Energy governance in Brazil: meeting the international agreements on climate change mitigation

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ENERGY GOVERNANCE IN BRAZIL:
Meeting the international agreements on climate change mitigation

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TABLES OF CONTENTS

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ACRONYMS

ANEEL	Agência Nacional de Energia Elétrica (National Electric Power Agency)
ANP	Agencia Nacional do Petróleo, Gas Natural e Biocombustíveis (Brazilian National Agency of Petroleum, Natural Gas and Biofuels)
ABINEE	Associação Brasileira da Indústria Elétrica e Eletrônica (Brazilian association of the electrical and electronic industry)
ABRELPE	Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais (Brazilian Association of Public Cleaning and Special Waste)
ABEEólica	Associação Brasileira de Energia Eólica (Brazilian Wind Energy Association)
ABEN	Associação Brasileira de Energia Nuclear (Brazilian nuclear energy association)
ABSOLAR	Associação Brasileira de Energia Solar Fotovoltaica (Brazilian Association of Photovoltaic Solar Energy)
ABRAGEL	Associação Brasileira de Geração de Energia Limpa (Brazilian Clean Energy Generation Association)
ABGD	Associação Brasileira de Geração Distribuída (Brazilian Distributed Generation Association)
ABIOGÁS	Associação Brasileira do Biogás (Brazilian Biogas Association)
BNDES	Banco Nacional de Desenvolvimento Econômico e Social (Brazilian National Development Bank)
CCEE	Câmara de Comercialização de Energia Elétrica (Electricity Trading Chamber)
CNAAA	Central Nuclear Almirante Álvaro Alberto (Almirante Álvaro Alberto Nuclear Power Station)
CGEE	Centro de Gestão e Estudos Estratégicos (Management and Strategic Studies Centre)
CTC	Centro de tecnologia Canavieira (Canavieira Technology Centre)

CDM	Clean Development Mechanism
CPDS	Comissão de Política de Desenvolvimento Sustentável (Sustainable Development Policy Commission)
CNEN	Comissão Nacional de Energia Nuclear (National Nuclear Energy Commission)
COES	Comité de Operación Económica del Sistema Interconectado (Nacional Economic Operations Committee of the Interconnected System)
CETESB	Companhia Ambiental do Estado de São Paulo (São Paulo State Environmental Company)
COMPERJ	Complexo Petroquímico do Rio de Janeiro (Petrochemical Complex of Rio de Janeiro)
COP	Conference of Parties
CEBDS	Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável (Brazilian Business Council for Sustainable Development)
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council for Scientific and Technological Development)
CNPE	Conselho Nacional de Política Energética (Brazilian National Council of Energy Policy)
CONAMA	Conselho Nacional do Meio Ambiente (National Environment Council)
DIAP	Departamento Intersindical de Assessoria Parlamentar (Inter-Union Parliamentary Advisory Department)
DIRUR	Diretoria de Estudos e Políticas Regionais, Urbanas e Ambientais (Regional, Urban and Environmental Studies and Policies Directorate)
INFRAERO	Empresa Brasileira de Infraestrutura Aeroportuária (Brazilian Airport Infrastructure Company)
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)
EPE	Empresa de Pesquisa Energética (Energy Research Agency)
FCN	Fábrica de Combustível Nuclear (Nuclear Fuel Factory)
FAO	Food and Agriculture Organization of the United Nations
FHC	Fernando Henrique Cardoso (thirty-fourth Brazilian president)

FINEP	Financiadora de Estudos e Projetos (Brazilian Funding Agency for Studies and Projects)
FGV	Fundação Getúlio Vargas (Getulio Vargas Foundation)
FGTS	Fundo de Garantia por Tempo de Serviço (Severance Premium Reserve Fund)
GIZ	German International Cooperation Agency (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GDF	Green Development Fund
GHG	Greenhouse Gas
GDP	Gross Domestic Product
INB	Indústrias Nucleares do Brasil (Brazilian Nuclear Industries)
COPPE/UFRJ	Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa em Engenharia (Institute of Graduate Studies and Engineering Research of UFRJ)
IBP	Instituto Brasileiro de Petróleo e Gás (Brazilian Petroleum Institute)
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of Environment and Natural Resources)
IEA	Instituto de Economia Agrícola (Agricultural Economics Institute)
IEMA	Instituto de Energia e Meio Ambiente (Institute of Energy and Environment)
INMETRO	Instituto Nacional de Metrologia, Qualidade e Tecnologia (National Institute of Metrology, Standardization, and Industrial Quality)
INPE	Instituto Nacional de Pesquisas Espaciais (National Institute for Space Research)
iNDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
LMTE	Linhas de Macapá Transmissora de Energia (Macapá Power Transmission Lines)
MP	Medida Provisória (Provisional Measure)
MDGs	Millennium Development Goals
MRE	Ministério das Relações Exteriores (Ministry of Foreign Affairs)

MME	Ministério de Minas e Energia (Ministry of Mines and Energy)
MMA	Ministério do Meio Ambiente (Ministry of the Environment)
MPF	Ministério Público Federal (Federal Prosecution Service)
NPT	Non-Proliferation Treaty
NAZCA	Non-state Actor Zone for Climate Action
OPEC	Organization of Petroleum Exporting Countries
PT	Partido dos Trabalhadores (Workers' Party)
PETROBRAS	Petróleo Brasileiro S/A (Brazilian Petroleum Company)
PAISS	Plano de Apoio à Inovação dos Setores Sucroenergético (Innovation Support Plan for the Sugar-Energy Sectors)
PND	Plano Nacional de Desenvolvimento (National Plan for Economic Development)
PNMC	Plano Nacional sobre Mudança do Clima (National Policy on Climate Change)
RENOVABIO	Política Nacional de Biocombustíveis (Brazilian National Biofuels Policy)
PPSA	Pré-Sal Petróleo S.A. (Pre-Sal Petroleum Business Corporation)
PAEG	Programa de Ação Econômica do Governo (Government Economic Action Programme)
PAC	Programa de Aceleração do Crescimento (Growth Acceleration Programme)
DETER	Programa de Detecção de Desmatamento em Tempo Real (Real Time Deforestation Detection programme)
PROINFA	Programa de Incentivo às Fontes Alternativas de Energia (Incentive Programme for Alternative Energy Sources)
PROMINP	Programa de Mobilização da Indústria Nacional de Petróleo e Gás Natural (Programme for the Mobilization of the National Industry of Oil and Natural Gas)
PMCMV	Programa Minha Casa Minha Vida (My House My Life Programme)
PROCEL	Programa Nacional de Conservação de Energia Elétrica (National Programme for the Conservation of Electrical Energy)

PNPB	Programa Nacional de Produção e Uso do Biodiesel (National Programme for the Production and Use of Biodiesel)
PROÁLCOOL	Programa Nacional do Álcool (National Ethanol fuel Programme)
PRODES	Projeto de Monitoramento do Desmatamento por Satélite (Satellite Deforestation Monitoring Project)
RENOVABR	Renova Brasil (Renew Brazil)
SEMAM/PR	Secretaria do Meio Ambiente da Presidência da República (Secretariat of Environment of the Presidency of the Republic)
SENAI	Serviço Nacional de Aprendizagem Industrial (Brazilian National Industrial Apprenticeship Service)
SINDIPETRO	Sindicato dos Petroleiros (Oil Workers Union)
SIGA	Sistema de Informações de Geração da ANEEL (Aneel's Generation Information System)
SIN	Sistema Interligado Nacional (National Interconnected System)
SISNAMA	Sistema Nacional do Meio Ambiente (National Environmental System)
STF	Supremo Tribunal Federal (Federal Supreme Court)
SDGs	Sustainable Development Goals
TAG	Transportadora Associada de Gás (Associated Gas Transportation Company)
UNICA	União da Industria de Cana-de-Açúcar (Sugarcane Industry Union)
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCSD	United Nations Conference on Sustainable Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNODA	United Nations Office for Disarmament Affairs
UFRJ	Universidade Federal do Rio de Janeiro (Federal University of Rio de Janeiro)
FEU-US	Universal Ecological Fund (FEU- Fundación Ecológica Universal)

WCED	World Commission on Environment and Development
WWF	World Wide Fund for Nature

INTRODUCTION

Since the first World Conference on the Human Environment in 1972, the United Nations has convened many times to search for solutions to protect the environment and mitigate climate change. In 1994, the 154 United Nations member States signed the United Nations Framework Convention on Climate Change (UNFCCC) to address global warming. In 1997, the assembly at the UNFCCC conference in Kyoto, Japan, approved the Kyoto Protocol, agreeing that industrialised countries were to take actions to stabilise greenhouse gases emissions. The latest and more expressive international meeting was the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC). It took place in Paris in December 2015. At this conference, a new international agreement was made to conduct initiatives worldwide for reducing the effects of climate change. In anticipation of the event, 187 states voluntarily submitted their Intended Nationally Determined Contribution (iNDC), in which countries drafted their post-2020 climate actions to be taken under the Paris agreement. The main goal of the new treaty is to hold the increase in global average temperature below 2°C above pre-industrial levels by reducing anthropogenic CO_2 emissions. Even though at the end of April 2021, 197 UNFCCC members had signed the agreement, there have been many questions about whether the treaty can and will be honoured. In fact, there is an emerging consensus among scholars that diplomat should move beyond the 2°C goal due to inconsistencies between science and international commitments and that a feasible global agreement is a utopia. Some argue that climate negotiation has become a political agenda and has allowed governments to make a good impression by appearing to take global warming mitigation seriously, whereas making a meagre effort or even taking no action at all.

Throughout the years, Brazil has actively participated in all international gathering to discuss environmental governance. Two of the most notable events organised by the UNFCCC were held in Brazil. The Brazilian government played a leading role by hosting the Earth Summit in 1992 and Rio+20 in 2012, both held in Rio de Janeiro. Brazil was also the protagonist in the Clean Development Mechanism creation under the Kyoto protocol, which was intended to foster clean development in developing countries. Two months before COP 21, Brazil submitted its iNDC. The government considered it extremely ambitious as it pledges to reduce GHG emissions by 37% in 2025 and 43% in 2030 below 2005 levels. However, since the iNDC submission, the country has been facing severe political and economic crises. These conjectures have worsened by the Coronavirus pandemic. Brazil's current situation indicates a dissonance with the country's pledges to reduce GHG emissions and its compliance with the international climate agreements. The Brazilian energy governance has great significance for achieving the global goals on climate change mitigations. Brazil has the world's 12th largest economy and ranked as the 7th most populated country. Area wise, Brazil is the 5th largest country in the world and therefore has great wind and solar power potential. Furthermore, around 60% of the Amazon Forest lies in Brazil. Its preservation also depends on Brazilian energy policies.

The energy transition is one of the main targets of the international agreements on climate change mitigation. In order to contain global warming, the world needs to abandon fossil fuels and expand the development and use of renewable energy sources. This research focusses on Brazil's energy governance and the conditions of the country's energy sector to put into practice the energy transition necessary to reduce GHG emissions.

Brazil is well known for having the cleanest electricity mix in the world. This reputation stems from the country's reliability on hydropower. Hydroelectric plants are responsible for most of Brazil's electricity generation, and in the last two decades, the county has shown a

considerable development of alternative sources such as wind, solar and biomass. Despite Brazil's enormous potential for generating renewable energy, its institutions are struggling to reduce the country's dependence on fossil fuels. The Brazilian energy sector drives on traditional sources. The electricity sector still depends on thermoelectric plants powered by fossil fuels (coal and diesel), especially when droughts occur. Large hydroelectric plants are a tradition in the country but have been very much criticised because of the environmental and social damage it causes and may not be as reliable as in the past. Due climate change, severe droughts put at risk the country's water resources. In addition, the transport sector is powered mainly by fossil fuels despite the country's strong ethanol industry. Almost seventy-five per cent of the Brazilian fleet is powered by gasoline and diesel. Considering Brazil's great territorial dimension, large population, and mainly road transportation, energy transition is urgent to make the country's iNDC pledges feasible.

To create and implement policies that stimulate energy transition in the country, decision-makers need to be independent and political choices must be based on science and the country's commitment to the international agreements it is signatory to. Currently, the decision-making process in Brazil is strongly influenced by interest groups that use their resources and power to direct public policies according with their interests. Power relation strategies, historically known in Brazil, are used to keep the energy sector on its traditional course. Clientelistic practices to gain or maintain power are used in the country in all areas of decision-making. In the energy sector, these practices favour monopolistic strategies for a limited number of companies. The enormous resources handled in the sector attract an oligarchic elite who seek opportunities for cronyism and rent-seeking. Under these circumstances, the capture of the state is inevitable, and public policies for the energy sector are directed to the interests of the incumbent industry. Under the control of these interest groups, policymakers tend to respond to stimuli from those around them and behave accordingly.

Brazil has good regulatory agencies and well-qualified professionals working on the development of policies for the energy sector. However, when it comes to decision-making for the implementation of these policies, the executive branch makes the final decision. At this decision-making level, both the power relations strategies and individual behaviour influence the policy choice. Currently, these two factors are the biggest obstacles to the energy transition in Brazil.

This research uses power relations strategies and behavioural economics as framework to understand the policymaking for the Brazilian energy sector. The literature shows that power relations strategies historically permeate Brazil's governance. Monopolistic practices, clientelism, bossism, political capture, cronyism, rent seeking, are subjects of many studies in different fields of knowledge. These phenomena, regarded in this research as power relations strategies, are a hindrance to a great deal of the decision-making processes in Brazil. This study seeks to contribute with public policy studies by understanding how these strategies influence policy choices for the Brazilian energy sector, especially how they limit the country's conditions to comply with international climate agreements. On the other hand, behavioural economics has been broadly applied in public policy studies to understand decision-making processes. Behavioural economics highlights the irrational aspect of decision making. This irrationality, also referred to as a behavioural failure, may be the reason people make choices against their long-term benefits. In order to understand the influence of Brazilian decision makers' behaviour in the energy sector policy choices, this research uses the following behavioural economics concepts: hyperbolic discounting and loss aversion; endowment effect and status quo bias; information avoidance; delusion of competence, overconfidence and planning fallacy. Behavioural economics shows that individuals make choices based on habits, preconception, simplified practical rules and personal experiences. Studies on power relations strategies and individual behaviour combined may offer a more elucidative explanation of the

Brazilian energy governance, which, in turn, give a more precise forecast of Brazil's capability to comply with the international climate agreements.

The power relations strategies mentioned above are the subject of many international and Brazilian studies (Dunne, 1995; Hopkin, 2006a; Quimpo, 2009; Bardhan & Mookherjee, 2012; Robinson & Verdier, 2013; Haber, 2002; Zywicki, 2016). Power relations strategies have been recurrently used to guide decision making in the Brazilian energy sector. That explains the great body of literature on the subject. The literature review carried out for the purpose of this research has shown a large body of evidence that monopolistic practices, clientelism, bossism, political capture, cronyism, rent seeking have strong influence in the decision-making processes for the Brazilian energy governance. In addition, information from primary sources have confirmed this hypothesis as demonstrated in chapter five. Nevertheless, when further studying the phenomena, a new insight seemed necessary to understand the reasons why and how certain decisions are made. Behavioural economics has been chosen as complementary theory to analyse the phenomena as stakeholder's personal behaviour appear to have enormous influence in policy choices. The first hint that this theory could give a more deep and modern insight to the subject of this research was found in the *Handbook on energy and climate change* edited by Roger Fouquet in 2013. Behavioural economics is a rather new theory and therefore is the Brazilian literature on this subject relatively limited. Nevertheless, using this theory as complementary to answer the research question proved to be particularly useful. To prove the hypothesis that stakeholder's personal behaviour has been affecting policy choice in the Brazilian energy sector, many pieces of evidence found in the literature as well as in newspaper articles, videos, audios, interviews, NGOs reports and working papers, among others, are demonstrated in chapter five.

Brazil's reputation as a 'green energy power' is an attribute that settles its energy sector, suppresses the need for change and hinders

technological and institutional innovation. Brazil's current energy policies are an unwise choice to meet the country's increasing energy demand and, at the same time, to decrease its GHG emissions. Even though Brazil has committed to all international agreement, Brazilian energy policies are still attached to decision-making processes from when environmental issues were not at the top of the world's political agenda as it is nowadays. Changes must be made to achieve an alignment between Brazil's energy policies and its iNDC pledges.

This study aims to analyse how decision-making processes take place regarding the Brazilian energy governance, particularly related to Brazil's collaboration with international agreements on climate change mitigation. The present research seeks to elucidate the extent to which Brazilian policymakers consider the country's commitments to reduce GHG emissions when implementing one or another energy policy. This investigation intends to answer the central question: to what extent current energy policies in the country are designed to comply with the international agreement to hold the increase in global average temperature below 2°C above pre-industrial levels? To answer this question, it is imperative to understand why one energy policy is chosen in detriment of others and what leads the decision-making processes in the Brazilian energy sector.

The hypothesis proposed to answer the research question is that the recurrent use of power relations strategies in the country's energy governance prevents innovative policies toward energy transition. The persistence of monopolistic and oligopolistic practices enabled by crony capitalism and rent-seeking dictates policy choices and imposes the use of established technologies, causing inertia in the Brazilian energy sector. Furthermore, the role of behaviour in policy choices investigated in behavioural economics may further elucidate that policymakers are influenced not only by political, economic, and institutional challenges but also by their deep-rooted personal behaviour, which can be decisive in the decision-making processes.

This research investigates the Brazilian energy governance and the challenges that the country faces to comply with the international climate agreements. The methodology chosen to conduct this study was an explanatory single case study. Case study is the most appropriate method for answering 'who' and 'why' questions (Yin, 2009), such as the one guiding this research. This approach is also known to be the most effective way to interpret intricate real-life events that occur in political, economic, institutional, and sociocultural domains (Bartlett and Vavrus, 2017). Brazil has a much-diversified energy matrix. It ranges from fossil fuels (oil, natural gas, and coal), renewable sources (hydro and nuclear power, biofuels, wind, and solar energy). Chapter three and four describe the applicability of this energy sources in the Brazilian energy sector. This context is presented to understand the sector's developments throughout the years. In a case study the context is always considered "as a way of understanding influences, relationships and in some cases cause and effect" (Chopard and Przybylski, 2021: 4). A qualitative research approach was used to investigate why certain policy choices are made in detriment of others, concerning the Brazilian energy governance. Brazil was chosen as case study because of its relevance for the international climate governance. The study of Brazilian energy policies and the circumstances of its formulation and implementation can contribute with the efforts to transitioning from fossil fuels to renewable energy use at international level.

According to Yin (2009) the data source list for a case study is quite extensive and includes literature review, documentation (e.g., administrative documents, formal studies, newspaper clippings, mass media articles, maps, and charts, white and working papers) interviews, films, videos, among others. Many of these sources were used during this study's data collection phase which took place in the period 2017-2020. During this interval up to 2022 Brazil has gone through a great political and institutional crisis especially due to the Bolsonaro's presidency –and his cabinet– and the Covid 19 pandemic which has affected the entire world. This period was a turmoil frequently portrayed in the news and

on the internet with many well-respected journalists, political scientists, writers, professors, etc. commenting the events in videos, articles, and interviews. This reality has contributed for the use of many sources in the data collection phase and beyond.

To build the framework on which this research is based, a literature review was carried out through an extent assessment of national and international studies, both primary and secondary sources. Chapter one presents the concepts found in the literature that explains the phenomenon best. Literature review was also used in the process of data collection and contributed with great part of the evidence shown in chapter five. Even though the occurrence of the power relations strategies mentioned above are frequent in the Brazilian energy sector, the vocalization of this practices by stakeholders in not as clear as it would be necessary do prove this research's hypothesis. That happens for two reasons: first, the phenomena are not named properly in everyday life or in locus as it is in the literature. Second, certain statements may be politically sensitives and therefore avoided by stakeholders. For those reasons, literature review was chosen the main strategy for data collection and the design of this study.

In an attempt to explain more completely the phenomenon, this research is based on the process of triangulation, which is the use of more than one research methods and approaches to investigate a particular subject. The framework combines two perspectives: the concept of power relations strategies and behavioural economics theory which were selected to be used as complementary after a thoroughly examination of a collection of written sources such as books, scientific articles, research reports. Furthermore, policy and legislations documents, outlooks from NGOs and international agencies, newspaper article, among others were used as secondary source of empirical evidence. In examining a problem like this in the Brazilian context, such sources are crucial to understand the reality of policymaking on the ground.

The fieldwork took place in the cities of Rio de Janeiro, São Paulo, Vitoria, and Brasilia. From July 21 to August 30, 2018, when the first round of interviews was conducted. The second phase of the research was conducted remotely between 10 and 31 of July 2020. In total, ten interviews were conducted with different Brazilian professionals in the fields of energy, public policy, and behavioural economics. The professionals chosen are active in different sectors, namely: academy, government, NGOs, private sectors, energy agencies. This choice was made based on earlier field work which resulted in the master research thesis *Energy transition in Brazil: barriers and possibilities within the institutional scope* (Ferraço, 2016). In this study evidence was found that information, incentives and planning usually are disconnected, unstructured and discontinued. With this reality a look into different professional areas facilitates a broader view of the phenomenon. Some interviewees were selected based on their knowledge on the subject as they were found during the literature review phase. Others were indications by their peers because of their knowledge and relevance in the field.

A semi-structured question list was used in search of evidence to answer the research question and verify the hypothesis. The interviewees were invited to try and answer fifteen questions related to the concepts which guide this research. The interviews lasted around one hour on average and were recorded to be analysed afterwards. All interviewees have agreed in having their names literally cited in this study.

By using a variety of written, audio-visual sources and a semi- structured interview, a great amount of relevant information was collected and verified, resulting in the validation of the findings, analyses, and conclusion. The later will reveal de lessons learnt from the combination of the concept of power relations strategies and behavioural economics theory and its use in the analysis of similar phenomenon.

In addition to this introduction and a general conclusion, this thesis is arranged with the following chapters:

The first chapter presents the theoretical framework on which this study is based. The first section elucidates the concept of power relations strategy and its synergy with behavioural economics theory. The subsequent four sections review the traditional concepts recognized as power relations strategies in this dissertation. These strategies are monopoly and oligopoly; clientelism; bossism and political capture; crony capitalism and rent-seeking. The last section introduces behavioural economics theory and some concepts studied by this strand of thinking. As behavioural economics comprises a vast variety of concepts, a selection was made considering the prevalence of such a concept in the phenomenon. The chosen concepts used in this study are hyperbolic discount, loss aversion, endowment effect, status quo bias, information avoidance, delusion of competence, overconfidence, and planning fallacy.

Chapter two is divided into two sections. The first one summarises the international agreements made on climate change mitigation. The overview starts with the first World Conference on the Human Environment in 1972 up to the United States' return to the Paris agreement. Section two outlines Brazil's five decades collaboration with the international community on climate issues and the country's attempt to comply with the global agreements.

Chapter three and four are both empirical literature-based sections and describe the Brazilian energy sector. The main goal here is to outline the state of the art of Brazil's current energy production and consumption. Chapter three addresses the traditional sources of energy that form the energy sector since the country's initial development in the 1930s. These sources are hydroelectric and thermoelectric power, oil, gas, and ethanol. Chapter four tackles the country's alternative energy industry and highlights the development of renewable energy sources which are: wind

and solar power, biomass, second-generation ethanol, biodiesel, biogas, and black liquor. Hydropower and ethanol are also considered renewable sources; however, they are presented in the previous chapter because these sources use started in the country in the 1950s and 1975s, respectively.

Chapter five reveals evidence that verify the phenomena described by the concepts introduced in theoretical chapter one. The passages presented illustrate that the theories chosen as framework for this study manifest itself in real life. This evidence was found in the literature, newspapers, documents and also in audio-visual material, which are nowadays an essential communication medium used by well-respected Brazilian scholars, journalists, politicians, philosophers, economists, among others. Furthermore, fragments of interviews conducted during fieldwork demonstrate that the framework chosen can in fact explain the phenomenon studied in this research.

The conclusion presents the answer to the research question. It also summarises how the power relations strategies described in the theoretical framework influence the decision-making processes in the Brazilian energy governance and how it hinders the country's effort towards energy transition. Furthermore, the conclusion recap how stakeholders personal behavioural have major influence in policy choice for the Brazilian energy sector. The conclusion also presents an explanation of how the combination of power relations strategy concept and behavioural economics theory can be a helpful tool in further research in this field of study.

CHAPTER 1
DRIVING FORCES BEHIND THE ENERGY POLICYMAKING: POWER RELATION STRATEGIES AND BEHAVIORAL ECONOMICS

This chapter introduces several concepts that are helpful tools to explain different phenomena in the political and economic realm. These concepts define a variety of phenomena that prove to be determinant to the current global energy governance and countries' public policies for achieving the international goals on climate change mitigation. This research explores two driving forces behind the energy policymaking: power relations strategies and policymakers' behaviour. A vast body of literature indicates that policies are moulded through power relation strategies historically practised. On the other hand, scholars have found under the umbrella of b0ehaviour economics theory, an innovative approach to analysing how policy choice can be influenced by individuals' behaviour. These approaches have also proven to be a very useful tool to understand the challenges that Brazil faces to comply with international climate agreements.

The first section of this chapter explains the term 'power relations strategies' and its synergy with some concepts of behavioural economics. Sections two to four tackle the following phenomena: monopoly and oligopoly, clientelism, bossism and political capture, crony capitalism and rent-seeking. For the purpose of this research these phenomena are called power relations strategies which are tactics that appear to have considerable influence in the policy-making processes with direct interference in the Brazilian energy sector. The last section describes the behavioural economics theory. Behavioural economics provides empirical evidence that common cognitive limitations affect individual's

decision-making. Therefore, it can be an effective tool to understand policy choices. As behavioural economics comprises many different concepts, a previous selection has been made. The concepts found most useful for this research are the following: hyperbolic discounting and loss aversion; endowment effect and status quo bias; information avoidance; delusion of competence, overconfidence, and planning fallacy. These concepts are explained separately also in the last section of this chapter.

1.1 Power relations strategies

The concept of power relations is used within a range of research fields such as politics, economy, sociology, education, geography, international relations, among others. In the literature it appears as framework of different studies such as feminism, education, social and spatial inequality, pedagogy, violence, poverty, etc. The elucidation of the power relations concept in this research was found in the thoughts of Marx and Foucault. The comprehension of power is the starting point for the considerations of both philosophers on power relations.

The Marxist perspective defines power as capacities grounded in structured social relations which entail enduring relations of reproduced, reciprocal practices (Jessop, 2012). For Marx, a study of a given society should not only focus on its subjects and structure but on its process of *reproduction* as well. "It is in the study of the process of reproduction that Marx analyses the class relationships of exploitation and domination" (Therborn, 1999: 231). In the Foucauldian approach, power is not something that can be owned, but rather something that acts and manifests itself in a certain way; it is more a strategy than a possession. It operates in day-to-day interactions between people and institutions (Bãlan, 2010). On this matter, Kelly highlights the following (among others) characteristics in Foucault's view of power: "the relationality of power, meaning that power is always a case of power relations between people, as opposed to a quantum possessed by people

and the strategic nature of power, meaning that it has a dynamic of its own, is intentional" (2012: 37). In both strand of thinking power is regarded as a phenomenon that occurs in all social interactions. These realisations generated the concept of power relations.

Marxists have study power relations through four main approaches (Jessop, 2012). First, they see power relations as manifestations of a specific form of class domination; second, they are interested in the connections between economic, political, and ideological class domination; third, they notice the limitations intrinsic to any exercise of power and, for this reason, continuing struggles are needed to reproduce the conditions for class domination, and therefore in the fourth place, Marxists address questions of strategy and tactics providing empirical analyses of actual strategies intended to reproduce class domination. Jessop states that

> the relations among economic, political, and ideological class domination can be considered in terms of the structurally-inscribed selectivity of particular forms of domination and the strategies that help to consolidate (or undermine) these selectivity's. The bias inscribed on the terrain of the state as a site of strategic action can only be understood as a bias relative to specific strategies pursued by specific forces to advance specific interests (ibid.: 10).

In the thoughts of Foucault, "power relations are rooted deep in the social nexus (…) to live in society is to live in such a way that action upon other actions is possible, and in fact ongoing (…). There cannot be a society without power relations (Foucault, 1982: 791). In *The Subject and Power* (1982), Foucault reflects on relations of power and relations of strategy. He calls attention to the word *strategy*, used

> to designate the means employed to attain a certain end; it is a question of rationality functioning to arrive at an objective (…) one may call power strategy the totality of the means put into operation to implement power effectively or to maintain it. One may also speak of a strategy proper to power relations insofar as they constitute modes of

> action upon possible action, the action of others. One can therefore interpret the mechanisms brought into play in power relations in terms of strategies (1982: 794).

Following the steps of Yu, De Klerk & Hess (2021), González-Ocantos & Oliveros (2019), Patnaik (2015), Hemphill & Wu (2013), who highlight the strategic features of monopolistic and oligopolistic practices, clientelism, bossism, cronyism, rent-seeking, this research will regard these concepts as power relations strategies as they are methods put into force to both gain and maintain power. They make the capture the state possible. In a vicious circle, the captured state reinforces power relations and encourages their use as strategies to maintain state capture.

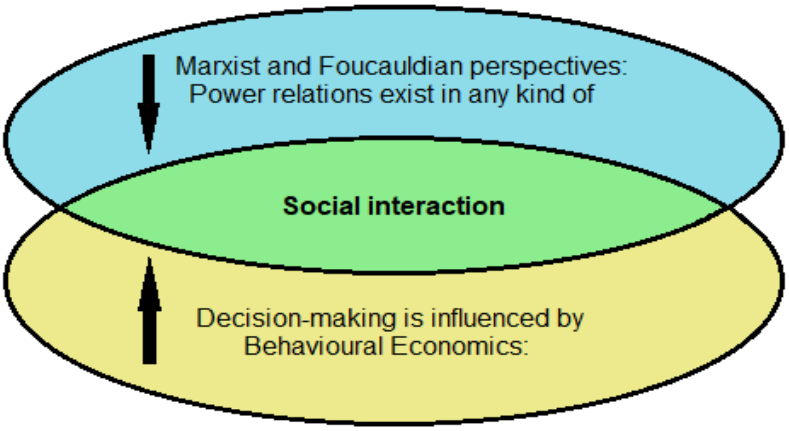
> When power relations repeat themselves and form a pattern, they become institutionalized; they become the rules of the game (…). Each time A gets B to do what A wants, A is not only achieving a desired outcome but is also confirming the dispositional arrangements of the game and reinforcing and maintaining the overall system (Eyben, 2005: 23).

Actors participating in this vicious circle remain in power and maintain the status quo. As a result, the possibilities of countries making the necessary changes to meet international agreements to mitigate climate change are limited.

1.1.1 Power relations strategies and behavioural economics: the synergy

Marxist and Foucauldian perspectives agree that power relations occur in any social interaction while behavioural economics highlights that decision makers are influenced by those they interact with (Gsottbauer & Van den Bergh, 2012; Samson, 2020; Wilson, 2020). Social interactions of any kind impact people's behaviour. When it comes to power relations the chance of behaviour change is even bigger as they often implicate actions upon other actions, domination, or both. The sociologist Noel P. Gist describes social interactions as "the reciprocal influence human

beings exert on each other through inter stimulation and response" (1950: 363). Social interaction is the intersection between power relations and behavioural economics, as shown in the diagram below.



Source: own production.

Power relations happens in social interactions at the same time that social interactions influence decision-making. Conclusively, it is fair to say that power relations influence decision-making.

Wilson (2020) states that behavioural economics avail of psychological insights to understanding economic decision-making. These insights diverge from conventional economic models grounded on rationality and reveal how human psychological tendencies affect economic life and may lead to imperfect rational choices. Furthermore, the author highlights: "social psychology shows how collective group dynamics and social contexts influence economic decisions. These insights have applications not only for individuals, but also for effective policy design and implementation" (ibid.: 4). Behavioural economics highlights the influence that social interactions have on decision-making. Furthermore, it draws attention to the effect of personal experience, emotional factors, preconception, and habits on people's judgments and choices.

In Neoclassical economics the concept of the *homo economicus* imply that humans use their consistent rationality when making decisions in order to maximize their benefits and utility. Contradicting this assumption, the term Bounded rationality coined by Herbert Simon (1982) suggests that people make decisions regardless their rational capability. Behavioural economics has in Simon's idea one of its pillars and further highlights the irrational aspects of decisions-making processes. "Research findings in behavioural economics make clear that economic decision-makers are often far removed from the rational *homo economicus*" (Berggren, 2012: 2). Behavioural economics reveals a variety of human idiosyncrasies identified as behavioural and cognitive deviations which shape individuals' judgment and choice. One of these deviations is people's inclination to make predictions and reach conclusions by using mental shortcuts known as heuristics (Samson, 2018). Heuristics, also known as rule of thumb, are used by general people to facilitate decisions-making. Although helpful, they can lead to cognitive biases (Kahneman & Tversky, 1996). Cognitive biases are "subconscious mental processes that impair rational thought-processes and ultimately lead to "irrational" choices (MacCann, 2006: 1468). Heuristics and cognitive biases are correlated and the use of one may be accompanied by the use of the other. According to Berggren, "decision-makers are characterized by cognitive limitations and biases, and they are affected or afflicted by such things as imperfect self-control, framing effects, choice bracketing, information and choice overload and a poor grasp of probability calculations" (2012: 2).

Examples of cognitive biases are hyperbolic discounting, loss aversion, endowment effect, status quo bias, delusion of competence, overconfidence (Lin, 2011; Samson, 2018).

Emmerling & Rooders (2020) stress that subconscious biases can seriously damage our individual ability to make good judgement, with us being unaware of it. Furthermore, group decision-making is even more complex, as biases can be intensified by the interaction between group members. In power relations, actors interact to pursue their rational

personal goals at the same time their biased behaviour may lead them to disadvantageous decision-making.

Power relations are built and nurtured by individuals or groups that wish to gain or retain power. Maintaining power is directly related to the maintenance of the status quo. According to Mosse, power relations strategies result in "uneven accumulation of political capital, in the form of symbolic or cultural capital, prestige, honour, or popularity. Political capital allows certain groups in society privileged access to public resources" (2005: 53). Furthermore, the author states that political capital favour the accumulation of economic resources and the reproduction of class structures. It has also an effect on individual behaviour. People's behaviour is conditioned by long-lasting inclinations (cognitive and behavioural) derived from historical pressure and tends to reproduce the existing conditions, that is, maintain the status-quo.

On the matter of the Brazilian energy governance, a vast literature (Rufin, 2012; Armijo & Rhodes, 2017; Fortes do Rego, 2017; Desposato, 2002) shows that power relations strategies, are historically employed. These strategies are a great hindrance for the creation and implementation of public policies to stimulate the energy transitions needed to comply with the international agreements on the reduction of CO_2 emissions.

Behavioural economists argue that individuals are biased in favour of the status quo (Samson, 2018; Lin, 2011; Kahneman, Knetsch & Thaler, 1991). Gsottbauer & Van den Bergh (2012) explain that behavioural economics brings forth empirical evidence that decision-making in negotiation-like situations is affected by systematic cognitive biases and social interaction. In their study they "examine the impact of bounded rationality and social preferences on bargaining in international climate negotiations and illustrate how particular deviations from full rationality affect the incentives to cooperate" (ibid.: 225). Wilson (2020) in her study contextualizing behavioural economics, highlights how issues of anchoring, hyperbolic discounting, and information avoidance have

hindered adequate action on environmental and climate issues. The author claims that behavioural economics presents suitable insights to comprehend the causes and policy solutions to these issues.

This research found in the combination of the concept of power relations strategies and behavioural economics a valuable tool to analyse the extent to what the Brazilian government will be able to contribute with the international efforts to mitigate the effects of climate change. The next four sections will detail the following power relations strategies: monopoly and oligopoly; clientelism; bossism and political capture; crony capitalism and rent-seeking. These strategies appear in the literature as the most influent in the phenomenon and therefore are the most significant for answering the research question. Subsequently, behaviour economy theory will be addressed, detailing the seven concepts – hyperbolic discount, loss aversion, endowment effect, status quo bias, information avoidance, delusion of competence, overconfidence and planning fallacy – best related to the phenomenon and most noteworthy for the analyses of the subject of this thesis.

1.2 Monopoly and oligopoly: control in the hands of few

The access control to any kind of resources that are valuable for the collectivity is considered a monopoly. These resources can be products, services, technologies, knowledge, and power, to name a few. The monopoly of these goods is valued because it reduces production costs and increase income and, it guarantees income stability, decreasing risk (Medina and Stokes, 2007). In economics, a monopoly is a market structure where a single seller supplies a specific good or service and can charge any desired price because consumers have no other firm to buy from. According to Velásquez (2013), monopolistic markets violate capitalist justice as they make a high profit by charging more for goods and services than they are worth. Monopolist enterprises have abnormal earnings by curtailing output which leads to a price increasing above a

competitive level. Consequently, a transfer of income from consumers to monopolists take place (Dunne, 1995; Oxfam, 2014). This system also hinders aspirant competitors due to high standard entry barriers, which keep them from bringing new and more efficient products to the market. This kind of unethical practices also happens when it comes to an oligopolistic market. The conduct of exclusive dealing arrangements, price-fixing, bid-rigging, market allocation, among others, are ordinary. Oligopoly is a more frequent practice and occurs when two or more firms merge to compete in the same trade. By joining forces, firms' managers can set prices and limit competition in the same way monopolistic firms do. "When a few large players are recognised as dominant powers in a single antitrust-defined market, we call this oligopoly and are very aware of potential tacit collusion, the stickiness of prices, retardation of innovation, and enhancement of entry barriers" (Ayal, 2013: 229). Antitrust is the name given to the collection of laws regulating businesses conduct and promote fair market competition favouring consumers. It is also known as competition law.

Public discontent with monopolistic practices has been expressed since the 19th century. The American businessperson John D. Rockefeller formed a trust in the oil industry in 1882, resulting in limited competition and price control. To limit monopolies' expansion, John Sherman, a lawyer and senator from Ohio, proposed the Sherman Antitrust Act. This law passed by Congress in 1890 and is the first legal measure against anti-competitive business and capital accumulation. "In the marketplace, it is antitrust that governs competition ensuring the existence of many small players and preventing the large from skewing the playing field to their advantage" (Ayal, 2013: 238).

According to Ayal, economic power was initially the core of antitrust law. Over time, the attention of competition policies has shifted to market power, narrowing the focus to markets analyses and their influence on price and output. "This unitary focus blinds us to the effects of economic power, which have to do with social and political realms" (2013: 222).

Large enterprises have a strong influence on politics and affect social justice. When officials regulate on behalf of incumbent firms to the detriment of the state or its citizens, it indicates the capture of policymaking. Elevated levels of wealth and corruption are often related to capturing power and politics by entrepreneurial elites exploiting inefficient antitrust regulations (Oxfam, 2014; 2018; Beke, 2018).

> Political capture is often associated with politicians requiring funds to get elected (and re-elected), thus becoming beholden to businesses which helped finance their campaigns (…) businesses requiring political support will be willing to pay for it, and governmental regulation has become an essential input to almost every large business (Ayal, 2013: 225).

Policymaking captured by entrepreneurial elites aligned with neoliberal ideas underpins the economic forces responsible for diminishing the working class's power to the advantage of the well-paid and wealth holders (Oxfam, 2018).

Deficient regulatory policies are convenient for non-competitive transactions. In such environments, elites take advantage of ineffective and unskilled antitrust authorities in other to guarantee benefits for their business (Oxfam, 2014). When the market grows freely, it may turn into long-term oligopolies in a particular market and economy-wide corporation. This kind of association often become dominant and protected by the state (Ayal, 2013). Consequently, smaller companies must face unfair competition. Consumers will eventually pay a higher price for goods and services controlled by monopolies, oligopolies, and well-connected people inside government (Oxfam, 2017).

Antitrust law prohibits market competitors from charging an agreed price for goods and services instead of competing against each other. This practice called price-fixing cuts down competition and limits options for consumers and other businesses. Another non-competitive tactic is parallel pricing which, according to Devlin (2007), has similar

economic consequences as explicit price-fixing. Hemphill & Wu (2013) state that there has been an extensive debate among academics and jurists whether and when parallel pricing practices configure antitrust law infringement. On the other hand, the authors argue that parallel exclusion[1] – which is a systematic anti-competitive strategy used by firms to prevent newcomers – has been neglected. "Parallel exclusion deserves much greater attention, for its anti-competitive forms have much greater social consequences than parallel pricing due to their potential to influence not just prices, but also the pace of innovation" (Hemphill & Wu, 2013: 1185). In other words, in the attempt to circumvent antitrust law, the parallel exclusion is more effective than parallel pricing. With the price increase, new entrepreneurship may still find a gap in the market, whereas parallel exclusion favours both unreasonable prices and delay innovation. The latter has a significant impact on long-run economic growth.

Monopolies and oligopolies use structures and capital resources to wield political influence, thereby blocking and shaping regulation to increase profit (Dunne, 1995; Machado, 2015; Ovodenko, 2016). Ovodenko (2016) does not deny the harmful effects of monopolistic and oligopolistic practices for the market. However, the author emphasises that conglomerates have been more rigorously regulated than competitive industries and forced to follow higher rates standards and rules regarding global environmental governance. Furthermore, the author states that "oligopolistic businesses tend to have the resources and market power to reduce environmental pollution more cost-effectively than do businesses in competitive markets" (2016: 111). Regardless of their political influence, oligopolies are frequently required to start and sustain market changes to achieve environmental goals globally (Ovodenko, 2016).

[1] Theoretically it happens as follows: "each firm either deals or refuses to deal with a new entrant; or either engages or does not engage in tying or exclusive dealing" (Hemphill & Wu, 2013: 1223). These practices may alternate depending on the direction the exclusion is more likely to occur.

It seems logical that some non-competitive markets can bring a positive outcome for society or part of it. However, the social costs of monopolies and oligopolies are more often highlighted in the literature. Non-competitive businesses harm not only the economy but also democracy. When large enterprises are entangled and control several important markets simultaneously, competition is restrained in economic and democratic matters. In such an environment, inequality increase, low productivity, technological delay, rent-seeking, corruption do not go unnoticed. Opposingly,

> democracy and competition entail maintaining the interaction of many small players rather than few large ones. The idea of 'one person, one vote' governs democracy, along with a court system ensuring that no large player (the majority) can use its power to exploit the small (minority) (Ayal, 2013: 238).

In January 2018, Oxfam international published 'Reward work, not wealth', an article on global inequality. According to this study, extreme inequality stems from monopoly power. Oxfam had already warned about the harm caused by non-competitive businesses. "Without competition, firms are free to charge exorbitant prices, which cause consumers to lose (…) goods become more expensive, and if incomes do not rise, inequality worsens" (Oxfam, 2014: 15).

According to Schmitz (2012), studies from the 1960s onward have shown that monopolies lead to a welfare loss. In the United States, government protection mechanisms such as tariffs, quotas, work rules "led to incentives to form monopolies, and then to actual monopolies, and then these monopolies led to large welfare losses" (Schmitz, 2012: 3). The author states that research results demonstrate that outputs are smaller under monopoly than under competition, indicating low productivity. "To produce a given level of production, a monopolist needs more energy, capital, and other inputs than a competitive industry would need" (Schmitz, 2012: 4).

When a small group of large firms dominate the market by employing oligopolistic practices, retardation of innovation may happen (Ayal, 2013). More specifically, parallel exclusion conducted by allied enterprises significantly affects society since it influences innovation's pace. According to Hemphill & Wu (2013), parallel exclusion harms innovation by slowing or blocking the introduction of *higher-quality* and *lower-cost* alternatives. These statements reinforce the results of some historical studies that demonstrate the way monopoly retards innovation (Schmitz, 2012).

Dunne (1995) states that rent-seeking occurs when a monopoly possibility emerges, and resources are invested to earn it. On the other hand, a 'rent protection' reaction may occur since competitors tend to fund initiatives to avoid the rise of a monopolistic market. According to the author, in both cases, resources are used inefficiently, causing social loss. Society would be better off if the resources expended to earn or avoid monopoly were invested in the production to benefit the population.

According to Machado (2015), monopolies and oligopolies are one of the reasons behind structural corruption. Powerful private enterprises can influence public policy to establish trusts. Using lobby strategies, firms may favour or bribe top-level officials who will cooperate with a chosen company facilitating a monopoly on the market (Dunne, 1995; Beke, 2018; Oxfam, 2018). "Privatisation deals, natural resources given away below fair value, corrupt public procurement, tax exemptions and loopholes are ways in which well-connected private interests can enrich themselves at the expense of the public" (Oxfam, 2018: 11):

> Economic power held by large firms or conglomerates affects not merely economic indicators or state regulation efficiency. It affects popular belief in the system itself, the underlying fabric that binds us together and instils citizens' cooperation and enthusiasm to trust that innovation and investment, both material and spiritual, will be rewarded individually and collectively. When citizens lose their belief in

> society's normative underpinnings, they become cynical and see the economic and social status as achievable only by and through the market's most prominent players. Citizens suffer directly because morality and belief in the justice of purpose are very much of each individual's welfare. And indirectly, because if individuals lose hope of reaping their just rewards, they cease sowing. They limit investment in their human capital and aim for short-term, opportunistic profiteering or downright rent-seeking. When all the good places at the table are taken, the less well-off either sulk at their seats or plan a revolution– neither being a favourable prospect for society (Ayal, 2013: 232).

According to Schmitz (2012), there have been examples of monopoly decrease by new technologies employed in history. In industrial markets where technological progress is necessary, entrants' exclusion is the "supreme evil" that antitrust laws should concentrate on (Hemphill & Wu, 2013). Ayal points out that "antitrust is not merely an economic statute, but symbolises democratic ideals as well, that none may accumulate sufficient power to force others into commercial submission" (2013: 229).

Beke (2013) stated that nurturing economic and political competition to reduce monopoly and oligopolies can effectively diminish corruption opportunities and incentives. To summarise, competition and innovation need to be fostered in order to prevent social loss.

1.3 Clientelism: the mutually beneficial trade of public resources

Clientelism is commonly defined as the concession of benefits for political support (Avelino Filho, 2004; Graham, 1999; Keefer, 2007; Armijo & Rhodes, 2017; Bobonis, Gertler, González-Navarro & Nichter, 2017). Clientelism occurs in the form of vote-buying strategies in which candidates hand out goods or services, exceptionally at the time of the campaign, but also after the election, when they reward political support

by giving jobs or contracts, even to non-qualified people. Another common practice is the intervention in state bureaucracy to favour allies to the detriment of others outside the support circle. Armijo & Rhodes argue that an "institutional environment that pushes toward clientelism may also encourage outright corruption: the direct exchange of bribes, kickbacks, and contributions to public officials by private actors seeking special treatment" (2017: 241). Clientelism implies a reciprocal relationship between patrons and clients. Although clientelistic politics occurs nowadays in many countries worldwide, clientelism is not a practice of modern societies. In fact, it was already observed in ancient Rome (Sousa, 2008).

Clientelism is often confused with Feudalism, a medieval decentralised political and military system in which people would work and fight for their lord in exchange for land and protection. Despite the similarities between feudalism and clientelism, the relation of patron-client is not feudal, but it is a feudal heritage (Kettering, 1988). In traditional agrarian societies, patrons and clients' relationship is fundamentally unequal since the patron provides clients with primary livelihoods assets. In contrast, clients reciprocate with economics and social benefit such as part of the harvest, rent, labour, respect, loyalty, and political support in the form of vote (Mason, 1986). This form of clientelistic relations, known as old clientelism, persist in modern democracies worldwide and has been absorbed into electoral politics (Hopkin, 2006a).

Socio-economic improvement changed the traditional agrarian rural scenario into a more urbanised and industrial one which originated a new kind of collaboration between empowered resource owners (patrons) and impoverished or low-status citizens (clients). The modern political sphere became dominated by organised parties which have taken the role of the patron. On the other hand, a more educated population with improved livelihood expected more effective material gains in exchange for their political support. In contemporary societies, the political boss, party leader and their brokers are the new patrons.

The clients, who abdicate their autonomy as citizens or are kept from acquiring such capacity are willing to exchange votes and political support for any kind of benefit, often means of subsistence, construction materials, jobs, career improvements even when the clients are not qualified for the job.

Furthermore, patrons have exclusive allocation control, and resources are generally scarce, yet clients are willing to trade their vote for potential benefit (Sousa, 2008). "In this new, 'mass party' clientelism, patrons have to 'buy' votes by distributing concrete excludable benefits and favours to individual voters or groups of voters" (Hopkin, 2006b: 3).

The study of clientelism after the Second World War is divided into two waves (Stokes, 2011). The first one was fundamentally anthropological and influenced by sociology and anthropology and secondarily by Sociology and indifferent to political regimes. The second wave was inspired by economics and primarily focused on clientelism under democracy. After a less productive period, the literature on clientelism has been increasing since 2007 and offers a range of different interpretations.

According to Sousa (2008), clientelism is an ancient political phenomenon that applies a voluntary compliance to domination. It permits access to state apparatus and resources as well as to political power. For the author, the practice of clientelism is reciprocal but uneven due to the unequal power relations. However, with the expansion of democracy from the late 1980s onwards, patron-client relations became more symmetrical. According to Hopkin, this renewed form of clientelistic linkages is different from de old ones because:

> There is less deference and dependency from clients, who feels increasingly free to use their vote as a commodity and exchange for whatever maximises its utility. As a result of this less hierarchical and personalised context, the new clientelism is more conducive to fluidity

> and change in electoral behaviour, opening up possibilities of greater competition and elite turnover (2006a: para. 6).

Stokes (2011) refers to clientelism as a method of electoral mobilisation in which material goods are handed out in exchange for votes, and the question "did you (will you) support me?" defines the allocation of resources. Kitschelt (2011) states that clientelism is primarily seen as an isolated action; however, it frequently indicates a longstanding relationship that starts before the elections and goes on during term of office and for many electoral campaigns.

