies must have measurable results in terms of inhibition of behaviors that cause environmental damage.

Source: OECD and World Bank (2015).



## 7.2 Recommendations based on experience of companies subject to regulation

### BOX 13 - Case Study: ENGIE

ENGIE, a leading company in energy transition, offers innovative services and solutions for reconciling the demand for energy and the need for climate change mitigation. It is present in over 70 countries where carbon pricing policies have already been implemented or are under preparation. Its experience in Europe with the EU ETS, carbon taxation, incentives for renewable sources, and energy efficiency measures spans for more than 10 years, and its involvement with the CDM in all regions of the world exceeds 15 years. During that period, they have supported discussions and creation of policies and carbon pricing regulations at national and global levels.

Globally, ENGIE is member of the World Business Council on Sustainable Development (WBCSD); the We Mean Business (WMB) coalition; the UN's Global Compact; the World Economic Forum; the IETA; the CPLC; and the Business Partnership for Market Readiness (B-PMR). In Brazil, they are part of the Electricity Sector Environment Forum – FMASE (Fórum de Meio Ambiente do Setor Elétrico), which promotes discussions and development of rational and effective carbon pricing policies to foster the decarbonisation process of the economy. Also, they monitor all their GHG emissions according to the Global Reporting Initiative (GRI), with a reduction target of 20% by 2020, and report on their progress to the CDP and to non-financial rating agencies, such as Vigeo Eiris and Robeco Sam.

In order to promote a global carbon market, and to be able to finance the level of ambition needed to limit climate change, the ENGIE believes that consistency, evenness, and international fungibility are factors to be considered as early as of the national policy preparation stage. They also important to ensure that new instruments are in synergy with current rules and contracts, and that planning efforts and mitigation results are acknowledged. Based on these criteria, the risks and economic costs may be managed to accelerate the transition towards a low carbon economy.

Based on the fundamentals and mechanisms of the international carbon market defined by Article 6 of the Paris Agreement, ENGIE now focuses on discussions at the domestic level. In this context, developing countries are particularly relevant, as they provide mitigation opportunities at lower costs when compared to industrialized countries, although demanding high investments. Creating domestic market mechanisms is a first step in promoting these investments. Therefore, the use of existing and tested solutions, such as the MDL, allows immediate engagement of the private sector and an efficient evolution towards a new mechanism defined by the Paris Agreement. Using mechanisms recognized by the United Nations in the context of Domestic policies may facilitate future international transactions, which are key to attracting capital and investments needed to reconcile the demand for economic growth with a global decarbonisation agenda. The Paris Agreement lays the foundation for the use and accounting of these international market mechanisms. Its effective regulation and implementation now depends on a constructive dialogue with stakeholders, as well as tangible examples able to illustrate the solution.



Considerations involving key points for a carbon pricing instrument design can be complemented by recommendations for companies that will be potentially covered by such policies in the future. In this sense, a group of good practices can be extracted from the evaluation of experiences of organizations currently operating in regulated environments. In addition to companies' points of interest identified in the previous chapter, special attention must be paid to the case studies made by the PMR Secretariat on Royal Dutch Shell (oil and gas), Rio Tinto (mining and metals), and Pacific Gas and Electric Company (generation, transmission, and distribution) (PMR, 2015). That study is the result of interviews with key representatives from those companies and a thorough document review. Generally speaking, five core recommendations on the preparation process for a carbon pricing policy can be drawn from those case studies:

### 1) Incorporating the climate change issue to corporate strategy

Setting a competent technical team to guide the company's climate actions is an important first step adopted by companies evaluated. In addition to forming a team of experts – consisting mainly of professionals experienced in commercial transactions, given the complexity of the pricing mechanism – the dissemination of the theme throughout the company should facilitate the identification of focal points that may identify risks and opportunities in all levels of the organization. The involvement and leadership of the CEO and the senior management is fundamental to creating a culture that encourages the adoption and maintenance of carbon emissions mitigation actions.

In the case of the companies surveyed, the incorporation of climate change to corporate strategy and transparent communications with investors and stakeholders allowed mitigating uncertainties around a future pricing scenario and defining effective investment strategies.

### 2) GHG emissions MRV

According to the experience of the evaluated companies, the GHG emissions monitoring, reporting, and verification accomplished a key role in the process of preparing for carbon pricing. After all, developing a GHG inventory capacity allows the company to know the origin of their direct and indirect emissions and thus identify abatement opportunities.