Clientelism has a broad scope. It embraces a variety of methods used to improve electoral support. Citizen-politician linkages appear in the literature under different labels, e.g., pork barrel, patronage, vote-buying, et cetera. Nichter & Peress (2017) refer to such methods as clientelistic strategies. According to Brinkerhoff & Goldsmith (2002), the 'slang' pork-barrel spending is a form of clientelism in which legislators allocate public resources to projects that benefit their district or region as a pay-off for political support. A patron-client relationship entails a mutual exchange of favours. According to Kettering (1988), *patronage* is the practice in which patron use resources he possesses or control to benefit his clients, while *clientage* is the retribution and loyalty of a client to his patron in return for granted benefits. Medina & Stokes (2007) distinguish clientelism and patronage, respectively, as *an economic monopoly*, when patrons control resources independently from elections' outcomes and *political monopoly* when patrons have control over goods because of his ruling position. Stokes considers patronage and vote-buying subclasses of clientelism:

> Patronage is distinct from the broader category of clientelism. In clientelism, the more powerful political actor may or may not hold public office, and therefore may or may not be able to credibly promise to secure public resources (…). In patronage, the patron holds public office and distributes state resources (2011: 4).

Regarding vote-buying, Stokes (2011) suggests that it is limited to the trade of one's vote for material benefits or protection, whereas clientelism in a more extensive scope includes the client's vote and his/her effort to gain for the patron the support of others. Other similar strategies are *turnout buying*, in which a reward is used to stimulate electoral participation of nonvoting supporters; *abstention buying*, when voters are rewarded for not taking part in the voting day and *broker mediation*, a strategy of party leaders to reach voters by using brokers who can deliver rewards more quickly.

Nichter & Peress (2017) state that researchers continuously portray clientelism as a top-down process, which is a phenomenon under elite control. The authors argue that tactics such as vote-buying or turnout buying described in the literature as elite's targeting strategies are, in fact, political machines responding to citizen's demand. Request fulfilling is the term introduced by Nichter & Peress to explain why political parties provide benefits to voters. "Citizens frequently request help from machines during campaigns and may threaten to cast votes for competitors if their requests are unfulfilled. When citizens initiate clientelistic exchanges, (…) machines predominantly fulfil the requests of voting supporters" (2017: 1088). The authors affirm that bottom-up requests of this kind crucially impact clientelism. Bobonis et al. (2017) also tackle citizens' significant participation in clientelism and emphasises that this demand-side perspective has not been investigated by most research on clientelism. In the same study, Bobonis et al. argue that economic vulnerability induces citizens to engage in clientelism. Robinson and Verdier had already made this claim:

> Under a natural condition, clientelism is relatively essential in countries with inferior technology and high inequality. Intuitively, at low-income levels, the political allegiance of clients is cheaper to buy with employment offers, and this makes clientelistic redistribution more attractive as a way of gaining support. This effect operates when aggregate productivity is low or, for given productivity and average income level, when inequality increases (2013: 263).

Bobonis et al. not only agree with his peers but also states that diminishing economic disadvantage is an effective strategy to fight clientelism. In their words: "Reduced vulnerability decreases requests among frequent interactors not only during the election campaign but also during the year after the election (…). Reduced vulnerability dampens citizens' participation in clientelism" (2017: 3).

According to Keefer, clientelistic practices happen because voters do not believe in politicians' real intentions of providing public goods, neither in the short- or long term. "Clientelism is most likely precisely when political competitors cannot make credible policy promises to voters" (2007: 813). In this scenario, candidates running for office use clientelistic practices themselves or appeal to patrons who have credibility with their subordinates to win votes. In exchange for this influence, candidates favour patrons with social and economic benefits. In "non-credible political settings", a frequently used practice is to "rely on patrons whose clients trust them but not the candidates" (ibid.: 806). The author argues that when candidates count on patrons to gain credibility, they save their own resources and that such strategy may cause the politicians to lose the freedom of promising public goods to improve voting results as patrons want to fulfil only their clients' need. Furthermore, patrons often retain a portion of the benefits promised during the campaign as retribution for endorsing the candidate. "When politicians are not credible, patron-client relationships are transported to the political realm, generating high targeted spending, high rent-seeking, and low levels of non-targeted good provision" (ibid.: 820).

Most relevant research on clientelism focus on the reciprocal patron/client relationship and, between them, the broker mediation, which has incremented the clientelistic phenomenon in its expansion across different political settings. As stated by Kitschelt, "clientelistic relationships may encompass a diffuse and unpredictable process of mutual giving and take between clients and their patrons, often assisted, and mediated by a layer of 'brokers' who organise and manage

clientelistic relations" (2011: para. 2). Traditionally clientelism is perceived as a pyramid-shaped interdependence or as named by Stokes (2007), a 'vertical dyadic alliance', with the suppliers at the top, brokers in the middle, and clients at the base. Guerguina & Volintiru (2017) argue that this pyramid framing of clientelism is not accurate because it relies on the assumption that political patrons control public resources and distribute them to their voters (clients) in order to subsist in office. According to the authors, this assumption fails because merely political support is insufficient in exchange for substantial favours such as public contracts. Secondly, not only parties in office that have access to state resources make use of clientelistic tactics. Also, non-ruling parties engage in clientelism.

Guerguina & Volintiru (2017) state that with the spread of democracy in the second half of the 20th century in many countries, clientelism has evolved into a complex, multi-layered and multidirectional phenomenon. In their studies on a new model of clientelism, the authors suggest that a more accurate perception of clientelism should acknowledge that the phenomenon is as a compound of vertical and horizontal linkages. "The vertical linkage between political parties and electorate is complemented by a horizontal nexus between parties and private contributors (…) resources are no longer used in relationship with the electorate, but with private campaign donors" (Guerguina & Volintiru, 2017: 116). Most democracies offer public financing for electoral campaigns. However, parties reach to private contributors to enlarge their resources as elections costs are high. Wealthy individuals and private companies provide external means of financing in exchange for privileged access to government procurement. This aligned relation between politicians and private companies guarantee liquidity for both sides. For the former, their permanence in power and wealth accumulation. For the latter, the maintenance of their business activities.

Gerring, Bond, Barndt & Moreno (2005) claim that less democratic countries experience economic growth behindhand. Even though

clientelism is not a phenomenon that happens exclusively in developing countries, there are much higher chances for it to occur in the developing world than in preeminent democracies (Stokes, 2011). According to Keefer (2007), the most valid reason for young democracies' weak performance is politicians' lack of credibility, which leads to a prevalent reliance on clientelism. "The inability of political competitors to make credible promises to citizens leads them to prefer clientelistic policies: to underprovided non-targeted goods, to over provide targeted transfers to narrow groups of voters, and to engage in excessive rent-seeking" (Keefer, 2007: 804). In sum, less democratic countries tend to have extreme poverty rates. The poorer the country, the greater the use of clientelistic practices. Younger democracies perform poorly because of politicians' lack of credibility. When politicians are unable to gain the voters' trust, they turn to clientelistic tactics, which creates a vicious circle because "when officials focus their resources and attention on sustaining clientelistic networks, public-service provision and popular well-being suffer" (Mello & Spektor, 2018: 124).

Stokes (2011) points out the paradox of clientelism: The patron-client relation is unequal and at the same time voluntary and exploitative from the client perspective. Nevertheless, clientelism persists. Why would one from the disadvantaged side keep the relationship going? According to the author, the norm of reciprocity is the "cement" that holds patron and client hand in hand. "Under clientelism, superior members of dyads reinforce the norm of reciprocity by giving their inferiors ceremonial gifts, which, like spontaneous and useful gifts, (presumably) create a sense of obligation that the gift must be reciprocated" (Stokes, 2011: 5).

The consequences of this "universal moral norm of reciprocity" (Gouldner, 1960 in Stokes, 2011: 5) within political settings has contributed for the increase of vulnerable populations, especially in developing countries. Clientelism harms democratic politics, retard economic development, and restrain electoral competition. Bobonis et al. (2017) state that vulnerability is the determining factor of clientelism

and that political clientelism is often regarded as a threat to democratic accountability and representation. In the words of Kitschelt, "clientelism involves reciprocity and voluntarism but also exploitation and domination" (2000: 849). In a vicious circle, the exploitation and domination of vulnerable people maintain economic elites in power, and that is why clientelistic practices continue being used.

A country in which clientelistic relations dictate the allocation of its resources subsists under governance that favours economic elites and limits the means for developing its people. "The major risk lies in the misuse of these resources to influence specific political decisions. Earlier studies identified the existence of a causal relationship between campaign contributions and policy outcomes" (Guerguina & Volentiru, 2017: 20). Often policymaking oriented by the economic elite results in more target than public policies. Under-provision of public goods, especially education, not only maintains but also increases vulnerable populations. On this matter, Bobonis et al. suggest that the reduction of vulnerability diminishes clientelistic relations, which is possible with "centrally mandated insurance mechanisms" (2017: 30). In other words, the increase of governmental mechanisms of social insurance improves the livelihood of the general population, which reduces the necessity of handouts to fulfil personal needs. Such a scenario would represent the end of clientelism in developing countries.

1.4 Bossism and political capture: oligarchical governance

Before entering the content to which the term bossism refers, it is necessary to determine the meaning of this concept. The definition of bossism is not clear when translated to Brazilian Portuguese, a determinant language used in this research since Brazil is its case study.

According to *The Columbia Encyclopedia,* bossism, in US history, is a "system of political control centring about a single powerful figure (the boss) and a complex organisation of lesser figures (the machine) bound together by reciprocity in promoting financial and social self-interest".[2] In the literature review, bossism appears related to clientelism, to patronage –concepts that have formerly been defined– and to the Spanish-American *caciquismo.* Roniger & Güneş-Ayata (1994) describes political bossism followed by the word *caciquismo* within brackets in an effort to translate the former. Zaluar (1994) argues that the clientelism in Brazil comes close to American bossism. Referring to the local existence of oligarchic and personalised structures of power, Carvalho (1997) mentions *mandonismo*,[3] a term used mainly in Brazil. The author suggests that this concept is remarkably close to *caciquismo* in Spanish-American literature and argues that "*mandonismo* is not a system, it is a characteristic of traditional politics" (Carvalho, 1997: para. 7). In order to characterise clientelism, Bahia (2003) uses the term *bossism*, as a loanword from the original English word bossism and does not translate it as *mandonismo*.

Due to the variety of definitions to the term bossism that appears in the literature, it is essential to say that, in this study, bossism is considered to be the same as the Brazilian *mandonismo* and vice-versa. For this research, *mandonismo* will be translated – and use throughout this thesis – as bossism, and that is, a way of doing politics in which oligarchic power uses its wealth to capture policymaking and influence policy outcomes for self-interest and as a wealth defence strategy.

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[2] *The Columbia Electronic Encyclopedia,* https://www.infoplease.com/encyclopedia/social-sciences-and-the-law/political-science-and-government/political-science-terms-and-concepts/bossism

[3] "Mandonismo means "tendency to, habit or desire to rule in any circumstance, especially with abuse and arrogance" (Houaiss Dictionary) and, according to the dictionary, is a word used mainly in Brazil. Mandonismo was formed from the association of the suffix -ismo to the radical mandon, from where it derived mand (ão). A term that risks not being forgotten these times". https://ciberduvidas.iscte-iul.pt/aberturas/mandonismo-uma-palavra-fenix-usos-de-alguma-coisa-foi-e-a-aceitabilidade-de-tao-unico/2386

Even though bossism appears in US political life in the mid-19th century,[4] it is far from being an oud practice. Scholars point to the manifestation of bossism in nowadays politics in different countries such as Indonesia (Amin, 2013), The Philippines (Quimpo, 2009; Kreuzer, 2012) and Brazil (Araujo, 2003; Morais, 2016). In various countries, practices like bossism are described in the literature as oligarchic power, elite domination, and political dynasty.

Historically, economic resources have continuously been accumulated. Consequently, economic elites emerge and retain political power (McDonald, 2017). Those who gain power by wealth accumulation form a grouping known as an oligarchy. When oligarchies capture public decision-making processes, bossism manifests itself. The word oligarchy may be a reminder of an aged and useless term to describe prevailing democracies. On the contrary though, oligarchic power has been proved to be at the centre of current decision-making processes. The term oligarchy portrays accurately nowadays politics of both "rule by the rich" (Menotti, 2011; Arlen, 2016) and "rule for only the few, and not for the many" (López García, 2017).

Oligarchs are members of society who possess enormous wealth and use it to shape public policies according to their private interest. Wealthy people have the advantages required to avoid institutional regulation (Arlen, 2016). According to Winters (2011), the American 'ultra-rich' have had the financial means and skilled associates at their disposal to accomplish a tax burden shift toward the less fortunate citizens.

Oligarchic power harms democracy. Concurrently, democratic polities represent a threat to oligarchy. An example of the former is "the growing discredit of basic democratic institutions, like political parties, legislatures and the judiciary" (López García, 2017: para. 9). The author

[4] *The Columbia Electronic Encyclopedia,* https://www.infoplease.com/encyclopedia/social-sciences-and-the-law/political-science-and-government/political-science-terms-and-concepts/bossism

states that in Latin American, almost 80 per cent of the people show discontent with democracy and believe that government is strongly influenced by the wealthy. Furthermore, The US policy of "reduced taxes on the ultra-rich (…) have strained the government's capacity to maintain infrastructure, provide relief to children and the poor, and assist the elderly" (Winters, 2011: para. 2). On the other hand, throughout history, massive wealth concentration has encountered resistance from different society segments. "The unique political challenge for oligarchs, and the basis of oligarchy, is defending against these threats" (Winters, 2013: 4). Winters affirms that "Oligarchy should be understood as the politics of wealth defence" (2011: para. 8). This kind of 'by wealth for the wealthy' modus operandi has been an established practice in Latin America "where politics is defined by weak states and the omnipresence of oligarchs who infiltrate state and political institutions to protect their wealth" (López García, 2017: para. 1). Not surprisingly, Latin America is the world's most unequal region. According to Arlen, excessive wealth concentration "may exacerbate unjust inequalities, while also undermining the fair value of political liberties and fair equality of opportunity. Oligarchic harm can certainly be magnified under conditions of distributive injustice or structural exploitation" (2016: 8).

Literature review on oligarchy[5] indicates that Jeffrey Winters (2011) has significantly contributed to understanding the oligarchy continuity within democracy. Pearce argues that "there is a long history of debate on how to conceptualise the concentration of power and wealth in the hands of the 'few'" (2018: 9). In this regard, the author emphasises that Winters (2011) presented convincing arguments for using the term oligarchy instead of elite for the exact reason that it stresses wealth as the primary source of power. However, Pearce goes further and adopt the term 'oligarchic elites', which holds Winters' emphasis on wealth and preserves power and status, inherent aspects of elites in its classic

[5] Arlen (2010), Gilens & Pace (2014), Mayville (2014), Rhoden (2015), Zeng (2015), Babajan (2018), Pearce (2018).

definition. According to Babajan (2018), Winters' interpretation of an oligarch is precise because it considers that oligarchs also hold an elite form of power such as organisational, mobilizational, political, et cetera. Nevertheless, elite members are not oligarchs if they do not have a massive wealth at their disposal. The latter keeps high-level agents such as managers, bureaucrats outside the oligarchic circle, even though such players are considered an essential instrument to the oligarchy. Rhoden describes elite as "people who have the power to effect change that average citizens or subjects cannot" (2015: 5) and further analyses how this concept differ from the definition of an oligarch. The author also relies on Winters's studies when enumerating six power sources for the elite, namely, 1) formal political right, 2) official position, 3) coercion, 4) mobilisation, 5) ideology and the last one, 6) material resource, which he borrows from Winters (2011). Elites may use each one of these power sources to influence policy outcomes on their behalf. However, "when one speaks of oligarchs contra elites, the discussion is not about one's political rights, official position, personal coercive ability, skill at mobilisation, or ideology, but instead about how a great inequality of wealth is utilised as political power" (Rhoden, 2015: 6).

According to an Oxfam rapport published in 2015, elites are at the centre of political capture, also known as "hijacking democracy" (Oxfam, 2015). This phenomenon occurs when elites dominate democratic institutions in order to guarantee that public-sector decision-making meets their interests. Hence, the government no longer works for the general population but small privileged groups. Political capture is a common phenomenon in young democracies with major negative effects since it enhances elite power, undermines the public sector, and increases inequality. Latin America is currently facing these adversities. Despite the democratisation of de jure political institutions in countries such as Brazil, Bolivia and Colombia, local economic elites are able to wield de facto political power and use their material resources to influence political and regulatory forces (Acemoglu & Robinson, 2006; Oxfam, 2015). Elite influence on the public domain is not only a feature of less

strong economies. In the US, despite its democratic elections system, economic elites and business representatives use a range of instruments such as foundations, think-tanks, media, lobbyists campaign financing, et cetera to impact policymaking. At the same time, the ordinary population and their associations may influence it a little or not at all (Domhoff, 2013; Gilens & Page, 2014).

Zeng (2015) stresses that the division between oligarchy and democracy is the absence of accountability towards the general population. The author describes oligarchy as a "political system" in which critical political agreements are made by a small leading body of either unelected or unaccountable members. Another power restraint strategy common in "pseudo-democracies" (Babajan, 2018) is "political dynasty", which is defined by Kenawas as "elected public officials (governor/ mayor/regent/ legislator) who have a familial connection with an incumbent at the same, lower, or higher level (district to provincial) based on marital relationship, vertical lineage, or extended family" (2014: 11). In his study, Kenawas investigates the political power monopolisation by political elites, which use their family ties and wealth to support their family members to be elected for public office. By forming a political dynasty, elites seek to maintain and spread their political power and, as a result, defend their wealth.

Oligarchic elites and their wealth defence strategies endanger sustainable global development. "Today's single biggest threat to our global climate commons is the group of billionaires who profit most from its pollution and, in turn, push government policies that promote more fossil fuels" (Menotti, 2011: 1). According to Macdonald (2017), from the world's top six companies in revenue, five operate in the oil, gas, and electric sector. Accordingly, the ones controlling these resources possess massive wealth and dominate governments. The author emphasises the need to detach the economy from fossil fuels and its oligarchy in order to achieve a sustainable economy and a de facto democratic governance. His strategy is indeed a pivotal solution to fight climate change; before it

happens, sustainable development goals cannot be achieved. For the sake of future generations, it is necessary a global government for the many. Wealthy political bosses from any economic sector need to be eradicated from the public domain, so does bossism practice.

1.5 Crony capitalism and rent-seeking

In different countries around the world, entrepreneurs increase their wealth by being well-connected in the political sphere. Through their friends in government, they win important contracts and get access to great business opportunities. This practice of using political connections to increase wealth is known as crony capitalism, which has its starting point in rent-seeking: the allocation of financial resources to shape public policies to benefit from it.

In the literature, the term crony capitalism (also known as cronyism) is often described as the practice of appointing friends, associates, and supporters to high-level posts regardless of their qualifications, while rent seeking appears as initiatives to increase one's existing wealth without creating new wealth or benefit for society (Haber, 2002; Aligica & Tarko, 2014; Salter, 2014). The concepts are commonly employed as correlated since the occurrence of one often means the practice of the other. Aligica & Tarko define crony capitalism as an economic system "either directly in connection to rent seeking, or indirectly, as an associated variable" (2014: 158).

Rent seeking is an expression coined by Anne Krueger in 1974 to describe interest groups' activities to obtain government favour. This idea was first developed by the economist Gordon Tullock's in 1967. From his perspective, economic favours, such as subsidies, preferential tariffs, and regulations, are not groundless. On the contrary, they are created based on interest groups' endeavour and their expenditure on political power to enrich themselves (Zywicki, 2016). When public

resources are made available by the government, especially at the federal level, both enterprises and individuals invest a considerable amount of money in order to guarantee their access to those resources. This procedure defines rent-seeking, and its practice often ensures the right to monopoly and means the security of uninterrupted businesses operations. The reliability offered by these transactions does not necessarily indicate wealth increase but rather wealth redistribution (Zywicki, 2016). The operating profits are often kept at the top management level (Sobel & Graefe-Anderson, 2014). Frequent examples of rent-seeking are cartel formation and lobby. In both cases, representatives of interest groups try to persuade officials and politicians to bend or make rules in their favour harming competition and consumers. According to Zywicki (2016), rent seeking is the 'engine' of crony capitalism.

The term 'crony capitalism' was coined by George M. Taber, a *Time's* business editor who wrote the headline "A case of crony capitalism" for a story written by John DeMott on the Philippines's economy. The article, published on April 21, 1980, described the countries' economic stagnation and corruption domination under Ferdinand Marcos' presidency: "It was a weird distortion of the free market that benefited a few and kept the masses in poverty. The cronies got rich, and the poor stayed poor" (Taber, 2015, para 4).

According to Zywicki (2016), the wording crony capitalism is misleadingly used to translate the phenomenon because it is the antithesis of capitalism, and the term 'corporatism' would be more precise to describe "an economic system of a symbiotic relationship between big government, big business, and big labour, aligned in a cooperative enterprise" (Zywicki, 2016: 78).

In a free market system, economic competitors seek to make a profit by fulfilling customers' wishes in a meritocratic logic, which means that the winners will be the ones who meet best the consumers' needs.

Opposingly, a system in which crony capitalism prevails, a lucrative and successful business is ensured by friendly relations between economic agents and the government (Sobel & Graefe-Anderson, 2014; Fortes do Rego, 2017; Zywicki, 2016; Koziuk, Dluhopolskyi, Farion & Dluhopolska, 2018). As stated by Salter (2014), crony capitalism is a two-way activity in which not only enterprises seek benefits from their close ties with politicians by influencing policy-making processes in their favour, but also government officials use private companies' support to their campaign to win or stay in power.

In his studies on how rent-seeking and crony capitalism occur, Zywicki (2016) states that rent-seeking occurs in three different forms as follows: 1) Direct rent-seeking, which happens when advantages such as tariff, subsidy, licenses, et cetera, are given to interest groups at the expenses of less-connected competitors. 2) Indirect rent-seeking takes place through the ratification of apparently impartial laws or regulations that benefit certain people to the detriment of others. 3) Rent extraction occurs when politicians receive a contribution from firms and industries by threatening to withdraw benefits or to break deals already settled. Furthermore, the author suggests that both direct and indirect rent-seeking cause a 'rent-sharing' effect which means that economic rents originated from the rent-seeking activity is split among employees. The knowledge that protectionist legislation generates rent that is shared with workers encourages the workers to facilitate such regulations.

> It sometimes can be challenging to determine whether a particular action constitutes rent-seeking or rent extraction (…) for purposes of understanding the dynamics of crony capitalism; however, it matters little whether a particular action is best understood as rent-seeking, rent extraction, or some combination thereof. What matters most fundamentally is that private industry and the government become so intertwined that the economic success of firms or industries —indeed, their very survival— depends on remaining in the good graces of political actors and, quite frequently, that political grace can be given or withheld in a largely arbitrary fashion (Zywicki, 2016: 90).

Crony capitalism occurs when enterprises, regulatory agencies, and government officials conduct business-friendly policy-making processes and investments, according to private interests. Salter describes crony capitalism as:

> a special type of moneymaking that economists call 'rent-seeking. Rent seekers pursue privileged advantages that typically show up as targeted exemptions from legislation, advantageous rules by regulatory agencies, direct subsidies, preferential tariffs, tax breaks, and preferred access to credit, and protection from prosecution (2014: 8).

Haber (2002) argues that governments driven by crony capitalism and rent-seeking make many economic policies that benefit holders of financial capital, primarily by offering them a higher return rate in order to persuade them to invest, which would not be the case without such privileges. In Haber's own words, "crony capitalism not only permits rent-seeking, but it also requires rents to be earned and distributed. Once rent-seeking becomes a fundamental part of economic life, however, rent-seeking above and beyond the minimum needed to induce investment will almost inevitably occur" (2002: 15). In that case, the issue is that a high level of rent-seeking is not only bad for economic growth (Krueger, 2002), but it also allows the establishment of monopolies and oligopolies formation in industries sector that should be open to perfect competition or industries that would not exist otherwise. Cronyism also hinders well-skilled entrepreneurs who have financial capital but no political connections (Haber, 2002). In the same study, Haber highlights also three crucial pitfalls of crony capitalism from the perspective of economic growth and distribution, namely: resources misallocation, short-term investments[6] and unequal income distribution.[7] The latter contributes to the rise of poverty levels.

[6] Government turnover may interrupt deals with interest groups favouring short-term transactions.

[7] Rents provided to a certain group often come from society in general. When an industry can charge freely for its products or services, a transfer of income from consumers to entrepreneurs will occur.

According to Oxfam (2018), approximately two-thirds of the world's billionaires' wealth originates not from hard work and merit as it is believed but from crony capitalism, monopolism, and inheritance. In fact, these phenomena are directly linked with the increase in inequality around the world. Furthermore, crony capitalism has a negative effect on society because of its unfairness and because it reduces government revenue and restrains the productive use of public resources (Committee for Economic Development, 2015; Oxfam, 2017).

Another major harm caused by crony capitalism is the reduction of innovation (Salter, 2014; Committee for Economic Development, 2015; Koziuk et al., 2018). A case study on crony sectors and ecologization in Ukraine by Koziuk et al. (2018) evaluates how industries driven by crony capitalism can be a barrier to sustainable development.

> Around the world, crony-business does not consider ecologization[8] as a priority of social activity at all. This situation is understandable since the interests of crony business, and environmental movements are quite the opposite, and the rent-orientation of the economy deforms and preserves social and economic development, reduces the innovation and competitiveness (…) It is also possible to foresee that the oligarch, who builds their wealth from the crony sector,[9] will block environmental initiatives and changes in environmental legislation, which will cause more severe sanctions for violations and limit the construction of environmentally hazardous facilities (Koziuk et al., 2018: 123).

Aligica & Tarko (2014) present a framework on crony capitalism analysing it from three different aspects, namely: (1) Microeconomic, referring to the basic economics of crony relations and rent-seeking, (2)

[8] "Ecologization essence can be defined as the implementation of an ecological approach to people's lives, which is conducive to the formation of a new worldview, according to which humans must evaluate their activities to how actions are harmonised with the laws of nature" (Koziuk et al., 2018: 116).

[9] Industries that depend a great deal on public policy, such as mining, oil and gas, infrastructure provision.

institutional and social, related to the distinct shape of institutions, policies, and processes in their context, and (3) ideological, which deserves more our attention because of its significance to the current research. The ideological aspect analysed by Aligica & Tarko alludes to "the ideas, rhetoric, beliefs, doctrines and other forms of legitimisation and justification of the specific policies and institutions" (2014: 157). According to the authors, the ideological environment in which crony capitalism operates has its particular legitimating rhetoric: "the rhetoric of "pragmatism" and "middle of the road" moderation, and, when more sophisticated, with a programmatic rejection of classical ideologies and public philosophies" (Aligica & Tarko 2014: 170). Furthermore, the authors point out that this phenomenon is relatively new and became stronger after the Eastern Bloc collapse, which has contributed to scepticism towards the state and the market. The 'loss of faith in politics and in economic organisations' has created a fertile terrain for populism.

Crony capitalism has been noticed in distinct parts of the world, both in developed and developing countries, and it is not a new phenomenon. American crony capitalism emerged in the 1930s under the Roosevelt presidency and his new deal strategies to recover from the great depression. Since then, it has been progressively growing with aggravation due to the financial crises in 2008 (Zywicki, 2016). The Philippines has been suffering from crony relations since the 1980s and its economy is "still stuck in a morass of crony capitalism" (Taber, 2015, para 5). Most Latin American countries are unhappy with 'usual politics', that is, crony capitalism's predominance (Shifter, 2011). In Brazil, with the economic reforms of the 1990s, conducted through privatisation processes, especially in strategic development areas – such as telecommunications, energy, and mining – power accumulation was intensified as a select small group had access to the share capital of some former state-owned companies (Fortes do Rego, 2017). Other countries such as Ukraine, Russia, Hong Kong, Singapore, Mexico, among many others, have their economies and politics driven by crony capitalism and

rent-seeking, which gives a sign that this trend is not going away anytime soon.

1.6 Behavioural economics: a tool to understand policymaking

Neoclassic economists based on rational choice theory or expected utility theory have used the term *homo economicus* or 'economic man' to represent humans as consistently rational and self-interested creatures that normally have the capability to make the right judgment in order to maximise their benefit or utility (Lin, 2011; Ainslie, 2015; Ávila & Bianchi, 2015; Nery, 2016). In contrast to this assumption, Herbert Simon (1982) proposed the idea of 'bounded rationality', which suggests that decision processes are influenced by our limited thinking capacity, information, and time availability (Samson, 2018). In other words, people make decisions despite their constricted knowledge, feedback, and processing capacity. Moreover, agents are inconsistent when making choices; their preferences change, mostly following the context and peer influence. Bounded rationality indicates that individuals are rational but have cognitive limitations, and therefore, they occasionally deviate from rationality. Bounded rationality is one of the psychological foundations of behavioural economics. Some manifestations of Bounded rationality are the following: *Choice overload*: when faced with too many options, individuals have difficulty in making choices; *Heuristic decision- making*: heuristics are shortcuts to decision making. It is a way of making choices based on practical experience. The choice made may not be the best one but is good enough for immediate goals; *Failure to assess statistical probabilities*: individuals are more likely to be influenced by bright and noticeable information rather than statistically accurate information. Furthermore, bounded rationality stresses that irregularities in choice behaviour may result in poor decision making. Behavioural economics engages in studying these anomalies in choice (Ainslie, 2015).

Behavioural economics challenges the rational aspects of the neoclassic expected utility model and uses psychology and sociology insights to understand individuals' and institutions' decision-making processes (Koch, Nafziger & Nielsen, 2014; Chetty, 2015; Samson, 2016). "While traditional economics assumes that individuals always behave rationally, behavioural economics often stress the 'irrational' aspect of decision making, often referred to as behavioural failure" (Pollitt & Shaorshadze, 2013: 524). "With the rise of behavioural economics, many psychological concepts have been acknowledged by economists and incorporated into economic models" (Feld, Sauermann & De Grip, 2015). Ainslie (2015) highlights that behavioural economics stands on two pillars, namely: behavioural and cognitive.

The behavioural approach arose in the early 1970s from John Kagel and Robin Winkler (1972) studies and their attempt to apply Skinnerian behavioural analysis to economic choices, which included hyperbolic discounting by the psychologist Richard Herrnstein (1967). According to Ainslie (2015), the researchers – hoe also coined the term behavioural economics – contrasted the assumption of the expected utility theory (EUT) with the premise of hyperbolic discounting. EUT implies that individuals are able to ignore current events and establish preferences that will not change with an increase or a decrease in information level. Opposingly, hyperbolic discounting suggests that preferences are moment related. In other words, humans, prefer a bigger reward when facing a long delay, but they choose a smaller reward in case of a shorter delay. In fact, "subjects will reverse their preferences from a larger, later (LL) reward to a smaller, sooner (SS) alternative as the pair become closer" (Ainslie, 2015: 262).

Simultaneously, separately from behavioural research, Daniel Kahneman and Amos Tversky were discovering regular mistakes that occur regardless of one's cognitive ability. Their research led to a Nobel Prize in economic science in 2002. In their studies, the researchers defined the mind's two modes of thinking: the intuitive, fast, and impulsive system 1

and the slow, rational, and deliberate system 2. According to them, people evaluate actions and their consequences carefully only when they are in the system 2. In most situations, people are in their system 1, in which they rely on simple heuristics and emotions. These findings resulted in the prospect theory created in 1979 and developed in 1992 (Kahneman, 2003). Prospect theory attempt to explain "how cognitive framing affects choices subjects make" (Ainslie, 2015: 264). This cognitive approach also became known as behavioural economics from the 1980's onward. Kahneman & Tversky suggest that "intuitive predictions and judgments are often mediated by a small number of distinctive mental operations, which we called *judgmental heuristics* (…) these heuristics are often useful, but they sometimes lead to characteristic errors or biases" (1996: 582). Heuristics are cognitive shortcuts, also known as rules of thumb, that individuals employ in order to make decisions more easily. On the other hand, cognitive biases are a kind of mental process of fast and shallow analysis that often leads to error in thinking and irrational choices (Lin, 2011; Samson, 2018). Heuristics and cognitive biases are reciprocally associated. The use of heuristics may lead to cognitive bias and vice-versa.

In contrast to the traditional perspective, behavioural economics argues that people decide based on habits, preconception, simplified practical rules, and personal experiences. It also points to the fact that individuals make decisions quickly and have difficulty reconciling short- and long-term interests. Another claim of this strand of thinking is that people are strongly influenced by emotional factors and the decisions of those they interact with. According to Gauri, "we are all biased. Experts, policymakers, and development professionals are subject to the same biases, rely on mental shortcuts (heuristics), and social and cultural influences as everyone else" (2016: 27).

Behavioural economics provides a range of concepts identified as behavioural and cognitive deviations that determine decision-making

processes. For the purpose of this research, only a few of these concepts will be used. They are the following:

1. Hyperbolic discounting: this concept structures are characterized by high discount rates over short horizons and low discount rates over long horizons (Laibson, 1997). Hyperbolic discounting indicates that people are far-sighted when planning if both costs and benefits occur in the future. However, they make short-sighted decisions if costs and benefits occur in the present (Pollitt and Shaorshadze, 2013). Hyperbolic discounting leads to a preference for small rewards that shortly occur over bigger and later benefits.

2. Loss aversion: individuals are risk-averse when facing possible gains but opposingly risk-seeking if dealing with potential loss. Individuals are inclined to prize losses more than gains. It stems from the fact that "the pain of losing is psychologically about twice as powerful as the pleasure of gaining" (Samson, 2018: 137). In fact, "empirical estimates and that losses are weighted about twice as strongly as gains (…). The disutility of losing $100 is roughly twice the utility of gaining $100 (Thaler, Tversky, Kahneman & Schwartz, 1997: 648). A more specific concept within this category is myopic loss aversion, which occurs when agents strongly focus on short term outcomes. This phenomenon is related to narrow framing, which suggest that investors prefer specific investments rather than the 'big picture' of a future transaction (Samson, 2018). Myopic loss aversion explain why politicians are short-sighted when making decisions. Their main drive is the possibility of re-election and not society's best interest (Gsottbauer & Van den Bergh, 2012). According to Cooper (2013), "myopic regulators" devote themselves to policies that can be implemented during their time in office, rather than more efficient alternatives that may reward only after their incumbency.

3. Endowment effect: individuals place extra value on goods they already own or services they already receive, disregarding their value in the market. The endowment effect results in the empiric phenomenon known as the 'offer-asking gap' in which "people will often demand a higher price to sell a good that they possess than they would pay for the same good if they did not possess it at present' (Korobkin, 2002: 1228). Pollitt & Shaorshadze (2013) provide two empiric examples of the endowment effect. According to the authors, people are normally used to their daily routine and habits that they are unwilling to change. Likewise, households stick to the devices they already have and show no desire to replacing them even when a more efficient alternative is available. These behaviours may represent a drawback when it comes to innovation in public policies. When "applied to regulatory decision making, this class of cognitive shortcomings will tend to make policies "sticky" around initial points (…) From this stickiness emerges a path dependency in policy choice where policies adopted in the past have a lingering effect on future policy adoption" (Cooper, 2013: 2).

4. Status quo bias: this bias is evident when individuals rather keep things the way they currently are by avoiding action or by sticking with decisions made before (Samson, 2018). Barbier (2013) highlights the likelihood of most social institutions to be hard to change. In earlier work, Barbier (2011) describes this inflexibility as 'institutional inertia', what North (1990) called 'institutional path dependence'. Lin (2011) states that the status quo bias keeps us from thinking before making choices and hold us inert despite the world's constant changes.

5. Information avoidance: in behavioural economics, information avoidance bear on situations in which individuals choose not to acquire knowledge even when they have free access to it. Even though people can benefit from the ignorance of unpleasant

information, in most cases, information avoidance leads to negative long-term consequences, as it "deprives people of potentially useful information for decision making and feedback for future behaviour. Furthermore, information avoidance can contribute to a polarisation of political opinions and media bias" (Samson, 2018: 136).

6. Delusion of competence: this occurrence involves peoples' deficiency in reflexive acknowledgement, either socially or pathologically, of their capability to make a decision or to function according to the requirement of a given situation. This feature is also known as the Dunning–Kruger effect, in which low skilled people are overconfident about their cognitive ability while the highly skilled individuals are more accurate in assessing their skills (Feld et al., 2015). The social psychologists David Dunning and Justin Kruger (1999) noticed a divergence between perceived and actual competence, which can elucidate much mistaken decision making.

7. Overconfidence effect and planning fallacy: the overconfidence effect is observed when individuals' self-confidence is greater than their real performance capability. Feld et al. define overconfidence as "the difference between the self-assessed skill level and the actual skill level" (2015: 6). Overconfidence has been pointed as de cause of a range of destructive events (e.g., strikes, wars, litigation, busyness failure) when stakeholders overestimate their actual ability, performance, level of control, or chance of success (Moore & Healy, 2008). Under the overconfidence effect scope, one could observe the planning fallacy, the case when individuals underestimate the required time to accomplish a task, often disregarding prior experience (Samson, 2018). First introduced by Kahneman & Tversky (1979), the planning fallacy indicates people's inclination to underestimate the amount of time and resources necessary to finish a project. "This error occurs when forecasters overestimate their ability and underestimate the possible

risk associated with a project. Without proper training, teams of individuals can exacerbate these phenomena causing projects to be based on the team's confidence rather than statistical projections" (Samson, 2018: 141).

In their research on behavioural economics related to climate change, Gsottbauer & Van den Bergh (2012) call to mind that in each stage of the negotiations concerning climate change agreements (preparation, information, and decisions), tasks are fulfilled by individuals. Tasks outcome will always be the result of behaviour and choices of agents working on those tasks regardless the job they hold (politicians, consultants, bureaucrat). According to the authors, "when decisions are more complex, political choices generally deviate from perfect rationality. For example, politicians operate under stress and time constraints causing selective attention and oftentimes make decisions based on imperfect information" (Gsottbauer & Van den Bergh, 2012: 228). The researchers also state that elected officials commonly make decisions based on heuristics; their forecasts are often inaccurate and overoptimistic. In addition, the authors imply that politicians are inclined to be myopic, which means they operate according to election schedule and immediate goals.

Behavioural economics offers empirical grounds for attesting that "decision making in negotiation-like situations is influenced by systematic cognitive biases and social interaction" (Gsottbauer & Van den Bergh, 2012: 225). Since its inception, behavioural economists and other scholars have verified the prevalent cognitive constraint of real-life individuals. "Because of these cognitive limitations, real people – real investors – are inherently not good at assessing risks" (Lin, 2011: 349). Based on the interdisciplinary approach of behavioural law and economics, Lin (2011) proposed a behavioural framework for security risks in which he states that investors are not as rational as assumed by the *homo economicus* model. In fact, the author suggests that, as real people, investors are likewise partially irrational and that "the rationality

of real investors is bounded by biases, heuristics, and other cognitive limitations. Investors are generally too loss averse, overconfident in their skills and over-optimistic about future returns" (Lin, 2011: 336). Based on the authors findings, it is correct to conclude that if real people have deficient rationality and investors belong to the same category of people, investors also have rationality flaws. That means that every individual suffers from limited rationality regardless of their role in society. This logic also includes legislators, politicians, bureaucrats, et cetera.

> If one accepts that people systematically err, one must also recognize that any government policy is itself conceived and implemented by people who likely suffer from the same biases (…) Regulators are likely to use heuristics –mental shortcuts– to form what they consider the optimal long-run policy choice. Behavioural economics demonstrates that these shortcuts, although timesaving, may lead to systematically flawed decision making (Cooper, 2013: 1).

The broad literature reviewed in this chapter provides significant instruments for the analysis of Brazil's current conjuncture regarding the implementation of climate change mitigation and adaptation policies. More specifically, these instruments will be used to analyse policy choices made in the Brazilian energy sector in order to comply with the Paris agreement, which highlights the need to decarbonise the energy industry in order to maintain *global warming* below 2°C. Although international climate change agreements have become more frequent and popular in the last decades, some concepts explained in this section originated even before the nineteenth century, as is the case of bossism and clientelism. These phenomena are strongly related to monopolistic and oligopolistic practices, which are often illegal but still persist. Crony capitalism and rent-seeking are concepts that originated in the 1970s, the same decade when an international committee met for the first time to discuss anthropogenic impacts on the environment. Since then, global warming has become a great concern worldwide. The influence of interest groups in the economy and politics has also grown into a strong obstacle for climate change mitigation. These tactics used by political and

economic oligarchies led to the capture of the Brazilian state at its distinct levels. Simultaneously, studies on individuals' behaviours in decision-making processes have proved to be important tools to analyse policymakers' choices. Behavioural Economics suggests several concepts that can explain why one or another policy is chosen and implemented. This research relates to both traditional power relation strategies and behavioural economics concepts to understand to what extent the Brazilian authorities can successfully meet international climate agreements concerning energy governance in the country.

CHAPTER 2
HISTORICAL OVERVIEW OF CLIMATE GOVERNANCE: TOWARDS ENERGY TRANSITION

Climate change is the greatest challenge humanity has ever faced. For almost five decades, all nations have been joining forces toward an appropriate global governance to mitigate its effects now and in the future. Many international gatherings have been organized to discuss how every country can commit and contribute to this effort. The first part of this chapter presents an overview of the international community's agreements on climate change issues under the United Nations coordination's since international concern emerged in the early 1970s. The second section shows Brazil's endeavour to contribute to the international effort to tackle climate change.

2.1 Global climate change mitigation and energy governance

Since 1972, when the United Nations (UN) convened for the first World Conference on the Human Environment in Stockholm, many other international conventions took place to pursue solutions for an ecologically responsible economic development. Right from the beginning, energy supply has been a critical factor in the debate on environmental issues. The Stockholm declaration adopted by the assembly in 1972 contains twenty-six principles, and its action plan is composed of 109 recommendations. The fifth principle of the declaration draws attention to fossil fuels' finitude, while the recommendations 57, 58 and 59 stress the importance of studying "the environmental effects

of energy production and use" (UN, 1972). Another important outcome of the conference is the creation of the United Nations Environment Programme (UNEP). This leading agency sets the environmental agenda and promotes sustainable development considering an array of environmental issues such as the energy production and consumption.

The first conference on the human environment in the early 1970s would become the first of many other gatherings under the UN's flag, aiming to drawing attention to international environmental responsibilities. For this study, it is important to mention a few of these assemblies and their respective outcome documents to point out their goals regarding the energy production and consumption. These relevant events and their respective documents are presented below.

Under the command of the Norwegian Prime Minister Gro Brundtland, the World Commission on Environment and Development (WCED) was created in 1983. The commission produced the document *Our common future*, also known as The Brundtland rapport published in 1987. This rapport solidified the concept of sustainable development as the one that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987: para. 30). The 'Our common future' document dedicates a whole chapter with thirty-one pages on energy and the choices that should be made to make energy production and consumption compatible with environmental preservation and economic development. Back in the 1980s, it was already clear that the increasing energy demand forty years later – and high CO_2 emissions as a result – would require an energy efficiency revolution to avoid an aggravation of environmental problems.

From June 3 to 14, 1992 was held in Rio de Janeiro the United Nations Conference on Environment and Development (UNCED) – also known as Earth Summit, Rio conference, and Rio 92 – when 172 heads of state adopted the Agenda 21, a global action plan to promote sustainable

development. The document's fourth chapter, "Changing consumption patterns," focuses on reducing the use of energy and materials in the production of goods and services. Another important outcome of the Rio conference was the creation of the United Nations Framework Convention on Climate Change (UNFCCC). This treaty entered into force in 1994 with the ultimate objective of stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (UN, 1992). The treaty stresses that all countries, especially the developing ones need to address their energy consumption, considering the need for improving energy efficiency and greenhouse gas emissions control. The signatory counties of the UNFCCC have been meeting annually since 1995, when the first conference of parties (COP 1) took place.

In 1997, at the UNFCCC conference in Kyoto, Japan (COP 3), the assembly approved the Kyoto Protocol, in which industrialized countries agree to stabilize the emissions of greenhouse gases. Concerning the energy sector, the Protocol emphasizes the necessity of enhancing energy efficiency and development and use of renewable forms of energy. In 2001 at COP 7 in Morocco with the 'Marrakesh Accord', the Kyoto protocol's implementation rules were approved and came into force in 2005. The first commitment period to the Kyoto protocol started in 2008, finishing in 2012. The second period was agreed to start after the amendment made at COP 18 in 2018, and it ended in 2020. In total, 192 parties have ratified the treaty.

Twenty years had passed after the first Earth Summit in Brazil when in 2012, the conference Rio+20 took place. Back in Rio de Janeiro for the United Nations conference on sustainable development (UNCSD), 122 heads of states agreed on the outcome document *The future we want* which renews UN member countries' commitment to sustainable development and the promotion of an economically, socially, and environmentally sustainable future for the planet and present and future generations. In the Agreement, the assembly decided, among other

things, that a set of Sustainable Development Goals (SDGs) to build upon the MDGs.[10] The document acknowledges that since the Rio 92 conference, there has been insufficient progress for achieving sustainable development and stresses the urgency to tackle the challenge of access to sustainable energy services for all. The *Future We Want* agreement also remarks the launching of the "Sustainable Energy for All" initiative by the Secretary-General, Ban Ki-moon in 2011, which focuses on energy efficiency, renewable energies, and universal access to energy. It also stresses the determination of the signatory countries to make it a reality.

As of January 2015, the UN's general assembly started the negotiations on the post-2015 development agenda, which would be presented at the World Summit on Sustainable Development in September 2015. These events resulted in the adoption of the 2030 Agenda for Sustainable development centred on 17 SDGs (UN, 2018a). The energy issues are dealt with within SDG number 7, which is entitled *Ensuring access to affordable, reliable, and modern energy for all*. Another important event in 2015 was COP 21, which took place from November 30 until December 12 in Paris. Before the event, 187 states voluntarily submitted their Intended Nationally Determined Contribution (iNDC). At the conference, a new international agreement was made and detailed in the outcome document *Adoption of the Paris Agreement*. The accord's main goal is to hold the increase in global average temperature below 2°C above pre-industrial levels by reducing anthropogenic CO_2 emissions. Concerning the energy issue, the document Acknowledges "the need to promote universal access to sustainable energy in developing countries, in particular in Africa, through the enhanced deployment of renewable energy" (UN, 2015: 2).

[10] As of September 2000, at the United Nations Headquarters in New York, was held the Millennium Summit where the world leaders set out a series of eight targets known as the Millennium Development Goals (MDGs) (UN, 2015).

At COP 22/2016 in Marrakech, Morocco, the attention went to the matters related to the Paris agreement's implementation. COP 22 was the first gathering after the Paris conference in 2015, which was broadly considered a success, based on the promises to address the problem. The Marrakesh conference was expected to be the event that would turn all those pledges into action. "Yet environmental campaigners said the Morocco summit was again heavy on rhetoric and light on real progress, with rich countries failing to do enough to help the developing world" (Worley, 2016: para. 2). Regarding energy issues, the conference organized a keynote panel with the following discussion topics: decarbonisation of energy supply, the development of climate-resilient and energy-efficient infrastructure, the opportunities and challenges around renewables expansion, and the use of carbon markets, pricing, and other policies to increase renewables markets. Furthermore, energy is one of the multi-stakeholder engagement proposal themes, which serves as structures to facilitate climate action and for tracking actions registered in NAZCA (Non-state Actor Zone for Climate Action), a web portal Launched in 2014 by UNFCCC, Peru, and France. The portal is meant to track the outcome of actions towards achieving the purpose and goals of the Paris Agreement and supporting the delivery of NDCs and the SDGs (UN, 2016). Broad-based actions by all segments of society, public and private, can be registered in NAZCA.

At COP 23 held in Bonn, Germany, in 2017 was launched *The Talanoa Dialogue*[11] "a traditional approach used in Fiji and the Pacific to engage in an inclusive, participatory and transparent dialogue" (UN, 2017). The initiative was designed to help countries implement and enhance their iNDCs. It was planned to start in January 2018 and should be constructive, facilitative and solution-oriented. The dialogue consisted of a preparatory and a political phase. The preparatory phase was intended

[11] In Paris, nations agreed that there should be a unique effort in 2018 to assess climate action progress. This one-off process which in 2015 was initially called the "facilitative dialogue", has been changed to *The Talanoa Dialogue* in 2017 under the Fijian presidency during COP 23.

to build a solid evidence-based foundation upon these three queries: Where are we? Where do we want to go? How do we get there? Preparatory phase resulting reports were to be used as a foundation for the Political phase. Another relevant event at COP 23 was Ukraine's proposal, which suggested that energy corporations should be brought closer to the UN climate actions. That should happen by placing them into an "intermediate layer" between the UNFCCC and national governments. The proposal raised the concern that such an initiative could enhance corporate influence over the UN talks (Timperley, 2017).

The Conference of the Parties (COP 24) took place in Katowice, Poland, in 2018 when the assembly conducted the negotiations for the entry into force of the Paris Agreement. Throughout the year, *The Talanoa Dialogue* was conducted. The preparatory phase was closed with a meeting on December 6, 2018, when synthesis of the preparatory phase was presented together with the Special Report on Global Warming of 1.5°C of the Intergovernmental Panel on Climate Change (IPCC). These results were considered the primary input from the preparatory phase into the political phase. However, the IPCC report launched in South Korea in October 2018 was a reason for disagreement among the Parties as the USA, Saudi Arabia, and Russia (gas/oil-producer countries) objected to the conference to welcome the report. The document pointed out that the world is currently completely off track, moving towards 3°C instead of 1.5°C this century. The three countries against the report supported a more laid-back position on the matter and that the conference would consider the results. As no consensus was reached under UN rules, the text did not pass, an outcome that caused a lot of frustration and disappointment among several Parties (McGrath, 2018). A dispute emerged during the discussion about Article 6 of the Paris Agreement, which regulates voluntary carbon markets. The most significant controversy was around the rules to avoid "double counting" of emissions cuts by the emitter country as well as the one buying carbon offsets. Brazil was at the centre of the discussion as Brazilian delegates

advocate that emissions reductions should account at the same time for the seller and the buyer of offsets (Carbon Brief, 2018).

Despite the dispute around the IPCC report, the political phase of *The Talanoa Dialogue* resulted in a declaration called *The Talanoa Call for Action*, the outcome of twenty-one ministerial round tables held on December 11, 2018, when the question "how do we get there?" was considered. The document highlights the need for multilateralism and cooperation in order to find solutions and build consensus for the common good. On the energy-matter, it requests initiatives towards universal access to sustainable and affordable energy sources, zero-emission transport systems, energy-efficient industries (UN, 2018b). It is indeed urgently necessary to put The Talanoa Call for Action into practice as the IPCC's sixth assessment report (AR6) published in August 2021 estimates that the world may pass the 1.5°C somewhere between 2030 and 2035, depending on the future emissions scenario (Hausfather, 2021).

The next Conference of Parties would take place in Brazil in November 2019, but the then President Jair Bolsonaro pulled the country out of hosting the event. Chile came forward, becoming the new host. However, social unrest due to anti-government protests led to the country's withdrawal from hosting the conference. Eventually, COP 25 took place in Madrid, Spain. Under the Chilean COP presidency. Negotiations around Article 6 of the Paris Agreement were resumed, and again Brazil was the centre of it. The root of the disagreement during COP 24 is the particular Brazilian understanding of the meaning of an iNDC, which leads to questions about the double-counting rules. Brazil's firm position on the issue was determinant for the agreement shortcomings over the Article 6 rulebook at COP 24 (Carbon Brief, 2019). Parties at COP 25 were unable to reach a consensus about this and other issues that therefore were postponed to COP 26 in 2020, when countries were required to increase their ambition efforts. However, due to the COVID-19 pandemic, the

event initially scheduled to take place in Glasgow in November 2020 was postponed to November 2021.

For more than four decades, since 1972, the United Nations have been making a lot of effort to tackle environmental issues. The Rio92 conference strongly mobilized public opinion, governments, and entrepreneurs. At first, all countries were alert and committed to environmental issues, and many promises were made through conventions and protocols. However, the Rio+20 conference was not successful. According to Dowbor (2012), its official documents are insufficient and timid, a disappointment to many. The conference took place in a less favourable context to reiterate previous agreements and provide an assessment opportunity for the current unsustainable and unequal economic growth. Europe was facing an economic crisis and the United States had started the presidential elections process. As a result the conference was not a priority. The American president and the German chancellor were expected until the last moment, but they did not attend, they only sent representatives. The Rio+20 scenario was different from the one of Rio92 as the United States refused to make any binding commitment to reduce greenhouse gas (GHG) emissions despite its high *per capita* emissions rate, and the least developed countries claimed their right to pollute until the developed ones take responsibility for their extensive damage to the environment (Magalhães de Moura, 2016). Despite many international meetings and agreements to develop strategies worldwide for climate change mitigation, results have not been satisfactory yet. In truth, some agreements have been rejected.

With the Kyoto Protocol, the United States would be forced to reduce its total emissions by an average of 7% below 1990 levels. However, Congress has not ratified the treaty even though President Clinton signed it. In 2001, the Bush administration expressly rejected the Agreement. As of June 1, 2018, President Trump announced the US's withdrawal from the Paris Climate Agreement. Besides scepticism about global warming being attributed to human activities, Trump's decision was based on

several economic, political, and legal reasons. It seems that the most significant cause for the withdraw has economic and financial grounds as declared the US president: "the United States will cease all implementation of the non-binding Paris Accord and the draconian financial and economic burdens the agreement imposes on our country" (The White House, 2017). After the withdrawal announcement, a wave of analysis emerged considering that the most effective approach to address climate change issues will be conducted by the market and its investments in technologies, instead of political agreements (Jenkins, 2017; Corneliussen, 2017; *UK's Telegraph*, 2017; *The Australian*, 2017).

Even though at the end of April 2021, 197 UNFCCC members had signed the Paris agreement and 191 of them had ratified it, there are lots of questioning about the treaty's effectiveness. Keuzenkamp states: "we are failing to honour the Paris Accord within the current economic paradigm. Only a paradigm shift seems an adequate solution (2019: para. 1)". In fact, there is an emerging consensus among political science scholars that diplomats should move beyond the 2°C goal due to inconsistencies between science and international commitments and that a feasible global agreement is idealistic (Levitt, 2011; Victor & Kennel, 2014; Rockström, 2017). Victor & Kennel (2014) argue that the 2°C goal is politically and scientifically misguided. Politically, it has enabled some governments to give the impression of taking global warming mitigation seriously while executing almost nothing. Scientifically, there are more effective ways to assess anthropogenic effects on the climate system other than the increasing average in global temperature. Jenkins states that in the last three decades, global warming has been on the daily news worldwide, yet "there is no appetite in the body politics for the kind of energy taxes and prohibitions needed to make a meaningful change in atmospheric CO_2" (2017: 1) and, indeed, according to the UN SDGs' platform there has been some advance on the energy issue (SDG 7) "due to recent progress in electrification, particularly in LDCs,[12] and improvements in industrial energy efficiency. However, national

[12] Least Developed Countries.

priorities and policy ambitions still need to be strengthened to put the world on track to meet the energy targets for 2030" (UN, 2018: 7).

In November 2019, The Universal Ecological Fund (Fundación Ecológica Universal FEU-US) published a report entitled The Truth behind the Climate Pledges, which concludes that almost 75 per cent of the current commitments to decreasing GHG emissions by 50 per cent by 2030 are partially or totally insufficient and some of the pledges are unlikely to be accomplished. At COP 25 in 2019, Parties recognized the vast gap between the current progress and the urgency to limit global warming. In Madrid, a multitude of protesters called attention to this discrepancy; among them was the climate activist Greta Thunberg who said that the conference of parties "seems to have turned into some kind of opportunity for countries to negotiate loopholes and to avoid raising their ambition" (Ruptly, 2019, 00:32). In fact, José Ferreras, an activist from Fridays for Future, says that corporates sponsors are among the conference attendees. He argues, "If you want to solve climate change, you don't meet the people who are destroying the planet" (in an interview with Marta Rodríguez Martínez from *Euronews* in 12-12-2019). According to Cárdenas (2019), for most scientists and members of civil society attending the conference, the results of this climate summit were meagre. Aden Meyer from the American non-profit organization Union of Concerned Scientists said: "In my almost 30 years in this process, I have never seen the almost total disconnection that we are seeing here in Madrid, between what science requires and people demand, and what the negotiations are giving, in terms of meaningful action".

The defeat of Trump in the American elections held in November 2020 could be light at the end of the tunnel. The new American president Joe Biden declared that his country would join international efforts to mitigate climate change and reaffirmed the US commitment to the Paris Agreement. Nevertheless, the Coronavirus pandemic that has affected the entire world since its appearance in China at the end of 2019 has

drawn the energies and resources worldwide to the fight against it, leaving all the nations unable to deal with the climate issue. Negotiations went on during Cop 26, held in Glasgow in November 2021. All nations present at the conference have agreed to phase down coal and some countries made a pledge to stop financing fossil fuel project. However, after the invasion of Ukraine by Russia, European countries have reactivated coal plant to address the shortage of Russian gas. At COP 27, held from 6 November until 18 November 2022 in the city of Sharm El Sheikh, in Egypt, the main development was that the parties have agreed for the first time on the need for funding arrangements to address loss and damage related to climate change. Nations are invited to contribute with the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF). New Zeeland, Austria, Germany, and Denmark already announced a funding of more than $ 240 million.

2.2 Brazilian governance: climate change mitigation and energy

Up to now, Brazil has participated in all UN general assemblies and UNFCCC gathering and has signed all their outcome agreements. Right from the start, Brazil has played a significant role in global environmental governance. Brazil was among the twenty-seven countries that took part in the first World Conference's preparatory committee on the Human Environment and worked actively during the gathering, suggesting amendments to the assembly's proposals. As a WCED or Brundtland Commission member, Brazil hosted one of its deliberative meetings and had a special participation in the advisory panel on industry.

In 1992 Brazil took a leading role in the global environmental agenda by hosting Eco 92. Prior to the conference, the environmental issue in Brazil was dealt with by a few different agencies and laws, e.g. The National Environmental Policy (Law No. 6.938/81) established in 1981 which

created the National Environmental System (SISNAMA); Ministry of Urban Development and Environment created in 1985, with the task of defining policies and coordinating governmental activities on environmental issues. Under this ministry, environmental quality control was dealt with by the National Environment Council (CONAMA) and, the Brazilian Institute of Environment and Natural Resources (IBAMA) created in February 1989. In 1990 the environmental issue was on the rise. With the prospect of organizing Rio-92 in Brazil, the Secretariat of Environment of the Presidency of the Republic (SEMAM/PR) was created. After the conference, that secretariat gave place to the Ministry of the Environment (MMA in Portuguese), created in November 1992. As of February 1997, a presidential decree created, the Sustainable Development Policy Commission (CPDS), to coordinate the preparation and implementation of Brazil's own Agenda 21. Regarding the energy issue, the country's Agenda 21 emphasizes the need to promote energy production and consumption efficiency. It calls for establishing norms and regulations for the rational use of energy by integrating the various sectors to reduce losses and waste of energy in large urban centres and points out the possibility of improving the efficiency of architectural projects and transportation systems. The document aims to stimulate the creation of economic and financial mechanisms to promote the use of energy from renewable sources, to seek innovative technologies and technical cooperation. Furthermore, it seeks to promote and finance energy research and development programmes, to stimulate the use of energy conservation technologies and reduction of energy intensity.

At COP 3 in 1997, Brazil had protagonist participation in creating the Clean Development mechanism (CDM), which is one of the procedures established in the Kyoto Protocol to promote clean development in developing countries. The CDM concept emerged from a proposition of creating a "Green Development Fund (GDF)" by the Brazilian delegation. The GDF was intended to encourage mitigation initiatives in developing countries. Despite the G77 and China's endorsement, the fund was not

implemented because developed countries opposed its non-compliance penalties. To reach an agreement, Brazilian and American representatives reorganized the original GDF proposal into the CDM, which is still in force. At COP 15 in 2009, Brazil undertook the voluntary commitment to achieve GHG emission reduction targets by reducing the deforestation in the Amazon which was significantly recorded in previous years. In order to meet this commitment, the National Policy on Climate Change (PNMC in Portuguese) was instituted and made official the objective of reducing greenhouse gas emissions from 38.9% to 36.1% compared to projected emissions by 2020. As of December 2017, the Brazilian Senate approved the Legislative Decree No. 178 of 11/12/2017, which ratifies the Kyoto Protocol amendments, formalizing the country's accession to the second period of the Agreement, which continued until the end of 2020.

As of June 2012, Brazil hosted for the second time the UN conference on the environment. The Rio+20 conference was a 20-year follow-up to the first Earth Summit, and its outcome document 'The future we want' mainly reaffirms prior Agenda 21 agreements. In November 2011, The National Commission for the United Nations Conference on Sustainable Development –created by Decree 7.495 of June 7, 2011– presented the document Brazilian Contribution to the Rio+20 conference, which was elaborated based on extensive consultations with society and government agencies. According to the Brazilian commissioners, the document presented a series of twenty-five themes that could not be ignored by the assembly because "they are the core of inclusive sustainable development for the planet" (National Commission for the United Nations Conference on Sustainable Development, 2011: 7). The theme of number 13 which deals with energy, reiterates the objectives of the Brazilian Agenda 21. Another five themes mention the energy sector regarding access to energy and the job opportunities that a new market in renewable energy sources represents. In addition, the document draws attention to the importance of the use of landfills for energy production and also presents suggestions for the promotion of

innovative research for the production of bioenergy from algae and forest biomass. The Brazilian commission also includes in its document eight proposals to be discussed by the assembly. Proposal number 2 suggests that access to adequate sources of energy should be one of the SDGs, which has been materialized in the form of SDG7 in the '2030 Agenda for Sustainable Development' adopted by the UN General Assembly in January 2015. Proposal number 3 is a 'Global Compact for Sustainable Production and Consumption'. Its item A – Sustainable Public Procurement – suggests that public sector consumption has the role of initiating changes in the sustainability standards of production and consumption by adopting criteria for the bidding of goods and services which inter alia privilege the lower consumption of raw materials and energy. Item B, also in proposal number 3, entitled "Consumption Classifications and Energy Efficiency' advocates the promotion of consumption labelling programmes and energy efficiency of products to evaluate and optimize both energy and fuel use.

Anticipating the country's participation in the COP21 in Paris, Brazil submitted its new climate action plan to the UNFCCC on September 28, 2015. The country's iNDC itself highlights its aspiring aspect: "Brazil will reduce greenhouse gas emissions in the context of continued population and GDP growth, as well as income per capita increase, making, therefore, this contribution unequivocally very ambitious" (Ministry of Foreign Affairs, 2015: 2). On September 21 and November 4, 2016, Brazilian iNDC was ratified and entered into force, respectively. The document presents Brazil's goal of reducing GHG emissions by 37% in 2025 and 43% in 2030 below 2005 levels. The FEU-US 2019 report considers Brazil's pledge sufficient[13] but:

> this climate pledge, however, was put forward by the previous administration. The current one, which took office last January,

[13] "Of 184 climate pledges, 36 were deemed sufficient (20 per cent), 12 partially sufficient (6 per cent), 8 partially insufficient (4 per cent) and 128 insufficient (70 per cent)" (Watson, McCarthy, Canziani, Nakicenovic & Hisas, 2019: para. 4).

> reversed key environmental and climate change-related policies and measures. This political reversal jeopardizes Brazil's chances of meeting its climate pledge. Furthermore, deforestation in Amazonia, as well as the destruction of other ecosystems, has accelerated the reduction of carbon sinks, impacting regional climate (Watson, McCarthy, Canziani, Nakicenovic & Hisas, 2019: 11).

Concerning *The Talanoa Dialogue* launched at COP 23, two Brazilian non-party stakeholders submitted their input to the UNPCCC. Brazilian Business Council for Sustainable Development (CEBDS) submitted its contribution on October 29, 2018. The document addresses the three queries: Where are we? Where do we want to go? How do we get there? On the energy-matter, it highlights Brazil's commitment to improving the renewable profile of its energy system as a priority in the medium and long terms. They acknowledge feed-in tariffs for renewable energy as a valuable tool to achieve energy transition (CEBDS, 2018). Furthermore, the document emphasizes the need to eliminate subsidies to fossil fuels and improve energy governance systems. It also suggests that energy efficiency auctions could promote efficiency. The second stakeholders to submit a contribution was WWF. The document *Talanoa Brazil: the São Paulo kick-start* is a report of the first *Talanoa Dialogue* in Brazil, entitled "São Paulo no Clima," a conference organized by São Paulo State Environmental Company (CETESB) in June 2018. The event brought together stakeholders from the public and private sector, academia, and civil society, with the purpose to share experiences, discuss challenges and potential of the State São Paulo in its strategy of tackling climate change. Took part in the event mister Mark Lutes, Specialist in the Climate Change and Energy Programme of WWF Brazil (CETESB, 2018).

Even though Brazil has been actively committed to international agreements on sustainable development, in practice, environment-friendly initiatives have not been implemented as effectively as intended. In the years following Rio 92, initiatives related to environmental issues in Brazil declined remarkably due to several factors, such as the return to the institutional routine and lack of financial resources; public opinion

disinterest; organizational conflicts, budget cuts for NGOs; political crisis[14] (Viola, 1998). The initiative of hosting the conference benefited and elevated the Brazilian environmental movement to an international context. However, the public policies developed in the period did not strengthen the country's commitment to environmental sustainability considerably. In truth, the processes of establishing environmental management and control proved to be not only peripheral to the central power but also inefficient (Rissato & Spricigo, 2010). Despite Brazil's leading role in the organization of the Rio92 conference, the preparation of the Brazilian Agenda 21 started only five years later in 1997 and took another five years to be launched in 2002. The complex and time-consuming process involved a series of studies and public consultations, which resulted in a final document that reflects the country's vision of its environmental problems. Nevertheless, the Brazilian Agenda 21 has been overshadowed by new priorities and therefore, not being used for its original purpose: guiding the country's environmental policies and development initiatives (Moura, 2016).

Under the Kyoto protocol's agreements, the Brazilian government committed to reducing its GHG emissions by reducing deforestation in the Amazon, which is Brazil's leading source of emissions. However, according to WWF Brazil (2018), deforestation in the Amazon had an increase of 13.7% in comparison to the previous 12 months. The data are the preliminary rates recorded between August 2017 and July 2018 by the Project for Deforestation Monitoring in the Legal Amazon by Satellite (PRODES in Portuguese). Furthermore, the announcement of the country's oil reserves pre-salt by the federal government at the end of 2007, among other reasons, led to a prioritization of this sector to the detriment of other renewable sources (Cortez, 2016), including the sugarcane ethanol sector as it is further elaborated in the subsequent sections.

[14] As of September 28, 1992, Brazilian president Fernando Collor de Mello was impeached.

Despite the Brazilian government's effort to organize and host the Rio+20 conference, it was not as successful as expected. In addition to the adverse economic and political conjuncture in different countries, the discourse prior to the conference was based on unproductive theoretical and conceptual discussions about the meaning of the green economy. It lacked focus, which did not add to the event's goals to advance actual actions towards necessary substantial improvement (Moura, 2016). Likewise, the Brazilian contribution document presented to Rio+20 had no specific focus and presented an array of 24 sustainable development challenges but did not elaborate on practical solutions.

Brazil's difficulty in implementing climate policies does not stimulate non-state actors to take actions on their own to help the county achieve its emissions reductions goals. Up to now, actions from Brazil registered in NAZCA are 471, representing 285 actors.[15] Far behind the United States (3,592 actions representing 2,113 actors), United Kingdom (1,679 actions representing 1,005 actors) and France (1,111 actions representing 537 actors).

Since 2015, when Brazil presented its iNDC to the executive secretary of UNFCCC, the country's political, economic, and social circumstances have indicated a discrepancy with the country's pledges to reduce GHG emissions. In fact, Brazil was a protagonist in the failure of agreements around article 6.4 of the Paris Agreement Rulebook at COP 24 and COP 25. The origin of the dispute is the way Brazilian delegates understand the goal of the iNDC. José Domingo González Míguez, a Brazilian representative at the conference, believes that an iNDC is formed by a range of government programmes and policies while there is a consensus that the document is intended to present the nations' target to cut CO_2. The overall Agreement is that each country has the duty to adjust its iNDC in the case of any CO_2 saving being sold abroad. As Brazil advocates for double counting the carbon offsets, the adjustment would not be necessary. Most Parties agree that double-counting put the

[15] For details go to https://climateaction.unfccc.int/views/country.html?country=BR

environment in jeopardy because it would give the impression that countries have met their targets even when CO_2 emissions increase. Furthermore, Míguez believes that any private initiative to cut CO_2 emissions should add to the country's effort to reduce emissions. He sees private initiatives as extra contribution as they are not part of the government programmes and policies. Another reason there is no need to alter the iNDC (Carbon brief, 2019). One way or another, Brazil found a way to keep its promises and still seems even more efficient in reducing its emissions. According to the Observatório do Clima (2020), a strategy they call carbon pedalling has increased the acceptable margin of CO_2 emissions in Brazil. In its first iNDC, Brazil was committed to reducing its greenhouse gas emissions by 37% by 2025 and 43% by 2030, compared to 2005 levels. Countries that signed the Paris Agreement agreed that countries with targets by 2025 should present a new iNDC by the end of 2020. Brazil presented its new iNDC in December 2020 and confirmed its previous targets. With the pedalling strategy, the initial percentage for reducing emissions proposed by Brazil has not changed, but the basis for calculating the percentage has changed significantly. The methodology for estimating emissions from land use in the country has been improved, which resulted in a significant increase in net emissions in the base year 2005 (from 2.1 to 2.8 billion tons of CO_2). The 43% reduction in the increased calculation base raises the target for 2030 from 1.2 to 1.6 billion tons of CO_2. This change allows Brazil to reach 2030, emitting approximately four hundred million tons of CO_2 more than the target proposed in 2015.

Even though other Parties have considered Brazil an obstacle to the Agreement over the carbon market, the Brazilian new iNDC presented by Bolsonaro's administration says:

> Brazil considers it essential that the negotiations on Article 6 of the Paris Agreement be concluded promptly and that the sustainable development mechanism (SDM) provided for, under Article 6, paragraph 4 of the Agreement be operationalized as soon as possible (…) in the event of a failure to conclude the negotiations and regulation

> of Article 6, the entire architecture of the Paris Agreement would be seriously jeopardized, to the detriment of the implementation of its objectives (MRE, 2020: 9).

The Observatório do Clima (2020) considers this statement little diplomatic and suggests a threat to the international community.

Between 2003 and 2010, during the two terms of former President Luiz Inácio Lula da Silva, Brazil experienced significant economic and social changes. However, with Lula's successor's impeachment, President Dilma Rousseff and her replacement by Vice-president Michel Temer, Brazil faced several corruption scandals and deep political crises. Since President Jair Bolsonaro took office on January 1, 2019, the country's political, economic, and social conjuncture has not improved. In fact, it has worsened with the Coronavirus pandemic. Right from the start of Bolsonaro's presidency, environmental agencies and policies have been restricted. Bolsonaro began his government by announcing the provisional measure 870 of January 1, 2019 (Medida provisória or MP in Portuguese) that established his Ministries. The MP provides essential information regarding the environmental policies that the current administration has implemented. According to the Socio-environmental Institute (ISA), the MMA not only lost political power but is now subordinated to economic interests and other areas of the government. With the changes announced, the ministry loses its competence to combat deforestation, forest fires, and desertification. An analysis of the first 100 days of the Bolsonaro government made by the Brazilian forum Observatório do Clima reveals that climate governance has been dismantled, and despite what the president said in Davos[16] regarding working with other nations to reduce GHG emissions, both his ministers for Environment and Foreign Affairs think the climate change does not exist. Bolsonaro's initial proceedings on the environment matter are anything but promising. He has even declared that Brazil could leave the

[16] Bolsonaro was at the annual meeting of the World Economic Forum in Davos, Switzerland, in January 2019.

Paris Agreement. Such a statement makes it difficult to predict how his governance on climate change will unfold. Up to early 2021, halfway through Bolsonaro's administration, Brazil has faced a lot of problems regarding environmental issues. In 2020 Brazil made headlines in the international media because of the vast fires that occurred in the Amazon and the Pantanal. According to Greenpeace, this happened due to a combination of severe droughts and neglect by the federal government. The aggravation of the situation is the result of the destruction project conducted by Bolsonaro's administration. The current government's policy has been causing the dismantling of structures and projects aimed at preserving the environment. On this matter, the Brazilian new iNDC says:

> As of 2021, Brazil will require at least US$ 10 billion per year to address the numerous challenges it faces, including the conservation of native vegetation in its various biomes. Further decisions regarding Brazil's indicative long-term strategy, especially the definition of the final date to be considered to this end, will take into account financial transfers to be received by the country (MRE, 2020: 9).

The Brazilian government blackmails other countries in saying that it requires at least $ 10 billion a year to preserve its biomes. Again, Brazil's current administration shows a lack of diplomacy (Observatório do Clima, 2020).

The Covid-19 pandemic in Brazil has taken on enormous proportions and has shown signs that it is out of control. Since the impeachment of President Dilma Rousseff in 2016, Brazil has been facing a severe political and economic crisis. The pandemic has further aggravated the ongoing crises. Without political and economic stabilization, Brazil's goals regarding the mitigation of GHG emissions will be hard to achieve within the period proposed.

Bolsonaro's presidency, which ended on December 31, 2022, had little or no commitment with climate governance (Observatório do Clima, 2022;

Ferris, 2022). The newly elected President Luiz Inácio Lula da Silva has pledged in his speech at COP 27 in Egypt, that his government will be fully committed to facing climate change with determination (Arlota, 2022; Harris and Hodgson, 2022).

Since the beginning of the 1970s, when an international summit was held to address the anthropogenic impact on the climate, the international community has met annually at different conferences to seek global governance policies that can curb the rise in temperature on the planet. Different agreements have been signed by most countries. The need for low GHG emissions at a global level is a known fact worldwide. In 1997, industrialized countries agreed to take initiatives to stabilize their emissions by ratifying the Kyoto Protocol. Since then, 192 nations have committed themselves to reduce their emissions. The Paris agreement, the last and most promising Agreement signed in 2015, has been endorsed by 191 of the 197 nations so far. Brazil has been present in all assemblies since the first international initiative in 1972. Since then, Brazil has been an active participant in attempts to contain global warming, being a signatory to both the Kyoto Protocol and the Paris Agreement. After leading two significant conferences (Rio92 and Rio+20), the country continues to contribute to the search for solutions. The international community has encountered numerous obstacles to implementing the signed agreements. Likewise, Brazil has had difficulties, especially in recent years, in implementing the policies agreed at a global and local level.

CHAPTER 3
HISTORICAL OVERVIEW OF THE BRAZILIAN ENERGY SECTOR: TRADITIONAL SOURCES

The third chapter of this study describes the current energy generation in Brazil and the history of its implementation since the start of the country's industrial development in the early twentieth century. The chapter is divided into four sections to present the situation concerning Brazil's primary energy sources: hydroelectric dams, oil and gas production, ethanol industry, and thermoelectric power under which nuclear energy is tackled. Brazil has developed a considerable renewable energy industry which will be presented in the next chapter. But first, a brief introduction on how the Brazilian energy sector started is presented below.

The development of the electric power sector in Brazil had its most significant impulse with the 1930 revolution, which the main goal was to change the economic base of the country. In other words, Brazil would stop being an agricultural exporter to become a country with its industry facing the ongoing challenges since the Second Industrial Revolution started in the second half of the nineteenth century (Kerecki & Santos, 2009).

The revolution of 1930 was a coup led by the states, Minas Gerais, Paraiba, and Rio Grande do Sul, against the election of Julio Prestes, a candidate supported by the state of São Paulo who never took office. The *coup d'état* resulted in ascension of Getúlio Vargas, who stayed in power for fifteen years afterwards. In 1951, Vargas was again elected president and stayed in office until 1954, when he committed suicide. The

following 18 months after Varga's death, the country had three different presidents until the election of Juscelino Kubitschek in 1956.

The second government of President Getúlio Vargas (1951-1954) emphasised initiatives for industrial development, such as the exploration of coal and ore, and created the National Road and the National Electricity Funds. In his government also founded Petrobras and proposed the creation of Eletrobras, which would only be approved in 1961 (D'Araujo, 2004) and officially installed as of June 11, 1962. Juscelino Kubitschek (JK) followed previous governments' plans for the industrial development of Brazil. One of the ways found by JK (1956-1961) to try and industrialise the country was to attract the investment of foreign capital in the country by encouraging the installation of foreign companies, especially from the automotive industry. With the end of JK's term in office, Brazil would face political uncertainty again. JK's successor, Jânio Quadros, resigned after one year in office, resulting in the ascension of his vice president João Goulart (1961-1964), mostly known as 'Jango'. The set of actions offered by João Goulart was aimed at the proletariat; it would discredit the great landowners' interests, the large business community, and the middle classes. João Goulart defended the realisation of reforms intended to promote income distribution but was unable to implement it due to a military coup that resulted in his deposition in 1964. After the coup, Brazilian politics returned to the development path driven in the first half of the century. The military stayed in power for 21 years – until 1985 – and had no interest in serving the masses, being a dictatorial government.

Marshal Humberto Castelo Branco (1964-1967), the first military president, implemented a Government Economic Action Programme (PAEG in Portuguese) to accelerate the pace of economic development and raise tax rates to reduce the public deficit. This first economic plan was considered successful since it calmed a period of uncontrolled inflation between 1964 and 1967. The economic and institutional reforms of the PAEG led the country in the following years to live a period

that came to be known as an 'economic miracle.' From 1968 onwards, Brazil started to grow again due to price stability and financial reforms. Nevertheless, the economic benefits did not reach the inferior part of the population, which suffered from the flattening of wages and political and civil rights loss.

General Emílio Garrastazu Médici's government (1972-1974) implemented the *First National Development Plan* (PND1), which was elaborated by the then minister of finance, Delfim Neto. Under his strategy, "the state took advantage of the increase in revenues and access to international loans to invest in pharaonic infrastructure projects" (García, 2014). So became known the large national integration projects conducted in the transportation sector such as the Rio-Niterói bridge and the Transamazônica highway. The main objective of the PND1 was to prepare the necessary infrastructure for the development of Brazil in the following decades. Médici's priority was promoting Brazil's development and growth by taking advantage of the then favourable international environment (Moreira, 2014). In the energy sector, Petrobras and Eletrobras, created in 1653 and 1962, respectively, underwent significant transformations. Petrobras became the largest Latin American company in the oil exploration sector and still holds its place among the world's largest. Eletrobras became the official planner and coordinator of electricity generation and distribution in Brazil. In 1973, Brazil and Paraguay signed the Itaipu treaty creating Itaipu Binacional, an agreement on the construction of the Itaipu hydroelectric power plant, the second-largest dam in the world with a capacity of 14,000 MWh (Itaipu Binacional, 2019).

In 1973 the international economy suffered a radical change. Arabic countries, members of the Organization of Petroleum Exporting Countries (OPEC) boycotted the United States and European countries for their support to Israel in a military conflict that year.[17] This first shock

[17] The Yom Kippur War or the October War between Israel, Egypt and Syria fought from October 6 to 25, 1973.

in the oil market did not affect the Brazilian economy very drastically, due to Brazil's 'economic miracle' in the period between 1968 and 1973, when the GDP (gross domestic product) grew at an annual average rate of over 10% (Viana, 2004). However, the exaggerated rise in oil prices has created a global crisis. The price of the barrel tripled at a time when Brazil imported 90% of the oil it consumed. Brazilian development model was based on an energy matrix supported by the low oil price. General Ernesto Geisel took office in 1974, started his presidency with policies designed to avoid the consequences of the global oil crisis in the years to come. Its development strategy redirected investments to the economy's primary sectors, such as metallurgy and petrochemical, to reduce the import of inputs without compromising the country's industrialisation process. Geisel efforts focused on tackling the latent crisis that already manifested in the world economy by importing goods other than oil. At the end of 1974, the government launched the II National Plan for Economic Development (PND2), which prioritised the reduction of Brazil's dependence on external energy sources. To accomplish that, large projects were initiated in the energy sector, such as the construction of hydroelectric plants (Itaipu, Sobradinho and Tucuruí), the Brazil-West Germany Nuclear Agreement, the National Alcohol Programme (Proálcool) and the exploration of oil. These projects were financed by the Arabic countries and their 'petrodollars.' With the market overvalued, oil-producing countries had the resources and interest to fund projects proposed by the Brazilian government. The foreign investments made in this period influenced the current Brazilian power system.

Because of the Iranian revolution in 1979, a new oil crisis happened. In that year, Shah Reza Pahlavi's pro-Western government was overthrown by a movement under the leadership of Ayatollah Khomeini, who did not have an interest in Western countries dependent on oil. The changes in Iran caused an unbalance in the oil market, and for the second time in the same decade, the price of the barrel increased enormously, causing an event that became known as the second oil shock of 1979. In the

following year, the Iran-Iraq war prolonged the international crisis. The conflict impacted the regular flow of oil when ships and oil facilities were bombed. Despite the PND2's goal of achieving a solid economic-industrial infrastructure and foster development in an attempt to make Brazil an 'emerging power', the second oil shock in 1979 generated severe economic consequences for the country, namely: the acceleration of the inflationary process; the reduction of GDP growth rates; unemployment and the public finance imbalance. If the first oil crisis did not make the military's plans for Brazil's development fail, the second crisis, in turn, caused the economic ruin of the dictatorship. The rise in the price of an oil barrel came back and triggered the US government's decision to raise interest rates. As the military's international loans were based on the American rate, the result in the Brazilian economy was a public deficit, inflation, and consumption retraction. The global crises of the 1970s caused an "impact on the world's perception of oil dependency and led the entire world, for the first time, to address energy planning from a multisector perspective, i.e., integrating the oil and electric sector" (Viana, 2004: para. 6). In Brazil, the crisis led the military government to prioritise the energy sector, leaving behind a legacy of physical, technological, and institutional structure that has solidified and is still active today: hydroelectric power plants, petroleum production, the Proálcool programme, and nuclear energy. These sources of the Brazilian energy matrix are detailed in the following sections.

3.1 Hydroelectric dams: source of energy and reputation

Dam construction in Brazil first started in the Northeast region at the end of the 19th century and progressed as part of a policy that sought to provide the north-eastern semi-arid areas with reservoirs to encourage the inlanders to stay in the region and thereby reducing migration to the Southeast of Brazil (Mello, 2011). The development of the Brazilian electric sector began in the 1950s when several research centres were created to support the construction of large dams. The introduction of

hydroelectric plants in the Brazilian electric matrix accelerated from the 1970s onwards, during the military dictatorship. Between 1960 and 1980, the following hydropower plants, among others, were built: Itaipu, Tucuruí, Ilha Solteira, Itumbiara, São Simão, Jupiá, Marimbondo, Água Vermelha, and Sobradinho. Nevertheless, at the beginning of the 2000s, a drop-in energy supply forced the Brazilian government to impose a power rationing from June 2001 to March 2002. Since then, the search for alternative energy sources has been intensified, as well as the interest in new hydroelectricity projects.

To implement these new projects a growth acceleration programme (PAC, Programa de Aceleração do Crescimento) was created. The first phase of the PAC1 was launched by former President Lula da Silva in 2007 and lasted until December 2010. The second phase, named PAC2, started in March 2010, still under Lula's government but was executed during the Dilma mandate (2011-2016). The PAC programme is still in force under Bolsonaro's administration. These developmentalist policies are intended to propel the Brazilian economy through investments in the fields of energy, transport, housing, and sanitation (PAC 2013). The PAC programme is based on the exploitation of natural resources (Kuijpers, 2013) and has facilitated several large hydropower projects.

Under the PAC programme, Brazil has been planning and executing many large new dam projects with high socio-environmental impact. In 2013, the Simplício dam, between the states of Minas Gerais and Rio de Janeiro, was completed. The dam construction is considered remarkable due to its high generation power. In 2016, another two plants were completed. Both part of the Madeira River complex in the state of Rondônia. The first one, the Jirau plant, had the first of its fifty turbines activated in 2013, at the end of the same year, the second dam, called Santo Antônio, already had twenty-two turbines operating. The Belo Monte hydroelectric plant, which began in 2011 and is expected to be completed by the end of 2019, has a seasonal peak capacity of 11.2 GW, the second largest in Brazil being surpassed only by the 14 GW generated by the Itaipu on the Paraná

River, on the border between Brazil and Paraguay. Another important project completed in 2015 was the Teles Pires plant, on the border between the states of Pará and Mato Grosso, with an installed capacity of 1,820 MW. With these constructions already implemented, some in progress and a few others planned, Brazil will probably solve its energy shortage problem. However, it is essential to remember the effects of these projects on the environment. Despite the adjustments made in the dam projects to reduce social and environmental impacts, the large investments made in the construction of hydropower plants in Brazil in the last few years have attracted the attention of scholars and environmentalists who argue that these initiatives undermine the country's image regarding clean energy generation. In parallel with the expansion of hydropower in emerging countries with high exploration potential, environmental pressure against this energy source grew worldwide, especially in opposition to large dam projects (Tolmasquim & Guerreiro, 2015). Although hydroelectric dams are known as a reliable source of clean energy, they are responsible for significant carbon dioxide (CO_2) and methane (CH_4) emissions (Fearnside, 2012; Mohajan, 2012; Ferreira & Fernandes, 2019), the latter been considered even more harmful to the atmosphere.

So far, Brazil has put into operation 217 hydropower dams and 426 Small Hydropower Plants (PCH in Portuguese). According to the National Electric Power Agency (ANEEL in Portuguese), in 2018, 74.2% of the country's electricity generation was by hydropower. This firm reliance on hydroelectricity has given Brazil a great reputation as a "green energy power" (Knodt & Piefer, 2015). This international recognition reinforces the decision-making processes in the same direction, considering that Brazil's hydroelectricity generation is increasing since there are in the country 38 power stations under construction and 148 dams in the project phase (ANEEL, 2018). Nevertheless, in the summer of 2014, when there was little rainfall to keep the water levels of the dams' reservoirs, thermoelectric plants – high GHG emitters – were intensively

used to generate power for national demand (Casagrande, 2015) and meet the needs of the residential, commercial, and industrial sectors.

The Belo Monte dam is currently the biggest power plant under construction in Brazil. Located in the Amazon region near Altamira city on the Xingu River in the state of Pará, the dam is one of PAC1's priority projects. It will become the third-largest hydroelectricity dam in the world with a generation capacity of 11,233 MW and investments of over US$18 billion. Brazil's ambitious hydropower expansion plan does not stop there. According to Amazon Watch (2011), the Brazilian government intends to build other dams upriver with larger reservoirs to make sure Belo Monte will generate power during the full year.[18] It took more than three decades for the Belo Monte project to be approved. The first attempt was made in 1975, but the construction started only in 2011 after many changes were made in the project because of several protests (Ferraço, 2018). Kuijpers (2013) states that the Belo Monte dam is a disputed project because of its size, the number of affected people and licensing process, which has been considered irregular, whereas it disregards Brazil's constitution and environmental law. Eight years have passed since Belo Monte's implementation started, and the social and environmental damage has been accumulated. The dam's construction has caused great biodiversity loss and affected the livelihood of riverine communities, indigenous people, and small farmers. It has submerged an area of 668 km^2, including four hundred km^2 of forest (see Appendix 3). By the end of the construction, a total area of 1,522 km^2 will be impacted (Amazon Watch, 2011). Understandably, Brazil avails itself of its great hydrological resources. However, Brazil has plenty of energy sources, such as solar and wind, which could be used to supply the country's

[18] Due to relevant seasonal variation, the Xingu river's flow oscillates, and therefore, the dam will operate at total installed capacity only a few months a year and generate merely an average of 4,500 MW, which makes the project inefficient as it is extremely expensive. "Since the Belo Monte Dam itself will be essential 'run-of-the-river, without storing water in its relatively small reservoir, economic analysis suggests that the dam by itself won't be economically viable" (Fearnside, 2012: 2).

growing power demand without causing such environmental and social impacts.

3.2 Oil and gas production: the central role of Petrobras

The Brazilian oil and gas industry started with Petrobras' foundation in the earlier 1950s. Nevertheless, the country was still dependent on oil and gas import when the first international oil shock occurred in 1973. Even though the crisis did not immediately affect Brazil, it was possible to predict that the country would face difficulties in importing oil in the following years. To avoid these imminent difficulties, President Ernesto Geisel (1974-1979) created a plan to reduce the import of oil, which led Petrobras to focus on offshore research and qualify for this new technology. As a result, the company began to invest in know-how, staff training, and equipment acquisition. The outcome of this plan was the discovery of the Campos basin at the end of 1974. With approximately 100,000 square kilometres, this basin is currently responsible for 45% of the national oil production (ANP, 2019). This discovery caused relief in the Brazilian economy since the expenses with oil import in Brazil jumped from seven hundred million dollars in 1973 to 2.8 billion dollars in 1974.

In 1975 the government opened the oil exploration in Brazilian territory to private initiative. The provision of exploratory services was agreed through "risk contracts," which contained a risk clause whereby Petrobras would recognise the services rendered but would only pay for the job in the case of discoveries of useful oil for commercial purposes (Costa, 2012). These contracts were signed between Petrobras and international private companies holding technology and responsible for conducting oil and gas exploration activities. Although the government argued that these agreements would not break the state monopoly, much of the public opinion advocated the slogan "the oil is ours" and that this statement would only become a reality with the maintenance of state

monopoly (Kucinski, 1977). The policy of opening oil exploration was maintained for 12 years. It was only interrupted with the 1988 constitution when the constituent assembly voted to prohibit the signing of new risk contracts due to its apparent inconsistency. It turned out that companies "were not interested in producing more oil, but in maintaining reserves" (Rocha, 1991: para. 4) and therefore, the veto over this type of contract was "undoubtedly a victory of Brazil" (Rocha, 1991: para. 4).

Under the new constitution, promulgated as of October 5, 1988, the government prioritised social reforms and kept its role in the economy. Regarding the oil sector, by the end of the 1980s, Petrobras achieved outstanding results for the offshore industry's technological development. In 1990, Petrobras had already discovered reserves of over forty-five billion barrels of crude oil and natural gas in both basins, Campos and Santos (Morais, 2013). At that point, the company was producing half of the national oil consumption and became less dependent on foreign capital while buying almost 100% of its equipment and materials from the Brazilian market (Guan, 2010). Petrobras' achievements were much appreciated at the Offshore Technology Conference as the company was recognised with the OTC Award in 1992 (Petrobras, 2006). Nevertheless, the Brazilian economy at the beginning of the 1990s was not very promising since the country struggled with debts and inflation. The election of President Fernando Collor de Mello (1990-1992) turned out to be a failure as he was impeached and charged with passive corruption and criminal association (Pousadela, 2009). Eventually, Collor de Mello resigned, and the vice-president Itamar Franco (1992-1995), took over the presidency. In order to stabilise the economy, President Franco's minister of finance Fernando Henrique Cardoso (hereafter, FHC) implemented in 1994 the *Real Plan* which was a three-stage strategy that started with a spending budget controlled by the National Congress; followed by an overall indexation process which would lead to the introduction of a new currency called *Real* (Hudson, 1997). Eventually, the *Real Plan* stabilised the economy and resulted in

the election of FHC as president for the two subsequent mandates, from 1995 to 2003.

During his administration, FHC implemented neoliberal reforms that had important developments in the country's oil sector and Petrobras. The company was, since 1988, exclusively responsible for administering the Federal Government's monopoly on oil exploration, production, and refining. In 1997, FHC promulgated the 'Petroleum Law' (Nr. 9.478/97), which allowed the oil and natural gas sector to become more flexible. After the approval of this Law, were created both the National Energy Policy Council (CNPE) and the National Petroleum Agency (ANP) responsible for the public policies and the regulation of the energy sector, respectively (Ribeiro & Novaes, 2014). With the 'Petroleum Law' approval, FHC broke the company's monopoly, allowing new companies to explore oil in the national territory. Petrobras began participating in auctions held by the ANP in competition with other oil companies for the right to explore oil fields, including those discovered by the company itself. In FHC's administration, private companies were allowed to enter the oil sector independently or through partnerships with Petrobras. In this way, multinational companies began to have access to large oil reserves located in the Campos basin. Furthermore, FHC's government reduced Petrobras' size by authorising the selling of the companies' refineries, distribution points, oil and gas pipelines, et cetera (Ribeiro & Novaes, 2014). Shell Royal Dutch became the first privately owned company to explore and find oil with good commercial production potential in Brazil.

Luiz Inácio Lula da Silva (Lula), leader of the Workers' Party (PT) and opposite to the government, was elected FHC's successor. Initially, Lula's government (2003-2011) maintained the softening of Petrobras monopolistic operation initiated by FHC, as well as the partnerships between Petrobras and other companies. However, after the initial phase of the government, Lula started to contest the policy regarding Petrobras and launched the PROMINP (Programme for the Mobilisation of the

National Industry of Oil and Natural Gas), showing interest in stimulating the development of the national oil and gas while increasing internal labour market. In 2003, the federal government introduced substantial changes in bidding requirements for oil and natural gas exploration and production projects. One of the changes regards the minimal local content requirement[19] for investments in the developments and production stages which was 37.8% on average during the FHC's government against an average of 80.1% at the beginning of Lula's second term (Ribeiro & Novaes, 2014).

With the discovery of pre-salt[20] basin oil reserves in 2006, Petrobras became the exclusive operator in all pre-salt oil fields. From that point on, a regulatory framework was created based on sharing agreements (instead of concession) for oil exploration, demonstrating that the Lula government had "a concern to retake the Brazilian state's role in the development of the country" (Ribeiro & Novaes, 2014: 52). One of the new regulation's goals was to align the sector more closely to the nation's interest, resulting in greater participation of the State. Another important event related to the pre-salt regulatory framework was the creation of Pre-Sal Petróleo SA (PPSA), a public company responsible for managing contracts related to the production and selling of oil, natural gas, and other fluid hydrocarbons from the pre-salt area. The PPSA purpose of increasing state's monitoring of companies' contracts and veto power faced critics from the opposition because of the fear that government control instead of the market would retard the pre-salt area development (Guan, 2010).

[19] A contractual clause on local content requiring that part of Brazil's goods and services for exploration and production activities must be national. Besides, preference should be given to contracting Brazilian suppliers whenever their offers price, term, and quality conditions equivalent to those of other suppliers also invited to submit proposals (ANP, n.d.).

[20] Reserves of oil and natural gas, located up to 5,000m below the seafloor, under a thick salt crust (pre-salt layer, hence the name "pre-salt"), which extends for 800 km between the states of Espírito Santo and Santa Catarina (see Appendix 5), considered the most prominent oil province found in the world in the last thirty years (Piquet, 2012).

Between 2003 and 2010, during the two terms of former president Luiz Inácio Lula da Silva, Brazil experienced significant economic and social changes. With a strong commodities market, new oil reserves discovery, and the implementation of *Bolsa Família,* a social-welfare programme that became an international model for the eradication of poverty, Brazil achieved a remarkable growth, which stemmed from Lula's high approval rates and resulted in the election of Lula's successor, President Dilma Rousseff (2011-2016), also from the Worker's Party (Partido dos Trabalhadores, PT). For the next five years, the government would continue its effort for economic stability and poverty eradication.

Concerning the oil sector, Dilma's government was criticised. Initially, because of her participation in the decisions for the purchase of Pasadena's oil refinery in the United States by Petrobras. In 2006 Dilma was chief of staff in Lula's government and the chair of Petrobras' board of directors. As a counsellor, Dilma voted in favour of the purchase of 50% of the refinery shares. The purchase generated suspicions of overbilling and alleged foreign exchange evasion, which led to an investigation by the Federal Court of Audit. In 2014 the Federal Justice initiated investigations of corruption and money laundering involving Petrobras. The federal police's operation, called Car Wash[21] (Operação Lava Jato in Portuguese) uncovered large-scale bribery, kickbacks and money laundering involving the state-run oil company. It was then estimated that the volume of resources diverted from the company's coffers would be billions of *reais*. Suspects of involvement in the scheme were people of expression within the country's economic and political scenario, including politicians of the PT itself. According to Pinguelli Rosa (2014), Dilma's second term inherited several problems from her first term, both in the electric power and in the oil sector, although the latter has a more political character due to the irregularities in Petrobras.

[21] The Car Wash operation includes investigation on illegal transaction concerning the Belo Monte dam's constructions, the nuclear power plant Angra 3, and the Petrochemical Complex of Rio de Janeiro (Comperj). For details go to http://www.mpf.mp.br/grandes-casos/lava-jato/entenda-o-caso

These and other events in Dilma's administration unfolded in several manifestations and opinions contrary to her government from both opposition parties and society in general. This dissatisfaction led to her impeachment and her replacement by Vice-president Michel Temer. This turmoil in the political sphere contributed to the disruption of the country's energy sector and the national economy in general.

Even though Dilma had already started to implement less protectionist policies for the oil sector, it was with Temer's ascension that the entrance of foreign and private investments in the development of Brazil's offshore oil blocks was again facilitated (Chetwind, 2016). In 2016, the government passed a bill nº 13.365/2016 that removed the clause requiring Petrobras to participate at least 30% in the production sharing regime. With this bill, the mandatory operator role imposed on Petrobras was replaced by a right to preference. This change allows Petrobras to participate only in the biddings for oil blocks in the pre-salt areas of its interests, leaving the other ones to private companies (Leão, 2017; Olim, Mensah & Yamachita, 2018; EIA-2019) Despite the discovery of the pre-salt oil reserves, Petrobras has lost a great deal of its market value. According to Olim, Mensah & Yamachita (2018), this depreciation occurred not only due to management decisions, such as the purchase of the Pasadena refinery, fuel price policies alongside economic crises, but also because of the protectionist policies imposed on the company related to its role in the development of the pre-salt area.

In the last five decades, the oil exploration and production in Brazil have gone from open to closed alternately, and in the current decade, a new opening prevails that began in the Temer government and continues with the Bolsonaro government. Favouring Bolsonaro's privatisation policies, the Federal Supreme Court (STF) authorised the sale of the Associated Gas transportation Company (TAG), without deliberation by the National Congress, on condition that a public bidding process occurred under the Brazilian procurement law (Forbes Brazil, 2019).

This decision is part of Petrobras' divestment plan[22] to be realised by selling the company's assets to reduce its debt by $10 billion in 2019 (Offshore Technology, 2019). Six months have passed since Bolsonaro took office. Up to now, analysts define his government mainly as neoliberal (Schaefer, 2018; Amazon Watch, 2019; Prinsloo, 2019; Bresser-Pereira, 2019), which means that the government power tends to shrink during Bolsonaro presidency, whereas the market power grows. It is essential to observe how this openness in the Brazilian energy sector will unfold when dealing with climate change mitigation.

3.3 Ethanol production: past and future solution

The use of sugarcane ethanol as fuel in Brazil dates from the late 1920s and early 1930s (Soccol et al., 2005) with the automobile industry's increase. Ethanol was then combined with gasoline, a mix inspired by the ethanol blends largely used in France three decades before (Kovarik, 2006). The increasing demand for ethanol led to establishing the Sugar and Alcohol institute by the Vargas government in 1933 to propel alcohol fuel production and provide technical assistance. Ethanol demand rose again in 1943, during II Word War, when German attacks threatened oil supply. After the war, ethanol use diminished as oil import normalised. From the 1950s onwards, the ethanol-gasoline blend was used sporadically only to drain sugar surplus (Kovarik, 2006). Ethanol production emerged again in 1975 with the creation of the National Alcohol Programme or Proálcool. After the oil shock in 1973, the Brazilian government intended to reduce the country's dependence on imported oil. The Proálcool was a response to both the sugar and oil price crisis in the international market (Lorenzi, 2018).