Although the regulation of emissions is not a reality in Brazil yet, many organizations already monitor and report their emissions through inventories. The early creation of this capacity places them ahead of other companies in a carbon pricing policy scenario where the implementation of a national MRV system will be indispensable. Moreover, the greater the number of companies that now and voluntarily publicly report their emissions, the better the quality of information available for regulatory authorities to establish an emissions baseline and set mitigation targets through policies - an important condition to ensure the integrity of the instrument to be adopted.

The assessed companies have selected to associate monitoring and reporting emissions, by establishing a domestic carbon price. This practice

allowed them to anticipate the mandatory regulation and thus identify investment options and more efficient and cost-effective strategies.

### **3) Identification of risks and opportunities in future policy**

Risks faced by the company and its business units involving future climate policies can be reduced through the organization's engagement in the instruments co-creation process. This involvement can thereby reduce the uncertainty inherent in the policy making process, in addition to favoring the identification of business opportunities arising from carbon pricing.

Taking advantage of the opportunities arising from the regulation can also be highly favored by the development of an internal cost mitigation curve for the company. This action contributes to enlarge the knowledge about the specific reality of the organization – both in terms of costs they incur to reduce emissions and the technologies available in the industry in which it operates.

Establishing internal goals to reduce emissions also offers incentives for companies to seek efficiency gains and optimize their operations, and may put them under more favorable conditions to respond to any future regulation. Companies that already have internal goals may have opportunities in progressively increasing the ambition of these commitments – moving, for example, from an explicit target of reducing the intensity of emissions per output unit to a target expressed in absolute terms – and coverages – going to gradually include emissions from other scopes than Scope 1 (direct emissions).

### **4) Early development of capabilities**

The company's participation in carbon pricing instrument simulations (see Box 11) is a way to accustom the company's key areas representatives to the type of decision that needs to be taken in regulatory scenarios. The voluntary involvement in the carbon market – through developing offset projects, for example – may give the organization a greater familiarity with methodologies, concepts, and processes associated with this type of instrument.

### **5) Stakeholder engagement**

The involvement of the business sector in the pricing instrument design process is critical to the success of the policy, which should be built in a transparent manner and based on dialogue between all stakeholders. From the company's point of view, take a leading role from the beginning of carbon pricing discussions can give greater credibility and reliability to the company in the corporate environment and before regulatory authorities. Moreover, collaborative work between companies, academic institutions, government agencies and non-governmental organizations since the early stages of instrument design may favor building a consensus on specific pricing issues.

The engagement of the business sector can be facilitated by the creation of business coalitions with similar views and interests. It can also be done through the cooperation of the business sector with nongovernmental organizations; technical data of companies



Collaborative work between companies, academic institutions, government agencies and NGOs since the early stages of instrument design may favor building a consensus on specific pricing issues.

may be valuable inputs for preparing studies to guide the policy design and promote sharing of good business practices.

#### 6) Internal carbon pricing

As discussed in the previous section, establishing a domestic carbon pricing has been a widely adopted tool for the business sector to identify hidden opportunities and risks in the company's operations and its value chain; to redirect resources to low-intensive GHG activities; and to encourage investment in R&D, in order to develop more sustainable products, services, and processes (CDP, 2016).

According to Caring for Climate (2015), three distinct approaches to internal carbon pricing can be identified:

**a) Shadow Price:** the term shadow price is commonly used to refer to the estimated price of a good or service for which there is no market defined. This strategy consists of designating a shadow price for GHG emissions to understand the potential impact of an external pricing on the profitability of a given project. Some organizations have used variations of shadow prices to test the sensitivity of their projects' financial indicators.

**b) Internal fees and trade systems:** Some companies have created programs and internal financial incentives to mitigate their GHG emissions. Some have created internal carbon taxes associated with activities and expenditures; others have established

internal emissions trading permits programs, through which plants or business units transact the rights to emit greenhouse gases, in order to ensure that emission reduction targets may be achieved.

**c) Implicit price:** Some organizations have not an explicit carbon price, but calculate an implicit price based on costs incurred to reduce their emissions.

Whatever the approach adopted, one of the biggest challenges associated with internal carbon pricing lies in choosing a price level suitable for GHG emissions. More important, however, than this price level (and as previous step) should be a clear definition of objectives to be achieved as a result of this measure – the kind of behavioral change to be encouraged and emission reduction projects to be made viable. Considerations on price levels in effect in jurisdictions already subject to such regulation and observations of international results achieved may also be useful in defining an internal price for GHG emissions. In any case, adopting an internal carbon price sends a positive signal to investors, and indicates the strategic role assigned to the management of issues related to climate change as part of corporate management (CDP, 2016).

Finally, the definition of an internal carbon price can be an important tool not only for GHG emissions management of the organization, but to improve its risk management and increase its competitiveness through efficiency gains in a context of transition to a low carbon economy.