[22] Disinvestment is the alienation to the private sector by the federal government of holdings within state companies or assets of these companies (National general controller (CGU) federal secretariat of internal control, 2017).

> "The programme is born based on public subsidies and financing, and the government, through Petróleo Brasileiro S/A - PETROBRAS, is responsible for buying, transporting, storing, distributing and mixing alcohol with gasoline, as well as determining the selling price of the product" (Michellon, Santos & Rodrigues, 2008: 2).

Proálcool had two distinct phases: the first one with anhydrous alcohol production, used as an additive to gasoline. Anhydrous alcohol (without water) can be mixed with gasoline in any proportion without impacting car efficiency. This flexibility was an advantage for sugarcane farming because "if the sugar price falls, alcohol could be produced instead, and vice-versa" (Soccol et al., 2005: 898). The second phase, from 1980 onwards, was marked by the production of hydrous ethanol or hydrated alcohol, to be used as pure fuel in ethanol-only powered cars, whose technology was developed in Brazilian universities and research centres (Puppim de Oliveira, 2002). In both phases, government subsidies and investments were crucial to the expansion of alcohol production and consumption to such an extent that in 1984, 94% of automobiles were powered by ethanol (Soccol et al., 2005). This high car production rate contrasting with low ethanol production led to a supply crisis in 1989, bringing discredit upon the ethanol-only fuelled car (Barbosa Cortez, 2016). The stagnation of ethanol output occurred as the result of fewer investments made in alcohol production due to economic crises and price control to fight inflation; and also because of low oil price in the international market; political hesitation concerning Proálcool; negative reaction from Petrobras;[23] and increase of national oil production.

Contrary to expectation, the oil price fell considerably in the 1990s, which resulted in Proálcool's steady dependence on government subsidies (Puppim de Oliveira, 2002). Additionally, at de beginning of Collor de Mello's tenure (1990-1992), an administrative reform started, putting into action the new president's national plan of economic

[23] The rapid growth in hydrated ethanol production resulted in a large surplus of gasoline that had to be exported, forcing Petrobras to make costly oil refining structure changes (Soccol et al., 2005).

liberalisation. These new policies included the deregulation of the sugarcane industry, in other words, the curtailment of state intervention in it. As a result, price control on the fuel sector was removed. This decision raised concern among producers since ethanol could not compete with gasoline (Moraes, Azanha & Zilberman, 2014). The ethanol production stagnation – which had already started in the mid-1980s – lasted until 2003. Back then, "in the absence of a demanding ethanol market, the technology stabilised as well, being fomented only incremental innovations" (Barbosa Cortez, 2016: 46).

As of 2003, a new phase started for the ethanol sector with the introduction of the Flex-fuel technology,[24] which enabled the internal ethanol market to grow significantly. This return to growth from 2003 onwards "created the market that enabled the capital goods industry to invest in developing new technologies and equipment" (Barbosa Cortez, 2016: 46). As a result, in 2005, 55% of passenger vehicles commercialised in Brazil were Flex- fuel powered. This rate rose to 87% in 2018 (Veiga Filho & Ramos, 2006; MME, 2018). The Flex cars had a strong appeal to customers since they could profit from ethanol's low price without the risk of supply crises from the past. "Currently, 90% of all car sales in Brazil are Flex-fuel vehicles" (Stattman, 2019: 28). However, Flex-fuel technology's success does not mean a continuous favourable outcome for the ethanol industry. At the end of 2007, Petrobras announced that oil had been found in the pre-salt area. This news caused great optimism among the company's technicians and led the federal government to define a strategy that prioritised large investments in pre-salt oil exploration (Bistafa, Gurgel & Paltsev, 2016). Following this, new investments in the ethanol sector stopped due to the economic crises that started in 2008; poor harvests related to severe weather and soil management; as well as financial obligation (EPE,

[24] FFV (Flex-fuel vehicle) models already existed in the USA and run on gasoline and anhydrous ethanol blends. However, the first FFV model on the Brazilian market was Volkswagen Gol, launched in 2003 and operating with a mix of gasoline and hydrated ethanol (Barbosa Cortez, 2016: 46).

2016). Additionally, in an attempt to control inflation, the Brazilian federal government frizzed petrol price, making ethanol less competitive. According to Angelo (2012), ethanol's price for the consumers was so high in most Brazilian states in 2012 that it became cheaper to fill up Flex-fuel vehicles with gasoline that contain about 20% ethanol. Furthermore, the author states that a return to fossil fuels and the rapid growth of the vehicle fleet have increased urban air pollution and CO_2 emissions. Some producers had no choice to mitigate the financial problems but to sell their assets, and others went bankrupt or ceased operation. Data from de Brazilian Energy Research Agency (EPE) (2016) show that between 2011 and 2015, as many as ninety-two sugarcane mills closed, while only ten new ones were installed and thirteen were reopened.

From 2013 onwards, different governmental policies, directly or indirectly, have improved the sugar and alcohol sector's scenario, leading the industry to return to growth. The anhydrous alcohol percentage blended with gasoline went from 20% to 25% in 2013 and up to 27% in 2015; the gasoline price increased; BNDES (National Development Bank) created funding programmes to promote renovation and expansion of sugarcane plantations and ethanol storage (EPE, 2016). Another governmental initiative was the Biofuture Platform proposed by the Brazilian government to diverse prominent countries[25] around the globe, launched in 2016. The Platform is "a mechanism for policy dialogue and collaboration among leading countries, organisations, academia and the private sector conscious of the need to accelerate development and scale up the deployment of modern sustainable low carbon alternatives" (Biofuture Platform, 2018). One of its goals is to encourage the production and commercialisation of advanced low-carbon fuels, including second-generation ethanol, also known as

[25] Biofuture Platform's current Member States are Argentina, Brazil, Canada, China, Denmark, Egypt, Finland, France, India, Indonesia, Italy, Morocco, Mozambique, the Netherlands, Paraguay, the Philippines, Sweden, United Kingdom, United States, and Uruguay.

bioethanol. In that same direction, the Brazilian Congress approved in 2017 the Brazilian National Biofuels Policy known as RenovaBio. "The bill aims to reduce the carbon footprint of the national fuel mix as well as ensuring a long-term demand for low carbon fuels in the country" (Biofuture Platform, 2018: para. 1).

Despite several governmental initiatives in the last six years, Brazil's ethanol sector has plenty of room to grow. According to the National Agency of Petroleum, Natural Gas and Biofuels[26] (2019), the contribution rate of ethanol to the country's transport fuel market in 2018 was 18.9% against 76.7% of fossil-based fuel and a small share of 4.4% of biodiesel. These features undermine Brazil's 'ambitious' iNDC, which entered into force in 2016 and promises a significant reduction in the country's GHG emission until 2030.

3.4 Thermoelectric power: predominantly fossil fuel-based

Thermoelectric power plants are driven by a variety of heat sources such as mineral coal, fuel oil, natural gas, biomass, and uranium which is the fuel of nuclear power plants. The following section presents the Brazilian thermoelectric power.

Currently, the Brazilian installed thermoelectric capacity reaches over 46 GW generated by fossil fuels, biomass, and nuclear thermal plants (SIGA, 2020). From this total capacity, 29.3 GW (63%) is fossil fuel-based, with a total of 2.291 plants operating with petroleum products, mostly small diesel generators; 167 plants powered by natural gas; twenty-three coal-fired units and four plants powered by process heat from other fossil fuels. As for biomass, the installed capacity is 15.3 GW (32.6%) generated predominantly by sugarcane bagasse-powered

[26] ANP in Portuguese.

plants (11.6 GW), complemented by units operating with a wide variety of biomass such as agro-industrial waste, liquid biofuels, forestry waste, animal waste and solid urban waste. The nuclear-installed capacity is close to 2 GW, generated by two plants (Angra 1 and Angra 2) (SIGA, 2020).

The Decennial Energy Expansion Plan 2027 (PDE 2027 in Portuguese) published in 2018 by the Ministry of Mines and Energy and the Brazilian Energy Research Agency emphasises that the expansion of coal-fired thermoelectric plants encounters obstacles in the environmental legislation, but it considers the possibility that new plants may become part of the expansion of the electrical system, in case of the existing plants be replaced with more modern energy-efficient plants which are adapted with greater control of GHG emission as well as other pollutants. After the deactivation of the Charqueadas (72 MW), São Jerônimo (20 MW) and president Médici A and B (446 MW) plants, the installed capacity of the national coal-fired thermoelectric park is 1.227 MW added to 1,445 MW from the participation of three plants powered by imported coal –Porto Pecém I (720 MW), Porto Pecém II (365 MW) and Porto Itaqui (360 MW)– making a total of 2,672 MW. In 2019 with the entry of the Pampa Sul TPP (345 MW), which will also use national coal, the installed capacity for coal in the National Interconnected System (SIN) rose to 3,017 MW.

Today's Brazilian electricity grid relies on 2189 diesel-powered plants and another seventy-five units driven by different kinds of fuel oil (SIGA, 2020). The thermoelectric plants powered by diesel and fuel oil, which have their contracts terminated between 2019 and 2027, will be disconnected from the system on the respective contracts' expiration dates, decreasing approximately 3,000 MW of generation from these sources in the national grid until 2027. The supply of these thermoelectric plants will be replaced by plants powered by natural gas to keep up with the country's energy growing demand and, besides, it is

expected that Brazil's third nuclear plant (Angra 3) will start its operation in 2026 (MME/EPE, 2018).

Natural gas is presented in the PDE 2027 as a reasonable path for the expansion of thermoelectric power. The demand for natural gas has increased due to its use as a substitute for other more polluting fossil fuels –such as coal and fuel oil– to mitigate GHG emissions as public concern about global warming has grown (Instituto Acende Brasil, 2016). Thermoelectric generation using natural gas stands out for its essential role in complementing hydroelectric generation, especially in the dry season, offering operational flexibility to the National Interconnected System (SIN in Portuguese), formed mainly by hydroelectric power plants. Furthermore, due to the expansion of intermittent renewable sources, such as wind and solar, natural gas-driven thermoelectric plants are considered an appropriate technology to be used in periods when wind and solar power generation is not available (Tolmasquim, 2016). In the short and medium-term, imported LNG (Liquid Natural Gas) represents the standard fuel for developing new plants. However, the development of pre-salt reserves, still with an uncertain horizon, could significantly expand the supply of national natural gas and, as a result, its contribution to the Brazilian energy grid. Taking into consideration the latent need for a steadier energy supply, nuclear expansion appears in the same document as an option to be considered (MME/EPE, 2018).

The primary biomass used for electricity generation in Brazil is sugarcane bagasse, and it has been growing, mostly because of the strong ethanol and sugar industry in the country that started with the National Alcohol Programme (Proálcool) in 1975. Biomass-based energy generated by thermoelectric plants is also called bioelectricity as it is considered to be a type of renewable energy. Bioelectricity in Brazil is mainly obtained through cogeneration[27] units within the sugar-energy

[27] Cogeneration is the process that allows the combined generation of electrical and thermal energy, both of which are used by sugar and alcohol production plants.

industry and, to a lesser extent, in paper and cellulose factories, with black liquor as an energy source. Depending on the energy efficiency of these units, there may be a surplus generation of bioelectricity that can be sold to power supply companies. However, a considerable number of units – especially in the sugar-energy sector – only meets its own energy demands (heat and electricity) with little or no surplus. This scenario has been slowly improving in the last two decades as both sugar and alcohol and paper and cellulose industries have expanded and implemented more modern units which are more efficient in cogeneration and energy use. This modernisation led to more significant bioelectricity surpluses and increased revenues. As a result, bioelectricity started to play a key role in complementing and diversifying Brazil's power supply (Tolmasquim, 2016).

From the total electricity supply in Brazil, 27.01% is generated by thermoelectric plants, being 1.67% by nuclear units. The larger share of 25.36% is generated by fossil fuel-powered units (65.91%) and biomass (34.09%). The fraction corresponding to biomass is divided into sugarcane bagasse (76.44%) and black liquor (16.76%). The other biomass types used in electricity generation in Brazil are forest residues, solid urban residues (incineration and gasification), firewood, rice husks, elephant grass, charcoal, vegetable oils and ethanol. These sources together represent 6.78% of the total biomass generation (SIGA, 2020).

Despite the efforts to maintain the Brazilian electricity grid predominantly renewable-based, the implementation pace of new hydroelectric plants, as well as the slow expansion and intermittency of renewable sources such as wind and solar, do not allow sectoral planning to abandon the thermoelectric options. Thermoelectric plants have beneficial characteristics, such as operational flexibility and less climatic vulnerability, which brings reliability to the system and gives the country greater energy security (Tolmasquim, 2016). Moreover, it is possible to implement thermoelectric plants in areas close to the consumption's centres, reducing losses and socio-environmental impacts inherent to

extensive transmission lines. Furthermore, thermoelectric plants need relatively small areas when compared to other sources of energy. This fact associated with flexibility in the choice of site prevents conflicts over land use.

3.4.1 Nuclear energy: risky alternative

The Brazilian government first showed interest in using nuclear energy in the early 1950s with the creation of the National Research Council (CNPq in Portuguese), which happened under President Vargas' initial plan of having autonomy in research development. At first, CNPq was divided into two parts, one part being devoted exclusively to nuclear research (Carpes, 2006). The nuclear research sector was disbanded from CNPq in 1956, with the creation of the National Nuclear Energy Commission (CNEN). This commission was attached to the Ministry of Mines and Energy after its creation in 1960. CNEN took control of the Brazilian nuclear policy, which was conducted with close collaboration from the United States. Under the USA's *Atoms for Peace* programme,[28] an American nuclear reactor was installed in Brazil to develop atomic energy research.

In the 1950s and 1960s, Brazil signed cooperation agreements for the peaceful use[29] of nuclear energy with the following countries: Italy, Paraguay, Portugal, Switzerland, Peru, Bolivia, India, Spain, France,[30] USA,[31] and Germany. With the last three countries, Brazil has also

[28] The programme originated from the "Atoms for Peace" speech of American President Dwight Eisenhower at the United Nations, pointing out the need to develop a peaceful application of nuclear power.

[29] In 1970, the Treaty on the Non-Proliferation of nuclear weapons was signed, also known as the Non-Proliferation Treaty or NPT, recognising the right of signatory countries to develop and use nuclear energy for peaceful purposes. Currently, 191 countries have signed the Treaty (UNODA, 2019).

[30] In 1974 an agreement was signed with France for knowledge transfer in nuclear reactors operation.

[31] Cooperation between the US and Brazil began in the 1940s when the two countries signed two agreements for the prospecting and trading of radioactive minerals. From then on,

reached an agreement for nuclear energy's civil use (technological and commercial). The cooperation agreement for the peaceful use of nuclear energy between Brazil and the United States was signed in 1965.

Although Brazil had signed a technology cooperation agreement with Germany in 1969, the county went through its previous agreement with the United States and in 1972 agreed to receive American enriched uranium in exchange for Brazilian natural uranium. Additionally, a contract was signed with the American company Westinghouse for the settlement of the first power reactor in Brazil, starting in the same year the construction of nuclear power plant Angra 1. Herewith the Brazilian government decided for the further use of enriched uranium and light water[32] in its reactors. According to Carpes (2006), this policy proved to be contradictory since the adoption of international cooperation policy and the signing of such agreements restricted the national scientific development in the field and thus contrasted with the interest in expanding the country's nuclear sector. In spite of the political divergence between those in favour of importing US technology and those who wanted to develop a national technology, the 1971 purchase of the American reactor to be installed at Angra 1 represented the victory of the group in favour of the development of a nuclear policy associated with US technology, contrary to the national-developmental character of the ongoing military regime. However, with the advent of the 1973 oil crisis, the international nuclear reactor market grew, causing the United States to suspend the uranium supply. To continue the ongoing nuclear projects, the Geisel government (1974-1979) expanded in 1975 the agreement signed with Germany six years earlier, ensuring the transfer of technology for uranium enrichment, construction of nuclear power plants and radioactive minerals prospecting equipment (CNEN, 2010). The PND 2, development plan implemented by Geisel prioritised the

several other agreements were signed, mainly cooperation agreements for the civil use of nuclear energy (CNEN, 2010).

[32] Opposed to the use of natural uranium reactors and heavy water, a nuclear programme started in the 1950s.

reduction of Brazil's dependence on external energy sources and, therefore, stimulated large projects in the Brazilian energy sector. Through the PND2, the government allocated large investments to the construction of nuclear plants in an attempt to meet the energy demand generated by the 1973 oil crisis.

Initially, the Brazil-Germany agreement aimed to construct eight nuclear reactors, but only two were concluded because of the lack of financial resources and domestic and foreign criticism. The reasons leading to the agreement concerned Brazil's energy demand, at that time and in the future, due to the increase in population and industry production. In this regard, COPPE[33] researchers criticised the government's initiative by stating that Eletrobras had underestimated the existing water resources in the Brazilian territory for electric power generation and overestimated the country's energy needs in the early 21st century (Silva, 2006).

President José Sarney (1985-1990) introduced an agenda that aimed to restore Brazil's credibility within an international scope after two decades of a military regime. In this regard, the Brazilian Nuclear Programme was particularly useful. The Sarney government had the task of making the transition between the military dictatorship and a democratic civil government, and therefore it was necessary to value the achievements of the previous administration. It was equally important to maintain and capitalise on the scientific and technological development in nuclear research achieved so far. Additionally, it was also essential to dispel any uncertainty about the intended peaceful purpose of Brazil's nuclear sector (Carpes, 2006).

[33] Alberto Luiz Coimbra Institute of Graduate Studies and Engineering Research of the Federal University of Rio de Janeiro.

In the Lula government (2003-2011), the Brazilian Nuclear Programme (PNB) was strengthened again as in the Geisel and Sarney[34] governments. In addition to contributing to Brazil's insertion in the international scenario, President Lula da Silva linked the nuclear energy sector to his agenda of valorisation of science and technology for the country's development. The PNB began in the 1950s but only gained relevance in the 1970s. Since then, its growth has gone through ups and downs and slowly evolved, but it has been able to include the production of nuclear fuel in its portfolio. As of 2006, the first module of uranium enrichment equipment plant was inaugurated at the Nuclear Fuel Factory (FCN), a centre within Brazilian Nuclear Industries (INB) in the city of Resende, in the state of Rio de Janeiro. The Uranium Enrichment Plant has been implemented in distinct stages, and its third module is already implemented since 2018. According to information released by INB (2019), Brazil is predicted to be self-sufficient in nuclear fuel production by 2037.

Today Brazil has two nuclear plants in operation, Angra 1, and Angra 2, and a third one, Angra 3, is still under construction (see Appendix 4). The three plants form the Almirante Álvaro Alberto Nuclear Power Station (CNAAA), located in the city of Angra dos Reis, in the state of Rio de Janeiro. Angra 1 was the first nuclear power plant built in Brazil. Its construction started in 1972, and it has 640 megawatts of power (IEA, 2019). The equipment for its construction was purchased from the American company Westinghouse in a 'turnkey' condition, that is, ready to be installed and did not provide for technology transfer by the suppliers (Eletrobras Eletronuclear, 2019). Angra 1 entered commercial operation in 1985. The construction of the nuclear plant Angra 2 began in 1981, but the pace of the activities slowed down from 1983 onwards due to the economic crisis that burdened the country at that time,

[34] Geisel and Sarney's administrations are considered the milestones in raising the nuclear issue to state policy (Carpes, 2006). Although the FHC government did not highlight the PNE, it was in his administration that Eletrobras Eletronuclear was created in 1997 as a subsidiary of Eletrobras (created 35 years earlier) to operate and build thermonuclear plants in Brazil.

stopping permanently in 1986. The unit was resumed in late 1994 and completed in 2000. The plant has a German technology reactor, resulting from the 1975 agreement. Angra 2 has a power of 1,350 megawatts (IEA, 2019) that can meet the energy demand of a city with up to two million inhabitants.

Angra 3 nuclear power plant is planned to generate 1405 megawatts (IEA, 2019). Its construction started in 2010. Its completion was scheduled for 2021 but has been interrupted since 2015 because of allegations of corruption in its construction bidding and contracting processes. According to Simbalista (2017), Eletrobras suspended civil engineering and building contracts after the Car Wash investigation uncovered a corruption scheme within its subsidiary Eletronuclear in mid-2015, leading to the imprisonment of Eletronuclear's chairperson, the Vice-Admiral Othon Pinheiro da Silva, a senior navy officer renowned for his expertise on nuclear energy (Netto, 2019). Following the corruption scandal, the company ran out of funding, delaying construction beyond 2018, even though Angra 3's design work and major equipment are already around 70 per cent completed or manufactured and stored on-site (Simbalista, 2017). Information about the resumption of Angra 3 released by Canal Energia Group and ratified by the Brazilian nuclear energy association (ABEN) indicates that building activities would resume in the first half of 2021. The Decennial Energy Expansion Plan 2027 (MME/EPE, 2018) indicates the start of the plant's commercial operation for January 2026.

Nuclear power is considered an alternative to the growing demand for energy in Brazil. Especially because of the large reserves of uranium in the national territory and know-how in uranium enrichment technology. In 2016, Brazil began to export enriched uranium to Argentina through INB (Brazilian Nuclear Industries). Brazil is currently the only country in Latin America that has mastered the technology needed for nuclear fuel production (Andrade, Silva, Hillebrandt & Franco, 2018). The development of a national nuclear technology attenuates the debates on

the increase of energy demand in the country and presents nuclear power as an alternative to mitigate the effects of fossil fuels on the environment since nuclear energy is considered clean because of its low GHG emission index (Quintella, 2019). However, there is a constant fear of possible radioactive leakages added to the doubt whether Brazil is prepared or not to handle large disasters (Quintella, 2019) such as Chernobyl in 1986 and Fukushima in 2011. These events bring back the anti-nuclear movement's concern, which has affected the public's general opposition to nuclear energy (Bradshaw, 2018). These particularities involving nuclear power generation have contributed towards the development of policies to foment the use of other clean energy sources such as wind, solar and biomass.

Brazil has a much-diversified energy matrix. Although the generation of energy in Brazil has expanded with the use of renewable sources, most of the energy injected into the Brazilian power grid comes from traditional sources of energy. The electricity sector uses thermoelectric plants powered by fossil fuels (coal and diesel), as well as sources considered renewable (hydroelectric and nuclear energy). Large hydroelectric plants produce most of the electricity consumed in Brazil as a result of the abundance of water resources and the country's tradition of building dams. However, a change in this sector is necessary because of the environmental and social damage caused by large dams. In addition, with ongoing climate change, the risk of severe droughts resulting in a decrease in the country's water resources is great. The transport sector also makes use of renewable fuels such as ethanol. However, the most used power in the sector is fossil fuel based. Around three-quarters of the Brazilian fleet is powered by gasoline and diesel. Due to the country's continental dimensions and its mostly road-based transport sector, a radical change in the transport sector is necessary to guarantee the reduction of GHG emissions in the country. The search for alternative sources of energy in the world is growing worldwide. Likewise, Brazil has also been developing its renewable energy industry.

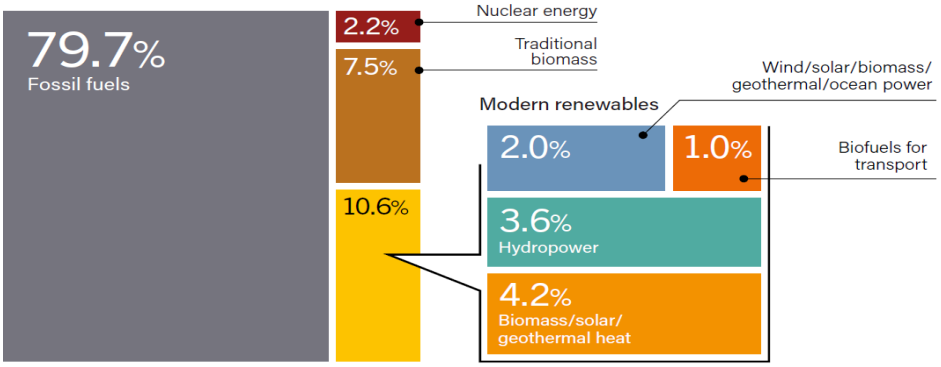
The share of renewable sources in the Brazilian energy sector will be addressed in the following chapter.

CHAPTER 4
RENEWABLES SOURCES IN BRAZIL: STEPS TOWARDS ENERGY TRANSITION

This chapter presents the developments in renewable energy in Brazil. It has three sections dedicated to investigating the country's power generation from the following sources: wind, solar and biomass. Within the last section, ethanol, and biodiesel (first and second generation), biogas, and black liquor will be addressed. Firstly, data on energy consumption source supply by sources is presented in order to clarify the extent to which energy transition is needed worldwide as well as in Brazil.

Climate change evidence is increasing, and therefore, an energy transition from fossil fuels to more intensive use of renewable energy sources is very much needed. Traditional fossil fuels –coal, petroleum, and natural gas– are non-renewable as they have formed over hundreds of millions of years, and their availability is limited. Yet, according to the REN21 report (2019), fossil fuels are the primary energy source in the world and contributed 79,7% of global final energy consumption in 2017 against 20, 3% of the energy generated from renewable sources (Figure 1). In contrast to fossil fuels, renewable energy sources are not depleted when exploited. These sources include hydro, wind, solar, biomass, geothermal, ocean thermal, wave and tidal action, as well as biogas generated of municipal and agriculture waste, and also from manure, sewage, plant material, green, and food waste.

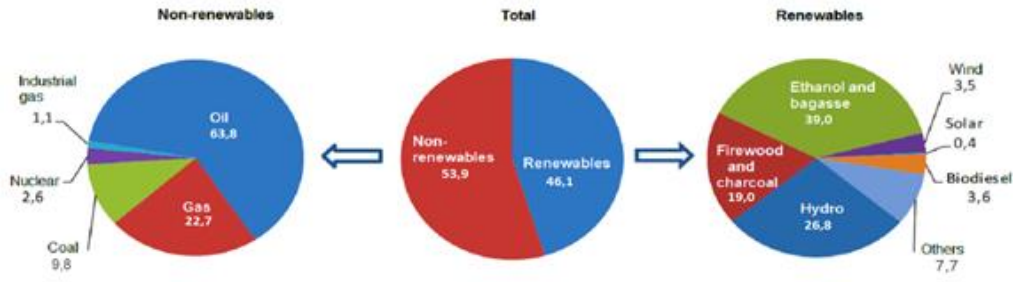
FIGURE 1. Estimated Renewable Share of Total Final Energy Consumption, 2017



Source: REN21 (2019) Based on OECD/IEA and IEA SHC.

Brazil stands out in the international scenario for having the cleanest electricity industry in the world (Abramovay, 2013; Knodt & Piefer, 2015). However, when analysing Brazilian total energy supply (Figure 2),[35] non-renewable sources are still the most used in the country, especially in the transport sector. Data from the National Agency of Petroleum, Natural Gas and Biofuels[36] (2019) show that the contribution rate of ethanol[37] to the country's transport fuel market in 2018 was 18,9% against 76,7% of fossil-based fuel and a small share of 4,4% of biodiesel.

Figure 2 **Brazilian domestic energy supply - 2019 (%)**

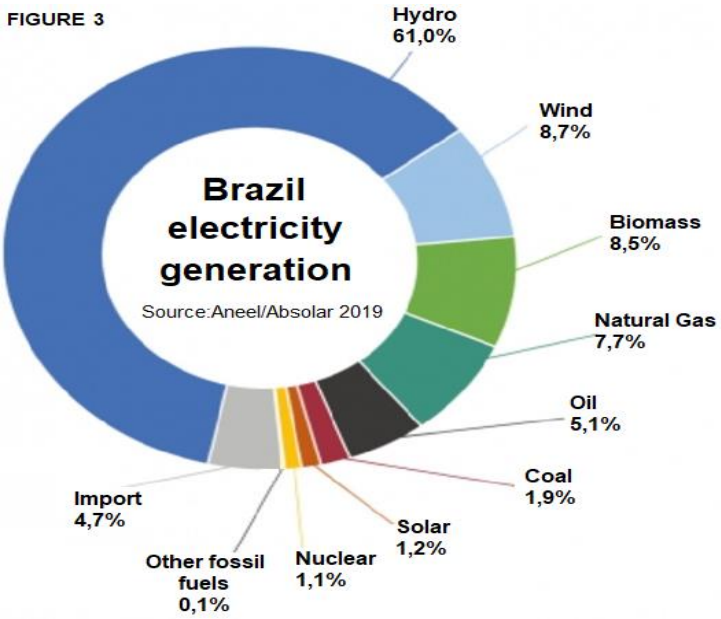


Source: Brazilian Ministry of mine and energy- 2020

[35] Own translation.
[36] ANP in Portuguese.
[37] Ethanol has already been discussed in this study.

Electricity in Brazil is generated from different renewable sources but mostly by hydroelectric plants. The history of hydro energy as the main source of energy has been previously discussed. This section will tackle the most used alternative sources after hydro which are wind, solar and biomass[38] as shown in the chart below (Figure 3).[39]

FIGURE 3



4.1 Wind power: a primarily private sector initiative

Wind energy is the transformation of the wind's motive force into useful energy, as it is the case with the use of aero generators to produce electricity, windmill to produce mechanical energy and sails to propel sailboats. As an alternative to fossil fuels, wind energy is renewable, permanently available worldwide and does not emit GHG, causing less impact on the environment. Wind power has firmly established itself as

[38] In Brazil, biomass is used to generate electricity through combustion processes and as a raw material for the manufacture of fuels such as ethanol and biodiesel, mostly used in the transport sector.

[39] Own adaptation and translation.

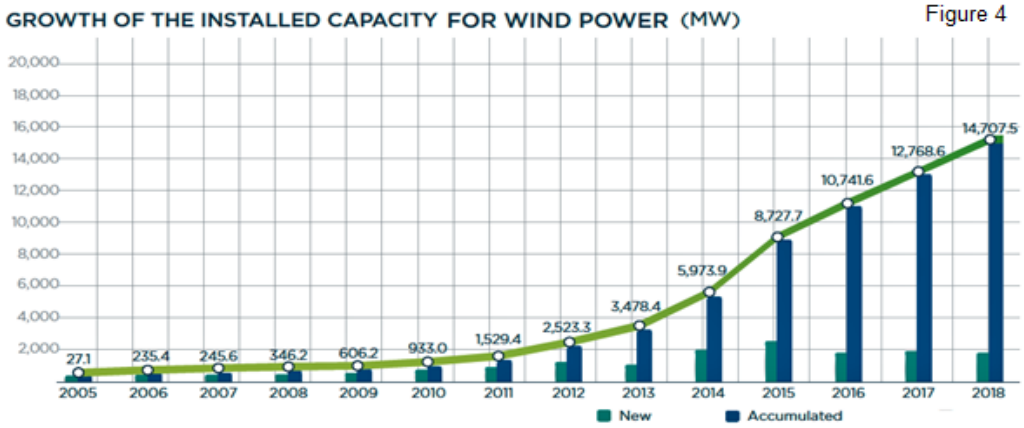
a new option for electric power generation. The extraordinary recent progress is that wind power is the lowest cost option when a new generation is added to the grid in a growing number of markets, and prices continue to fall. Commercial wind power facilities currently exist in more than ninety countries, with a total installed capacity of 591 GW at the end of 2018, providing about 8% of the global electricity supply (Ohlenforst, 2019). Wind energy has the least impact with its implementation, and most importantly, it does not emit CO_2 and can replace other CO_2 emitting sources (ABEEólica, 2019).

The first wind turbine to operate commercially in Brazil was installed in 1992 in Fernando de Noronha, an archipelago located 225 miles (360 km) from the country's northeast coast nearby the Pernambuco state. At that time, the technology was still incipient and needed to be consolidated in both domestic and international markets. Eventually, at the beginning of the 2000s, wind power was already being generated on a large-scale in different countries such as Denmark and Germany, while in Brazil, it was yet as good as non-existent (Diniz, 2018).

Between 2001 and 2002, the Brazilian electricity sector suffered a severe supply crisis that culminated in an electricity rationing plan by the then President Fernando Henrique Cardoso whose successful campaign reduced energy consumption among the population. His effort helped to prevent regular disruptions that could have affected the country's economic growth (Castro, 2014). The crisis has forced the government to execute infrastructure projects to meet the country's increasing energy demand. It also led to creating the Incentive Programme for Alternative Energy Sources PROINFA (Programa de Incentivo às Fontes Alternativas in Portuguese), an incentive programme for alternative energy generation that started in 2002. The programme aimed to foster energy generation development from alternative sources – wind, biomass, and small hydro – and is still in force.

In 2003 Luiz Inácio Lula da Silva from the Worker's Party became president. His government sustained hydropower as part of its developmentalist agenda, and simultaneously, large public support programmes were initiated to insert other alternative energy sources into the supply planning. Proinfa introduced feed-in tariffs[40] which ended in 2008. An auction-based system was introduced instead. In December 2009, the first exclusive auction for wind power contracted 13,000 MW in wind power projects (Bradshaw, 2018). From then on, wind power generation in Brazil begun to expand rapidly, as shown in the chart below.

Figure 4



Source: ANEEL/ABEEólica – Annual Wind Energy Report 2018

In 2012, ABEEólica (Brazilian Wind Energy Association) and Abragel (Brazilian clean energy generation association) joined together and launched the Renewable Energy Certification Programme in order to stimulate renewable energy generation. The project put together experts in certification, market, energy, and sustainability to specify sustainable energy ventures' concepts. Up to now, more than 1,300,000 RECs have been issued in Brazil (ABEEólica, 2019).

[40] A feed-in tariff (FIT) is a policy instrument to foster alternative energy sources' development and use. It guarantees grid access, long-term contracts (commonly between 15 to 20 years), cost-based purchase price, which means that a fraction of the resources and capital used for energy production are compensated.

According to the Brazilian Energy Research Agency (Empresa de Pesquisa Energética in Portuguese), wind power has been evaluated as considerably competitive compared to other technologies that are candidates for expansion. It costs less than thermal and hydro energy; however, wind power offers less contribution to the grid (EPE, 2018).

Abramovay argues that "the predominance of hydroelectric dams poses a risk as this source is susceptible to seasonal droughts" (2013: 7). In Brazil, rainfall does not occur year-round distributively, and with climate change, extended periods of drought are more frequent. Wind power is considered to properly complement the Brazilian hydropower-based energy supply (Bradshaw, 2018). River's lowest outflow periods is when the wind incidence is adequate for power generation. Wind speeds are higher during the dry season when reservoir levels decrease. This feature makes wind energy a suitable alternative to complement hydropower shortage when water deficit occurs (Alves, 2010; Moraes, 2015). On the other hand, the intermittency of wind power (and solar) is an issue of concern (Moraes, 2015; Bradshaw, 2018; Queiroz-Stein, 2019). The intermittent supply capacity of wind energy, which suffers from variations in wind regimes, is a critical issue. One of the main ways to solve this problem is the development of large-scale energy storage systems, which is not available within the current electrical structures (Bradshaw, 2018; Queiros-Stein, 2019).

Uncertainties in de energy policies are also a challenge for wind energy and other alternative sources. Up to 2016, Brazil registered fast economic growth. Growing energy demand required an annual increase of 4.5% in energy supply (Bradshaw, 2018). A drop in commodities' price in 2015 changed the scenario and pushed the country into a recession and consequently decreased energy consumption (Gomes, 2017). Besides, rainfall in 2016 was satisfactory to refill dams' reservoirs. These events led the government to adjust its energy contracting plans. As a result, a reserve energy auction for wind and solar to be held in December 2016, was cancelled by MME with the claim that a drop in

energy demand was expected in the following year (Bradshaw, 2018). Another policy change in the sector was the unprecedented *decontracting* auction held in August 2017 by Electricity Trading Chamber (CCEE- Câmara de Comercialização de Energia Elétrica in Portuguese). The auction allowed previously contracted project to be released from their obligations against the payment of reducing fines (ABEEólica, 2018). Wind, solar and small-generation plants projects eligible to participate in the *decontracting* auction must have Reserve Energy Contracts and have not started testing. In all, twenty-five generation projects took part in the procedure from which sixteen wind farms had their contracts terminated. The energy companies pointed out distinct reasons why their projects did not take off. The most important reason was the rise of the dollar that hindered the purchase of imported equipment.

Large-scale wind generation is predominantly onshore and geographically concentrated in Brazil's Northern and Southern regions, which are, notably, the regions with the greatest potential for this source of energy (EPE, 2018). The five states with the greatest wind energy generation in 2018 were Rio Grande do Norte, Bahia, Piauí, Ceará and Rio Grande do Sul. Wind parks are connected to the national electricity grid through the National Interconnected System (SIN) and in 2018 accounted for 8.60% of total energy supply added to the system (ABEEólica, 2018; Bradshaw, 2018).

In his study, Diniz (2018) analysed 719 wind power plants and found out that 483 of them are exclusively owned by private partners, while the other 236 plants are public-private partnerships. He concluded that most wind generation projects implemented in Brazil during the last decade have been led by the private sector, stressing that the sector's regulatory and Institutional framework has been successful in stimulating private investment.

Up to 2018, BNDES invested 64.4 billion of *reais* (approximately 15.8 billion US dollars). One of the BNDES's requirements to invest in a project is that a certain amount of its funding goes to social projects. According to ABEEólica, the Brazilian wind energy association (2018), most of the time, contracted companies surpass the required percentage and develop much bigger social projects such as digital inclusion activities, oral health and nutrition, training for local workers, encourage tourism, schools, and day-care, et cetera. Opposingly, Frate, Brannstrom, Morais & Caldeira-Pires (2019) show in their study incidence of environmental justice violation in wind farms licensing processes which were granted lacking social-environmental impact evaluation and costs and risks assessment, and without relevant community consultation. Their article draws attention to unreliable municipal reports and simplified licensing processes through which wind farms projects are approved. The authors argue that wind power promoters reckon the overall support for this energy source due to its renewable features and devoid of social-environmental impact. These arguments justify wind farms promotion. Supporters argue that employment and economic activity increase whilst the environment is protected. However, critics state that employment is limited to a few people, tourism does not increase by wind farms, and the environment is negatively affected.

4.2 Solar power: sun-rich but technology poor

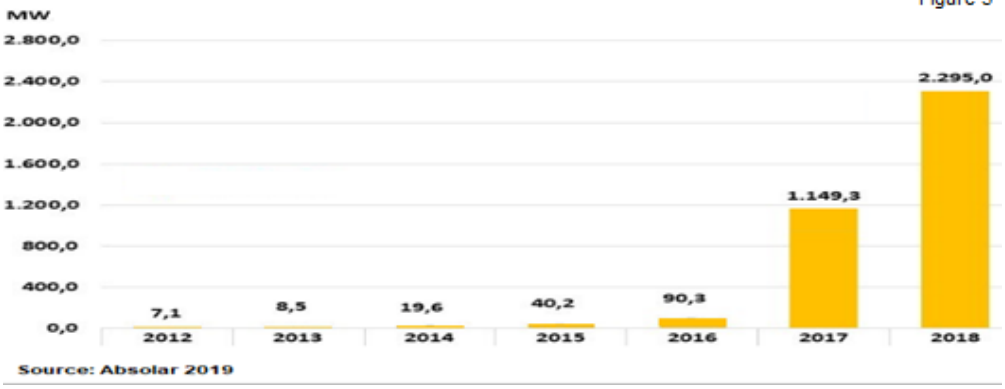
Solar energy is generated through technologies that convert light to electricity (Photovoltaics) and light to energy by heat (solar thermal energy[41]). In the USA in 1954, the first silicon photovoltaic cell was born, which is still one of the main elements of plates that capture solar energy. From there began the modernisation of sun energy capture. Since "Solar One" – a photovoltaic powered residence built-in 1973 by The Institute of Energy Conversion at the University of Delaware (USA) – Solar energy

[41] Solar-thermal technology uses the sun's heat to generate thermal energy, which produces steam. The steam drives a turbine that generates electricity.

for domestic use has grown considerably worldwide, considering that the global solar power installed capacity in 2018 was at least 505 GW in comparison to the 15 GW global capacity in 2008 (REN21, 2019). In Brazil, it was not until 2014 that the first centralised public solar energy purchase took place (MME, 2018b) through energy auctions supervised by The Brazilian Electricity Regulatory Agency (ANEEL- Agência Nacional de Energia Elétrica, in Portuguese). In 2017 Brazilian solar Photovoltaic (PV) capacity jumped considerably compared to previous years and continued to grow in 2018, as shown in the chart below.

Net Brazilian solar PV capacity

Figure 5



Source: Absolar 2019

Despite regular purchase from the federal government in recent years[42] (Figure 6) and a growing number of projects awarded a contract, these measures are still considered by the industry to be insufficient to encourage manufacturing in Brazil (Freire, 2017). It is important to observe that the following chart shows no data for the year 2016. It is because the only auction for reserve energy that would take place that year in December was cancelled, and both wind and solar energy were not contracted. Another event involving both energy sources was the *decontracting* auction already mentioned in the previous section. It was

[42] In 2016 solar source was let out from the first auction with the promise that it would be included in the second one, which was eventually cancelled (Absolar, 2018).

a setback also for the solar industry as it resulted in the contract termination of nine solar photovoltaic projected plants. The contracting discontinuation in 2016 and 2017 represents possible insecurity and risks for the sector in 2019 and 2020 (Sauaia, 2018).

Figure 6 **Evolution of solar PV contract auction in Brazil**

	LER * 2014	1º LER 2015	2º LER 2015	LEN** A-4 2017	LEN A-4 2018	LEN A-4 2019	LEN A-6 2019
Contracted (MW)	543,8	822,6	913,1	556,9	815,0	203,7	530,0
Cumulative contracted (MW)	553,8	1.376,4	2.289,5	2.846,4	3.661,5	3.865,2	4.395,2
Average price (US$/MWh)	88,03	84,29	78,32	44,31	33,25	17,62	20,33

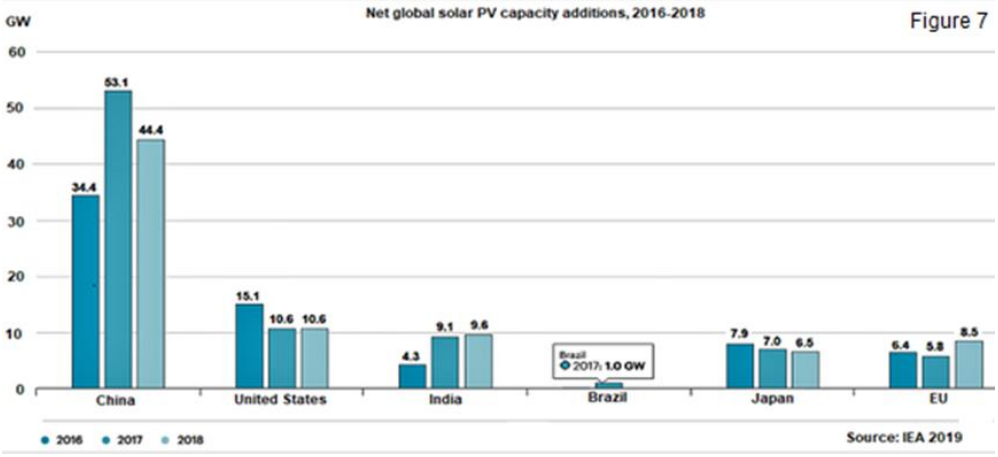
*Reserve energy auction (in Portuguese, LER-Leilão de Energia de Reserva). Contracts energy from both new and existing plants in order to increase security of electricity supply.
**New energy auction (in Portuguese, Leilão de Energia Nova). Contrats energy from plants that will still be built.

Fonte: CCEE/ABSOLAR, 2019.

The Photovoltaic industry in Brazil faces a technological, industrial, and economic gap as the country masters only the extremities of the photovoltaic manufacturing chain, which is to say, the initial stage, which is quartz ore extraction and transformation into metallurgical silicon and the last one which is the assembly of photovoltaic solar panels (Davies, Frisso & Brandão, 2018). The top four manufacturer countries in 2019 are China, Canada, South Korea, and the USA (Colville, 2019). Despite its large quartz reserve, Brazil's domestic PV technology is still dependent on importing foreign technology and components (Camilo, 2018). Like wind energy, intermittency is also a challenge for solar power as its supply variates according to the incidence of light, a problem that could be solved by energy storage systems (ABEEólica, 2018; Bradshaw, 2018).

According to experts, the country faces missed opportunities in developing solar generation due to the lack of investments and projects in the past. Today the sector is chasing advanced technologies, and the industrial process encounters competitiveness problems. The Chinese took the lead and transformed the photovoltaic generation market, with lower equipment prices and large-scale production capacity (Medeiros, 2009; Medeiros, Gagliano & Teixeira, 2012). According to Rodrigo

Sauaia, executive president of the Brazilian Associations of Photovoltaic Solar Energy, Brazil already manufactures all system components. Inverters, structures, and trackers are already quite competitive. However, one of the most important bottlenecks for the national supply chain is the unfair tax burden imposed on domestic manufacturers. The producers buy imported components and pay high taxes on these inputs, which they incorporate into their end products. This strategy makes national products up to 30% more expensive than those made abroad (Sauaia, 2018). These challenges are presented in the solar source's participation in the Brazilian energy supply, which is only 1.2% (Figure 3), and when comparing the net Brazilian solar PV capacity with the other countries as in the following chart (figure 7).



The main challenge for popularising solar power generation is its price. The reason for the high cost is the market dependence on imported photovoltaic plates and components as well as the installation of the system that must be done by specialised companies (Gobbo, Silva & Bone, 2019).

The resources for the purchase and installation of the equipment are troublesome for most middle and low-income populations. As a funding

alternative for the purchase of solar power systems, is there a bill discussed in the Federal Senate that makes it possible to use the Severance Premium Reserve Fund (FGTS, Fundo de Garantia por Tempo de Serviço, in Portuguese).

Launched in 2002, the Programme of Incentives for Alternative Energy in Electricity (Proinfa) favoured wind, biomass, and small hydro with the feed-in tariff policy letting out solar energy. Photovoltaic solar energy can be generated by large power plants connected to the National Interconnected System, consisting of an extensive grid of transmission lines or by distributed generation. As solar technologies became less expensive worldwide, in 2012, the Brazilian Electricity Regulatory Agency (ANEEL) introduced net-metering regulations to facilitate distributed access,[43] micro[44] and mini[45] power generation to electricity distribution and compensation systems. The net metering regulation also applies to wind, biomass, and hydropower (ANEEL, 2012), but it was primarily formulated to foster solar power generation (Bradshaw, 2018).

Another obstacle to the expansion of photovoltaic systems is the lack of skilled professionals. There is a strong concern about the need for a workforce qualified according to international standards, a requirement that reflects on the quality of the projects undertaken. Experienced workers in photovoltaic technology are not available in all markets or geographic areas of the country, and there is a high demand for more skilled professionals in the sector (Neto, Sauaia & Koloszuk, 2019). Seeking to solve the problem, Absolar leads a proposal to create a seal or certification of quality and technical competence, in conjunction with the

[43] Distributed generation in Brazil is based on the net metering model, in which the generating consumer receives a credit to his account for the positive balance of energy generated and inserted in the grid after deducting his own consumption. The available power grid is used as backup when the locally generated power is not enough.

[44] Central geradora de energia elétrica com potência instalada menor ou igual a 75 kW.

[45] Central geradora de energia elétrica, com potência instalada superior a 75 kW e menor ou igual a 5MW.

Brazilian association of the electrical and electronic industry (Abinee),[46] Brazilian Distributed Generation Association (ABGD)[47], the German International Cooperation Agency (GIZ),[48] Brazilian national industrial apprenticeship service (Senai),[49] and of higher education institutions (Neves, 2019). However, Neto, Zago, Silva, Moreira & Lopes (2019) show that from the 278 of Brazilian universities analysed in their study, 43.8% do not offer courses in renewable energy and in their electrical engineering graduation courses. The average workload destined to the subject is only 2.02% at the institutions, including renewable energy in their graduate programmes. In addition, most of the renewable energy courses offered in electrical engineering graduation in the Brazilian university are non-compulsory, which means they are optional for their engineering students, demonstrating a lack of commitment to the field's professional qualification.

4.3 Biomass: a highly available power

Biomass is any solid, liquid, or gaseous, both vegetal and animal-based substances used to generate energy, mostly referred to as bioenergy. Examples of raw materials biomass are agricultural crops and their residues, forest waste, organic by-products (livestock and wood processing effluent), municipal solid waste, vegetable oil and animal fats waste. Biomass is used as feedstock to produce fuels, electricity, and heat. Biomass energy can be generated through the combustion of dry biomass or its gasification as well as through the capture of biogas (methane) by controlled anaerobic digestion.

Brazil has one of the world's largest agricultural commodities productions and has, therefore, a great biomass power potential both for

[46] Associação Brasileira da Industria Elétrica e Eletrônica in Portuguese.
[47] Associação Brasileira de Geração Distribuida in Portuguese.
[48] Deutsche Gesellschaft für Internationale Zusammenarbeit in German.
[49] Serviço Nacional de Aprendizagem Industrial in Portuguese.

solid biomass – used as fuel in thermoelectric plant – as well as for residual biomass from agriculture to produce second-generation (2G) ethanol and biogas. The country's high biomass availability attests to the feasibility of 2G fuel production adding value to the first generation (1G) fuel productive chain and, as a result, diversifying Brazil's energy supply. Yet, the lack of long-term public policies has been delaying expanding the use of this renewable source in the energy sector (Lopes, Martins & Miranda, 2019). Another barrier for commercial-scale production of 2G biofuels is the technological boundaries that increase production, making industrial plants economically unfeasible (Vidal, 2019). Eventually, this scenario is improving as in 2017, the then President Michel Temer sanctioned Law no. 13,576, establishing the national biofuels policy known as RenovaBio. In discussion since mid-2016, the programme proposal was launched by the Ministry of Mines and Energy (MME) on December 26, together with the Ministry of Agriculture and several representatives of the sugar-energy sector (Lorenzi & Andrade, 2019).

RenovaBio's main goals are: 1) increase the production of biofuels (with emphasis on ethanol and biodiesel); 2) guarantee a long-term market in order to ensure reliable energy supply; 3) reduce greenhouse gas emissions (GHGs) to meet targets established in Brazil's Intended Nationally Determined Contribution (iNDC) proposed at the United Nations Conference on Climate Change, COP-21 in Paris in 2015 (Câmara dos Deputados Federais, 2017).

Before RenovaBio, the government launched in February 2017 the Brazil fuel Programme introduced by MME to attract foreign investments to the oil refining sector in Brazil. Even though the MME's rapport on the Brazil fuel programme mentions biofuels several times, it only tackles crude oil and its derivatives. Issues involving bioethanol is not discussed throughout the rapport. Petrobras, a clear beneficiary of the Brazil fuel Programme, criticised the RenovaBio plans through a public consultation claiming that the guidelines of the two programmes would not be aligned

and therefore would create uncertainty, which in turn, would reduce the attractiveness for investments in the fuel industry in Brazil as a whole, whether in the production of biofuels, in oil refining and in supply infrastructure (Petrobras, 2017). Lorenzi & Andrade (2019) argue that from a theoretical point of view, there is a clear conflict of interest since the RenovaBio programme – as it is currently formulated – creates a dispute between the sugar and ethanol industry and the fossil fuel sector, especially between ethanol plants and Petrobras. Furthermore, the authors also claim that these stakeholders collide in the search for sustainable solutions regarding the Brazilian environmental and energy supply issues once Petrobras advocates for preserving the current dynamics while the sugar-ethanol sector insists on the need for new incentives to the iNDC goals.

Despite the inconsistency regarding biomass power policies, development and production, this source of energy occupies first place in the Brazilian total energy supply, accounting for 61.6% of a total of 46.3 of all renewable energy production (see figure 2) and third place in the country's electricity generation grid, representing 8.5% of the country's electricity production, only behind hydro and wind energy generation which accounts for 61.0% and 8.7%, respectively (see figure 3). The participation of biomass in the Brazilian electricity grid is still below its potential, but it is believed that it will expand in the future (Marafon et al., 2016).

Biomass use listed in the chart below account mostly for electricity generation for private use, that is, not intended for the public sector, since the analyses of the energy destination data from a total of 573 plants (see chart below), shows that none of them is listed as PS or Public Service provider (SP in Portuguese). Except for 1G ethanol, biomass power is mostly used within the private industry sector.

Figure 8

Brazilian biomass power generation capacity								
Biomass		Installed capacity		*Energy destination				
		Qty	(KW)	ESP	IEP	GPR	GPR-NR482	PS
Forest	Biogas + Fuelwood	1	5.000,00	0	1	0	0	0
	BFG** + Biomaas	12	127.705,05	3	2	7	0	0
	Firewood	7	82.215,00	4	0	3	0	0
	Forestry waste	60	473.317,00	9	12	39	0	0
	Black liquor	18	2.538.634,00	10	6	2	0	0
	Charcoal	8	48.197,00	1	2	5	0	0
Subtotal		106	3.275.068,05	27	23	56	0	0
Municipal solid waste	Biogas + MSW	21	171.588,60	0	10	11	0	0
(MSW)	Charcoal + MSW	3	8.250,00	0	0	3	0	0
	MSW	1	4.278,00	0	0	1	0	0
Subtotal		25	184.116,60	0	10	15	0	0
Animal waste (AW)	AW + Biogas	14	4.481,20	0	0	14	0	0
Subtotal		14	4.481,20	0	0	14	0	0
Liquid biofuels	Ethanol	1	320,00	0	0	1	0	0
	Vegetable oil	2	4.350,40	0	0	2	0	0
Subtotal		3	4.670,40	0	0	3	0	0
Agroindustrial	Sugarcane bagasse**	407	11.669.341,20	79	211	114	0	0
	Rice Husk	13	53.333,00	1	4	8	0	0
	Biogas + AGW****	3	10.974,00	0	1	2	0	0
	Elephant grass	2	31.700,00	0	1	1	0	0
Subtotal		425	11.762.624,20	80	217	125	0	0
Total		573	15.233.684,45	107	250	213	*****	0
Destination percentage				18,8	43,8	37,4	0	0

* ESP - Electricity self-producers
IEP - Independent electricity producers
GPR - Generating plant registration
GPR-NR482 - Registered by Normative Resolution no. 482 of 2012, by Aneel.
PS - Public service providers for electricity generation. Source: IBGE 2015

** Blast Furnace Gas
*** Two plants with combine destination type: APE/PIE and APE/REG and a third one is undentified.
**** Agricultural waste
***** The plants with combined destination type and the undentified one has not been included in this sum.

Source: Aneel's generation information system (SIGA in Portuguese), 2020.

It is important to notice that the national power supply and electricity production charts published in 2019 by MME and ANEEL/Absolar, respectively, represent biomass contribution to Brazil's diversified electricity grid not only as a public good but also as fuel since many firms

use it in their attempt to implement off-grid solutions. Thus, biomass power participation in the SIN does not occur through governmental public service provision; instead, enterprises are given tax, financial and credit incentives to generate biomass energy. Electricity Self-Producers (ESP) –which represent 18,6 of all plants – seek to meet their own demand with the possibility of selling their power surplus to energy distribution companies upon authorisation from ANEEL; whereas Independent Electricity Producers (IEP) have the commercialisation of energy as their main goal – upon previous authorisation – while meeting their own demand is optional (IBGE, 2016). This group accounts for 43.8% of the Brazilian biomass power generation. The GPR category is responsible for 37.6 of the production. Generating Plant Registration (GPR) is granted to small plants (with power generation capacity up to 5 MW) with no need for authorisation or concession from the regulatory agencies to operate. The other two categories (GPR-NR482 and PS) have no representatives, according to SIGA 2020. REG – RN482 are plants registered by ANEEL's Normative Resolution n. 482, of April 17, 2012, with a generation capacity of up to 1 MW which are considered mini-generators or micro-generators allowed to connect to the distribution network to inject their surpluses and, thus, be financially compensated by the distribution concessionaire. The PS category is public service providers (SP in Portuguese) for electricity generation.

4.3.1 Ethanol of first and second generation

The most common biomass-based source of energy is ethanol which is classified into two sorts, namely, first and second generation ethanol. First generation (1G) ethanol is produced from vegetable oils and sugars from edible crops such as corn and sugarcane and therefore compete with the food industry. Second generation (2G) ethanol – also known as cellulosic ethanol[50]– is produced from non-food feedstock, which is mostly by-products and waste from agriculture. First and second

[50] 2G ethanol is extracted from lignocellulosic fibres of a vegetable. In the case of sugarcane, it is obtained from straw and bagasse after extracting the juice.

generation ethanol have the same physical and chemical properties. What differs is the raw material used and the production process. Traditional ethanol (1G) is produced from sugarcane juice or molasses, corn, sugar beet, et cetera, whereas 2G ethanol is made from sugars extracted from the plant's cellulose, present in straw and sugarcane bagasse, sorghum, wood, to name a few sources.

Brazil is the second-largest producer of sugar cane 1G ethanol, behind the USA with their corn ethanol. In Brazil, first generation ethanol is produced from the juice resulting from the crushing of sugar cane which is mostly used in the transport sector. First generation ethanol production in Brazil has already been broadly discussed. This section will only tackle the country's 2G ethanol industry among other biomass-derived fuel, namely biodiesel, biogas, and black liquor.

4.3.1.1 Second generation ethanol (Bioethanol)

Also known as 2G ethanol, 2GE or bioethanol, second generation ethanol in Brazil is made from the waste resulting from ethanol and sugar production, such as straw and bagasse, which can be reused to generate electricity and more ethanol (2G). The bioconversion of lignocellulosic material into bioethanol is difficult not only because of the cost of raw material collection and storage but also due to the biomass breakdown processes, which results in a great diversity of sugars. Furthermore, the application of these physical-chemical processes requires a large amount of funding (Lima Luz, Kaminski, Kozak & Ndiaye, 2009). However, second generation ethanol has been developed systemically in Brazil since 2010, involving the government, private national and foreign firms, and research institutions (Senna & Ansanelli, 2016). Studies with several semi-perennial grass types such as elephant grass, energy cane and sorghum used as energy crops have been conducted in several countries. The results show that such plants differ in terms of production potential, physical-chemical biomass properties, environmental management demand. Laboratory and pilot-scale studies have also found the potential

of elephant grass for the production of cellulosic or second generation ethanol (Marafon et al., 2016). Recent research by the Federal University of Parana and Mato Grosso states has demonstrated the potential of avocado kernels for bioethanol production (Kowalski, Schneider, Moretto, Cardoso & Gomes, 2018).

The RenovaBio programme is not the first initiative intended to foster biofuels production in Brazil. In 2011, BNDES, in collaboration with FINEP (Financiadora de Estudos e Projetos in Portuguese), launched the Innovation Support Plan for the Sugar-Energy Sectors (PAISS in Portuguese). This initiative stimulated the construction of the GranBio and Raízen plants, and the CTC (Centro de Tecnologia Canavieira in Portuguese) and Odebrecht Agro-industrial research centres which started their research and development programmes and a commercial scale 2G ethanol production. The expectation was that 2G ethanol would be introduced in the national energy matrix and revolutionise the sugar-energy sector. The prediction was that more than a dozen 2G ethanol plants would be operating by 2025. Despite the two plants built for commercial-scale production and a pilot plant of CTC, seven years after the launch of PAISS, none of the goals or expectations was met. This is due to a series of problems, especially in the pre-treatment phase,[51] which caused major plant shutdowns, in addition to an annual production below 10% of capacity since the start of operations (Lorenzi & Andrade, 2019).

4.3.2 Biodiesel of first and second generation

To produce biodiesel, different raw materials are used. First generation biodiesel is produced from natural oils (soybeans, peanuts, palm, canola, sunflower, algae), while second generation biodiesel is made from non-food-based biomass such as animal fat, industrial residues, and recycled oils (DIRUR/IPEA, 2019).

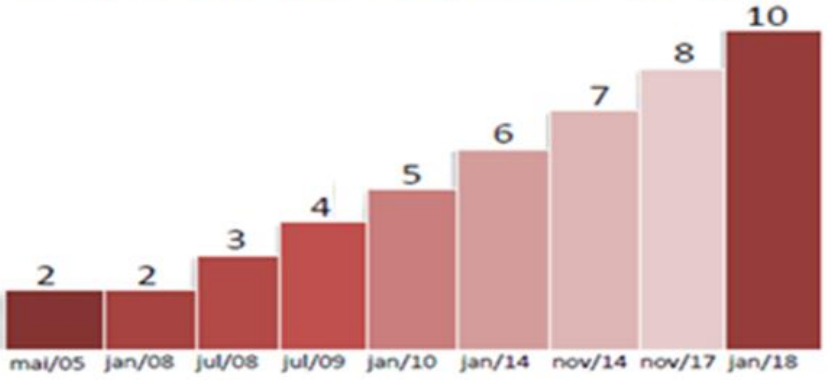
[51] Biomass (bagasse or straw) needs to be physically or chemically cleaned into their fibres to be exposed; this process is called pre-treatment.

Just as in the case of ethanol, the first generation biodiesel industry also suffers the dilemma of using food raw materials for its production. In order to solve this problem, Brazilian researchers have been working on alternative feedstock such as macauba coconut oil, castor beans and algae which have been proven to be suitable for the production of second generation biodiesel (Langer, Silva, Teixeira & Souza, 2018). In fact, initiatives to foster biodiesel manufacture and consumption in Brazil started in 2004 when the National Programme for the Production and Use of Biodiesel (PNPB in Portuguese) was launched. The programme is the roots for strengthening the biodiesel industry in Brazil (Vidal, 2018). Its main goal was to increase biodiesel production and use sustainably and contribute to social inclusion. In order to meet the objectives of the PNPB, the government created different instruments such as the Financial Support Programme for Investments in Biodiesel and tax reduction, which were adjusted according to the producer's profile, the origin of the production (by region) and the type of raw material. Priority should be given to family farming, the North and Northeast regions and castor beans as raw material.

The government implemented other measures to support the PNPB. A Social Fuel Seal was granted to biodiesel producers that prove to acquire a pre-determined percentage of raw material from family farmers for biodiesel production. Seal owners are eligible to participate in auctions to sell their products to the National Petroleum Agency (ANP in Portuguese), benefit from differentiated social contributions collection and enjoy better financing conditions from the public development bank. In addition, biodiesel was officially introduced in the Brazilian energy supply through Law 11,097 of January 13, 2005, which set the mandatory minimum percentage of 2% of biodiesel to diesel sold to the final consumer for the entire national territory. This share grew throughout the following years up to 10% in 2018, as the chart below demonstrates:

Figure 9

Evolution of the blend of biodiesel to diesel (%)



Source: Adapted from Vidal (2019); ANP (2019).

The primary feedstock used to produce biodiesel in Brazil was soybeans. Despite the governmental efforts to foster biodiesel production from different raw material, soybeans remain on top, as shown in the chart below.

Raw material used in the production of biodiesel (B100) in Brazil (m3) Figure 10

Raw matererial	2013	2014	2015	2016	2017	(%)
Soy oil	2.231.464	2.625.558	3.061.027	3.020.819	3.072.446	71,6
Cotton oil	64.359	76.792	78.840	39.628	12.426	0,3
Animal fat (1)	578.427	675.861	738.920	622.311	720.935	16,8
Other fatty materials (2)	46.756	37.255	60.086	134.297	483.544	11,3
TOTAL	2.921.006	3.415.466	3.938.873	3.817.055	4.289.351	100,0

Source: Translated from Vidal (2019); ANP (2018).

(1) Includes beef fat, chicken fat and pork fat;

(2) Includes palm oil, peanut oil, turnip oil, sunflower oil, castor oil, sesame oil, used frying oil and other fatty materials.

Furthermore, the endeavour to extend biodiesel manufacture to less developed areas and small farmers has failed. Biodiesel production concentrated in the Midwest and South of the country. According to Vidal (2019), in 2014, 85% of farmers who supplied raw materials for

biodiesel production were from the south and only 7% from the country's Northeast. This was because family farming in that region was unable to produce enough castor oil to meet the demand caused by the increasing percentages for the mandatory blend of biodiesel to diesel. Sampaio & Bonacelli (2018) state that the PNPB opened the biodiesel market for soy agribusiness just like Proálcool expanded the market for sugarcane agro-industries.

4.3.3 Biogas: a non-finite energy source

Natural gas or methane is a type of fossil fuel derived from fossil remains of organic material that lies buried deep in the ground for thousands of millions of years, while biomethane or biogas is considered a green source of energy even though it is chemically identical to natural gas. The difference that makes biogas a green alternative is that it is not finite. Biogas is produced by biological processes of anaerobic digestion of organic material from agricultural and industrial residues, as well as municipal waste. Public and private sectors around the world have been investing in anaerobic digesters to increase renewable energy production.

Anaerobic digestion plants work at low temperatures allowing micro-organisms to digest the raw material in a controlled reactor in the absence of oxygen to produce biogas. In Brazil, different biomass types are used to generate biogas. According to the Brazilian Energy Research Agency (EPE, 2018), the types of biomasses most useful to produce biogas through bio digestion are liquid or pasty, such as vinasse and filter cake from the sugar-ethanol industry, residues from agro-industry and confined livestock, solid urban waste, sludge from sewage treatment and winery waste. With lower yield but still considered useful, the alternatives are bagasse and straw (from cane, soy, and corn), agricultural residues (wood, beans, peanuts, cassava, cocoa, and coconut), husks from rice and coffee. A diverse range of biomass can be used for the production of biogas. In the Brazilian scenario, biogas

production is more substantial in the municipal solid waste management and sugar-ethanol industry, and therefore the focus of this section.

4.3.3.1 Biogas from Municipal Solid Waste

In landfill sites, anaerobic digestion occurs when organic waste decomposes. This naturally occurring biological process produces what is known as landfill gas which can be tapped to generate energy. Instead of going to dumps and other destinations without proper use, solid waste can be converted into energy which is fundamental to alleviate global warming and groundwater contamination. Currently, biogas production from municipal solid waste (MSW) management in Brazil accounts for an energy potential of 171.588,60 kW generated by twenty-one plants from nine different member states of the federation (SIGA, 2020). This figure is a modest fraction of the country's MSW energy potential, which is estimated to be around 7GW (Santos et al., 2019).

According to a study on landfills conducted by the Brazilian Association of Public Cleaning and Special Waste (ABRELPE) in partnership with the Brazilian Biogas Association (Abiogas), Brazil dumped more than 42 million tons of solid waste into landfills in 2018. The organisations estimate that Brazil captured 4.2 billion Nm^3 of biogas. However, only 9% of this potential was used for electricity generation (751 GWh), and another 2% produced 35 million Nm^3 of biomethane. Researchers state that if all the organic matter generated in 2018 had been destined for landfills, the country's potential could supply forty-nine million homes.

Law Nr. 12,305/10 which instituted the National Policy for Solid Waste (PRNS in Portuguese) seeks to organise how the country deals with waste, demanding transparency in waste management from public and private sectors. The policy's goal is to encourage environmental development and business management to improve production and the reuse of solid waste, including recovery and energy use (Mendonça & Bornia, 2019). Moreover, the Brazilian government's endeavour to

mitigate open dumps is likely to increase the country's number of landfills. As a result, the energy potential of the source will grow. This scenario offers a great opportunity to minimise landfills' environmental impacts and their GHG emissions (Santos et al., 2019).

4.3.3.2 Biogas from sugar and ethanol industry

The Brazilian sugar-energy sector is self-sufficient in the production of electricity (Ramos & Nachiluk, 2017). Thermoelectric units in the sector are driven by the burning of sugarcane bagasse for electricity production. Currently, biogas production from the sugar-ethanol industry in Brazil represents an energy potential of 10.974,00 kW generated by three plants from three different member states of the federation (SIGA, 2020). In addition to burning bagasse, the sector has invested in biogas generated from anaerobic digestion of bagasse, vinasse, and sugarcane straw. Biogas is rich in methane, which has a calorific value that is similar to that of natural gas and therefore suitable for aero-derivative gas turbines and electricity generators. Despite this enormous potential, biogas has a modest presence in the national energy grid. However, according to the Decennial Energy Expansion Plan 2027[52] (MME/EPE, 2018) it is estimated that the cane harvest will grow at a rate of 2.8% per year until 2027, increasing the percentage of cane destined for ethanol from 55% in 2017 to 60% in 2027, an increase due to the greater demand for biofuel. As a result, there will be a growth in the amount of waste that can be used for biogas production. Considering that all vinasse and filter cake resulting from the ethanol industry will be destined for bio-digestion, biogas potential will reach 7.2 billion Nm^3 in 2027. This percentage represents the production of 3.9 billion Nm^3 of biomethane.

Biogas can be consumed directly or processed into biomethane by r*emoving* unwanted components such as CO_2 and H_2S. Biomethane has

[52] It is important to note that it is the first time that PDE 2027 explicitly supports biogas as a possible candidate for expanding the National Interconnected System – SIN (MME/EPE, 2018).

several uses, such as electrical generation, injection into natural gas networks, and biofuel for light, medium or heavy vehicles (EPE, 2018). Biomethane has the same uses as biogas, with the advantage that it can be transported for more distant use.

4.3.5 Black liquor: the fuel of the pulp and paper industry

Black liquor is a liquid waste with significant energy potential, obtained as a by-product in the paper and cellulose industry. After cooking the wood, a digestion process takes place, which turns the wood into cellulose paste. The leaching that occurs in this process results in a dark coloured liquid (black liquor) which is used as a fuel to generate energy for the pulp and paper mills.

Currently, black liquor represents an energy potential of 2.538.634,00 kW generated by 18 plants from ten different Brazilian member states of the federation (SIGA, 2020). According to the Food and Agriculture Organization of the United Nations in 2018, Brazil was the second major producer and the first major exporter of pulp for paper accounting for 11% and 24% of global rates, respectively (FAO, 2019). Unlike what happens with paper production, which grew only 0.8% per year between 2010 and 2018, the pulp industry has been growing at an accelerated rate (5.1% per year, on average, in the same period). The competitiveness of the national product ensured its good position in the global market.

Pulp production is more energy-intensive than paper production. The growth in pulp production increases the energy consumption of the pulp and paper segment and also of the industry as a whole. However, there were gains in energy efficiency due to improvements in the production process over the years. In addition, new and more efficient plants went into operation. According to the Energy Efficiency Atlas of the Brazilian Energy Research Office (EPE, 2019), in 2018, 86% of the paper and pulp industry's energy demand was driven by renewable energy, mainly black

liquor and wood waste chips. The document also shows that paper production in non-integrated mills uses a less renewable energy mix – as it does not have renewable by-products from the pulp industry process – and a greater share of electricity. Consortia between pulp and paper production contributed to the increase participation of black liquor in the industry's power grid. Besides, part of the fuel oil was replaced by natural gas and wood chips.

Brazil has an international reputation for its clean energy matrix. This reputation is due to the strong contribution of hydroelectric energy to the national electricity grid. With the growing consensus that large dams are not as clean as initially thought, the country's reputation is threatened. Methane emissions from large wetlands for the construction of reservoirs and other environmental and social damage demystify large dams' environmentally friendly nature. Despite the dam tradition of the Brazilian electrical sector, the Brazilian government developed a range of policies that allowed the country's renewable energy industry into the national energy grid. The wind sector, in particular, has achieved considerable space in the Brazilian energy market. The photovoltaic energy sector was also well received in the market, although its use is greater in the private sector. In addition to these two renewable energy sources, the transportation sector has also been increasing its variety of renewable fuels with the production of second generation biofuels, biogas from solid waste and black liquor, a fuel resulting from the cellulose industry. Brazil's energy sector is formed by a variety of energy sources, which is a good premise to lead the country to an energy transition. However, it is necessary that more robust public policies are developed and implemented so that the country can fulfil its commitments made to the international community to help and contain global warming.

CHAPTER 5
POWER RELATIONS AND INDIVIDUAL BEHAVIOUR: INFLUENCES ON ENERGY POLICYMAKING

Barbier (2013) argues that it is evidently challenging to overcome the different policy, market and institutional flaws that cause global warming and climate change. According to the author, this incompliance can be explained by the likelihood of most social institutions being hard to change. In earlier work, Barbier (2011) describes this inflexibility as 'institutional inertia', what North (1990) called 'institutional path dependence'. The Brazilian energy model has been institutionalised on an administrative, technical, and cultural level due to repetitive decision making throughout history. Path dependence, reinforced by positive returns of institutional arrangements established over time, has led the Brazilian energy sector to a lock-in and, therefore, not easily open to innovative initiatives (Ferraço, 2016). Brazil has great potential for generating renewable energy, yet its institutional apparatus is struggling to put this transition into practice. For this transition to occur, a great amount of financial resources is required, together with a strong political will. The allocation of state resources is the core around which all political relations take place. The distribution of public wealth occurs under a great deal of pressure from political and economic power relations. These power relations occur in all economic sectors and not differently in the energy sector.

Brazil has a reputation as a clean energy producer (Knodt & Piefer, 2015) because its power grid that is mainly supplied by hydro power generation. However, this source is explored through the installation of large hydroelectric plants that have great social and environmental

impacts as discussed in section 3.1. As shown in the chart in page 79 , the use of wind and solar energy has grown considerably in recent decades. However, a greater use of these sources is needed to improve the quality of the country's matrix, by limiting not only the emissions but also large dams' social and environmental impacts. Regarding the Brazilian energy matrix, there is much to be improved, especially in the transport sector, which is largely by road and therefore still requires a huge consumption of fossil fuels (ANP, 2019). This reality has been kept unchanged due to power relations strategies which maintain energy policies in the same direction. These strategies prevent the significant energy transition necessary to contain the effects of greenhouse gas emissions and hinder Brazil's effort to contribute to international climate agreements.

The energy sector requires an enormous amount of public resources to operate and therefore is a fertile environment for power relations to occur. State agents and private stakeholders relate to each other in order to guarantee their power and profit that the energy sector has to offer, which is not little. For this purpose, a variety of power relations strategies are applied. Energy policymaking is defined by stakeholders that have the ability to stay on top of these power relations.

Another important aspect that is decisive for energy policymaking – or any other policy-making process – is policymakers' individual behaviour. While power relations strategies are put into practice in a group setting and therefore, have a greater chance of being conscious, individual behaviour tends to be unconscious, which often makes it difficult to be perceived and corrected. As previously discussed, behavioural economy highlights that individuals make decision grounded in habits, preconception, simplified practical rules, and personal experiences. It also indicates that people make decisions too fast and have problems tuning short- and long-term interests. Furthermore, this strand of thinking claims that actors are highly influenced by emotional factors and the choices of those they socialise with.

Behavioural economics theory provides an array of concepts that can be applied in a numerous environment in order to understand policymaking. Certain behaviours in policymaking for the Brazilian energy sector can be explained by the selected behavioural economics concepts presented in chapter one.

This chapter presents empirical evidence found through a literature review and interviews that were conducted during this research. The chapter is divided into two parts: the first one presents evidence of how the power relations strategies implicate in the policymaking for the Brazilian energy sector. The second part shows how policymakers' behaviour influences energy governance in Brazil.

Brazil has been having challenging times. President Dilma Rousseff's second term in office (2011-2016), her impeachment and her succession by her vice president already signalled a period of economic instability and therefore policies towards an energy transition have been delayed. Under the government of President Jair Bolsonaro, the challenges increased even more. "His term in office has been disastrous for science, the environment, the people of Brazil and the world" (Nature, 2022 para.2). Due to Bolsonaro' policies, actions and discourse, Brazil has become a Global Pariah (Rubens Recupero[53] in interview to Carrança, 2002). Journalist Reinaldo Azevedo[54] states that "the Bolsonaro government is so absurd and does not know the concept of verisimilitude. Someone would say: this is unbelievable, do not put it in your column, no one will believe it" (2022, 30:20). Some evidence presented in this chapter may be perceived as unbelievable and even anecdotal, but it does represent the exceptional times experienced in Brazil during Bolsonaro's presidency.

[53] Brazilian professor, lawyer, diplomat, and writer. He was Minister of Finance, Environment and Articulation of Actions in the Legal Amazon (1992-1995). Secretary General of the United Nations Conference on Trade and Development (1995-2004).

[54] Brazilian political journalist, broadcaster, and writer. Currently, Azevedo is a columnist for the *Folha de São Paulo* newspaper.

5.1 Power relations strategies in the Brazilian energy sector

In a young democracy, as is the case of Brazil, transfer of public resources commonly occurs through power relations strategies. In different forms, these strategies are great instruments for forming political and economic monopolies which infringe capitalist justice (Velásquez, 2013). Monopolistic practices foster clientelism and rent-seeking, with the capture of the state as a result. When politicians rule on behalf of incumbent enterprises to the detriment their constituents, the capture of policymaking is occurring (Oxfam, 2014 and 2018; Beke, 2018). This kind of power relations strategies are used to define the outcomes of public policies in many economic sectors and benefit respective elites. These phenomena are also observed in the Brazilian energy sector.

This section will address these power relations strategies in the following subsections: monopolistic practices despite de law; clientelism; a usual strategy; and political capture shaping policymaking. Bossism, patronage, pork barrel, vote-buying, bid-rigging, rent-seeking, crony capitalism are also types of power relations strategies. These concepts will be mentioned disorderly throughout the subsections as they occur intertwiningly. In an attempt to verify the extent to which these strategies alter the Brazilian energy sector's policy outcomes, empirical evidence in which these tactics appear will be provided, sometimes concurrently and even perceived as equivalent.

5.1.1 Monopolistic practices despite the law

For almost five decades, the Brazilian oil industry has been a monopoly of the State exercised by Petrobras since its creation in 1953. With the administrative reforms of the 1990s and policies strongly based on privatisations of Fernando Henrique Cardoso's government (1995-2003), Petrobras adopted a strategy of gradually opening up to private firms into the market as well as partnerships between the state company

and private enterprises. Nowadays, the Brazilian oil sector is an open-marked model with Petrobras as the main power holder. Concerning the exploration of the pre-salt oil reserves and politicians' willingness to make good use of them, Rufin (2012), as if predicting the future, highlighted the challenges that the sector would have to face. The author draws attention to Brazil's highly fragmented parliament, where well-intentioned parties compete with many others that are mere "patronage machines" formed by old-school politicians who negotiate their parliamentary votes for their own profit and interests. This kind of politicians' switches parties according to more profitable rent-seeking opportunities. Furthermore, the author argues that such an environment allows technocrats and high-level bureaucrats to control a great deal of public resources, which are very attractive to private-sector executives eager to gain or maintain monopolistic license to exploit these resources. This scenario has traditionally contributed to marked dominance by favoured enterprises.

> Executive-legislative collusion has left policymaking in Brazil subject to strong influence from organised interest groups. For example, successive presidents appointed political cronies to key directorships in the oil giant Petrobras so that they could award contracts to well-connected companies in exchange for bribes (Mello & Spektor, 2018: 120).

The State wants to profit from the country's oil reserves, and most private companies will do what it takes to have a share of these resources. With such powerful interests at stake, the explorations of the pre-salt reserves are certain now and, in the future, even if it is opposed to the Brazilian iNDC, which proposes a considerable reduction in the country's carbon emissions. In this respect Larissa Araujo Rodrigues[55] says:

> The private sector is dictating the rules in the energy sector. Although Petrobras is a state-owned company, half of it belongs to private capital.

[55] Portfolio Manager at *Instituto Escolhas* of sustainable development.

> Petrobras has grown and invested a lot in technologies and its professionals. The company will not stop its activities because it has an especially important role, in numbers, in people, in the economy. The government will not renounce what Petrobras represents for the country (interview with author, July 2020).

The Brazilian constitution forbids the formation of monopoly and oligopoly; however, monopolistic practices occur oftentimes in the energy sector, especially (but not only) because of the magnitude of infrastructure projects necessary to make the sector run. Marcelo Lima[56] testifies:

> monopoly is prohibited in Brazil, but there is an unspoken agreement. Not necessarily on the existence of a company's monopoly but the acceptance of the big capital's monopoly. Big companies win the concession of big projects to exploit the country's natural resources, as is the case of the exploration of the pre-salt, hydroelectric, coal, etc. This interest also occurs in the renewables sector. This model of large, centralised plants, this development model of concentration itself, justifies the realisation of large projects requiring a high concentration of capital. This model maintains the power of these large companies. That is an example of how the state/finance nexus works. These great financial monopolies capture Congress to pass their desired policies (interview with author, July 2020).

> From a structural point of view, there are no monopolies and oligopolies, but when most concessions for the realisation of infrastructure projects are granted to the same companies –such as Odebrecht, OAS, Camargo Corrêa– the question arises: Isn't that a monopoly? Contracts are paid with public money from Brazilian society, usually through loans granted by BNDES at very low-interest rates. Isn't that a monopoly? One has to be very naive to believe that the constitution is being respected (Rodrigo Flora Calili,[57] interview with author, July 2018).

[56] Climate & Energy Campaigner at Greenpeace Brazil.

[57] Assistant professor of the Graduate Programme in Metrology and the Master programme of Urban and Environmental Engineering at PUC-Rio.

Hemphill and Wu (2013) explain that exclusionary schemes –such as those that occur in Brazil– often are not the result of oligopoly's careful, calculated plan but rather occur through firm's customary practices. An exclusionary scheme can emerge from simply replicating leading companies' actions by following monopolist's strategies before its divestiture or by keeping new groups out. Monopolistic and oligopolistic practices may have contributed to the failure of the 2004 National Programme of Production and Use of Biodiesel (PNPB in Portuguese). The project had social sustainability as one of its pillars was designed to favour the inclusion of family farming, especially in the north and northeast of the country, in biodiesel production. However, Stattman's (2019) study on biofuel governance in Brazil shows evidence that "developments in the ethanol and biodiesel sector are primarily driven by agri-business and energy industry linked to Ministry of Agriculture and Ministry of Energy and Petrobras, respectively" (p. 34). The researcher states that biodiesel governance occurs according to the interests of state and non-state actors, and their logic is "an emphasis on quantity, a neglect of crop diversity and regional spreading, power with the large scale (energy and agricultural) producers rather than with small scale family business, and a preference of energy security above environmental sustainability of energy sources" (p. 35).

Monopolistic practices also occur in the energy transmission and distribution sector. Brazil's economic growth in the late 1970s resulted in strong demand for electricity. State-owned companies were created to meet this demand, and several regional electric monopolies emerged. From 1980 onwards, the favourable context for the development of the sector fell apart, and at the end of the decade, the electricity sector became a limiting bottleneck for the country's economic growth. The concessionaires did not have the resources to finance the system expansion to meet growing energy demand adequately. In the second half of the 1990s, after long debates, the electric market's reform was implemented, and competition was adopted as the core of the new

electric market. However, monopoly management of the national grid (transmission and distribution) was preserved. Currently, this scenario has a strong influence on policy creation and implementation. The distributed generation model is already regulated in Brazil, and it facilitates access to renewable energy such as solar and wind, and it is a start towards energy transition. However, it encounters strong resistance from distribution companies that greatly influence the policymaking for the sector. According to Marcelo Lima, the reasoning behind this resistance is that if everyone becomes an energy producer, customers will be lost, and companies will go out of business. To avoid this, companies press the government to delay the implementation of distributed generation model. Lima states that researchers in the field believe that this pressure would happen in the future, when half or at least a quarter of the population was producing their own energy, when the change in the system would be more significant. However, there has currently been fierce lobbying, and a change in regulation has already been projected under the pressure of energy distribution companies to make the system unfeasible. On this matter, Marcelo Lima states:

> the distributed generation model would be ideal because energy is generated close to consumption which makes it cheaper. There are many possible mechanisms to accomplish this model as the government encourage it by implementing social projects like *Minha Casa, Minha Vida*,[58] in which the houses have solar generation systems already installed. Nowadays, it is possible for the excess energy produced to be returned to the grid at the same price as the energy purchased, which is very fair because what is generated in excess becomes a credit to be used later in a 1 to 1 ratio. However, the biggest obstacle to this initiative is the large distributors that were privatised and became oligopolies. An example of it is Enel Distribution São Paulo, former state-owned Eletropaulo. They want to sell a certain amount of energy for 1 *real* and

[58] *The Minha Casa, Minha Vida* is a federal housing programme launched in March 2009 by the Lula da Silva government. The programme subsidises house or apartment acquisition by families with an income of up to 1.8 thousand *reais* and facilitates the conditions of access to the property for families with an income of up to 7 thousand *reais* (PMCMV, Law no 11.977, July 7, 2009).

> buy the excess for 40 cents, which is a 60% difference in the value of the same energy. They claim that people use the network, the wires, and that has a cost. They want to charge the consumer for this. Today, it is possible to recover the initial investment in the purchase of photovoltaic panels in 2 years, so it is worth it, but if the value of the excess energy falls by 60%, the investment will only return in 10 years, then it is no longer worth investing in a photovoltaic system. Energy development is no longer in the public interest; it is not to solve society's challenges but rather to serve the private interests of shareholders. Public services do not serve the public interest because they are managed by private interests (interview with author, July 2020).

Bradshaw (2018) corroborate with Lima's statement as she argues that distribution companies in Brazil have claimed that distributed generation would bring financial instability to them. For that reason, they have been strongly resistant to the updating of net-metering regulations that took place in 2015. According to them, the net-metering connections to the grid has been unfairly paid for.

In order to promote the energy transition required to decrease carbon emission in Brazil, Rufin (2012) suggests that the country needs to ditch its protected monopoly and develop instead an internationally competitive energy cluster. However, in other to accomplish it, it is necessary to get rid of traditional politicians eager to convey funds straight to their bank accounts, benefiting their supports along the way. "Pure rent-seeking of this kind will take resources away and allocate it to uses of very little economic value" (p. 596). Furthermore, Rufin states:

> we should not forget that many private-sector managers, both domestic and foreign, would be delighted to consolidate or obtain monopolistic positions that would ensure them a comfortable life. All too often, the desire to build national champions and new clusters in Brazil has resulted in the creation of protected, market-dominant positions for privileged companies at the expense of Brazilian consumers and other sectors of the economy (2012: 596).

As discussed in section 1.2 of this study's framework, monopolies and oligopolies are harmful to both economy and democracy. When large enterprises and politicians are intertwined and operate different important businesses simultaneously, competition is obstructed in economic and democratic matters (Ayal, 2013). Monopolistic practices are the roots of structural corruption. Lobby strategies are used to buy off politicians and top-level officials to establish trusts (Dunne, 1995; Machado, 2015; Beke, 2018).

Market dominance in the Brazilian energy sector mostly occurs due to the influence big corporations' CEOs have on politicians. By supporting electoral campaigns for candidates to the executive and the legislative branches, construction companies' senior officials are able to influence policy outcomes. According to Corrêa (2019), the business lobby in the National Congress makes frequent use of the so-called "parliamentary fronts".[59] There are parliamentary fronts for all sectors of the political sphere. Related to the energy sector, there is a variety of parliamentary front, such as the ones in defence of renewable energies or in favour of energy efficiency. There is the biodiesel mixed parliamentary front and even one on behalf of mineral coal – defended by deputies from coal-producing regions and who feel obliged to meet their voters' expectations – despite the environmental harm caused by coal use. There is also a front for the sustainable development of petroleum and renewable energies, organised by the Brazilian Petroleum Institute (IBP) and, another parliamentary front representing the sugar-energy sector, strongly encouraged by the Sugarcane Industry Union (Única). Undeniably, parliamentary fronts are instruments that unite business lobby and political parties in a space where a common language is spoken: the defence of both personal and group interests. With regard to the energy sector, the three most important projects being currently

[59] Parliamentary fronts are informal and nonpartisan groups that work on behalf of a cause or interest to the group. They have no official power according to the *House of Representatives' statute*. However, depending on the organisation's degree, they can be mobilised to defend or attack a particular cause (Corrêa, 2019).

negotiated in the national Congress are the modernisation of the electricity sector (which resulted in the privatisation of the Eletrobras System), the expansion of the free market for electric energy and the new commercial model for natural gas.

In June 2021, the Brazilian Congress approved the provisional measure proposed by Bolsonaro for the privatization of Eletrobras. The government guarantees that the sale of the company should reduce the value of the electricity bill next year by 5% to 7% and will still bring a profit of 100 billion *reais* to the public coffers (Carrança, 2021). However, the electricity sector is going through a crisis because of the drought caused by climate change. As the Brazilian electric system is 61% dependent on hydroelectric power, water scarcity also generates energy scarcity. It is at this juncture that the government decided to privatize Eletrobras. According to ONS, at the beginning of 2021, the lack of rainfall led to the highest increase in thermoelectric energy use since January 2015 (G1, 2021). Since October 2020, the Bolsonaro government started operating thermoelectric plants, including those powered by diesel, to make up for the deficit in the electricity sector. Thermoelectric energy is not only more polluting but also has a high operating cost. As a result, Aneel announced in March 2021 a 52% increase in the energy tariff. The Provisional measure 1032-C/2021, (also called Eletrobras MP), includes clauses that guarantee the expansion of thermoelectric power plants in the country. It also facilitates the contracting expansion of small hydropower plants (PCHs in Portuguese). Concerning Eletrobras privatization bill and its eight megawatts thermal gas plants requirement, Duvivier[60] states:

> Our electrical system urgently needs planning and organization. Countries worldwide are moving towards an energy transition in search of cleaner and more sustainable energy to deal with the urgent crisis of climate change. The consensus is to reduce the dependence on

[60] Brazilian actor, comedian, screenwriter, and writer. Considered one of the most important voices in Brazil's political commentary, Gregorio Duvivier hosts Greg News, a weekly TV programme broadcasted on HBO.

> thermoelectric power plants, but Brazil is doing the opposite. Despite the country's almost infinite potential to generate solar and wind energy, which are not only clean but are getting cheaper and cheaper, Brazil is going against the grain using more and more thermoelectric plants (2021, 13:44).

This policy is very damaging to the Brazilian iNDC pledges because the privatization of Eletrobras could increase CO_2 emissions in the Brazilian electricity sector by 25% (IEMA, 2021).

The Eletrobras MP had not been enough discussed before being passed by Congress. According to deputy Alessandro Molon, the opposition had only 24 hours to decide between the vote against or in favour of the proposal (*O Globo*, 2021). That happened because provisional measures are processed more quickly in Congress. That is why it is common for deputies and senators to take advantage of these characteristics of MPs to include in the main text amendments to approve projects in their interests or those of their supporters. According to Duvivier (2021), the provisional measure for the privatization of Eletrobras has been amended to guarantee the contracting of gas-fired thermoelectric plants to increase energy generation in the country, benefiting the businessman Carlos Suarez, a former partner of the OAS company. Suarez is one of the richest men in the country and is known as the gas man. He is also the owner of Brasil PCH, a company that has 13 PCHs under its umbrella.[61] During the voting session for the Eletrobras MP, deputy Glauber Braga questioned deputy Elmar Nascimento, MP's rapporteur, about his contact with Suarez. According to Braga, the entrepreneur directly participated in the text articulation for the approval of the MP. Braga's claims have been confirmed by Nascimento himself. About this fact, Duvivier (2021) emphasizes: “the Brazilian state is often captured by those who have the financial power (…) now, thanks to the privatization

[61] According to Duvivier (2021), others interested in hiring PCHs are several politicians and businessmen from Mato Grosso do Sul state. Several parliamentarians own PCHs. Small hydropower plants cause less environmental impact but have high generation costs.

of Eletrobras, we will have less state and more oligarchies controlling our energy" (2021: 35).

Currently, 2/3 of the politicians elected for the national Congress are liberal professionals and entrepreneurs (DIAP, 2019). The fact that the Congress is formed mostly by representatives of the market can be decisive for the Brazilian energy sector's policies outcome. In this regard, Marcelo Lima comments: "it is the manifestation of the power of money within the estate/finance nexus. In order to continue reproducing benefits for private capital, it is necessary to put people into the policy-making process" (interview with author, July 2020).

Larissa Araujo Rodrigues, when asked if she believes that market representatives in the parliament are able to influence policymaking, answers:

> that is for sure. This statement is valid for all the laws that are being discussed in Congress today. Since 2006 when I started to work with energy, I do not see much change. All I saw of change was negative, unfortunately. Especially when it comes to the big sectors such as oil. In the case of the solar energy industry, which is exceedingly small, Congress makes it so difficult to approve anything that benefits this sector. Especially the distribution companies, which are always working to prevent the incentive laws from passing. It is very difficult to approve anything that facilitates the development of the solar energy sector (interview with author, July 2020).

Indeed, there are no state initiatives for the solar source in Brazil, although this source generates electricity cheaper than all fossil sources, biomass thermoelectric, and small hydroelectric plants. With the little public incentive, prices negotiated at auctions have almost halved in four years. This was possible thanks to gains in scale, improved technology, and increased efficiency. Brazil really needs to wake up to this opportunity, since the initiatives so far are still timid (Sauaia, 2018).

The second section of the framework chapter bring up a discussion about the influence of monopolistic practices on innovation. Schmitz (2012), Hemphill & Wu (2013), Ayal (2013), and Beke (2013) highlight that the domination of anti-competitive market by large players retard innovation. Monopolistic practices obstruct the introduction of *higher-quality* and *lower-cost* alternative options. To supress social loss, it is necessary to foster competition and innovation. According to Sandro Yamamoto:

> the Brazilian State misses the opportunity to implement innovative technologies. It is necessary to renew the electrical sector. We do not yet have legislation to use storage systems, as is already the case in Chile. If the legislation is ready, even if the State does not take the initiative, the market is in charge of implementing it, as in the case of wind and solar, which today are already competitive in the market. This occurred at the private sector initiative and not because of the State's concern with environmental issues or putting its iNDC into practice (interview with author, July 2018).

Larissa Araujo Rodrigues confirms Yamamoto statement and adds on:

> the development of wind and solar energy in Brazil occurs due to the private sector and not at the government's initiative. The government only takes advantage of this development as it gives the country a good image. So, it is possible to infer that the private sector is dictating the agenda and not the government. And on both sides of the table, because nowadays, the private sector is claiming that Brazil needs to protect the Amazon. At the same time, who is behind deforestation is the local agribusiness sector. The current government is in the role of service provider for these companies (interview with author, July 2020).

These testimonies corroborate the study by Diniz (2018) in which he analyses the corporate chain of 719 wind farms. His study found that from the total, 483 have exclusively private partners and that the other 236 plants have the State as a partner. "The results show that most of the wind generation projects implemented in the country during the last ten

years were conducted by the private sector" (Diniz, 2018: 233). In the case of solar energy, between 2012 and 2018, its generation grew from 7 MW to more than 2,300 MW and raised more than ten billion *reais* in new private investments. Miklos (2019) predicts that the country's photovoltaic panel industry will attract 100 billion *reais* in new private investments by 2030.

According to Guilherme Moraes de Lima,[62] the country finds it difficult to break the pattern of using fossil fuels and large hydroelectric plants in its energy sector. To explain this difficulty, he suggests the concept of *capitalismo de laços* that characterises the "model of capitalism practised in Brazil in which the state is shared, hijacked by interest groups. As a result, subsidy policies prevail, for example, via BNDES. It is a mutually beneficial model for public and private agents" (interview with the author in July 2018).

Coined by Sergio Lazzarini[63] in 2010, the concept *capitalismo de laços* means

> a negative relationship between the private sector (companies) and the public sector. Large monopolies with great economic power that end up having a major influence on the government, and that influence often occurs through lobbying, campaign financing, through acts of corruption. This influence ends up causing the government to favour these groups by strengthening them even more. So, it is a vicious circle in which the powerful win and the population, in general, is at the margin of this process (Nakabashi, 2019).

When the State overlooks its role and opportunities to function as developer and regulator in such an important sector for the country's development, as is the case of the energy sector, private agents of the market will use any possible tactics to gain control and spread their

[62] Founder and director at Ponto Futuro - Inteligência Analítica e Comportamental.
[63] Doctor of Business Administration from John M. Olin School of Business, Washington University, Associate professor at Insper.

monopolistic practices. In such an environment, the general population will pay a price much higher than public services and natural resources are worth.

As explained in detail in the second section of chapter one, the creation and maintenance of monopolies and oligopolies contributes to keeping control of resources in the hands of a small group. Despite the Brazilian legislation inhibiting the creation of monopolistic groups, the Brazilian energy sector faces problems caused by the restriction of public policies to expand the use of new energy sources, which is imposed by a centralized decision-making power. The political influence of small groups is significantly strong, which prevents the expansion of government support to market segments willing to develop and implement modern technologies for the generation and distribution of cleaner and more sustainable energy. Monopolistic practices are one of the great challenges to be overcome for Brazil to be able to intensify its energy governance in the direction of the transition to minimize the effects of global warming.

5.1.2 Clientelism: a usual strategy

The literature review present in chapter one shows that clientelism is the most common power relations strategy for distributing public resources. Despite their old roots, clientelistic relations still persist in modern democracies, and it is a common practice in political realms worldwide. In Brazil, clientelism and co-optation as a form of political interaction permeate the country's political history (Carvalho, 1997) and still endures. Clientelistic practices occur throughout all Brazilian municipalities in diverse ways, adjusting local policies for public resources distribution. It goes beyond local politics, reaching as far as the federal government (Silva, 2017).

Large construction companies direct or indirectly involved with the energy sector, finance the political campaigns of candidates and their

parties, who once in power, make the arrangements that favour these companies with contracts to supply goods and services to the state. The campaign fund is used in clientelistic practices for vote-buying and guarantees victory at the polls. After the elections, elected representatives continue to facilitate the hiring of these same companies that supported them. This cycle of campaign financing, clientelism, election and hiring repeats in Brazil every two years when elections at the federal and state level alternately take place. Clientelistic practices also occur within the administration in power itself as the head of the executive branch offers funding for local reforms, especially in infrastructure, to parliament members in order to pass certain bills. In turn, infrastructure reforms are a useful way to keep voters for the next election at the state level. A recent example of clientelistic politics financing was the Odebrecht scandal. The company was diverting large sums of money into party campaign slush funds, known as "caixa 2".[64] Odebrecht is a major construction company partaker in many large-scale infrastructure projects in Brazil, such as the Belo Monte Dam, Petrochemical Complex of Rio de Janeiro (Comperj), nuclear power plants 1, 2, and 3, among many other enterprises. Odebrecht benefited enormously from these contracts, whereas politicians used bribes to boost their election campaigns. "Here, a synergy is formed between one economic sector and political elites, both of whom gain from ensuring there is no effective rule of law" (Pearce, 2018: 11). Another recently uncovered caixa 2 scheme involved Braskem, a petrochemical company that is an affiliate of Odebrecht. The former chief executive and shareholder of the Brazilian petrochemical, Jose Carlos Grubisich, was arrested in New York because of corruption and bribery that the US Justice Department has charged him with (Trager, 2019). According to the proceedings filed in the Brooklyn office of the United States District Court Eastern District of New York:

[64] Caixa 2 is an illegal financial practice that consists of not recording certain in or out monetary transactions, creating a parallel fund. From an electoral perspective, they consist of cash donated to electoral campaigns that are not declared to the electoral courts (Castilhos, 2018). Declared campaign resources would be called Caixa 1.

> Between approximately 2002 and 2014, Braskem, together with Odebrecht, certain Braskem and Odebrecht employees and agents and other co-conspirators, engaged in a massive bribery scheme that resulted in the diversion of approximately $250 million of Braskem's funds into a secret slush fund, and the subsequent use of that slush fund to pay bribes to government officials, political parties and others in Brazil to obtain and retain business (the United States of America v. Jose Carlos Grubisich, 2019: 5).