#### **BOX 14 - Carbon Pricing Business Leadership Criteria**

As part of the initiatives launched in the months leading up to the COP 21 and seeking to promote the business sector involvement in issues related to climate change, we highlighted the for the Carbon Pricing Business Leadership developed by the United Nations Global Compact together with the UNEP and the Secretariat of the UNFCCC.

The criteria include three dimensions ((CARING FOR CLIMATE,2015):

- 1) **PRICE IT**, or the integration of carbon pricing into long-term business strategy. Establishing an internal carbon price is recommended at a level that is high enough to affect investment decisions and reduce greenhouse gases emission;
- 2) **SUPPORT IT**, or publicly advocating the carbon pricing importance. The privileged position occupied by business leaders should be used to influence policy-makers to provide signals strong enough to direct investments that would avoid higher costs in the future, and inspire other organizations to adhere to the criteria;
- 3) **REPORT IT**, or the communication of progress achieved through public corporate reporting. Said reporting promotes the continuous improvement of company's performance in terms of actions related to climate change, in addition to measuring efforts and sharing best practices.



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# Appendix 1

## INTERVIEW SCRIPT

### NATIONAL COMPANIES INSIGHT ABOUT A POSSIBLE CARBON PRICING POLICY IN BRAZIL

1. How the climate change policies are inserted in the company's strategy?
2. Does the company manage/monitor the risks and opportunities associated with possible regulations related to greenhouse gases emission? What are the methods and who is responsible for managing/monitoring of those risks and opportunities?
3. How does the company evaluate the possibility of Brazil to adopt some form of greenhouse gas emissions pricing? What is the probability that the company attributes to have a future legislation covering the sector in which the company operates? Did the company's expectations in relation to that possibility change after the Paris Agreement? Please explain.
4. Which sectors should be a priority for a carbon pricing policy in Brazil? Please explain.
5. Is the Brazilian business sector prepared for regulated greenhouse gas emissions? If not, what conditions and capabilities need to be developed so that a carbon price could be adopted (e.g.: monitoring, reporting, and verifying emissions, technical training, protection of competitiveness, etc)?
6. Which sectors/institutions should lead the discussions on the adoption of a carbon pricing policy in Brazil? How the business sector could be involved in these discussions and in the design process of a carbon pricing instrument?
7. If Brazil adopts a carbon pricing instrument, what would be the most appropriate type of instrument (marketing system of emission allowances, taxation, or a hybrid instrument) for the Brazilian reality? And for the company's operating sector in particular? Please explain.
8. Whereas there is no single format for introduction of carbon pricing instruments, being necessary to select, for example, phased implementation, permits allocation mechanisms, forms of recycling revenues, offset, connection to other markets, which attributes the policy makers must take into account for a pricing instrument?
9. If a pricing instrument is adopted in Brazil, which would be the appropriate price level for tCO<sub>2</sub>e to achieve the policy objectives by 2030? Would the price be enough to encourage the adoption of less carbon-intensive technologies in the industry in which the company operates?
10. Did the company assess the impact of a carbon pricing instrument on the company's production costs in terms of value chain and ability to compete with international companies? If yes, what are the conclusions of that assessment? If not, what would be the expected effects?
11. How does the company evaluate the possibility of receiving any kind of technical support by the regulatory authority and/or other specialized agent to promote the transition to a carbon pricing scenario? As can the international experience contribute to the success of this type of policy in Brazil?
12. What supplementary/compensatory/protective policies could be adopted to minimize the negative impacts of emissions restrictions on the business sector activities?

# Appendix 2

## INTERVIEW SCRIPT

### COMPANIES OPERATING IN ENVIRONMENTS WITH REGULATED CARBON PRICES

1. In which jurisdictions / under which carbon pricing regimes does the company operate?
2. Has the company somehow anticipated the carbon pricing regulation? Which measures did it take in order to prepare for the regulation (e.g.: internal carbon pricing...)?
3. By the time carbon pricing came into force, was climate change already incorporated into corporate strategy? If not, has the regulation contributed for that?
4. What have been the main concerns of company's executives concerning regulation before it became effective? How were they addressed at the time?
5. Which capacities / processes have been developed or put into place in order for compliance to be possible (e.g.: MRV)?
6. How has the company engaged in discussions on the design and implementation of carbon pricing? Has it engaged in such process pro-actively or in a reactive manner? Are there mechanisms available for promoting such participation?
7. How has the company been impacted by the carbon pricing regulation? What have been the effects in terms of costs and competitiveness?
8. How has the company's value chain been impacted by the policy?
9. From the company's standpoint, which policy elements are desirable in order for uncertainty to be minimized and negative impacts to be reduced?

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