The infrastructure sector in Brazil is dominated by family-owned companies: Andrade Gutierrez, Camargo Corrêa, Odebrecht, Queiroz Galvão – founded in the 1950s – and OAS established in the 1970s. Some powerful families have strong control over the country's economy and politics and have contributed to Brazil's long history of clientelism, patronage and regionalist politics (Kuijpers, 2013). Campaign funding has become a notable form of corruption in many Latin American countries. Clientelistic networks of state patronage present in the dictatorial regimes turned into suitable electoral campaigns support when democratic elections were established. Profitable business opportunities have arisen not through free competition but via elite networks, illicit financial flow, and favoured access to contracts for the supply of goods and services. Big corporations, such as the Brazilian Odebrecht, has been accused of funding numerous election campaigns and bribing government officials and politicians in Brazil, Argentina, Colombia, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru, and Venezuela (Pearce, 2018).

Armijo and Rhodes (2017) state that Brazilian infrastructure reforms are impregnated with clientelism throughout history and across all federation levels. In fact, since 2014, nearly every leading Brazilian construction company has been involved in the Car Wash scandal. "The former CEO of construction firm Andrade Gutierrez[65] told a judge that his

[65] Andrade Gutierrez operates in the energy sector through Cemig (Companhia Energética de Minas Gerais S.A.) and Santo Antônio Energy. The latter is the commercial organization

firm conceptualised bribes to public officials as an ordinary cost of doing business; bribes were included in the project budget and calculated by a formula like that used for executive bonuses" (Armijo and Rhodes, 2017: 241). Up to now, Federal Prosecution Service (Ministério Público Federal, MPF in Portuguese) has conducted 181 prosecution processes charging CEO's, contractors, politicians, executives, et cetera., for participating in irregular campaign financing and bribe schemes between 2003-2012 in negotiation for public-work contracts. These facts lead to the conclusion that these major firms have captured the state. Politicians who resort to clientelistic practices are eager to be funded by those companies interested in both grant a contract and define policymaking. In their study about campaign donations and government contracts in Brazil, Boas, Hidalgo & Richardson (2014) corroborate that campaign contributors are rewarded with contracts for public infrastructure contracts. Figueiredo (2016) relates to the same study to conclude that the capture of the State by economic groups is categorically related to the continuously increasing campaign costs[66] as well as to the proportional increase of donations value. Campaign funds provide the opportunity for elites to capture the government as their campaign contributions are linked to policies of their choices.

Campaign funds are crucial for political parties and governments during the elections and subsequently. They are the resources needed to secure the votes of poor and deprived people and the politicians' means for remaining in power. Desposato (2002), in his studies on vote-buying in Brazil, argues that Brazilian state governments have a great deal of power due to the country's federalist system. Governors hold a significant degree of power as resources distributions are ruled at the state level. Consequently, deputies trade support for the legislative

behind the hydroelectric plant of the same name located on the Madeira River, in the state of Rondônia which Andrade Gutiérrez built in consortium with other constructions companies, among them Odebrecht.

[66] According to Figueiredo (2016), since the late 1980s, when democracy was re-established in Brazil, the Brazilian candidate-centred electoral system has contributed to increasingly expensive and highly competitive elections.

agenda of the executive branch to obtain resources to please their own constituencies and supporters. The author claims that legislative members use their power to approve or reject bills to secure their capability to deliver public goods –paving roads, electricity provision, health facilities – and private goods such as profitable infrastructure contracts or undemanding well-paying jobs for campaign contributors and supporters. State governors' resources control states' legislative delegations to the National Congress. Different interests and political positions between both States and States governors may influence deputies' positions, which in turn, divide the congress and effects policymaking.

The currency of exchange for clientelistic relations is the allocation of public resources. Private resources (formerly public as it comes from public contracts) in form of campaign financing are used to win votes. Once elected, politicians facilitate government contracts for large companies that have funded their campaigns. Overpriced infrastructure projects are conducted and paid for with public funds, which return to politicians in form of bribes.

Clientelistic practices in Brazil occur at distinct levels of the political scenario. They are strategies for maintaining power that can be used top-down, bottom-up and even horizontally. Top-down relationships occur between candidates and voters. In contrast, bottom-up agreements are made on the amount of funding destined for candidates in exchange for benefits distribution to campaign supporters. After the election, the relationships may take a horizontal form in which both politicians and supporters agree and benefit from their winning campaign. According to Figueiredo (2016), Brazilian studies on private campaign financing provide enough empirical evidence that corporations are willing to provide more funding to parties and politicians that are more efficient in delivering both contracts and desired policies.

Stokes (2012) uses Desposato's article mentioned above in order to draw attention to the *Institutional consequences of clientelism*. The author highlights how clientelism affects political parties' performance within legislative bodies. Indeed, Desposato's study published in 2002, in which he compares the Brazilian state of Piauí and Brasília (the federal district), demonstrates that parties that have voters support by providing public goods show legislative cohesion. For instance, party members vote coherently when taking part in roll-call votes (the case of Brasilia). On the other hand, in Piauí, where parties commonly use clientelistic strategies (resources distribution within a private network) to win votes, Desposato's study reveals less cohesion when politicians participate in the legislative process. This lack of cohesion has important consequences to policymaking throughout all Brazilian governance levels and sectors.

Desposato highlights the importance of the executive branch on the state level in the Brazilian political realm. "Many decisions about the distribution of resources are made at the state level" (2002: 2). In this regard, in an attempt to understand the policymaking concerning the explorations of the pre-salt oil reserves and royalties' revenue distribution, Queiroz-Stein[67] argues that federalism was a relevant factor in the process. He states that the Brazilian constitution determines the autonomy of all federated entities and, therefore, there is significant pressure for decentralization by the subnational entities. According to him, the autonomy of subnational units

> empowers governors and mayors a lot, and so there are many agents with much power. This also applies to the national Congress, which is formed by a large number of parties with the capacity to alter the result of parliamentary voting. Nowadays, the number of most influential parties in the national parliament reaches 11 to 13, with which it is necessary to negotiate in order to approve any regulation. This division shapes the form of the negotiation. It is necessary to share power among parties, mayors, governors. Power is excessively decentralised and

[67] Member of the research group Transformation and Sustainability Governance in South American Bioeconomies (SABio).

> fragmented, which ends up being the element of fragility at the moment of policymaking. The need to comply with quite different and sometimes contradictory interests generates a wavering decision making (interview with author, July 2020).

This fragmentation mentioned by Queiroz-Stein illustrates the coalitional presidentialism, the political model prevailing in Brazil since 1988. The term was coined by the Brazilian political scientist Sérgio Abranches in his article *Coalition Presidentialism: The Brazilian institutional dilemma* (1988). According to the scientist, coalitional presidentialism in Brazil is a political system built from the combination of extensive and heterogeneous federalism, open list proportional representation, a multiparty system, bicameralism, and a strong and minority presidency (Abranches, 2019). Mello & Spektor (2018) state that the Brazilian

> multiparty presidentialism's addiction to corrupt and rent-seeking practices has important consequences for the regulatory environment and the overall relationship between companies and the state. As firms devote more of their energies and capital to securing advantageous deals through government connections, more of their revenue will come from rent-seeking and less from improvements in productivity (p. 124).

Pereira, Bertholini & Raile (2016) studied coalition management and governing costs using Brazil as a case study. The authors argue that there was a higher governmental cost during the PT governments. PT administrations formed an ideologically quite heterogeneous coalition that included conservatives, liberals, and progressives and, therefore, quite different from the relatively centre-right homogeneous coalition during the FHC presidency. Moreover, during Lula's first term, Government costs increased dramatically, most of which went to his own party. Especially pork (or pork barrel) related costs have increased considerably. One important example was the *mensalão* scandal.[68]

[68]*Mensalão* was an illegal political financing scheme organised by the Workers Party (PT) to corrupt Congress members to guarantee support for the government. The *mensalão*

Armijo and Rhodes (2017) suggest that Brazil's average governance costs is higher than in most fellow countries, whereas policy predictability is low. Given that every administration must distribute benefits in order to form a coalition, government costs increase. As a result, political clientelism occurs and funds allocation criteria is rather partisan than pragmatic. Such an environment is tempting to political capture by local elites.

Clientelism is an old practice in Brazil (Carvalho, 1997) and its use as a strategy for the division of State resources and spreads across all levels of government and economic sectors. As discussed extensively in section 1.3 of the first chapter, the practice of clientelism occurs at the bottom of the political process, among voters and candidates for local government, as well as at the highest level of the federal government (Guerguina & Volintiru, 2017). Funding for political campaigns is the biggest corridor for financial resources. Great political campaigns supporters as construction companies use clientelism as strategy to elect politicians that are willing to help them to benefit from State resources. These strategies strongly influence the policy choice and, in the case of the energy sector, undermine Brazil's effort to comply with the international agreements on climate change mitigation.

5.1.3 Political capture shaping policymaking

Clientelism and political capture are major threats to democratic accountability mechanisms since they prevent the government from implementing public policies that meet citizens' needs. Bardhan & Mookherjee (2012) call attention to the difference between these two concepts as they are often muddled when used to describe one or another phenomenon. According to them, clientelism occurs when

happened between 2003 and 2004 during the first term of Lula's presidency. The scheme was made public in 2005 when Roberto Jefferson, a former deputy and then president of the PTB, denounced the existence of a monthly payment to PP and PL deputies in exchange for supporting the Lula government.

political parties and governments make strategic transfers to poor and disadvantaged groups in order to guarantee their votes and consolidate political power accordingly. On the other hand, political capture happens when "underlying socio-economic inequality translates into higher implicit welfare weights assigned to wealthier and more powerful classes in policymaking and implementation" (Bardham & Mookherjee, 2012: 2). The authors highlight that clientelism oftentimes is typified by the transference of 'inferior' consumption goods to constituencies, while capture is mostly characterised by the transference of 'superior' production goods to local elites. For the purpose of this study, power strategies involving campaign funding will be regarded as clientelism, while the use of resources to obtain and maintain public contracts will be considered political capture.

Almeida and Zagaris (2015) draw attention to the occurrence of political capture in the Petrobras corruption scandal. According to the authors, testimonies given to prosecutors of the Car Wash operation have demonstrated that political parties had control over Petrobras' board of directors. Throughout history, the company's board of directors has been designated by the Brazilian presidency office. From 2003 forward, nominations to the board were controlled by the then-president Lula da Silva's Workers Party (PT) and other two parties – the Brazilian Democratic Movement Party (PMDB) and the Progressive Party (PP) – which formed Lula's administration's political coalition. According to witnesses, winning bidders had to compulsorily add an average of 3 per cent on top of the costs for every service provided. This sum was called 'political adjustment'. The authors state that under this scheme known as *Petrolão*,[69] Petrobras employees of lower ranking were also able to accumulate millions of dollars paid by the contracted companies as bribe in return for their contract with the company. From 2003 to 2013, up to USD 200 million was diverted from Petrobras' contracts. The money was

[69] Petrolão and mensalão were major corruption scandals that occurred within Brazilian politics between 2003 and 2013. Schemes involving numerous Brazilian politicians and businessmen facilitated the diversion of public money, kickbacks, and money laundering.

used to help finance 2010's election campaigns that elected Dilma Rousseff. On the matter of the corruption scandals investigated by the Car Wash operation Azevedo states:

> there was, there is, and there will be ingrained corruption in the country, and it must be permanently combated. The Brazilian state was and is captured by corporations, by private interests. Politicians end up having to relate to it; they are part of it because many of those who take over the State also run for office or have representation in the parliament. Therefore, the work of fighting corruption must be permanent (2021, 10: 58).

An evident model of political capture takes place when elites organise both into business associations and form their own parliamentary fronts. In Brazil, this is the case of the farming front, knowns as 'ruralists', which in 2015 used its influence to reduce primary forests protection under Brazil's Forestry Code (Oxfam, 2016). Former federal deputy Tereza Cristina, who is praised for her good coordination at the farming front, is the current minister for agriculture and, therefore, is one of the National Energy Policy Council members. Related to the energy sector, nine parliamentary fronts – with goals varying from the development of renewable energy source up to the increase of coal use – are currently working in national Congress in order to assure policy outcome that suits their interests (Corrêa, 2019).

Political capture has been a habitual occurrence in the energy sector for decades. The negotiation around the construction of the Belo Monte dam is evidence of political capture in the sector. The capture of policymaking occurred throughout its approval process, which took more than three decades. Different administrations have dealt with big corporations' influence around the negotiations to implement the biggest and most expensive hydropower dam ever built in Brazil. The companies that took part in the Norte Energy consortium to build Belo Monte benefited from many government funds. Hochstetler & Tranjan (2016) analysed BNDES' loan contracts from 2002-2012. Their results show that 82% of the total

electricity contracts were granted to small hydroelectric dams and wind power plants. However, they represent only 20% of the lending fund agreed during that decade. On the other hand, the authors found that the largest loan was for constructing the Belo Monte dam, which was much larger than all those projects together.

> Belo Monte is an extremely large project that will not produce the amount of energy promised. As it is a run-of-river plant, the generation of energy is minimal during the dry season. In the end, it is a project to give contracts to large companies and generate the resources (bribes) that are used to finance political campaigns and elect governments who perpetuate this practice, generating a vicious circle (Rodrigo Flora Calili, interview with author, July 2018).

Despite the negative socio-environmental effects that large dams cause, big companies that lead the electricity market continue to design new hydroelectric plants in the country. The government is meant to be a regulator of the entire process, but it is lenient instead. As a result, the practice of bossism occurs. Well-connected large company CEOs have access to top government officials and are able to influence policy outcome that benefits their businesses. Despite the classified nature of such negotiations, much information has been disclosed. At least five companies linked to the Norte Energy consortium have been investigated[70] by the Car Wash operation for bribe payment to federal government agents in exchange for being favoured and winning the auction for the concession of the Belo Monte dam. Evidence shows that large constructions companies determine the direction of policies in the

[70] Through the Car Wash operation, the federal public prosecution service filed charges against former senator Edison Lobão, his son, Márcio Lobão, and four other people for their involvement in a corruption scheme in the Belo Monte dam construction contract. As a result of this scheme, the Consortium companies have committed themselves to make bribe payments of about 1% of the value of the contract to politicians from the Workers' Party (PT) and the Brazilian Democratic Movement (MDB). Between 2011 and 2014, illicit payments were made in the amount of R $ 2.8 million *reais.* For details go to http://www.mpf.mp.br/grandes-casos/lava-jato/entenda-o-caso/curitiba/acoes/processo-penal-100

energy sector (Kuijpers, 2013; Boas, Hidalgo & Richardson, 2014; Armijo & Rhodes, 2017; Pearce, 2018). On this matter Larissa Araujo Rodrigues testifies:

> I do believe there is a process of government capture by private interests. Looking at big projects in hydro energy and oil and gas in Brazil, you see that before the projects go through regulatory agencies like ANEEL or ANP, they go through the National Council of Energy Policy (CNPE),[71] which is an executive body. The executive signs these big projects, so there is a capture of that part of the executive (interview with author, July 2020).

Marcelo Lima also agrees that there is a capture of capital over the state. According to him, State officials' decisions are in response to intense pressure from those who finance them and therefore are responsible for perpetuating the current (and others) government in power. It is common for large companies to elect politicians who approve policies that benefit these companies. At present, there is this pressure to privatise the entire natural gas production process, which is originally Petrobras' domain. The market highly appreciates this kind of policy because it generates financial speculation. It is believed that natural gas will save the Brazilian electrical matrix because this source covers the intermittency of solar and wind power. Marcelo Lima states:

> there is pressure on the Amazon Forest on several fronts, including energy. Here comes the state/finance nexus that David Harvey[72] talks about. As in the United States, where it is possible for the Treasury Secretary to come from Wall Street. In Brazil, the current minister of economy Paulo Guedes is one of the BTG Pactual investment bank

[71] The CNPE is composed of ten ministers of the government in office and the Brazilian Energy research Agency president. For details go to http://www.mme.gov.br/web/guest/conselhos-e-comites/cnpe/relacao-de-integrantes-do-cnpe

[72] David Harvey is a well-known academic and author who affirms the existence of a state-financed nexus that runs the state. According to him, the mass of capital is managed not by the state alone but in collaboration with financial institutions, both national and international. Furthermore, the author argues that the state-finance nexus enables the financial sector to control the whole economic system (Harvey, 2019).

> founders, which also operates in the energy market. Paulo Guedes does his role of serving capital very well because of his origins. BTG Pactual bank, also investigated by Car Wash operation,[73] has a large portfolio of investments in natural gas. It is no coincidence that Guedes is working on urgent basis for the privatisation of companies in the natural gas sector.[74] Lobbyists argue that natural gas can be easily turned on and off according to the need. However, they do not mention that it is an expensive procedure, and therefore it is left on consistently. It turns out that the megawatt-hour of gas is more expensive than the megawatt-hour of solar and wind energy. That difference is paid by the consumer (interview with author, July 2020).

An event that corroborates Marcelo Lima's concerns about the pressure on the Amazon took place in the plenary session of the 2019 World Economic Forum in Davos, Switzerland, during an encounter[75] between the American ex-vice president and environmentalist Al Gore and the Brazilian president Jair Bolsonaro. On Al Gore's comment, "we are all very concerned with the Amazon; it is something that touches me deeply", the Brazilian president responded, exposing his economic point of view on the subject: "we have a lot of wealth in the Amazon, and we would like to explore that wealth with the United States" (Vetter, 2019, 01:18:40).

[73] On August 23, 2019, a search and seizure operation was carried out at addresses linked to Bank BTG Pactual. The measures aimed at obtaining evidence concerning two different Car Wash investigation fronts: possible wrongdoing involving the Petrobras sale of assets in Africa to the bank. Another investigation front deals with a possible bribe transfer agreement to guarantee privileges to Bank BTG Pactual in Petrobras' rigs project for the pre-salt explorations. For details go to http://www.mpf.mp.br/grandes-casos/lava-jato/linha-do-tempo

[74] In 2019, the first year of Guedes in office, three Petrobras subsidiaries were privatised: Liquigás, a liquefied gas distributor; TAG (Transportadora Associada de Gás), which operates in the natural gas sector; and BR Distribuidora, a gas station chain.

[75] The encounter can be seen in the documentary The Forum by director Marcus Vetter. For the related fragment, go to https://youtu.be/CPpH7FRFcY0

Ricardo Baitelo[76] associates the current government's decisions to its belief in the neoliberal-related administration model, which includes privatisation, deregulation, and free-market capitalism. In his words:

> the current government follows the precepts of the neoliberal economy like no other. The government stated that it intended to make a ten-year energy plan that would serve the market's interest. As the government realises that wind and solar sources are offering a better price, the government tends to revise the auction rules and, at some point, will modify the rules to guarantee this space for the thermoelectric plants in the energy mix. The new 10-year plan clearly ensures a larger space for pre-salt's natural gas (interview with author, July 2020).

Another case of political capture that has been brought to public scrutiny was the negotiations around the construction of the Petrochemical Complex of Rio de Janeiro (Comperj), one of Petrobras refining units that would be expanded in 2008. As one of the world's largest oil companies, Petrobras invests billions of dollars a year in contracts to enlarge its operation capacity. "In 2010, Petrobras' international initial public offering (IPO) raised $70 billion, briefly elevating Petrobras to the world's fourth-largest firm. Petrobras used its ample financing to fund several poorly justified mega-projects, of which the most notable was Comperj" (Armijo & Rhodes, 2017: 237). To implement such a big project, companies are welcome to present their proposals in fair market competition. However, at least since 1998, a group of contractor companies switched from competition to collaboration. It formed a so-called 'club' constituted by sixteen firms, namely: Odebrecht, UTC, OAS, Camargo Corrêa, Queiroz Galvão, Mendes Junior, Andrade Gutierrez, Galvão Engenharia, Iesa, Engevix, Toyo Setal, Techint, Promon, MPE, Skanska e GDK S.A. Another six companies also participated in fraud: Alusa, Fidens, Jaraguá Equipamentos, Tomé Engenharia, Construcap e Carioca Engenharia (Ministério Público Federal, 2018). The cartel, a selected group of high-ranking executives, took part in bid-rigging

[76] Technical Specialist at Brazilian Photovoltaic Solar Energy Association – ABSOLAR.

schemes. The group decided in advance which of the firms would win a specific bid. A deceitful competition was set up, enabling the chosen winner to charge much higher fees than it would occur in a free market. Petrobras officials collaborate with the scheme by allowing overpriced contracts in exchange for bribes (Segal, 2015).

Not surprisingly, occurrences such as the swindle around the construction of Belo Monte and Comperj have been considered great scandals and strongly criticised. However, Kitschelt (2000) argues that privileged access to government contracts or procurement opportunities as a reward for electoral campaign support are very common clientelistic practices. It occurs not only within state-owned or regulated companies, but it also stretches the reach of party patronage into private capitalist enterprises, especially in economic sectors whom the state is the major customer, such as civil engineering/construction. In such an environment, political capture is most likely to occur.

State capture is a strategy of wealth defence. Oligarchic elites use their fortune to capture policymaking and assure their interests are preserved when politicians chose between one or another policy. Such decision-making environments are a threat to democratic choices. Winters (2011) states that oligarchs know that democracy represents potential risks to their wealth. On the other hand, they lean on the near veto they hold over threats to wealth accumulation. Rodrigo Flora Calili states:

> Every Brazilian citizen knows that this relationship between the government and lobbyists exists. Every Brazilian with a minimum of education understands that this happens. I have been a little distrustful of how to end it and the corruption that comes with it. Likewise, I doubt the possibilities of putting an end to these oligarchies that have been in the government for years perpetuating this system. I still do not see hope. To change this paradigm, heavy investment in basic education is necessary, which despite the advances in recent years, is still poor. It is even necessary for the change in the paradigm in decision making when choosing government officials, which, in turn, will define public policies

> to be implemented in the energy sector but also in any other policy-making processes (interview with author, July 2018).

In 2011, the International Forum on Globalization (IFG) published *Outing the Oligarchy*, *a special report* in which a list of billionaires who benefit from today's climate crisis is presented. Among these wealthy oligarchs is Eike Batista, once Brazilian richest man, and a remarkable example of a crony capitalist – as his fortune is the result of his relationship with government officials (Cuadros, 2016) – has been investigated under the car wash operation. In 2018, Batista was sentenced to thirty years in prison for crimes of active corruption and money laundering because of his participation in a scheme of bribes paid to the then governor of Rio de Janeiro, Sérgio Cabral, who is also sent to prison. According to the sentence, he transferred US$ 16.5 million to the former governor's criminal scheme. In May 2019, the Brazilian Securities and Exchange Commission ordered Batista to pay a 130.7 million dollars fine for the crime of insider trading. Batista was found guilty of trading shares of OGX oil and gas in possession of inside information. The lawsuit started in 2014 and investigated whether Batista, as OGX controlling shareholder and board of director's chairperson, made a profit on privileged information, selling or buying the company's shares, before important decisions were disclosed to the market. In fact, when OGX started having financial problems due to drilling challenges, Batista met with former president Lula da Silva and the then-president Dilma Rousseff, hopping for their support as he had plentifully contributed to their presidential campaigns (Cuadros, 2016). According to Koziuk:

> Crony capitalism is understood as a capitalist economy in which business success depends on personal relationships between businesspersons and government officials. Such connections are actively used in developing economies to obtain licenses, subsidies, and state orders on beneficial terms, violating formal and informal rules (2018: 114).

Crony systems rest on those personal connections. Agreements are reliable during the term of that particular government. As soon as the officeholders are replaced, those personal connections break, offending the agreed privilege for certain groups.

> For this reason, economic agents under crony systems, including the politically connected, will operate with short time horizons. This causes cronies to demand high rates of return, even for projects that have short maturities. It may, in fact, completely discourage long-term investing (Haber, 2002: 16).

Pearce (2018), in her paper E*lites and Violence in Latin America*, analyses how far the rich in Latin America are responsible for the logic behind violence reproduction amongst the poorest. According to the author, oligarchic elites provided with power, social status, and wealth are strong political actors who operate to defend their affluence. In Latin America, the construction sector in particular, makes huge profits from contracts with the State. Odebrecht benefited enormously from these contracts, whereas politicians used bribes to boost their election campaigns. "Here, a synergy is formed between one economic sector and political elites, both of whom gain from ensuring there is no effective rule of law" (Pearce, 2018: 11). The author wonders how far these elites are willing to go to win and protect those contracts and draw further attention to human rights violations by mining and energy companies in Latin America. One example is the murder of Bertha Caceres in 2016. She was the leading activist against the Agua Zarca dam in Honduras. In 2018 David Castillo Mejia was arrested and accused of being the mastermind behind the murder. He was the executive president of Desarrollos Energéticos SA, DESA, and the contractor building the dam. Another violent act concerning dam construction in Latin America was the killing of the Peruvian Hitler Rojas Gonzales, vice-president of Yagén Defence Front, which has been fighting the construction of Chadin 2, 600 MW hydroelectric power plant on the Maranon River in Peru, the main source of the Amazon River. The dam would flood an area of 32.5 Km^2, a region with many villages, vast croplands, and valleys rich in biodiversity. The

dam would be run by AC Energia, a subsidiary of Odebrecht. According to Hill (2016), even though the Chadin 2 is not mentioned in the sentence, the question remains whether Rojas Gonzales's opposition to the dam project played a role in his death. He was killed right after he was elected mayor. The connection between Rojas Gonzales's death and Chadin 2 is doubtful; however, his killer, Alejandro Rodrigues García, was the local contact concerning logistics issues and also a guide for the company's representatives. Odebrecht contradicts this information and states to have no connection with the murderer (Hill, 2016). According to Grandez et al. (2020), it has been found that the grant awarded to A. C. Energía for the development of the Chadín 2 has resulted in a cause of forfeiture by not starting works according to the work schedule. Odebrecht has not prioritised the development of the projects in the short term. In fact, the company is selling several assets due to serious cases of corruption in which it has been implicated. Eventually, the Economic Operations Committee of the National Interconnected System (COES) has found that there is an energy surplus in Peru, and the development of such a large dam is not seen as an urgent topic in an economically viable way.

> In Latin America, the defence of property and income still requires elite agency and shapes its oligarchic elites' priorities. There is no external guarantor in the State. Rather, there are individuals to lobby and suborn in a context where the rule of law is weak, public security underfunded, and its agents corruptible. In addition, the emergence of illegal rent-seeking and trafficking has opened new routes to rapid wealth accumulation (Pearce, 2018: 12).

Oxfam (2017) published *An economy for the 99%*, a briefing paper in which the contemporary economic model's unfairness is denounced. Their study shows that many of the super-rich use their power, prestige, and relations to influence political circles and to ensure that the rules favour them. An example of it is the Brazilian movement RenovaBR, a group supported by entrepreneurs, whom the most prominent is the star television presenter Luciano Huck. The movement elected seventeen of the 120 Candidates launched for legislative assemblies and national

Congress in the 2018 elections. Another example is the Support Programme for the Development of Public Leadership, sponsored by the foundation created by the second richest man in Brazil, Jorge Paulo Leman. He is Co-founder of 3G Capital, a global investment firm that holds 10.07% of the preferred shares in Eletrobras, a major Brazilian electricity company whose privatisation is one of the priorities of Paulo Guedes, Brazil's current economy minister.

Furthermore, Oxfam condemn millionaires who finance think tanks and universities to affect political and economic perspectives according to their self-centred false premises, such as: natural resources are limitless, the state's role should be minimised, companies need to maximise their profits, et cetera. In Brazil's case, Oxfam censures billionaires who lobby to reduce taxes and use their fortunes to help buy the political results they want, influencing elections and policymaking. Some of the Brazilian super-rich in São Paulo prefer to go to work by helicopter in order to avoid the traffic jams and infrastructure problems common to the city.

As previously discussed in the chapter 1, section 1.4, state capture takes place through the action of oligarchic groups that use their financial resources to influence decision-making processes (Rhoden, 2015; López García, 2017). Large construction companies linked directly or indirectly to the Brazilian energy sector belong to very prominent families that for decades, have influenced the politics in the country and, consequently, have the power to determine the direction of policymaking (Armijo and Rhodes, 2017). Their wealth was built by their participation in bidding processes to provide services to the State. In most cases, the State is their biggest client and therefore its biggest source of income. The energy transition necessary to lower CO2 emission levels implies a new business model, which costs a lot of financial investment. Companies that are in the market today see no benefit in facilitating this transition and therefore use all their influence and resources to control policy choices (Azevedo, 2021). State capture is a great obstacle for the implementation

of more effective policies to contribute with the international efforts to reduce greenhouse gas emissions.

Power relations strategies such as monopolistic practices, clientelism, political capture, as well as bossism, patronage, pork barrel, vote-buying, bid-rigging, rent-seeking, crony capitalism have been recurrently used in Brazil since the beginning of local political relations and decision-making processes. Varying in extent, frequency and results, these strategies have shaped public policies according to the wishes of those who use them. Politicians, bureaucrats, oligarchies, businesspeople who use these power strategies defend their wealth and traditional economic development model which is based on unsustainable exploitation of natural resources. These strategies are strong obstacles to be overcome in the effort for an energy transition. On this matter, the Brazilian government will have to make major change in the way policymaking occur in order to effectively comply with the international agreements on climate governance.

Furthermore, the choices for public policies that keep the usual business going are related to the behaviour of individuals involved in decision-making processes. Behavioural economics theory is an important instrument to analyse these behaviours and indicate why one or more policies are formulated and implemented. The following section presents evidence that policymaking for the Brazilian energy sector is influenced by personal behaviour of decision-makers.

5.2 Individual behaviour and decision-making processes

Behavioural economics opposes the rational characteristics of the neoclassic expected utility model and turns to psychology and sociology insights to comprehend peoples' and organizations' decision-making processes. Since the arising of behavioural economics theory in the 1980s, several studies have shown evidence that common behaviour

deviation and cognitive limitations affect individual's choices (Gsottbauer & Van den Bergh, 2012; Berggren, 2012; Ainslie, 2015; Samson, 2018; Emmerling & Rooders, 2020). Section 1.6 presents a detailed discussion on this subject matter. The current section brings evidence of such behaviour deviation and cognitive limitations and how they affect the choices in the Brazilian energy governance.

Behavioural economics provides various concepts that can be used as tools to explain why one or another decision is made. To respond the main question of this research –what extent current energy policies in the country are designed to comply with the international agreement to hold the increase in global average temperature below 2°C above pre-industrial levels? – the following concepts are used: hyperbolic discounting and loss aversion; endowment effect and status quo bias; information avoidance; delusion of competence; and overconfidence and planning fallacy. As discussed in chapter one, these concepts define individuals' behaviour which can lead to inadequate decisions concerning Brazil's efforts to comply with the international agreements on climate change mitigation. These concepts selected to investigate the phenomenon describe behaviours such as: preference for small and short-term rewards over bigger ones in the future (Pollitt and Shaorshadze, 2013); focus on short term outcomes (Samson, 2018); unwillingness to change daily routine and habits (Cooper, 2013; Lin, 2011); reluctance to acquire knowledge (Wilson, 2020); deficiency in reflexive acknowledgement (Feld et al, 2015), self-overestimation of ability (Moore & Healy, 2008); misjudgement of the amount of time and resources required to finish a project (Kahneman & Tversky, 1979).

5.2.1 Hyperbolic discounting and loss aversion

Hyperbolic discounting defines people's far-sighted behaviour when making choices if both costs and benefits occur in the future but make short-sighted decisions if rewards occur in the present. In other words, it indicates a preference for small short-term rewards over bigger but

later ones. Hyperbolic discounting can be associated with loss aversion, a concept that explains that individuals are risk-averse when choices indicate potential gains but contrarily risk-seeking when facing possible loss. A branch of this concept, myopic loss aversion, arise when actors are highly focused on short term results. Like in any other policy choice domain, these behavioural phenomena also occur in decision-making processes in the energy sector as a result of stakeholders' political interactions. This research has found evidence of behaviours related to hyperbolic discounting and loss aversion in different spheres and circumstances in Brazil. This evidence can be observed in Desposato's study published in 2002, which draws attention to constituencies' demand for private versus public goods and politicians' response to it. His research was extended to five Brazilian states: Bahia, Piauí, São Paulo, Rio Grande do Sul, and the Federal District (see Appendix 2). Even though the author confirms the great differences between the states in terms of income, education, and development, he argues that voters in Bahia and Piauí, which are needier, are not more likely to exchange their votes for private goods than voters from the other states. The chances that high-income voters would vote in exchange for private goods is the same; the only difference is that the price for their vote is higher than the ones from the low-income population. Besides, there is hardly a candidate willing to pay their price. According to Desposato, the reason voters are more willing to vote in exchange for private goods rather than public goods is the value they put in short-term rewards. Low-income forces voters to discount future utility from public goods programmes. As a result, they appreciate more immediate private goods than future public ones. High-income voters are also prone to value quick return over later benefits. However, "marginalised voters *might* trade their votes for a basket of food, for example. But this same basket of rice and beans has little value for a high-income voter" (Desposato, 2002: 20).

The preference for short-term rewards is also a characteristic of career politicians in Brazil who are especially prone to engage in political actions that may help them to hold power. They put their effort in policy-

making processes or relations that give them a certain assurance of re-election or any kind of high-paying political office job. Politicians in Brazil are often accused of implementing policies, especially infrastructure projects, in order to convince their constituencies to vote for them. Often these projects are of low quality, poorly executed and intended to show short-term results –often within four years which is the length of a term of office. Bardham (2012) draws attention to the connection between such clientelistic behaviour and the preference for short-term benefits.

> Strategic transfers made by political parties and governments to poor and disadvantaged groups as a means of securing their votes, in an effort to consolidate political power, provide an appearance of successful pro-poor targeting of public services. But they usually come at the expense of long-term development since they create biases towards private transfer programmes with short-term payoffs at the expense of public goods or private benefits of a long-run nature, such as education or health (p. 2).

On his analysis about a study on economics and religion in Brazil,[77] Ghiraldelli (2019a) argues that there is in the country an enormous difficulty in politically educating its population because of the politicians' short-term thinking. Left-wing parties have turned their focus on short-term goals exactly like right-wing parties and want to resolve the country's crises through elections. Candidates approach churches to get votes, but they do not work to educate the population politically after being elected. The result is that, after the election, voters still lacking political discernment, are unable to choose their representatives according to projects that meet their needs, voting once again without political awareness.

Analysing social inequality and violence in Brazil, Bugalho[78] (2020a) speculates how progressive politicians could convince their voters that

[77] For the study, go to https://bibliotecadigital.fgv.br/dspace/handle/10438/25709

[78] Philosopher and writer. Specialist in Literature and History. Fellow of the Royal Society of Arts.

public policies to solve the problem of violence cannot be short-term but long-term. According to Bugalho, affirming that solutions will only be possible in the long run has no electoral appeal, and for this reason, politicians think about their terms of office, that is, what they can do within a four-year term. Furthermore, the writer states that it is challenging for a politician to convince the population of the benefits of long-term projects, which tend to be a state project and not just a government one.

This evidence found in different contexts show that the preference for short-term rewards is a prevalent characteristic of Brazilian policymaking and policy choice. As long-term results are unlikely to be achieved – shown by the country's customary difficulties in creating and implementing long-term public policies (Carpes, 2006; Oliveira, 2007; Hochstetler & Tranjan, 2016; Lopes, Martins & Miranda, 2019) – loss aversion also become a widespread feature when it comes to decision making. One is prone to think about how fast benefits can be achieved – regardless of how big and profitable it is – as long as the risk of haven no benefit at all is avoided. These characteristics of decision-making processes in Brazil extend to the energy sector. Hochstetler & Tranjan (2016), when studying host communities' resistance to specific electricity projects, found evidence that the construction of fossil fuel plants, which are responsible for higher greenhouse gas emission rates, find less opposition than wind and small hydropower plants, commonly regarded as clean and sustainable. The authors infer that communities focus more on local and short-term impacts than those that may occur in the long run. According to Guilherme Moraes de Lima:

> It is very difficult for people to make sacrifices in the present –even because of costs or economic efficiency– focusing on future gains. The few moments when the issue of sustainability comes up are in moments of threat of price or supply crisis. Only then people have the willpower to at least redeem and be efficient in their energy consumption. Furthermore, it seems to me that this is not a concern nor a priority for

> public officials and the country's leadership (interview with author, July 2018).

Since de 1980s Brazil has been implementing public policies in order to improve the country's energy efficiency. In 1984, Inmetro (National Institute of Metrology Standardization and Industrial Quality) launched its labelling programme to regulate energy efficiency of electrical equipment and Procel (national programme for the conservation of electrical energy) was created in 1985 to promote the efficient use of electricity and combat its waste. After the power rationing imposed on consumers in 2001, the government sanctioned Law 10.295-2001, which deals with energy efficiency. This law establishes minimum levels of efficiency and forces the industry to produce more efficient electrical equipment. The consumer, in turn, chooses which product to buy.

> Although it has always been thought that people rather pay for low price equipment's than efficient ones, nowadays this is no longer confirmed, because the most efficient devices are no longer as expensive as they used to be. In any case, if the consumer chooses not to pay for the most efficient device, he will certainly pay the difference in the electricity bill, which will eventually be more expensive (Samira Sana Fernandes de Sousa,[79] interview with author, August 2018).

However, the country's economy does not allow the Brazilian population, in general, to opt for the most efficient equipment. Choices are made according to the conditions of the moment; that is to say, consumers buy the cheapest product that most of the time is the one of lower quality and efficiency. If at the time of purchase, one can save one hundred *reais*, for example, one benefits from this immediate saving. The problem of increasing expenses with the electricity bill is dealt with afterwards. Generally, people make choices that best serve them in the here and now, even if the gain is greater in the future. This is a classic example that occurs mainly because of the majority of the Brazilian population's

[79] General Coordinator for Energy Efficiency at the Brazilian Ministry of Mines and Energy.

purchasing power. Samira Sana Fernandes de Sousa says that this way of making decisions is also recurrent in the energy sector.

> Yes, this way of thinking determines considerably the choices made. Regarding energy efficiency, this is a reality. Officials in office think much more about what is possible to carry out in a government term of four years and not in what the country can improve in 30 or 50 years, which are the planning horizons that we work in. We, the technicians, think more about policies for the long term, but the government in office implements rather policies that favour their administration within their four-year mandates (interview with author, August 2018).

Rodrigo Flora Calili corroborates Sousa's statement:

> There is no long-term investment. All policies that the government defines have a fixed term of four years. Politicians are not thinking about the long term. They want to win the next election and thus perpetuate the same politicians with the same egocentric mentality. They do not think about benefits globally; they do not think about the population; they only think about themselves, about diverting public money and corruption schemes (interview with author, July 2018).

These statements show that in Brazil both politician and population opt for short-term solutions. When asked if energy governance in Brazil is based on quick solutions with lesser results rather than slow ones with better results, in the long run, Larissa Araujo Rodrigues corroborates:

> yes, with certainty, because who gives the final call is CNPE, a body composed of government ministers who make government policy, not state ones. A minister can stay in office for at least four years (if he is not fired earlier) and at most eight years. One term, or even two, is a short amount of time, therefore their performance must be immediate. There is no state policy (long-term) for the energy sector. That is why the sector continues to do business as usual, and the private sector benefits from it" (interview with author, July 2020).

This is the result of a long history of short-term policy-making processes in the sector. During the first term of President Cardoso, a major restructure of the electricity system took place. By 1998, sixteen distribution companies were sold; another three energy companies had been prepared to be partially or totally privatised. Also, ANEEL had organised public auctions to sell the license for new hydropower plants and transmission lines. Nevertheless, no organisation took responsibility for long-term planning and policy management for the system as a whole (Oliveira, 2007). Since 2006, the Brazilian energy research company publishes its decennial energy expansion planning, which focuses on long term solution for the energy sector. However, it is not put into practice due to frequent professional's turnover. According to Sandro Yamamoto,[80]

> the planning on paper is well elaborated, but it turns out not being put into practice because people move from one organization to another too quickly, in this way, the person who would execute the planning leaves without implementing it. Another person with other interests assumes the role, and the planning ends up not being executed (interview with author, July 2018).

This negligence regarding long-term planning seems to be a recurring issue as companies and institutions point out the absence of medium and long-term policies for fuel supply in the country, including biofuels' role (MME, 2017).

As of 2011, the government implemented a price control policy for gasoline and diesel in order to artificially keep them below the foreign market and reduce inflationary pressures. A negative effect of this policy was the gradual loss of competitiveness of ethanol in relation to gasoline, in addition to causing an increasing financial fragility in both sectors (Bistafa, Gurgel & Paltsev, 2016). In other words, domestic sales of ethanol decreased while sales of gasoline increased considerably. Added

[80] Technical, regulatory and infrastructure Coordinator at ABEEólica: - Brazilian Wind Energy Association.

to this scenario was the high debt rates of producers. The result was one of the biggest crises suffered by the Brazilian ethanol industry in the last decades. Queiroz-Stein calls this price control policy a "short-term imprudent" decision. This strategy was part of the then-president Dilma Rousseff plan of action, which main objective was to eliminate (or at least minimise) rent-seeking activities around the country's public debt. These practices were regarded as a systematic means of capital accumulation which occurs since the early 1980s (Bastos, 2017). In the short term, the plan improved some social indicators but quickly led the country to uncertainty, high inflation, and low growth. Dilma's attempt to lower interest rates by artificially containing energy and gasoline prices without cutting public spending went awry, and as a result, inflation initially dampened, returned with greater force later on (Coronato, Freitas & Utsumi, 2015). On this conjuncture Guilherme Moraes de Lima comments:

> The literature shows that a person is twice as impacted by a loss than by an equivalent-sized gain. So, when one is in a position to make decisions in public policies choice – which fundamentally are decisions on the allocation of resources and economic incentives (by which some will lose, and others will win) – there is a tendency, an irresistible incentive for politicians or policymakers – with a short mandate – to push any losses beyond the horizon of their mandates. At some point, when the situation becomes unsustainable, the bill is passed on to the consumers (interview with author, July 2018).

The creation and implementation of public policies within a period of four years are common in all sectors of governance in Brazil. Considered electoral policies, they aim to convince voters to re-elect the same politicians and keep them in office for a second term. In the energy sector, these short-term policies are not applicable, as the realization of projects for the modernization of the sector requires a lot of time and large investments. An energy transition in Brazil will only be possible when governments move in the direction of long-term policymaking. Given the current preference for short-term policies, the country will be late in the

race for the much-needed energy transition to be conducted by all countries around the globe.

5.2.2 Endowment effect and status quo bias

Another two aspects of people's behaviour that affect their decision-making processes are known as endowment effect and status quo bias. These behaviours may be a hindrance when it comes to the creation and implementation of public policies. Endowment effect implies that individuals stick to their routine and habits and are not open to innovation. Status quo bias suggests that actors rather keep things the way they are by avoiding action or persisting with the previous choices.

Regarding the Brazilian energy sector, endowment effect and status quo bias have been inhibiting initiatives towards increasing the use of more sustainable energy sources. Larissa Araujo Rodrigues illustrates this scenario by saying:

> Brazil is not taking measures to enable the energy transition. It is business as usual. Because the Brazilian energy matrix has a large share of hydroelectric power, the government uses this as propaganda. Nothing has changed after the submission of the country's iNDC to the UNFCCC. There is, in fact, an increase in the share of wind and solar sources and even biomass. However, traditional non-renewable sources are also increasing. The national energy plan indicates that 80% of investments are in oil and oil products and not in renewable energy. This is the current energy policy in Brazil. Because it is believed that the share of renewables is already quite high compared to the rest of the world, the policy is to maintain these numbers and continue with investments in the exploration of pre-salt oil reserves (interview with author, July 2020).

Queiroz- stein (2019) draws attention to the importance of analysing socio-technical regimes to facilitate coordination between actors and sustain certain economic and social achievement. These regimes, which are structured systems dependent on technological standards and

institutional arrangements, may hinder the development of innovative technologies and policies for the energy sector. The author claims that:

> from a political economy perspective, regimes are considered the locus of established practices with associated rules, which enable or constrain incumbent actors' actions. These incumbent actors favour regimes' existence and act in their defence, which is one of the lock-in mechanisms that act to prevent transitions or ensure that changes are incremental, without abrupt changes in trajectory (Queiroz-Stein, 2019:13).

An empirical manifestation of his statement has occurred in the Brazilian energy sector's not far past. The electricity reforms in the late 1990s in Brazil was designed to foster different energy sources other than hydro. However, the urge to diversify the system was not strong enough to neutralise the traditional hydropower industry. As a result, the political practice that fosters and hold on to hydro energy was incorporated by the new regulatory structure. According to Bradshaw, the electrocrats[81] (engineers and policymakers) had their own interest in maintaining the prevailing system, "the political and technical characteristics of the existing hydropower system shape the deployment of new technologies and serve as a defence for the status quo" (2018: 84). Nowadays, the support of hydropower is still strong. Carlos Alexandre Principe Pires, current director of the Energy Development Department of the Ministry of Mines and Energy, argues that hydroelectric power plants have a vital role in the Brazilian electrical system because of its fundamental differential, which is its capacity for energy storage through water reservoirs. He considers biased the debate around social and environmental impact caused by large hydroelectric dams and its contribution to GHG emission:

[81] Bradshaw (2018) names electrocrats government officials who had graduated from predominately engineering university programmes stimulated during the prosperous years of hydroelectricity development in Brazil.

> this discussion was created to draw attention to the wind and solar sources. The lobby will always exist; in fact, there are associations such as ABEEólica and Absolar only because there is a need for lobbying (interview with author, August 2018).

In 2001 severe droughts reduced the water levels of dam's reservoirs resulting in an energy crisis. That was the push political actors and technocrats needed to amend the electricity supply system. Policies were created to favour the renewable energy markets. Since then, solar and wind energy has been growing considerably. However, the intermittency of these technologies has been a common argument to affirm that "hydropower should still maintain a higher value in the energy system. In fact, the electricity industry sees the value of wind power as an "add-on" to the existing system" (Bradshaw, 2018: 101). And indeed, Carlos Alexandre Principe Pires corroborates:

> nowadays, it is impossible to expand *ad aeternum* wind and solar parks without having the backup of large reservoirs because the wind source generates energy only 40% of the time and the solar source even less, only 20% as long. It means that the rest of the time is necessary to have another system to accumulate energy to meet the country's demand (interview with author, August 2018).

The Brazilian energy sector has been facing challenges to change its path. The preservation of traditional structures, both institutional and technological, is often advocated by incumbent actors. The energy sector diversification must overcome status quo maintenance strategies before an energy transition can occur. Petrobras' criticisms of the RenovaBio programme in 2017 demonstrate this reality. Petrobras points out that the RenovaBio programme would be in disagreement with the Brazil fuel programme also launched in 2017 by MME, which aims to attract foreign investments to the refining sector of petroleum-based fuels. According to Lorenzi and Andrade (2019), the ethanol industry and Petrobras compete for their representativeness within the Brazilian environmental and energy policymaking. Petrobras defends the maintenance of the

current dynamics while the sugar and ethanol sector insists on the need for new incentives to achieve the iNDC goals. According to Larissa Araujo Rodrigues:

> oil companies were born as oil companies, so they continue to do what they have always done. Petrobras innovated a lot to reach the pre-salt, but it is an innovation in the same operation area. It does not expand to other areas of energy exploration. To achieve an energy transition, oil companies should become energy companies. Petrobras could go through this transformation since it already has investments in biofuels and renewable energy, but this investment is minimal. Because it does not make a profit like oil exploitation does (interview with author, July 2020).

Interviewees for this research, when asked whether incumbents actors opt for traditional energy sources because of a certain apprehension towards innovation or their tendency to maintain status quo, confirm this hypothesis. Marcelo Lima says:

> it is certainly a project in terms of maintaining the status quo because today the projects are centralised. Large projects are the ones more capable of mobilising capital and exponential profit, and there is where the market is concentrated. Few large companies have this capacity to do bulky things and expand profit, and therefore it is easier for them to maintain the monopoly (interview with author, July 2020).

Larissa Araujo Rodrigues adds:

> maintenance of the status quo is exactly what it is. It is not the fear of taking risks but more a perception that the future will not change much. Despite this discussion on energy transition, in Brazil, 80% of the investments still are on oil exploration, and in the world, the big oil companies are still growing. They still have billionaire investment plans in the sector. Companies do not see the need to change if it is still working. In the end the decision is economical. From a list of projects, the money goes to the one that gives the most financial return. This

reality makes the transition more difficult (interview with author, July 2020).

Brazil has a compelling reputation for using green energy (Knodt & Piefer, 2015). This is due to the enormous potential for hydro energy in the country. The development of technology for the use of water resources began in the middle of the last century. From the 1970s onwards, grew the use of hydroelectric plants in the country's electricity grid. Many companies have become giants in the sector and also very influential in the political realm (Kuijpers, 2013; Boas, Hidalgo & Richardson, 2014; Armijo & Rhodes, 2017; Pearce, 2018). Also in the 1970s, the development of the oil sector made Petrobras one of the largest oil companies in the world. Despite the Brazilian government still being the largest shareholder, Petrobras is a mixed capital company with a great share of private capital, which has strong influence in the decision-making processes (Guan, 2010: Leão, 2017; Olim, Mensah, and Yamachita, 2018). The Brazilian oil sector is very profitable, even more so after the discovery of the pre-salt oil fields in 2006. Despite the growth of the wind, solar and biofuel sectors, the incumbent hydroelectric and oil sectors are the ones that most strongly influence energy policies in Brazil, not to mention the strong lobby of the thermoelectric sector (Duvivier, 2021). It took many decades and huge investments to develop these sectors. The actors benefiting from the financial, social, and political profits of this development will not facilitate its replacement by a new business paradigm.

5.2.3 Information avoidance

One more common decision-making aspect that behavioural economics draws attention to rests on the fact that individuals choose not to acquire knowledge even when they have free access to it. This behaviour is known as information avoidance. Unawareness of troublesome information can be beneficial. However, it may lead to negative consequences in the long run. According to Samson (2018), information

avoidance prevents people from having the knowledge that may be useful for their decision-making processes.

A recent case of information avoidance in the Brazilian political scenario took place in July 2019 when the country's president Jair Bolsonaro accused the National Institute of Space research (Inpe) of overestimating deforestation in the Amazon. Bolsonaro declared that data "doesn't relate to the reality" after Inpe released satellite statistics showing that over 1000 km^4 of the forest had been cut down in the first two weeks of July, which means a rise of 68% in comparison with the whole month of July the year before. The institute sustained the data's accuracy in 95%, so did other scientific Brazilian institutions (BBC, 2019). Despite that, President Bolsonaro dismissed Ricardo Galvão, director of the institute since 2016, an engineer, physicist with more than 40 years of experience as a professor and scientist. After his dismissal, Galvão was named one of the ten most influential people in science in 2019 by the English journal *Nature*.

Information avoidance has proven to be a frequent practice in the current government. As of July 13, a year after firing the head of INPE, Minister Marcos Pontes (Ministry of science and technology) dismissed Lubia Vinhas from her position as general coordinator of Earth Observation at the same institute. The researcher was responsible for both departments, DETER and PRODES, which are systems for monitoring deforestation in the Amazon. The dismissals' circumstances are similar: they happened shortly after INPE released alarming data on forest destruction, which displeased the federal government. By voiding and denying scientific information, Bolsonaro's administration intends to circumvent criticism by Brazilian and foreign investors and businesspeople against its environmental policy (ClimaInfo Intitute, July 14, 2020).

According to Queiroz-Stein, the country is experiencing 'exceptional times' in which science has often been overlooked in decision-making processes:

> Although the energy sector has very consolidated bureaucracies, as is the case with Petrobras, MME, ANP, at the same time, they are always somewhat obscure when it comes to decision
> making. Questions remain: where does the influence come from? What is the level of autonomy of these agencies? (Interview with author, July 2020).

Larissa Araujo Rodrigues agrees and stresses that there is an exceptionally large gap between career professionals who work with energy and the positions indicated by the executive to work in the sector. According to her, the technicians who work in agencies such as ANP, ANEEL, and EPE are very competent. These people who make careers in this field are responsible for research and technical notes and do their best, so that information with a good quality reaches the hands of the people who make the final decision, which in this case is the CNPE, an executive council formed by ministers who have no technical knowledge but do have the decision-making power. She states:

> the big agreements are signed at the end within the executive. Decisions are not made merely based on technical criteria at ministerial level. At that level, large entrepreneurs influence decisions. Sometimes a technical study can even be the basis for a political decision. If it is the case, it is even better, but often technical information is ignored (interview with author, July 2020).

Brazil has built a good reputation for the use of renewable energy. Data from the Brazilian electricity matrix show that hydroelectric energy (61.0%) is the most used, followed by wind energy (8.7%) and biomass (8.5%) (ANEEL/Absolar, 2019). However, when looking at the Brazilian

energy mix as a whole – including the transport sector[82]– the use of fossil fuels is greater than renewable sources, 53,9% and 46,1% respectively (MME, 2020). A quick Google search shows that data on the electricity matrix is more plentiful than that on the energy mix. Often charts named *Brazilian Energy Mix* show data on electricity mix. As a result, the percentage related to hydropower use appears more frequently than the ones on the use of fossil fuels. This evidence is remarkable but not necessarily a sign of information avoidance. However, it could lead to misleading conclusions.

Another piece of information that is worth looking at is the use of biomass in Brazil. SIGA data show that biomass use as an energy source in Brazil does not directly contribute to the Brazilian energy grid. In fact, biomass energy is generated by the company's plants for their own consumption, which, in turn, do not use (totally or partially) the energy from the national grid. From 573 plants listed on SIGA, none has the status of public service providers for electricity generation (PS)[83]. In the electricity matrix charts, biomass appears as the third most used energy in Brazil. However, this source does not inject energy into the grid. By generating their energy from biomass, companies spare energy from the grid and other sources. Nevertheless, biomass does not contribute directly to the Brazilian electricity grid.

Every ten-year planning released by the MME – that guides the policies in the energy sector – shows that Brazil's energy supply grows with concern to the criteria of sustainability, reliability, and efficiency. For example, in the planning for the electricity sector, it is well defined how the electrical matrix will be composed in 10 years. Water, wind, and solar sources are well represented in the planning. According to Sandro Yamamoto, his colleagues and himself at ABEEólica participate in the

[82] Data from the National Agency of Petroleum, Natural Gas and Biofuels (2019) show that ethanol's contribution rate to the country's transport fuel market in 2018 was 18,9% against 76,7% of fossil-based fuel and a small share of 4,4% of biodiesel.

[83] See chart Brazilian biomass power generation capacity on the section Biomass, 4.3 *supra*.

debate that the matrix should be diversified and sustainable. However, he states: "When it comes to the real energy supply, we note that the amount of energy generated does not match with the planning" (interview with the author, July 2018). This discrepancy happens because the installed plants do not deliver the amount of energy corresponding to their initial generation potential. Old plants lose their yield over the years due to a series of factors. In the case of hydroelectric plants, not only the machinery ages but the reservoir no longer stores the same amount of water as at the beginning because of the diversified use of water, siltation, or both. The planning is done according to the plants' initial generating capacity. As this capacity is no longer real, the demand resulted in not being met as expected. As a result, thermoelectric plants are used to supply the energy deficit, which, in turn, results in more expensive bills –paid by consumers– and more polluting energy, says Yamamoto. This scenario demonstrates that the correct information about the real generation capacity is unknown, either due to information avoidance or simply due to poor management in the sector. Either way, this misinformation results in the initial planning not being conducted, which, in turn, affects the percentage of clean and sustainable energy injected into the Brazilian energy grid.

Brazil has good facilities and qualified professionals for research and development on energy. However, universities and research institutes are occasionally consulted and often ignored, especially when the data provided is not aligned with the political interests of decision makers (Ferraço, 2016). In recent years there has been a decrease in investments in the R&D sector (Neri, 2021), and as never before in the history of the country, scientific information was avoided during the government of President Jair Bolsonaro (Roque, 2020; ClimaInfo Intitute, 2020). To meet the commitments made with the international community on climate change mitigation, Brazil needs to increase investment in science. In addition to this, it is necessary to align research progress and the decision-making process. Only then can effective climate policies be implemented.

5.2.4 Delusion of competence

Behavioural economics theory defines delusion of competence as the deficiency in reflexive acknowledgement regarding one's own capability to make decisions or to function in order to fulfil requirements. Also known as the Dunning-Kruger effect, it suggests that low skilled people are overconfident about their cognitive ability to perform well, whereas highly skilled individuals are more careful when estimating their own skills.

In the Brazilian political realm, especially in recent years, actors often found themselves in circumstances which behavioural economists would call "behaviour deviation and cognitive limitations." A recent example of it happened in a meeting with diplomats of the Secretariat for National Sovereignty and Citizenship Affairs in August 2019, the then Minister of Foreign Affairs Ernesto Araujo[84] – in a clear case of illusion of competence in addition to information avoidance – made the following statement: "I do not believe in global warming. See, I went to Rome in May when I experienced a severe cold wave. This shows how the theories of global warming are wrong." The journalist and cartoonist Mauricio Ricardo Quirino commented on the chancellor's speech:

> he is a person absolutely incapable for the position he occupies and that illustrates the Dunning-Kruger effect, which is when a person tends to believe that he (idiot) is right and who is right is stupid. One tends to be convinced that is smarter than others (2019, 07: 30).

According to Quirino, a diplomat should not comment on a subject about which he has no in-depth knowledge. The scientific community considers

[84] In 2018, when the then-elected President Jair Bolsonaro appointed Ernesto Araujo to the post of minister of foreign affairs, both retired and on duty diplomats published a manifest stating that the president's candidate was unprepared to assume the post of chancellor minister: "we were led to make this statement given the gravity, not to mention the ridiculousness, of some of the nominee's manifestations, which deeply embarrass us, when they do not offend Brazil itself" (Brasil de Fato, 2018).

his argument to be a common mistake as it confuses weather with climate. The fact that it is more or less cold in a given location at any given time does not refute the existence of global warming, which has already been proven globally through a complex computational study of temperature averages around the world and for long periods.

Another recent case that questions the competence of the current Brazilian government in the energy sector was the blackout in the State of Amapá. Journalist Bob Fernandes (2020) comments: "the blackouts of Amapá illuminate the abyssal incompetence of President Bolsonaro to manage the government" (2020, 01:08). On November 03, 2020, the state of Amapá in the extreme north of Brazil suffered a blackout that lasted 22 days. The blackout occurred due to heavy rain and an explosion followed by a fire that damaged the three local generators. The lack of energy affected thirteen of the sixteen municipalities in the State of Amapá, generating many demonstrations, chaos, lack of water, increased violence. LMTE[85] (Macapá Power Transmission Lines), the company responsible for the distribution of energy in the State, when requested by MME to restore energy, affirmed that it did not have the personnel and equipment necessary to restore the system. It culminated in the state company Norte Energia having the responsibility to solve the problem. Amapá's electrical system has always been supported by hydroelectric energy from the Tucurui dam. However, the solution found was less sustainable. Fuel-powered thermoelectric generators have been provided until the problem is definitively solved. In this regard, Bob Fernandes says that the crisis in the distribution of energy in Amapá exposes not only the mismanagement of the current government but also the problems of the neoliberal policy that is being practised in the country. He warns that the privatisation of state-owned companies is not

[85] The company was created by the Spanish energy company Isolux Corsan. In 2008 LMTE won the auction for power transmission in the Brazilian state of Amapá for 30 years. Since then, Isolux started to face financial problems and, in 2016, entered a judicial reorganisation process. At the end of 2019, the company sold the LMTE concessionaire to the Gemini Energy company, which is controlled by Starboard Asset, a fund specialised in managing holdings in financial difficulties.

necessarily the salvation that many believe. He also states that Gemini Energy, the company that bought LMTE from Isolux Corsan, has the same short-term profit philosophy as the investment fund Starboard Asset. "There are those who call these funds vulture funds. They certainly know why they give such a necrophagous name to an investment fund" (2020, 04:18). This occurrence in Manaus is only one of many examples of lack of ability to manage public policies for the Brazilian energy sector.

Brazil has not been able to stand out in the solar energy international scenario, which is the case of India, Turkey, and China, for example. According to Samira Sana Fernandes de Sousa, Brazil had many research projects before China took the lead as a photovoltaic panel supplier. "The projects did not take off because there was no government investment, and then China comes with its prices, and nobody can compete." Rodrigo Sauaia (2018), Absolar's executive president, states that unlike Brazil, China has a central government that is very efficient in making decisions. "When they decide on a policy, its implementation is fast" (para. 8). India developed a national plan for the promotion of solar energy that includes large plants but also the generation in industries, public buildings, commercial facilities, and residences. In the Indian plan, the energy generated is contracted by the government but through the market. The goal is to reduce its dependence on coal and fossil fuels. As most of the Indian population still does not have access to electricity, solar energy systems with batteries are being installed all over the country. Turkey has followed a similar path and implemented a policy of financial incentives to generate solar energy. Today, five years later, Turkey is the sixth European country in the generation of solar energy. Brazil has adopted the compensation system[86] which tends to be less attractive as it does not offer direct financial incentives.

[86] The Electric Energy compensation system came into force in 2012 when ANEEL enacted its Normative Resolution 482 with the rules for distributed generation. This system works as an "exchange" between the private generator's energy and the energy from the grid. All surplus energy generated by the consumer's solar system is injected into the network and granted to the distributor as a loan. This energy then goes back to the consumer in the form of energy credits –with a 60-month usage validity– which are used to compensate for that

Brazil was expected to become self-sufficient in fossil fuels with the discovery of pre-salt[87] oil reserves in 2006, since Petrobras has the technology to explore the discovered oil fields and also to transform crude oil into gasoline and gas Natural. In July 2019, philosopher Paulo Ghiraldelli Junior (2019b) and politician Ciro Gomes (2019) warned about the illogical policy of exporting oil and importing oil derivatives. Both question the neoliberal policy of the current government that intends to privatise Petrobras refineries. According to them, Petrobras' facilities are paralysed and contributing to the increase in unemployment in the country. They argue that Brazil has a large amount of oil in its territory and is able to extract it and that national refineries can process Brazilian oil and produce its derivatives to sufficiently meet the country's demand. The lack of logic in this policy is that it stops the refineries' activities and then import gasoline and natural gas from the USA. In addition to increasing public spending because of the exchange rate difference between the dollar and the *real*, this policy makes the Brazilian population pay a high price for oil products. According to Sindipetro (2019), this policy is an attempt to dismantle Petrobras to privatise it in the future. Eight refineries are in the planning for the first two phases of privatisation, and it puts thousands of jobs in the oil sector at risk.

The competence of the Brazilian government has been frequently questioned. This distrust is due to the frequency in which mismanagement events occur in different periods, administrations, and sectors. Rufin (2012), draws attention to the preparation to host the

energy that was consumed from the grid in times when the local system generates no or little energy, as occurs at night or on cloudy and rainy days (ANEEL, 2012).

[87] It is important to note that the pre-salt exploration does not contribute to meeting the goals of the Brazilian iNDC. However, the import and export policy practised by the current government mentioned above, which allows the exploitation of Brazilian petroleum by foreign companies, not only contributes to the global increase in GHG emissions but still prevents Brazil from producing its own wealth, which could be used to help the country invest in its own energy transition in the future.

World Cup in 2014 when government-owned airport operator, Infraero, showed "inability" to make the necessary improvement to the country's airport in time for the event. To solve the problem, the then leftist and pro-state-centred government of Dilma Rousseff was forced to turn to the private sector for assistance. Concerning the energy sector, Rufin states that great investment is needed to expand energy sources in Brazil, which will only be possible through a partnership with the national and international private sectors. "Despite the huge size and capacity of the Brazilian state, it lacks the technology, organisational capacity, and capital to simultaneously accomplish all that is needed" (Rufin, 2012: 597).

The energy sector is a network industry and therefore requires high initial investments with long-term returns. As such, it is an unattractive activity for the private sector. Consequently, the State becomes the main provider and regulator of this service and therefore, has the duty to provide a structure in itself or mechanisms that promote this attractiveness. In order to execute both tasks, it is necessary to have an adequate physical structure, a support mechanism aimed at the private sector and a careful budget planning. In developing countries, such as Brazil, it is common to have a difference between the financial resources planned by the government for a given project and the effective value of the investments made. This variation in values occurs due to governmental and bureaucratic inefficiencies that generate contractual instability. Poorly prepared bid notices, for example, are subject to multiple interpretations since they do not clearly address important points of the contract. Another key factor is the delay in payments to contractors and suppliers. As they know from experience that a delay will occur, they incorporate in advance extra value for payment delay to their job, good and service. These are some of the reasons that make projects more expensive. In addition, lobbies and favour exchange practices between political parties and companies are also often the cause of diversion of investments (IPEA, 2010).

These events not far in the past are only a few examples of the delusion of competence phenomenon. Unfortunately, they are not characteristics of the current government only. Lack of competence in Brazilian governance goes far back in Brazilian history. Alcoforado (2019) states that Brazil still faces problems –such as corruption, cronyism, and highly influential lobby– that started in the colonial period. The attempts to overcome these problems were weakened by the overthrow of the worker's party in 2016; the repression of social movements; and policy choices against the working class. "The inability of the Brazilian government and political institutions in general, to offer effective responses to overcome the economic crisis that has affected the nation since 2014 and its powerlessness to repress widespread corruption has contributed to the advance of fascism as a solution to the country's problems" (p. 1). According to the author, to overcome the economic crisis that affects Brazil, it is necessary to replace the neoliberal economic model that benefits the market and has been devastating the Brazilian economy since 1990, especially after 2014. In the energy sector, the privatisation of the oil and gas refining, distribution, and transportation sectors within Petrobras benefits international capital. With the privatisation of oil fields originally under Petrobras' control, foreign production increased from 8.3% in 2011 to 26.5% in 2018 (Gauto, 2019). With the auctions planned by the current government, this growth tends to continue.

According to Doria[88] (2020), "during the military dictatorship, there was not only corruption but also incompetence. The military likes to say that it has administrative competence, but they do not." According to the journalist, at the end of the military government in 1985, they surrendered the country, submerged in a deep economic crisis, with a hyperinflation that democracy took almost ten years to resolve. At that time, the level of children in primary school age outside school was so high that it took 15 years for democracy to restore this deficit. After 35

88 Journalist, writer, and speaker. Columnist for CBN Broadcasting and newspapers *O Globo* and *Estadão*.

years, those memories have been lost, and the military is back within Bolsonaro's government. While the country is suffering from the greatest pandemic of the century, a general office as minister of healthy is unable even to spend the Ministry's annual budget. Doria calls attention to the importance of a good team. He argues that the previous PSDB and PT governments had a dedicated team. Party people who understood health, education, environment, et cetera. "Bolsonaro was elected without having a party or team. He turned to the military, and they do not know how to govern" (2020: 08:00). According to him, it seems that

> the objective of Bolsonaro's government is the destruction of everything that the New Republic created.[89] Today, the Ministry of Education is the opposite of what it was over the past 35 years; the minister of the environment works to dismantle environmental regulation. This government does not care about the environment when the world's leading capitalists are overly concerned about the environment. This government does not believe in science in a world where economics, science and technology are completely intertwined (2020: 02: 16).

The writer Henry Bugalho associates the election of President Bolsonaro with the mob rule concept[90] which occurs "when the angry mob chooses an authoritarian ruler who is not the most competent, but the one who screams the most. That is exactly what happened in Bolsonaro's election. The population voted for a highly incompetent, populist politician who does not know how to govern" (2020b, 01: 28) The author draws attention to the fact that Bolsonaro had an unimpressive career as a deputy of the parliament's passive clergy for almost 30 years without any executive experience in public management. Despite that, he has been

89 The New Republic is a term used to describe the period in Brazilian government and politics that started on March 15, 1985, when civilians recover the federal government's leading after twenty-one years of military dictatorship.

90 Also known as ochlocracy, the term illustrates the mob's rule or mass and its power that influence governments. "In the absence of democracy and the engagement of its actors, ochlocracy mimics itself in a willingness to appear as a democracy. Relying on demagogues and dictators, ochlocracy contains *democratic illusion*, where the *ochlos* (scum) is trying to show up like *demos* (political people)" (Hasanović, 2012: 61).

elevated to the post of president of the country. Once elected, Bolsonaro had to form his cabinet, which would be very technical as he had promised during his campaign. Bugalho relates Bolsonaro's cabinet formation to the Dunning-Kruger effect:

> Because he is incompetent, he is unable to recognise the incompetence of those he chooses to assist him in the government. He has no capacity to recognise what is technical and what is not. The result is a government of technically incompetent ministers who are faithful to the president's ideology, as is the case with of the Ministry of Education, Ministry of Economic, the Ministry of the Environment, the Ministry of Foreign Affairs, et cetera (Bugalho, 2020b, 07:20).

Furthermore, Bugalho states that this practice is not exclusive to the current administration as public positions in Brazilian governments have always been used as political plum.

Guilherme Moraes de Lima[91] states that Brazil would have good conditions to implement policies in the direction of an energy transition using off-grid solutions. However, he believes that there is no social and political organisation for this to happen. "It is not possible to dissociate this (energy transition) from the rest of the public policy discussion that begins with the state's model and the type of government that we want to have." While in other countries, the State has a role of a regulator in defence of the people's interests, this does not seem to be the case in Brazil.

> The state's role in Brazil is an unresolved thing, and this influences political discussion in general. In health, education and in all other sectors, the state must be a leader, a regulator, an executor. In Brazil, most politicians' discussions are usually at a very shallow level (Guilherme Moraes de Lima, interview with author, July 2018).

[91] In interview with author, July 2018.

According to de Lima, this superficial level is related to the unpreparedness of politicians in general. About President Jair Bolsonaro, he says: "I do not think he has the capacity to raise the discussion around the implementation of appropriate public policies for the country. This is not an optimistic statement, but it is not possible to pretend that things are different." Not only President Bolsonaro has been the target of much criticism, but also his cabinet members. Guilherme de Queiroz-Stein condemns the lack of skills of Bolsonaro's choices to form his administration: "the incompetence of the current government is saving us: imagine if they were competent in implementing their senseless ideas" (interview with author, July 2020).

The statements presented above may lead one to think that they do not represent the Brazilian conjuncture. It is true that the Bolsonaro government is exceptionally ideological, following the global trend of the growth of far-right ideologies (Guimarães and Oliveira e Silva, 2021). It is also true that public policies aligned with the international effort to mitigate climate change were not a priority in his government (Roque, 2020). However, as mentioned in prior sections, the elevated level of clientelism, crony capitalism and a general capture of the state -which are historically recurrent phenomena- lead elected politicians to appoint allies, campaign supporters and their friends to positions and jobs they are often unqualified for (Haber, 2002; Aligica & Tarko, 2014; Salter, 2014). In this way, decision-making processes end up contaminated by incompetent actors who are incapable of making the most efficient choices. As long as this is the profile of decision makers within energy governance in Brazil, effective policies for the fulfilment of international agreements will be delayed.

5.2.5 Overconfidence effect and planning fallacy

Overconfidence effect and planning fallacy are also concepts applied within behavioural economics to understand individuals' actions. Overconfidence effect reflects individuals' overestimation of their own

performance capability. Frequently the planning fallacy phenomenon falls within the scope of the overconfidence effect. Overconfident actors, when planning, could commit planning fallacy as they underestimate the time necessary to finish a project. In the Brazilian energy sector, these phenomena have occurred too frequently throughout history. The nuclear agreement between Brazil and the then East German is an example in which overconfidence occurred. The collaboration between the two countries aimed to project Brazil as a civilian nuclear power, expanding its geopolitical leadership in Latin America. However, "the deal included megalomaniac aspects, many controversial technical details and a financial cost unbearable for a developing country" (Wrobel, 2017: 286). Diplomats negotiated the project under the military government's command while the scientific community was marginalised from the decision-making process. The transfer of technology was one of the characteristics of the agreement. However, the Brazilian government did not give training and education the necessary priority. This neglect has contributed to the failure of the agreement. "To create a capacity to absorb the German know-how and build up an autonomous industrial basis required a much greater investment in education and training" (Wrobel, 2017: 287). According to Carpes (2006), the scientific community at the time and members of CNEN complained about the lack of continued strategic planning. Originally, the Brazil-Germany agreement would be responsible for eight nuclear reactors, but only two were accomplished. Nowadays, the energy expansion planning in Brazil is still unreliable. According to Samira Sana Fernandes de Sousa, national energy planning includes the construction of new nuclear thermoelectric plants.[92] However, so far, only two are in operation (Angra 1 and 2), and one is under construction (Angra 3). "It is not because it is in the planning that it will necessarily be carried out" she said. Another example of a failure in planning, according to Sousa, is the case of the interconnection of Roraima's electrical system to the

[92] In 2015 the then Minister of Mines and Energy, Eduardo Braga, predicted 12 new plants by 2050, four of them by 2030 and eight in the next 20 years. For details, go to https://www.ipen.br/portal_por/portal/interna.php?secaoid=40&campo=2387

national power grid. “This interconnection should have already been made. In the State of Roraima, energy generation is almost completely by diesel, except for a portion generated by interconnection with Venezuela” (interview with author, august 2018).

Problems concerning strategic planning appears to be recurrent in the Brazilian energy sector. Guilherme Soares de Lima states:

> In the case of energy policy or the lack of it, there is a previous problem: the definition of which development model is intended for Brazil. An economic development model that determines first what is the role of the state in implementing this model. This planning is not clearly defined starting from investments or what role Brazil wants to play in the generation of renewable energy, such as wind and solar sources. Brazil has a privileged condition to not only be a generator but to be a developer of technology for renewable energy generation. It is necessary to define strategies in advance, which does not happen (interview with author, July 2018).

In her interview for this research, Samira Sana Fernandes de Sousa (2018) reported: “one thing that many of my co-workers and I think is that the sector lacks a more strategic vision. The ruler in office only wants to think about his term in office; he does not think about a strategy to the country, where the country wants to arrive in 2050 or 2100, for instance”. The professor of the civil engineering and environment department at the Pontifical Catholic University (PUC / Rio de Janeiro), Tácio Mauro Pereira de Campos, ratifies[93] the testimony of Sousa: “from the energy policy point of view, the country is in disarray, and the prospect is terrible. This is mainly due to the lack of planning and investment”. The professor points out that he is well aware of the performance of Light, a private company responsible for the energy supply in the state of Rio de Janeiro. According to him, the company’s geotechnical sector has only three trained employees to ensure the smooth operation of the seven plants that generate the energy

[93] Interview with author, July 2018.

distributed by Light. He argues: “there are no personnel, no incentive, everything is abandoned”. The lack of personnel to attend any emergency that may occur, as was the previously mentioned case in the State of Amapá, is also a problem in other states of the federation.

Another planning failure example occurred regarding the introduction of wind energy to the Brazilian national grid. The first wind energy fields contracted in the auctions of 2009, 2010 and 2011 were almost ready in 2012. However, there were no transmission lines to connect the wind parks to the SIN (National Interconnected Systems). According to the Brazilian legislation, the auctions for energy generation and transmission lines projects are held separately. This feature of the law generates a mismatch in the schedule if the government does not pay attention to this issue. At that time, while the wind farms were being built, the project for the extension of the transmission lines was not planned to be completed simultaneously. When the government contracts energy projects, the structure for connecting these projects to the national grid must be expanded at the same time. Usually, the term to build such a structure is, on average, two years. However, the wind farms contacted at those auctions were built in areas far from the demand centres, and therefore, the transmission lines would take longer to be built. This scenario caused an inevitable delay. According to Jannuzzi (2014), this caused monetary loss for the state and the population because the companies awarded a contract for the energy generation to the central grid must be paid anyway. Eventually, you pay for energy that is not being used (as cited in Ferraço, 2016: 66).

Planning has also proved inadequate for the effective development of alternative energy sources. Lorenzi and Andrade (2019), in their study on second-generation ethanol (E2G) in Brazil, demonstrate that planning anticipated a result that had no real conditions to be achieved. In 2011, the National Bank for Economic and Social Development and the Financing Agency for Studies and Projects launched the BNDES-Finep Plan to Support Innovation in the Energy and Sugar-Chemical Sectors

(Paiss in Portuguese). The authors state that this programme has enabled companies such as GranBio, Raízen, Odebrecht Agroindustrial and the Centre for Technology Canavieira (CTC) to start their research programmes for the development and production of the E2G on a commercial scale. According to them "the forecast was that E2G would become a significant part of the national energy matrix and revolutionise the sugar-energy sector" (p. 3). The expectation was for the construction of more than ten E2G plants to start operating by 2025. However, eight years after the launch of Paiss, only one pilot plant (CTC) and two commercial-scale plants were built (GranBio and Raízen). In addition, none of the production goals or expectations was met. Several problems caused major shutdowns at these plants, resulting in production below 10% of capacity in all years of operation. In 2015, Granbio projected to produce 9.84 million litres of E2G. However, it is estimated that only 1 million litters were produced due to problems with the pre-treatment phase. Raízen also faced the same problems, which led the company to cancel its initial plan to build seven more plants after E2G production costs reached the first generation ethanol level. "The first expectations and promises for E2G in Brazil were precipitated, promising too much too soon (...) current expectations point out that E2G should become a paradigm in the sugar-energy sector from 2030" (Lorenzi & Andrade, 2019: 14).

To strengthen the biodiesel industry, the Brazilian government launched in 2004 the National Programme of Production and Use of Biodiesel (PNPB in Portuguese). The initiative was intended to foster sustainable production and use of biodiesel and at the same time promote social inclusion. For that reason, the north and northeast regions should be prioritised as well as family farming and castor beans as raw material. Despite this policy, most biodiesel production in the early years of PNPB (2005-2009) occurred in the centre-west and south regions, and soybeans from large producers were predominant. According to Stattman (2019), the government associated PNPB implementation difficulties with the biodiesel companies' lack of support, experience, and

agricultural knowledge with assisting family farmers. On the other hand, family farmers had small-arable land and limited knowledge of biodiesel crops. Once more, planning and implementation appear to be in discordance. The PNPB have been conducted without the required conditions, which led to its poor results.

These are some energy policy examples that were unsuccessful due to the lack of efficient planning. Throughout history, Brazilian governance has been the subject of public criticism concerning policy planning and implementation. Moreover, it seems that this problem will not be solved in the coming years. Ricardo Baitelo shows great concern about the newest National Energy Plan (PNE2050) published on October 09, 2020. He argues that the plan limits the expected growth of wind and solar energy sources, conditioning it to the expansion of thermoelectric plants. Also, the plan gives the impression of opposing the expansion of hydroelectric plants in the Amazon with the expansion of the nuclear energy programme. In other words, if it is not allowed to expand hydroelectric plants in the Amazon region, the solution will be to introduce 20 Gigawatt of thermoelectric. Furthermore, Baitelo states his distrust in the PNE2050:

> the government does not want to commit to planning. EPE, under the current government's command, is responsible for the research and the planning. The plan has been rewritten several times. It was supposed to be released in 2014, but it was cancelled. In 2016 the calculations were already completely obsolete. Then they launched fragmentary reports with some premises. And now they launched this plan in a hurry. It seems an incomplete plan (interview with author, July 2020).

Overconfidence and planning fallacy are common occurrences across all administration sectors in Brazil. Concerning Brazil's commitment to the international climate agreements, their incidence in the energy sector needs to be addressed.

Changes in the energy sector are imperative to curb global warming. The entire world is looking for solutions for a transition from fossil fuels to renewable energy sources. Brazil is also in this search and has already taken steps in this direction. However, Brazil faces serious obstacles to implementing energy policies conducive to this transition. Power relations strategies such as monopolistic practices, clientelism and the political capture, as shown in the first part of this last chapter, effect decision-making processes shaping the policies for the sector. These power relations strategies exert a force contrary to changes needed since their influence on policymakers is extraordinarily strong. The State is responsible for directing the energy sector. Its capture limits innovation and development towards an energy transition in the country. In addition to these power relations strategies, the behaviour of actors involved in decision-making processes is of great significance when choosing one or other policy. The aspects of behavioural economics theory: hyperbolic discounting and loss aversion; endowment effect and status quo bias; information avoidance; delusion of competence, overconfidence, and planning fallacy, explain how individual behaviour affect policy choices. The second part of this final chapter shows evidence of how these behaviours interfere with the decision-making processes. Both, power relations strategies and policy makers' behaviour are major obstacles that the Brazilian energy sector needs to overcome in order to implement an energy transition and thus be able to comply with international agreements to mitigate climate change.

CONCLUSION

At present, all nations worldwide are seeking to implement public policies at the local and global levels to address climate change. Together 192 nations have signed different agreements pledging to join efforts to control global warming. A transition from fossil fuels to alternative energy sources is essential to achieve this goal. This research sought to understand how Brazil's energy governance contributes to this international endeavour. The aim of this research was to answer the following question: to what extent current energy policies in the country are designed to comply with the international agreement to hold the increase in global average temperature below 2°C above pre-industrial levels? Empirical evidence found during this study show that Brazil is having great difficulty in renewing its energy policies to contribute effectively and urgently to the international community's efforts. As discussed in chapter 5, power relation strategies practised by interest groups and policymakers' personal behaviour are great obstacles preventing the necessary changes in the Brazilian energy sector. To make a significant contribution to climate issues, great attention must be paid in policy-making engagement and policymakers behaviour. Considering the technological aspect, energy transition in Brazil is already possible (see chapter 4). However, the lack of political will is a massive challenge to overcome. To boost renewable energy, as Rufin (2012) suggests, it is necessary to wean the incumbent industry and policymakers that reinforce the use of traditional sources of energy instead of promoting innovation in the sector. A history of corrupt practices during contract negotiations (Armjo & Rhodes, 2017) compromises projects outcome and often frighten private investors, especially foreigners. This pattern hinders the arrival of innovative technologies that Brazil needs to pursue its energy transition.

The starting point for the central research question was the corruption scandals in the country which were headlines in the news in Brazil and abroad in mid 2010s. In the centre of the scandal was Petrobras and other Brazilian companies accountable for power generation in the country. A poorly managed energy sector opposed to a bold promise – presented in the Brazilian iNDC– to lower the country's carbon emissions by 37% by 2025 and 43% by 2030, below 2005 levels (MRE, 2015), is a contradiction that needs attention. The historical occurrence of power relations strategies in the general Brazilian governance, and particularly in the energy sector was the initial baseline found in the literature to form the theoretical framework. Widely studied by many scholars, monopoly and oligopoly (Beke, 2018; Ayal, 2013; Hemphil & Wu, 2013); clientelism (Armijo & Rhodes, 2017; Gherguina & Volintiru, 2017); bossism and political capture (Macdonald, 2017; Arlen, 2016; Rhoden, 2015); crony capitalism and rent-seeking (Zywicki, 2016; Salter, 2014; Sobel & Graefe-Anderson, 2014) are the power relations strategies found most useful to ground this research.

A further and in-depth literature review directed this study to behavioural economics, a theory that uses psychology and sociology insights to understand individuals' and institutions' decision-making processes (Koch, Nafziger & Nielsen, 2014; Chetty, 2015; Samson, 2016). The first insight that behavioural economics was the right path to follow came from Pollitt & Shaorshadze (2013) with their article *The role of behavioural economics in energy and climate policy* in the *Handbook on energy and climate change* edited by Fouquet (2013). Behavioural economics offers a range of concepts (Samson, 2020) that are valuable tools to analyse individuals' behaviour and choices. A closer examination of the policymaking in the Brazilian energy sector led to the conclusion that the most applicable concepts to understand the phenomena were the following: hyperbolic discount, loss aversion, endowment effect, status quo bias, information avoidance, delusion of competence, overconfidence, and planning fallacy.

Even though Brazil is a modern liberal democracy, its political power is concentrated in the hands of small oligarchic groups which have major influence in the policy-making processes (Araujo, 2003; Morais, 2016). The oligarchic bosses exercise their power within the political realm to shape decision-making processes in their favour. This form of bossism is a practice that has occurred in Brazil since the colonisation and still influences policy outcomes. Bossism, in turn, reinforces rent-seeking and crony capitalism. Political elite elected by the people or those who hold power because of their oligarchic roots, have easy access to the financial opportunities offered by the State. This structure results in an accumulation of wealth and political power by well-connected people. In the energy sector, it determines the direction of policymaking, keeping the incumbent industry profitable and therefore, hard to change. The construction of the Belo Monte dam is an example of it (see sections 3.1 and 5.1.3). The energy sector attracts the most economic and political interest because of its enormous financial resources. To take advantage of the political and economic benefits that the energy sector provides, high-level entrepreneurs, politicians, public and private agents use different power strategies. They use these strategies to influence policies according to their interests or the groups they represent (Stattman, 2019). Such power relations strategies recurrently occur at all Brazilian political levels.

In the 1990s, Brazil went through an economic reform that led to privatisation processes, especially in strategic development areas, such as telecommunications, energy, and mining. Hereby, a control decentralisation of important Brazilian companies was expected. Instead, power accumulation was intensified, as a select group of owners divided the share capital of some of these companies (Fortes do Rego, 2017). As a result, more firms were submitted to common controlling groups. Such outcomes are common in Brazilian governance and policy-making processes. Policy choices like this one are the fuel that reinforces the ongoing power relations strategies. These practices occur in a deep-rooted way which makes pattern change a complex matter. This way of

doing politics is replicated when new energy policies are proposed, making it difficult to comply with the international agreements on climate change mitigation.

In recent years, power relations strategies have receded the country's climate governance. The political crisis that started in 2016 with the impeachment of Dilma Rousseff, led to the election of President Jair Bolsonaro, which in turn, weakened the country's environmental policies (Ferris, 2022; Observatório do Clima, 2022). Bolsonaro's government reversed many environmental regulations as a bargain to ensure power. His changes in the legislation have made it even more challenging to control GHG emissions in the country. Lula da Silva's presidency, which started on January 1st, 2023, will face great challenges to rebuilt and improve the country's conditions to cooperate with the international climate governance.

Despite recent local and international critics, Brazil holds its reputation as a green energy power. This status hinders the discussion on energy transition in the country as stakeholders in the sector stress that Brazil's energy matrix is far cleaner than other similar economy. However, data show otherwise (see figure 1) and point out that Brazil has a long way to go before being able to comply with international agreements. The Brazilian iNDC is mainly based on ending illegal deforestation, and it is believed that if this happens, the country will achieve its goal. But in recent years, deforestation has grown rather than decreased (Watson, McCarthy, Canziani, Nakicenovic & Hisas, 2019); at the same time, few changes have occurred in the energy sector. Brazil boasts of its electrical matrix because hydropower is its primary electricity source, but when it comes to the energy industry in general, hydropower represents much less than the consumption of oil and diesel (see figure 2). With Brazil's large and growing population, road transport mainly and high unemployment rates – that has led to workforce uberization, which, in turn, has increased the county's car fleet – the use of fossil fuels has a decisive weight in the economy. Considering this scenario, the

exploitation of the pre-salt oil reserves will go on for decades to come. In the face of such economic wealth, interest groups use their power relations strategies and find fertile ground to exert their influence. To comply with international climate agreements, an off-grid system of distributed wind and solar energy is needed. However, as discussed in chapter 5, an oligarchic elite controls the Brazilian energy sector keeping the use of incumbent energy sources. If political bosses from this oligarchic elite stay in control of the energy policymaking processes, it will not be possible to make the energy transition necessary to lower Brazil's CO_2 emissions.

The Brazilian constitution prohibits monopolies. Although monopolies and oligopolies do not exist in the legal form, monopolistic practices of interest groups have led to the capture of the State. As a result, policymaking permits oil and gas distribution to happen under oligopolistic control (see section 5.1.1). Petrobras dominates most exploration processes even though competition in the oil and gas exploration industry exists. However, exploration techniques are remarkably similar. The existence of competition does not make a difference if all companies work in the same way. With a monopoly of capital and power by a small number of stakeholders, monopolistic practices of exploration and distribution of energy occur. These practices are harmful to the environment and of great hindrance to an energy transition. Exploring the pre-salt oil and gas reserves also makes it challenging to develop and use alternative energy sources. Power relations strategies result is the low participation of renewable sources in the Brazilian energy matrix. Monopolistic practices delay innovation because incumbent energy companies refuse to make room for new and more efficient technologies. Dominant stakeholders have the power to suppress the participation of the clean energy industry in the Brazilian energy matrix, hindering its expansion and technological innovation. The Brazilian energy sector has shown a low rate of innovation in the use of renewable sources. The current Brazilian economic conjecture confirms Hemphill and Wu's arguments (2013) that monopolistic practices result

in long-term economic damage. It certainly hampers the achievement of the country's GHG mitigation pledges. Despite Brazil developments in the wind, solar and biofuels sector, the use of this energy sources is still below the country's generation capacity. This retardation is the result of the occurrence of power relations strategies and their effects on policymaking for the Brazilian energy sector.

Brazil is a democracy, with direct elections for president, governors, mayors, and for members of congress. The latter are responsible for the decision making and implementation of public policies. However, candidates running for office are primarily selected within the party. This selection is influenced by entrepreneurs who donate resources for the party's political campaigns. In this way, interest groups support candidates they identify with. Once elected, politicians will be loyal to their supporters by suggesting and passing laws that benefit the interests groups (Corrêa, 2019). In the energy sector, big enterprises such as construction and energy companies, and investors in incumbent energy sources, determine who will run for office. They invest in their campaigns in exchange for a public policy that favours their businesses. The Brazilians super-rich buy political influence aiming to direct public policies and benefit from them. Cuadros (2016) presents an example of it in his article *The Brazillionaire* that tells the history of Eike Batista, once the richest man in Brazil, seeking Government's help when his investments in oil and gas were in trouble. Batista had strongly financed the campaigns of Lula da Silva and the then President Dilma Rousseff. This is one of many cases of Government and private sector entanglement, extensively discussed in chapter 3.

Crony capitalism is a customary practice in Brazil and an obstacle to the energy transition. Cronyism facilitates access to decision-making processes (see section 1.5). Brazilian well-connected people invest a large part of their fortunes in politicians and teams of highly trained professionals (lobbyists, lawyers, consultants). Their goal is continuity of their business and the maintenance of the status quo (Bradshaw, 2018).

The use of this kind of power strategy slows down technological innovation and the implementation of alternative policies necessary for an energy transition in the country.

To mitigate the effects of climate change is energy transition urgently needed. In addition to investing in modern technologies, it is necessary to abandon the usual energy production and consumption practices (Rufin, 2012). This would immediately indicate a reduction in the profits of incumbent companies in the sector. Companies try to increase their profits by paying the lowest tax rates possible. In Brazil, this fashion is possible because of the customary practice of cronyism within the political realm, and it is stimulated by the short-term profit requirement of large firms' shareholders. If this practice continues, it will be difficult to implement public policies that stimulate the energy transition in the short and medium term.

In a country like Brazil, where social inequality is enormous, clientelistic practices are highly likely to occur. Due to clients' lack of resources, small gains in the short term are more valued than more meaningful results in the long run (see section 1.3). In Brazil, clientelistic practices find a fecund environment because of client's immediate interests. As a result, public policies with future outcomes do not receive the necessary attention. Since solutions to mitigate climate change now is only necessary to avoid natural catastrophes in the future, actions tend to be postponed.

Clientelism, monopolistic practices, cronyism, and rent-seeking, are historically institutionalised power relations strategies in Brazil and have great interference in the policy-making process for the Brazilian energy sector. They are detrimental for the energy transition in the country. The Brazilian State has a fundamental role in creating and implementing public policies for the sector, as well as in investing in technological innovation to make the transition happen. However, this is not possible because the State is subordinate to the private sector. As

Azevedo (2021) states, the private sector has captured the Brazilian State. Additionally, stakeholder's behaviour also compromises the development of new policies in the country. As claimed by North 1990, Lin (2011) and Gauri (2016), once the public and private agents are accustomed to thinking in a certain way about public policies, the tendency is for these individuals to continue to make decisions that lead to the same direction. The private sector has major influence on Brazilian politics. So much so that it has culminated in the capture of the State. The government has set targets to meet the international agreements to attract investments and make a good impression, but the reality is different. If the agreements to contain the global temperature below 2% are fulfilled, fossil fuel exploration companies will suffer very severe economic losses. For this reason, the capture of the Brazilian State is unlikely to disappear. That makes the country's commitment to the international climate governance hard to fulfil.

In addition to traditional power relations strategies and equally important, is the behaviour of agents involved in both decision- and policy-making processes required to reduce the anthropogenic effect on the environment. As discussed in chapter 1 and 5, behavioural economics explains that individual's behaviour is decisive in the research, proposals, choice, implementation, and enforcement of public policies on climate change mitigation or policies on any other subject matter. Individual's limitations studied by behavioural economists such as hyperbolic discounting and loss aversion, endowment effect and status quo bias, information avoidance, delusion of competence, overconfidence and planning fallacy have been useful tools in this research for analysing policy choice in the Brazilian energy sector.

Studies in behavioural economics demonstrate that the use of heuristics results in frequent errors (Gsottbauer & Van den Bergh, 2012; Cooper, 2013). These errors happen because the impulsive and intuitive part of the brain – System 1, according to Kahneman (2003) – is used in decision making. In Brazil, politicians and public officials generally make

decisions using heuristics, which lead to systematic errors. The creation and implementation of public policy take place with little basis in scientific studies and data. Policymakers, in general, are overconfident about their ability to solve problems. However, the intuitive part of their brain leads to hasty decisions disregarding lengthy calculations, which are more likely to guarantee reliable results. The use of heuristics frequently occurs in the political realm because it reduces effort and time. On the other hand, it can cause losses at the end. When scientific data showing possible negative results are ignored, society is harmed in the long run.

By nature, individuals prefer to maintain their routine, carry on with established situations and practices in which the gain is real, or even when the gain is only the avoidance of discomfort that a change may cause. These behaviours are defined by behavioural economics as status quo bias and endowment effect (Pollitt & Shaorshadze, 2013; Samson, 2018). They are not comportment of ordinary individuals only. They are also a common behaviour of public officials, private agents, entrepreneurs, politicians, high-level decision-makers, and therefore have great influence on the decision-making processes in the creation and implementation of public policies in the Brazilian energy sector. As argued in section 5.1.3, the sector is historically run by interest groups, oligarchies that practice cronyism and rent-seeking. Due to their advantageous position, these groups have no interest in policy changes in the sector. Endowment effect and status quo bias, added to this scenario, cause the postponement of the energy transition to an even more distant future.

In Brazil, the development of the energy sector has always been a responsibility of the federal government. Despite the many privatisations conducted since the 1990s, the State is primarily accountable for the sector's management. Brazil has well-established regulatory and research agencies and trained professionals to create policies that favour energy transition. However, the executive and the

national congress are responsible for creating new policies. Decision-making positions are generally political positions, that is, indications of the government in power (Haber, 2002; Aligica & Tarko, 2014; Salter, 2014). Since public agents in elective positions or indicated by elected politicians are responsible for final decisions, it is common scientific information and data provided by energy experts to be ignored because they do not meet the interests of oligarchic groups.

Brazil is a wealthy country, especially in natural resources. Its institutions, although democratic, are still fragile. Throughout history, Brazil has suffered several economic and political crises. Between 2003 and 2014, the country experienced a significant economic improvement. However, since 2016 Brazil has been going through successive crises, both political and economic. The administration of President Jair Bolsonaro (2019-2022) proved to be a big drawback (Nature, 2022 para.2). The Coronavirus pandemic has further aggravated the crises. Beside Bolsonaro's lack of skills to run the country in all sectors, the management of the pandemic revealed his inability to lead. In the first months of his term, Bolsonaro showed not to notice the solemnity of his role as president. He was involved in diplomatic disagreements with France and Germany, especially for his disregard for environmental issues. Many of his supporters turned themselves against him as he was causing the country more harm than gain. His lack of knowledge and inadequacy for the presidency impressed the majority and many wondered how he was not removed from office. Bolsonaro surrounded himself with people who lacked the competence and ability to take on administrative functions of such responsibility. His original cabinet and even the last one – after several changes made halfway his mandate – is formed by people with low qualifications to function contentedly. Bolsonaro's government was permeated with delusion of competence behaviour as discussed in pages 133 and 134. As a result, serious mistakes were made by his ministries of economy, environment, health, education, to name a few. Wrong decisions made in any public sector have a drastic influence on the country's development in general. They

certainly influence the energy sector on which the development of a country depends. Delusion of competence in the Brazilian government has not exclusively been detected during Bolsonaro's government, but beyond doubt, this behaviour has been dramatically exacerbated by his administration.

The influence of interest groups in the election of parliamentarians and in the designation of government officials is customary in Brazil. The candidates best positioned in the election are those who receive the highest investment in their campaigns. Competence for the task is not the attribute that defines who is the best candidate. Instead, the candidate's loyalty to the group's interests is a decision factor for their supports. The financial resources for the campaign are enormous, and with the support of oligarchic forces, candidates for public office are empowered with overconfidence, while their ability to make the right decisions does not correspond to the position's demands. As argued in section 5.2.5, overconfidence has led decision-makers to successive mistakes in planning policies to favour the development of the Brazilian energy sector in the direction of an energy transition. Planning in the energy sector has been failing to develop alternative energy sources to achieve the Brazilian iNDC and to comply with international agreements. Changes in policies for the energy sector are fundamental for the reduction of GHG emissions. Since developed countries still find many obstacles in hastening the abandonment of fossil fuels, developing countries encounter even more challenges. A country like Brazil, with its historical and behavioural peculiarities, will face even greater obstacles to make the necessary changes, adapt to this new reality, and contribute to international efforts to contain global warming.

The use of power relations strategies has been customary throughout the development of the Brazilian energy sector. Since the first developmental initiatives in the country, the use of natural resources has been at the centre of disputes over power and wealth (McDonald, 2017). Studies on clientelism, monopolistic practices, cronyism, rent-seeking, state capture

are abundant. However, when looking for empirical evidence in field research, these concepts do not appear as clearly as in the literature. In the interviewees' statements, it was possible to notice a difficulty in naming these phenomena as they are called in the literature. In other words, interviewees describe the phenomena without mentioning the names given to them in the literature. In the face of this reality, researchers need to analyse the testimonies closely together with the literature, so that their hypotheses can be confirmed or not. Considering the concepts offered by behavioural economics, it is essential to take subjectivity into account in analysing the evidence. Human behaviour changes according to a vast range of variables and is therefore difficult to analyse. However, the concepts of behavioural economics selected for this research were quite recurrent during the search for empirical evidence, which facilitated the confirmation of the hypotheses presented at the beginning of this study.

The mitigation of climate change by reducing GHG emissions in the energy sector is a vital requirement in international agreements (see chapter 2). Understanding the limitations and obstacles that countries face in pursuing their energy transition is crucial. It clarifies in what stage a country is at and signals the need for even greater efforts to meet their commitments to contribute with climate governance. When a problem becomes public, it is much easier to search for solutions. Brazil is the fifth largest country in the world, the sixth country in population, the thirteenth in GHG emissions and has 60 per cent of the Amazon, the largest forest in the world, on its soil. These characteristics place Brazil in a central spot in the global climate governance. The results of Brazil's efforts to pursue its energy transition are of foremost importance to the rest of the world, whether these results are positive or negative. Brazil has been going through severe political and economic crises. The situation has worsened even more with Bolsonaro's government and the coronavirus pandemic. Understanding and monitoring the Brazilian scenario contribute to the global efforts to mitigate climate change.

This research offers a hybrid approach to understand decision making in countries with similar political and economic institutions as Brazil's. Power relations strategies, as the ones highlighted in this research occur in many other countries (Quimpo, 2009; Winters, 2013; Koziuk, Dluhopolskyi, Farion & Dluhopolska, 2018). As well as the behaviours addressed in these studies are not a Brazilian peoples' feature. This research brings valuable contribution to the studies of decision making and policy choice for the energy sector towards the energy transition that the world needs to contain global warming.

For Brazil to be able to fulfil its commitment to international agreements on climate change, the energy transition in the country must be intensified. For this to happen, strong institutions are needed. Brazil has shown a considerable improvement in its institutions since the mid-1980s. However, after the impeachment of President Dilma Rousseff and the four years term of ex-President Jair Bolsonaro, Brazilian institutions have gone through a generalized weakening which makes policy implementation difficult. In particular, the ones related to environment protection. In October 2022, Brazil elected Luis Inácio Lula da Silva president of the country again. He inaugurated his presidency on January 1st, 2023, and as he said in his speech on COP 27 in Egypt, Brazil is back in the climate change debate. His government will make efforts to mitigate global warming and to decarbonize the economy. Lula da Silva's election was a decisive factor to put the country back on track in the race for a more sustainable energy governance (Arlota, 2022; Harris and Hodgson, 2022). However, his presidency will face a strong opposition as many supporters of his predecessor, Jair Bolsonaro, have been elected or re-elected to the House of Representatives and Senate.

APPENDICES

Appendix 1

Interviewees	Profile
Carlos Alexandre Principe Pires 07-08-2018 Brasilia, DF	- Specialization in public policies and management in the energy and mineral sectors from PUC / Rio - Director of Energy Development at the Brazilian Ministry of Mines and Energy
Guilherme de Queiroz-Stein 16-07-2020 Remote	- PhD candidate at University of Münster-Germany - PhD candidate in Public Policy at the Federal University of Rio Grande do Sul- Brazil
Guilherme Moraes de Lima 24-07-2018 São Paulo	- MSc in Behavioural Science from the London School of Economics (LSE) - Founder and manager direct at Ponto Futuro strategic consulting
Larissa Araujo Rodrigues 10-07-2020 Remote	- PhD in Energy economics from the University of Sao Paulo- Brazil - Project and Product Manager at Instituto Escolhas
Marcelo Laterman Lima, 31-07-2020 Remote	- MSc Environmental science and energy from the University of Copenhagen - Climate & Energy Campaigner at Greenpeace Brazil
Ricardo Lacerda Baitelo 17-07-2020 Remote	- PhD in Electrical and Power Transmission Installers from the University of Sao Paulo-Brazil - Technical Specialist at Associação Brasileira de Energia Solar Fotovoltaica - ABSOLAR
Rodrigo Flora Calili 26-07-2018	- PhD in Electrical and Electronics Engineering from PUC/Rio

Rio de Janeiro	- Assistant professor of the Graduate Programme in Metrology and the Master programme of Urban and Environmental Engineering at PUC-Rio
Samira Sana Fernandes de Sousa 08-08-2018 Brasilia, DF	- MSc in public policies and development from IPEA - General Coordinator for Energy Efficiency at the Brazilian Ministry of Mines and Energy
Sandro Yamamoto 23-07-2018 São Paulo	- MBA in Business management from FGV - Diretor Técnico na ABEEólica - Associação Brasileira de Energia Eólica
Tácio Mauro Pereira de Campos 27-08-2018 Rio de Janeiro	- PhD in Soil Mechanics from the Imperial College London - Professor of Civil, geotechnical and Environmental Engineering of the civil engineering and environment department at the Pontifical Catholic University (PUC / Rio de Janeiro)

Appendix 2

Map of Brazil

Source : Freepik.com

Appendix 3

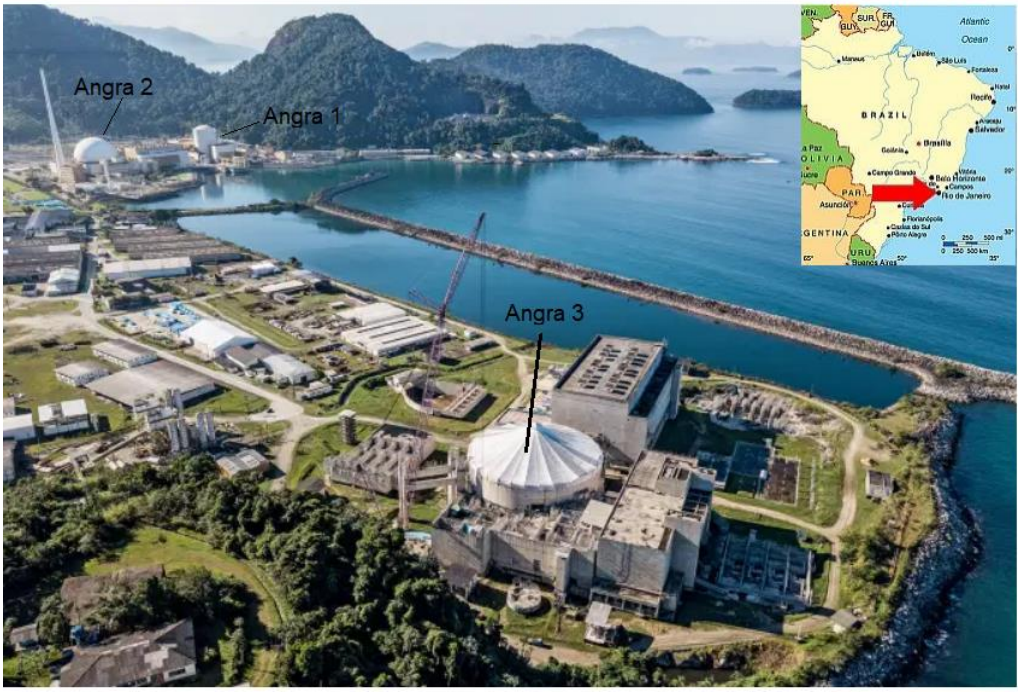
Belo Monte Dam - State of Pará - Brazil

Source: Engeneering News-Record, map by Jeffrey Cox - 2015

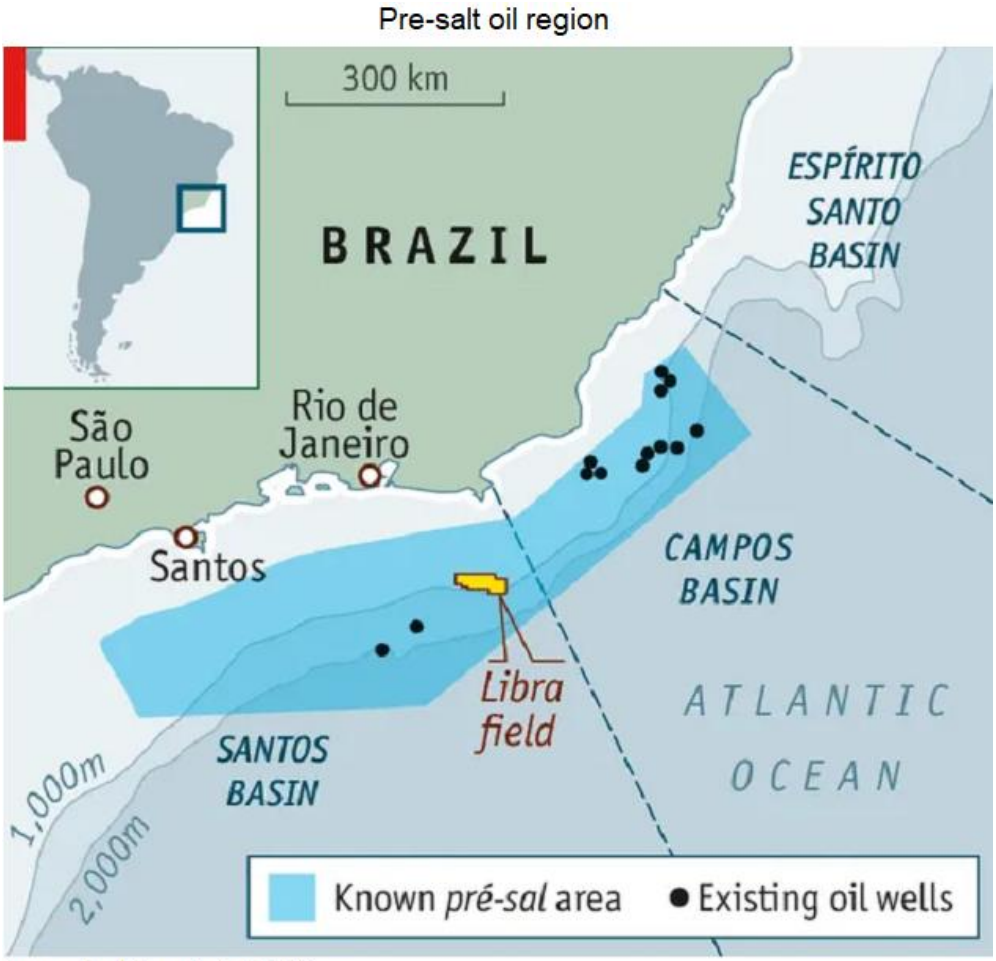
Appendix 4

Angra Nuclear Power Station - Angra dos Reis - Rio de Janeiro

Source: Revista Veja - 2018



Appendix 5



Source : Brazil Energy Insight (2019)

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SUMMARY

This study aims to analyse how decision-making processes take place regarding the Brazilian energy governance, particularly related to Brazil's collaboration with international agreements on climate change mitigation. The present research seeks to elucidate the extent to which Brazilian policymakers consideration the country's commitments to reduce GHG emissions when implementing one or another energy policy. This investigation intends to answer the central question: to what extent current energy policies in the country are designed to comply with the international agreement to hold the increase in global average temperature below 2°C above pre-industrial levels? In order to answer this question, it will be necessary to find out what leads the decision-making processes in the Brazilian energy sector.

The hypothesis is that power relations strategies recurrent occurrence in the country's energy governance prevents innovative policies toward energy transition. The persistence of monopolistic and oligopolistic practices enabled by crony capitalism and rent-seeking dictates policy choices and imposes the use of established technologies, causing inertia in the Brazilian energy sector. Furthermore, the role of behaviour in policy choice investigated in behavioural economics may further elucidate that policymakers are influenced not only by political, economic and institutional challenges but also by their deep-rooted personal behaviour, which can be decisive in the decision-making processes.

This thesis results from a qualitative research carried out through a literature review of national and international studies, both primary and secondary sources. The fieldwork took place in the cities of Rio de Janeiro, São Paulo, Vitoria and Brasilia. From July 21 to August 30, 2018, the first round of interviews was conducted. The second phase of the

research was carried out remotely between 10 to 31 of July 2020. In total, ten interviews were conducted with different Brazilian professionals in the fields of energy, public policy and Behavioural economics. A semi-structured question list was used to search for evidence to answer the research question and verify the hypothesis. The interviewees were invited to try and answer fifteen questions related to the concepts that guide this research. The interviews lasted around one hour on average and were recorded to be analysed afterwards. Power relation strategies practised by interest groups and policymakers personal behaviour are the obstacles preventing the necessary changes in the Brazilian energy sector. To make a significant contribution to climate issues, improvement in policymaking and behaviour are urgently needed. Considering the technological aspect, energy transition in Brazil is already possible. However, the lack of political will is a massive obstacle to overcome. To boost renewable energy, it is necessary to wean the incumbent industry and policymakers that reinforce the use of traditional sources of energy instead of promoting innovation in the sector.

This study is arranged as follows: the first chapter presents the theoretical framework on which this study is based. The first section explain the concept of power relations strategies and its synergy with the behavioural economics theory. The following four sections review the traditional concepts named power relations strategies for this dissertations. These strategies are monopoly and oligopoly; clientelism; bossism and political capture; crony capitalism and rent-seeking. The last section introduces the behavioural economics theory and some concepts studied by this strand of thinking. As behavioural economics comprises a great variety of concepts, a selection was made considering the prevalence of such a concept in the phenomena. The chosen concepts used in this study are hyperbolic discount, loss aversion, endowment effect, status-quo bias, information avoidance, delusion of competence, overconfidence and planning fallacy. Chapter two is divided into two sections. The first one summarises the international agreements made

on climate change mitigation. The overview starts with the first World Conference on the Human Environment in 1972 up to the United States' return to the Paris agreement. Section two outlines Brazil's five decades collaboration with the international community on climate issues and the country's attempt to comply with the global agreements. Chapter three addresses the traditional sources of energy that form the energy sector since the country's initial development in the 1930s. These sources are: hydroelectric and thermoelectric power, oil, gas and ethanol. Chapter four tackles the country's alternative energy industry and highlights the development of renewable energy sources which are: wind and solar power, biomass, second-generation ethanol, biodiesel, biogas and black liquor. Hydropower and ethanol are also considered renewable sources; however, they are presented in the previous chapter because these sources use started in the country in the 1950s and 1975s, respectively. Chapter five reveals how the concepts introduced in chapter one occur in practice. The evidence was found in the literature, videos fragments, media and most specifically, during fieldwork. Finally, the conclusion of this dissertation is presented. The findings demonstrate that Brazil's currently energy governance lacks the political will, constitutional stability and public agent's expertise to comply with the international agreements.

Since the first World Conference on the Human Environment in 1972, the United Nations has convened many times to search for solutions to protect the environment and mitigate climate change. In 1994, the 154 United Nations member States signed the United Nations Framework Convention on Climate Change (UNFCCC) to address global warming. In 1997, the assembly at the UNFCCC conference in Kyoto, Japan, approved the Kyoto Protocol, agreeing that industrialised countries were to take actions to stabilise greenhouse gases emissions. The latest and more expressive international meeting was the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC). It took place in Paris in December 2015. At the conference, a new international agreement was made to carry out

initiatives worldwide for reducing the effects of climate change. In anticipation of the event, 187 states voluntarily submitted their Intended Nationally Determined Contribution (iNDC), in which countries drafted their post-2020 climate actions to be taken under the Paris agreement. The main goal of the new treaty is to hold the increase in global average temperature below 2°C above pre-industrial levels by reducing anthropogenic CO2 emissions.

Throughout the years, Brazil has actively participated in all international gathering to discuss environmental governance. Two of the most important event organised by the UNFCCC were held in Brazil. The Brazilian government played a leading role by hosting the Earth Summit in 1992 and Rio+20 in 2012, both held in Rio de Janeiro. Brazil was also the protagonist in the Clean Development Mechanism creation under the Kyoto protocol, which was intended to foster clean development in developing countries. Two months before COP 21, Brazil submitted its iNDC. The government considered it very ambitious as it pledges to reduce GHG emissions by 37% in 2025 and 43% in 2030 below 2005 levels. However, since the iNDC submission, the country has been facing severe political and economic crises. These conjectures have worsened by the Coronavirus pandemic. Brazil's current situation indicates a dissonance with the county's pledges to reduce GHG emissions and comply with the international climate agreements.

The energy transition is one of the main targets of international agreements. In order to contain global warming, the world needs to abandon fossil fuels and expand the development and use of renewable energy sources. This research focusses on Brazil energy governance and its energy sector's conditions to put into practice the energy transition necessary to reduce GHG the country's emissions. To understand the policy choices in the Brazilian energy sector this study uses power relations strategies and Behavioural economics as frame work.

Monopolistic practices, clientelism, bossism, political capture, cronyism, rent-seeking, are power relations strategies of great hindrance to the decision-making processes in the Brazilian energy sector as they limit the country's conditions to comply with international climate agreements.

The Brazilian constitution forbids the formation of monopoly and oligopoly; however, monopolistic practices occur oftentimes in the energy sector, especially (but not only) because of the magnitude of infrastructure projects necessary to make the sector run. Market dominance in the Brazilian energy sector mostly occurs due to the influence big corporations' CEOs have on politicians. By supporting electoral campaigns for candidates to the executive and the legislative branches, construction companies' senior officials are able to influence policy outcomes.

Literature review shows that clientelism is the most common concept used to analyse power relations strategies for distributing public resources. Despite its old roots, clientelistic relations still persist in modern democracies, and it is a common practice in political realms worldwide. In Brazil, clientelism and co-optation as a form of political interaction permeate the country's political history and still endures. Large companies finance the political campaigns of candidates and parties who once in power make the arrangements that favour these companies with contracts to supply goods and services to the state. Studies show that corporations are willing to provide more funding to parties and politicians that are more efficient in delivering both contracts and desired policies. Clientelism facilitate the maintenance of incumbent energy sources.

Bossism is a way of doing politics in which oligarchic power uses its wealth to capture policymaking and influence policy outcomes for self-interest and as a wealth defence strategy. When oligarchies capture public decision-making processes, bossism manifests itself. Oligarchic

elites use their fortune to capture policymaking and assure their interests are preserved when politicians chose between one or another policy. Such decision-making environments are a threat to democratic choices. Political capture has been a habitual occurrence in the Brazilian energy governance for decades. The negotiation around the construction of the Belo Monte dam is one clear example of political capture in the sector.

Crony capitalism (also known as cronyism) is often described as the practice of appointing friends, associates and supporters to high-level posts regardless of their qualifications, while rent-seeking appears as initiatives to increase one's existing wealth without creating new wealth or benefit for society. These concepts are commonly employed as correlated since the occurrence of one often means the practice of the other. Crony capitalism and rent-seeking are also common practices in Brazil and are obstacles to the modernization of the country's energy sector.

Alongside with power relations strategies, behavioural economics theory is also useful to elucidate the decision making in the Brazilian energy governance. Behavioural economics highlights the irrational aspect of decision making. This irrationality also referred to as a behavioural failure, may be why people make choices against their long-term benefits. In order to understand the influence of Brazilian decision makers' behaviour in the energy sector policy choice, this research uses the following Behavioural economics concepts: hyperbolic discounting and loss aversion; endowment effect and status-quo bias; information avoidance; delusion of competence, overconfidence and planning fallacy.

Hyperbolic discounting leads people to a preference for small rewards that shortly occur over bigger and later benefits. Concurrently, loss aversion suggests that individuals are risk-averse when facing possible gains but opposingly risk-seeking if dealing with potential loss. Individuals are inclined to prize losses more than gains. A more specific

concept within this category is myopic loss aversion, which occurs when agents strongly focus on short term outcomes. Myopic loss aversion explain why politicians are short-sighted when making decisions. Their main drive is the possibility of re-election and not society's best interest. Evidence show that in Brazil both politician and population opt for short-term solutions. The energy governance in Brazil is based on quick solutions with lesser results rather than slow ones with better results, in the long run.

Endowment effect: individuals place extra value on goods they already own or services they already receive, disregarding their value in the market. These behaviour may represent a drawback when it comes to innovation in public policies. Simultaneously, status-quo bias is evident when individuals rather keep things the way they currently are by avoiding action or by sticking with decisions made before. Status quo bias keeps us from thinking before making choices and hold us inert despite the world's constant changes. The Brazilian energy sector has been facing challenges to change its path. The preservation of traditional structures, both institutional and technological, is often advocated by incumbent actors. The energy sector diversification must overcome status quo maintenance strategies before an energy transition can occur.

In behavioural economics, information avoidance bear on situations in which individuals choose not to acquire knowledge even when they have free access to it. Even though people can benefit from the ignorance of unpleasant information, in most cases, information avoidance leads to negative long term consequences. Information avoidance has proven to be a frequent practice in Brazilian governments, especially in the current one. The country is experiencing exceptional times in which science has often been overlooked in decision-making processes.

Delusion of competence involves peoples' deficiency in reflexive acknowledgement, either socially or pathologically, of their capability to make a decision or to function according to the requirement of a given

situation. This feature is also known as the Dunning–Kruger effect, in which low skilled people are overconfident about their cognitive ability while the highly skilled individuals are more accurate in assessing their skills. The competence of the Brazilian government has been frequently questioned. This distrust is due to the frequency in which mismanagement events occur in different periods, administrations, and sectors.

The overconfidence effect is observed when individuals' self-confidence is greater than their real performance capability. Overconfidence has been pointed as de cause of a range of destructive events (e.g. strikes, wars, litigation, busyness failure) when stakeholders overestimate their actual ability, performance, level of control, or chance of success. Under the overconfidence effect scope, one could observe the planning fallacy, the case when individuals underestimate the required time to accomplish a task, often disregarding prior experience. Throughout history, Brazilian governments have been the subject of public criticism concerning policy planning and implementation planning and it seems that this problem will not be solved in the coming years. These are many examples of energy policies that were unsuccessful due to the lack of efficient planning.

Power relations strategies are part of the history of the development of the Brazilian energy sector. Since the first developmental initiatives in the country, the use of the country's natural resources has been at the centre of disputes over power and wealth. Studies on clientelism, monopolistic practices, cronyism, rent-seeking, state capture are abundant. However, when looking for empirical evidence, these concepts are not mentioned as clearly as in the literature. In the interviewees' discourse, it was possible to notice a difficulty in naming the phenomena as they are called in the literature. In other words, interviewees describe the phenomena without mentioning the names that the literature gives them. In this case, the researcher needs to know how to translate the testimonies so that their hypotheses can be confirmed or not.

Considering the concepts offered by behavioural economics, it is essential to take subjectivity into account in analysing the evidence. Human behaviour changes according to a vast range of variables and is therefore difficult to analyse. However, the concepts of behavioural economics selected for this research were quite recurrent during the search for evidence, which facilitated the confirmation of the hypotheses presented at the beginning of this study.

Brazil has a much diversified energy matrix. Although the generation of energy in Brazil has expanded with the use of renewable sources, most of the energy injected into the Brazilian power grid comes from traditional sources of energy. The electricity sector uses thermoelectric plants powered by fossil fuels (coal and diesel), as well as sources considered renewable (hydroelectric and nuclear energy). Large hydroelectric plants produce most of the electricity consumed in Brazil as a result of the abundance of water resources and the country's tradition of building dams. However, a change in this sector is necessary because of the environmental and social damage caused by large dams. In addition, with ongoing climate change, the risk of severe droughts resulting in a decrease in the country's water resources is great. The transport sector also makes use of renewable fuels such as ethanol. However, the most used power in the sector is fossil fuel-based. Around three-quarters of the Brazilian fleet is powered by gasoline and diesel. Due to the country's continental dimensions and its mostly road-based transport sector, a radical change in the transport sector is necessary to guarantee the reduction in Brazil's GHG emissions.

Brazil has an international reputation for its clean energy matrix. This reputation is due to the strong contribution of hydroelectric energy to the national electricity grid. With the growing consensus that large dams are not as clean as initially thought, the country's reputation is threatened. Methane emissions from large wetlands for the construction of reservoirs and other environmental and social damage demystify large dams' environmentally friendly nature. Despite the dam tradition of the

Brazilian electrical sector, the Brazilian government developed a range of policies that allowed the country's renewable energy industry into the national energy grid. The wind sector, in particular, has achieved considerable space in the Brazilian energy market. The photovoltaic energy sector was also well received in the market, although its use is greater in the private sector. In addition to these two renewable energy sources, the transportation sector has also been increasing its variety of renewable fuels with the production of second-generation biofuels, biogas from solid waste and black liquor, a fuel resulting from the cellulose industry. Brazil's energy sector is formed by a variety of energy sources, which is a good premise to lead the country to an energy transition. However, it is necessary that more robust public policies are developed and implemented so that the country can fulfil its commitments made to the international community to help and contain global warming.

Even though Brazil is a modern liberal democracy, its political power is concentrated in small oligarchic groups which have significant influence in the policy-making processes. The oligarchic bosses exercise their power within the political realm to shape decision-making processes in their favour. This form of bossism is a practice that has occurred in Brazil since the colonisation and still influences the political outcome nowadays. Bossism, in turn, reinforces rent-seeking and crony capitalism since the political elite, whether elected by the people or those who hold power because of their oligarchic roots, have easy access to the financial opportunities offered by the State. The result is an accumulation of wealth and political power by well-connected people. In the energy sector, it determines the direction of policymaking, keeping the incumbent industry profitable and therefore hard to change.

Power relations strategies are the cause of the low participation of renewable sources in the Brazilian energy matrix. Monopolistic practices delay innovation because the incumbent industry does not want to make room for new and more efficient products and techniques. Dominant

companies that can influence the results of the creation of public policies have the power to suppress the participation of the clean energy industry in the Brazilian energy network, which hinders its development in terms of expanding use and technological innovation.

Clientelism, monopolistic practices, cronyism and rent-seeking, are historically institutionalised power relations strategies in Brazil and have great interference in the policy-making process for the Brazilian energy sector and are detrimental in the search for the energy transition in the country. The State has a fundamental role in regulating and investing in technological innovation, creating and implementing public policies and regulation of the private sector to make the transition happen. However, this is not possible because the State is subordinate to the private sector. The private sector has captured the Brazilian State.

Stakeholder's behaviour also compromises the development of new policies in the country. Once the public and private agents are accustomed to thinking in a certain way about public policies, the tendency is for these individuals to continue to make decisions that lead to the same direction. In addition to traditional power relations strategies, and equally important are the particular behaviour of agents involved in both decision- and policy-making processes required to reduce the anthropogenic effect on the environment. Behavioural economics explains that individuals behaviour are decisive in the research, proposals, choice, implementation, and enforcement of public policies on climate change mitigation or policies on any other subject matter. Individual's limitations studied by behavioural economists such as hyperbolic discounting and loss aversion, endowment effect and status-quo bias, information avoidance, delusion of competence, overconfidence and planning fallacy have been useful tools in this research for analysing policy choice in the Brazilian energy sector.

Power relation strategies practised by interest groups and policymakers personal behaviour are the obstacles preventing the necessary changes

in the Brazilian energy sector. To make a significant contribution to climate issues, improvement in policymaking and behaviour are urgently needed. Considering the technological aspect, energy transition in Brazil is already possible. However, the lack of political will is a massive obstacle to overcome. To boost renewable energy it is necessary to wean the incumbent industry and policymakers that reinforce the use of traditional sources of energy instead of promoting innovation in the sector.

For Brazil to be able to fulfil its commitment to international agreements on climate change, the energy transition in the country must be intensified. For this to happen, strong institutions are needed. Brazil has shown a considerable improvement in its institutions since the mid-1980s. However, after the impeachment of President Dilma Rousseff and the election of the current president, Jair Bolsonaro, Brazilian institutions have gone through a generalized weakening which makes policy implementation difficult and in particular the protection of the environment. 2022 elections was a decisive factor to put the country back on track. Similar to what happened in the United States with the election of current President Joe Biden, the election the progressive president Luiz Inácio Lula da Silva has lead Brazil to resume its climate change mitigation policies.

SAMENVATTING

Deze studie heeft tot doel te analyseren hoe besluitvormingsprocessen plaatsvinden met betrekking tot het Braziliaanse energiebeleid, voornamelijk met betrekking tot de samenwerking van Brazilië met internationale overeenkomsten inzake mitigatie van klimaatverandering. Het huidige onderzoek probeert te verhelderen in hoeverre Braziliaanse beleidsmakers rekening houden met de toezeggingen van het land om de uitstoot van broeikasgassen te verminderen bij het implementeren van een of ander energiebeleid. Dit onderzoek is bedoeld om de centrale vraag te beantwoorden: in hoeverre is het huidige energiebeleid in het land ontworpen om te voldoen aan de internationale afspraak om de stijging van de wereldwijde gemiddelde temperatuur onder de 2°C boven het pre-industriële niveau te houden? Om deze vraag te beantwoorden, zal het nodig zijn om te achterhalen wat de besluitvormingsprocessen in de Braziliaanse energiesector leidt.

De hypothese is dat machtsrelaties strategieën die herhaaldelijk voorkomen in het energiebeleid van het land innovatief beleid ten aanzien van energietransitie in de weg staan. Het voortbestaan van monopolistische en oligopolische praktijken, mogelijk gemaakt door vriendjeskapitalisme en rent-seeking, dicteert beleidskeuzes en dwingt het gebruik van gevestigde technologieën af, wat inertie veroorzaakt in de Braziliaanse energiesector. Bovendien kan de rol van gedrag bij beleidskeuzes die in de gedragseconomie theorie wordt onderzocht, verder verduidelijken dat beleidsmakers niet alleen worden beïnvloed door politieke, economische en institutionele uitdagingen, maar ook door hun diepgewortelde persoonlijk gedrag, dat bepalend kan zijn in de besluitvormingsprocessen.

Dit proefschrift is het resultaat van een kwalitatief onderzoek uitgevoerd door middel van een literatuuronderzoek van nationale en

internationale studies, zowel primaire als secundaire bronnen. Het veldwerk vond plaats in de steden Rio de Janeiro, São Paulo, Vitoria en Brasília. Van 21 juli tot 30 augustus 2018 vond de eerste ronde interviews plaats. De tweede fase van het onderzoek werd op afstand uitgevoerd tussen 10 en 31 juli 2020. In totaal zijn er tien interviews gehouden met verschillende Braziliaanse professionals op het gebied van energie, publiek beleid en gedragseconomie. Een semigestructureerde vragenlijst werd gebruikt om bewijsmateriaal te verzamelen om de onderzoeksvraag te beantwoorden en de hypothese te verifiëren. De geïnterviewden werden uitgenodigd om vijftien vragen te beantwoorden met betrekking tot de concepten die leidend zijn voor dit onderzoek. De interviews duurden gemiddeld ongeveer een uur en zijn opgenomen om achteraf te geanalyseerd te kunnen worden.

Het onderzoek is als volgt ingedeeld: het eerste hoofdstuk presenteert het theoretische kader waarop dit onderzoek is gebaseerd. In het eerste paragraaf wordt het concept van machtsrelatie strategieën uitgelegd en de synergie ervan met de gedrag economische theorie. De volgende vier paragrafen bespreken de traditionele concepten genaamd machtsrelatie strategieën voor deze dissertatie. Deze strategieën zijn monopolistische en oligopolische praktijken; cliëntelisme; bossisme en political capiture; vriendjeskapitalisme en rent-seeking. Het laatste deel introduceert de gedragseconomie theorie en enkele concepten die door deze denkrichting worden bestudeerd. Omdat gedragseconomie een grote verscheidenheid aan concepten omvat, is er een selectie gemaakt met een oog op de prevalentie van de concepten in de fenomenen. De gekozen concepten die in dit onderzoek worden gebruikt, zijn hyperbolische korting, verliesaversie, schenkingseffect, status-quo bias, bevestigingsbias, delusion of competence, overmoed en planningsfout. Hoofdstuk twee is verdeeld in twee secties. De eerste vat de internationale afspraken over klimaatmitigatie samen. Het overzicht begint met de eerste Wereldconferentie inzake het menselijke leefmilieu in 1972 tot de terugkeer van de Verenigde Staten naar het akkoord van Parijs. Deel twee schetst de vijf decennia durende samenwerking van

Brazilië met de globale gemeenschap op het gebied van klimaatkwesties en de poging van het land om te voldoen aan de internationale overeenkomsten. Hoofdstuk drie behandelt de traditionele energiebronnen die de energiesector vormen sinds de eerste ontwikkelingen van het land in de jaren dertig van de vorige eeuw. Deze bronnen zijn: waterkracht en thermo-elektrische energie, olie, gas en ethanol. Hoofdstuk vier behandelt de alternatieve energie-industrie van het land en belicht de ontwikkeling van hernieuwbare energiebronnen, namelijk: wind- en zonne-energie, biomassa, ethanol van tweede generatie, biodiesel, biogas en black liquor. Waterkracht en ethanol worden ook als hernieuwbare bronnen beschouwd; ze zijn echter in het vorige hoofdstuk gepresenteerd omdat het gebruik van deze bronnen in het land respectievelijk in de jaren 1950 en 1975 begon. Hoofdstuk vijf laat zien hoe de in hoofdstuk één geïntroduceerde concepten in de praktijk voorkomen. Het bewijsmateriaal is gevonden in de literatuur, videofragmenten, media en vooral tijdens veldwerk. Ten slotte wordt de conclusie van dit proefschrift gepresenteerd. De bevindingen tonen aan dat het Braziliaanse energiebeheer momenteel niet over de politieke wil, constitutionele stabiliteit en de expertise van overheidsfunctionarissen beschikt om de internationale overeenkomsten na te leven.

Sinds de eerste Wereldconferentie over het menselijke leefmilieu in 1972 zijn de Verenigde Naties vele malen bijeengekomen om oplossingen te zoeken om het milieu te beschermen en de klimaatverandering te beperken. In 1994 ondertekenden de 154 lidstaten van de Verenigde Naties het Raamverdrag van de Verenigde Naties inzake klimaatverandering (UNFCCC) om de opwarming van de aarde aan te pakken. In 1997 keurde de vergadering op de UNFCCC-conferentie in Kyoto, Japan, het Kyotoprotocol goed, en kwam overeen dat geïndustrialiseerde landen maatregelen moesten nemen om de uitstoot van broeikasgassen te stabiliseren. De laatste en meer expressieve internationale bijeenkomst was de 21e Conferentie van de Partijen (COP21) van het Raamverdrag van de Verenigde Naties inzake klimaatverandering (UNFCCC). Die vond plaats in december 2015 in

Parijs. Op deze conferentie werd er een nieuwe internationale afspraak gemaakt om wereldwijd initiatieven te ontplooien om de effecten van klimaatverandering te verminderen. Vooruitlopend op het evenement hebben 187 staten vrijwillig hun Intended Nationally determined Contribution (iNDC) ingediend, waarin landen hun klimaatacties voor de periode na 2020 hebben opgesteld die in het kader van het akkoord van Parijs moeten worden genomen. Het belangrijkste doel van het nieuwe verdrag is om de stijging van de mondiale gemiddelde temperatuur onder de 2°C boven het pre-industriële niveau te houden door de antropogene CO2-uitstoot te verminderen.

Door de jaren heen heeft Brazilië actief deelgenomen aan alle internationale bijeenkomsten om milieubeleid te bespreken. Twee van de belangrijkste evenementen georganiseerd door de UNFCCC werden gehouden in Brazilië. De Braziliaanse regering speelde een leidende rol door gastheer te zijn van de Earth Summit in 1992 en Rio+20 in 2012, die beiden plaatsgevonden in Rio de Janeiro. Brazilië was ook de hoofdrolspeler in de totstandkoming van het mechanisme voor schone ontwikkeling onder het Kyotoprotocol, dat bedoeld was om schone ontwikkeling in ontwikkelingslanden te bevorderen. Twee maanden voor COP 21 diende Brazilië zijn iNDC in. De regering had een zeer ambitieus plan opgesteld omdat het belooft de uitstoot van broeikasgassen met 37% te verminderen in 2025 en 43% in 2030 onder het niveau van 2005. Sinds de indiening van de iNDC heeft het land echter te kampen met ernstige politieke en economische crises. Deze vermoedens zijn verergerd door de pandemie van het coronavirus. De huidige situatie van Brazilië wijst op een dissonantie met de toezeggingen van het land om de uitstoot van broeikasgassen te verminderen en te voldoen aan de internationale klimaatovereenkomsten.

De energietransitie is een van de hoofddoelen van internationale afspraken. Om de opwarming van de aarde in te dammen, moet de wereld fossiele brandstoffen opgeven en de ontwikkeling en het gebruik

van hernieuwbare energiebronnen uitbreiden. Dit onderzoek richt zich op het energiebeleid van Brazilië en de omstandigheden in de Braziliaanse energiesector om de energietransitie in de praktijk te brengen die nodig is om de broeikasgasemissies van het land te verminderen. Om de beleidskeuzes in de Braziliaanse energiesector te begrijpen, gebruikt deze studie machtsrelatie strategieën en gedragseconomie als geraamte.

Monopolistische uitoefening, cliëntelisme, bossisme, political capture, vriendjespolitiek en rent-seeking, zijn machtsrelatie strategieën die de besluitvormingsprocessen in de Braziliaanse energiesector enorm belemmeren, aangezien ze de voorwaarden van het land om te voldoen aan internationale klimaatovereenkomsten beperken.

De Braziliaanse grondwet verbiedt de vorming van monopolies en oligopolies; monopolistische uitoefening komen echter vaak voor in de energiesector, vooral, maar niet alleen, vanwege de omvang van de infrastructuurprojecten die nodig zijn om de sector draaiende te houden. Marktdominantie in de Braziliaanse energiesector komt vooral voort uit de invloed die CEO's van grote bedrijven hebben op politici. Door verkiezingscampagnes voor kandidaten voor de uitvoerende en wetgevende macht te ondersteunen, kunnen hoge functionarissen van bouwbedrijven de beleidsresultaten beïnvloeden.

Uit literatuuronderzoek blijkt dat cliëntelisme het meest gebruikte concept is om machtsrelatie strategieën voor het verdelen van publieke middelen te analyseren. Ondanks hun oude wortels bestaan cliëntelistische relaties nog steeds in moderne democratieën, en het is een gangbare praktijk in politieke kringen over de hele wereld. In Brazilië bestaan cliëntelisme en coöptatie als een vorm van politieke interactie. Ze doordringen de politieke geschiedenis van het land en dat duurt nog steeds voort. Grote bedrijven financieren de politieke campagnes van kandidaten en partijen die eenmaal aan de macht zijn de regelingen treffen die deze bedrijven bevoordelen met contracten om

goederen en diensten aan de staat te leveren. Studies tonen aan dat bedrijven bereid zijn meer financiering te verstrekken aan partijen en politici die efficiënter zijn in het leveren van zowel contracten als gewenst beleid. Cliëntelisme faciliteert het onderhoud van bestaande energiebronnen.

Bossisme is een manier van politiek bedrijven waarbij oligarchische macht haar rijkdom gebruikt om beleidsvorming vast te leggen en beleidsresultaten te beïnvloeden voor eigenbelang en als een strategie voor het verdedigen van rijkdom. Wanneer oligarchieën openbare besluitvormingsprocessen vastleggen, manifesteert zich bossisme. Oligarchische elites gebruiken hun fortuin om beleidsvorming vast te leggen en ervoor te zorgen dat hun belangen behouden blijven wanneer politici tussen het ene of het andere beleid kiezen. Dergelijke besluitvormingsomgevingen vormen een bedreiging voor democratische keuzes. Political capture is al tientallen jaren een gebruikelijke fenomeen in het Braziliaanse energiebeheer. De onderhandelingen over de bouw van de Belo Monte-dam zijn een duidelijk voorbeeld van Political capture in de sector.

Vriendjeskapitalisme (ook bekend als vriendjespolitiek) wordt vaak beschreven als de praktijk van het aanstellen van vrienden, medewerkers en supporters op hoge posten, ongeacht hun kwalificaties, terwijl het rent-seeking verschijnt als initiatieven om iemands bestaande rijkdom te vergroten zonder nieuwe rijkdom of voordeel te creëren voor de maatschappij. Deze concepten worden gewoonlijk gebruikt als gecorreleerd, aangezien het voorkomen van de ene vaak de praktijk van de andere betekent. Vriendjeskapitalisme en rent-seeking zijn ook gangbare praktijken in Brazilië en zijn obstakels voor de modernisering van de energiesector van het land.

Naast machtsrelatie strategieën is de gedragseconomie theorie ook nuttig om de besluitvorming in het Braziliaanse energiebeleid te verhelderen. Gedragseconomie benadrukt het irrationele aspect van

besluitvorming. Deze irrationaliteit, ook wel gedrag falen genoemd, kan de reden zijn waarom mensen keuzes maken tegen hun voordelen op de lange termijn in. Om de invloed van het gedrag van Braziliaanse besluitvormers op de beleidskeuze voor de energiesector te begrijpen, gebruikt dit onderzoek de volgende concepten van de gedragseconomie: hyperbolische korting en verliesaversie; schenkingseffect en status-quo bias; bevestigingsbias; delusion of competence; overmoed en planningsfout.

Hyperbolische kortingen leiden ertoe dat mensen de voorkeur geven aan kleine beloningen die op korte termijn plaatsvinden boven grotere en latere voordelen verder in de toekomst. Tegelijkertijd suggereert verliesaversie dat individuen risicomijdend zijn wanneer ze geconfronteerd worden met mogelijke winsten, maar juist risico zoekend zijn als ze te maken hebben met potentieel verlies. Individuen zijn geneigd verliezen meer te waarderen dan winsten. Een meer specifiek concept binnen deze categorie is Myopic loss aversion, hetgeen optreedt wanneer partijen sterk focussen op kort termijn resultaten. Myopic loss aversion verklaart waarom politici kortzichtig zijn bij het nemen van beslissingen. Hun belangrijkste drijfveer is de mogelijkheid van herverkiezing en niet het belang van de samenleving. Er zijn aanwijzingen dat in Brazilië zowel de politici als de bevolking kiezen voor kortetermijnoplossingen. Het energiebeheer in Brazilië is gebaseerd op snelle oplossingen met minder resultaat in plaats van langzame oplossingen met betere resultaten op de lange termijn.

Het Schenkingseffect leg uit dat individuen hechten extra waarde aan goederen die ze al bezitten of diensten die ze al ontvangen, zonder rekening te houden met hun waarde op de markt. Dit gedrag kan een nadeel zijn als het gaat om innovatie in overheidsbeleid. Tegelijkertijd is de status-quo bias duidelijk wanneer men dingen liever houdt zoals ze nu zijn door actie te vermijden of door vast te houden aan eerder genomen beslissingen. Status-quo-bias weerhoudt ons ervan na te denken voordat we keuzes maken en houdt ons inert ondanks de

constante veranderingen in de wereld. De Braziliaanse energiesector staat voor uitdagingen om haar koers te veranderen. Het behoud van traditionele structuren, zowel institutioneel als technologisch, wordt vaak bepleit door gevestigde actoren. De diversificatie van de energiesector moet status-quo-onderhoudsstrategieën overwinnen voordat een energietransitie kan plaatsvinden.

In de gedragseconomie heeft bevestigingsbias betrekking op situaties waarin individuen ervoor kiezen om geen kennis te verwerven, zelfs als ze er vrije toegang toe hebben. Hoewel mensen kunnen profiteren van de onwetendheid van onaangename informatie, leidt het vermijden van informatie in de meeste gevallen tot negatieve lange termijn gevolgen. Het vermijden van informatie is een veel voorkomende praktijk gebleken in Braziliaanse regeringen, vooral in de huidige. Het land beleeft uitzonderlijke tijden waarin de wetenschap vaak over het hoofd wordt gezien in besluitvormingsprocessen.

Delusion of competence houdt in dat mensen een gebrek hebben aan reflexieve erkenning, sociaal of pathologisch, van hun vermogen om een beslissing te nemen of te functioneren in overeenstemming met de vereisten van een bepaalde situatie. Dit kenmerk staat ook bekend als het Dunning-Kruger-effect, waarbij laagopgeleide mensen overmoedig zijn over hun cognitieve vaardigheden, terwijl hoogopgeleide personen hun vaardigheden nauwkeuriger beoordelen. De bevoegdheid van de Braziliaanse regering is vaak in twijfel getrokken. Dit wantrouwen is te wijten aan de frequentie waarmee wanbeheer gebeurtenissen voorkomen in verschillende perioden, administraties en sectoren.

Het overmoed effect wordt waargenomen wanneer het zelfvertrouwen van individuen groter is dan hun werkelijke prestatievermogen. Overmoed is aangewezen als de oorzaak van een reeks destructieve gebeurtenissen (bijv. stakingen, oorlogen, rechtszaken, mislukking van de drukte) wanneer belanghebbenden hun werkelijke bekwaamheid, prestaties, controleniveau of kans op succes overschatten. Onder het

begrip van overmoed zou men de planning fallacy kunnen waarnemen, het geval waarin individuen de benodigde tijd onderschatten om een taak uit te voeren, vaak zonder rekening te houden met eerdere ervaring. Door de geschiedenis heen zijn Braziliaanse regeringen het onderwerp geweest van publieke kritiek op beleidsplanning en uitvoeringsplanning en het lijkt erop dat dit probleem de komende jaren niet zal worden opgelost. Er zijn vele voorbeelden binnen de Braziliaanse energiebeleid die niet succesvol waren vanwege het gebrek aan efficiënte planning.

Machtsrelatie strategieën maken deel uit van de geschiedenis van de ontwikkeling van de Braziliaanse energiesector. Sinds de eerste ontwikkelingsinitiatieven in het land staat het gebruik van de natuurlijke bronnen centraal in geschillen over macht en rijkdom. Studies over monopolistische praktijken, cliëntelisme, bossisme, political capture, vriendjespolitiek en rent-seeking zijn er in overvloed. Bij het zoeken naar empirisch bewijs worden deze concepten echter niet zo duidelijk genoemd als in de literatuur. In de verhandeling van de geïnterviewden was het mogelijk om een probleem op te merken bij het benoemen van de verschijnselen zoals ze in de literatuur worden genoemd. Met andere woorden, geïnterviewden beschrijven de verschijnselen zonder de namen te noemen die de literatuur ze geeft. In dit geval moet onderzoekers weten hoe de getuigenissen moeten worden vertaald, zodat hun hypothesen wel of niet kunnen worden bevestigd. Gezien de concepten die de gedragseconomie biedt, is het essentieel om rekening te houden met subjectiviteit bij het analyseren van het bewijsmateriaal. Menselijk gedrag verandert volgens een groot aantal variabelen en is daarom moeilijk te analyseren. De concepten van gedragseconomie die voor dit onderzoek werden geselecteerd, kwamen echter vrij vaak terug tijdens het zoeken naar bewijsmateriaal, wat de bevestiging van de hypothesen die aan het begin van dit onderzoek werden gepresenteerd, vergemakkelijkte.

Brazilië heeft een sterk gediversifieerde energiematrix. Hoewel de opwekking van energie in Brazilië is uitgebreid met het gebruik van

hernieuwbare bronnen, is de meeste energie die in het Braziliaanse elektriciteitsnet wordt geïnjecteerd, afkomstig van traditionele energiebronnen. De elektriciteitssector maakt gebruik van thermo-elektrische centrales die worden aangedreven door fossiele brandstoffen zoals kolen en diesel, evenals bronnen die als hernieuwbare bronnen worden beschouwd, zoals waterkracht- en kernenergie. Grote waterkrachtcentrales produceren het grootste deel van de elektriciteit die in Brazilië wordt verbruikt als gevolg van de overvloed aan waterbronnen en de traditie van het land om dammen te bouwen. Een verandering in deze sector is echter noodzakelijk vanwege de milieu- en sociale schade die grote dammen aanrichten. Bovendien met de aanhoudende klimaatverandering is het risico op ernstige droogte die leiden tot een afname van de watervoorraden van het land groot. Ook de transportsector maakt gebruik van hernieuwbare brandstoffen zoals ethanol. De meest gebruikte energie in de sector is echter gebaseerd op fossiele brandstoffen. Ongeveer driekwart van de Braziliaanse vloot wordt aangedreven door benzine en diesel. Vanwege de continentale dimensie van het land en de grotendeels op weg gebaseerde transportsector, is een radicale verandering in de transportsector noodzakelijk om de BKG-emissies van Brazilië te verminderen.

Brazilië heeft een internationale reputatie voor zijn schone energiematrix. Deze reputatie is te danken aan de sterke bijdrage van waterkracht aan het landelijke elektriciteitsnet. Met de consensus dat grote dammen niet zo schoon zijn als aanvankelijk werd gedacht, wordt de reputatie van het land bedreigd. Methaanemissies van grote wetlands voor de aanleg van reservoirs en andere milieu- en sociale schade ontrafelen het milieuvriendelijke karakter van grote dammen. Ondanks de damtraditie van de Braziliaanse elektriciteitssector, ontwikkelde de Braziliaanse regering een reeks beleidsmaatregelen die de duurzame-energiesector van het land toestonden in het nationale energienet te komen. Vooral de windsector heeft veel ruimte op de Braziliaanse energiemarkt. Naast deze twee hernieuwbare energiebronnen heeft de transportsector ook haar variëteit aan hernieuwbare brandstoffen

vergroot met de productie van biobrandstoffen van de tweede generatie, biogas uit vast afval en black liquor, een brandstof die voortkomt uit de cellulose-industrie. De energiesector van Brazilië wordt gevormd door een verscheidenheid aan energiebronnen, wat een goed uitgangspunt is om het land naar een energietransitie te leiden. Het is echter noodzakelijk dat er een robuuster overheidsbeleid wordt ontwikkeld en uitgevoerd, zodat het land zijn toezeggingen aan de internationale gemeenschap kan nakomen om de opwarming van de aarde te helpen in te dammen.

Hoewel Brazilië een moderne liberale democratie is, is zijn politieke macht geconcentreerd in kleine oligarchische groepen die een aanzienlijke invloed hebben op de beleidsvormingsprocessen. De oligarchische bazen oefenen hun macht binnen het politieke domein uit om besluitvormingsprocessen in hun voordeel vorm te geven. Deze vorm van bossisme is een praktijk die sinds de kolonisatie in Brazilië voorkomt en tegenwoordig nog steeds de politieke uitkomst beïnvloedt. Bossisme versterkt op zijn beurt rent-seeking en vriendjeskapitalisme, aangezien de politieke elite, of ze nu gekozen zijn door het volk of degenen die de macht hebben vanwege hun oligarchische wortels, gemakkelijk toegang hebben tot de financiële kansen die de staat biedt. Het resultaat is een opeenstapeling van rijkdom en politieke macht door mensen met goede connecties. In de energiesector bepaalt het de richting van de beleidsvorming, waardoor de gevestigde industrie winstgevend en dus moeilijk te veranderen blijft.

Machtsrelatie Strategieën zijn de oorzaak van de lage deelname van hernieuwbare bronnen in de Braziliaanse energiematrix. Monopolistische praktijken vertragen innovatie omdat de gevestigde industrie geen ruimte wil maken voor nieuwe en efficiëntere producten en technieken. Dominante bedrijven die de resultaten van het maken van overheidsbeleid kunnen beïnvloeden, hebben de macht om de deelname van de schone energie-industrie aan het Braziliaanse energienetwerk te

onderdrukken, wat de ontwikkeling ervan belemmert in termen van toenemend gebruik en technologische innovatie.

Cliëntelisme, monopolistische praktijken, vriendjespolitiek en rent-seeking zijn historisch geïnstitutionaliseerde machtsrelatie strategieën in Brazilië en hebben een grote invloed op het beleidsvormingsproces voor de Braziliaanse energiesector en zijn schadelijk bij het zoeken naar de energietransitie in het land. De staat speelt een fundamentele rol bij het reguleren van en investeren in technologische innovatie, het creëren en uitvoeren van overheidsbeleid en het reguleren van de particuliere sector om de transitie mogelijk te maken. Dit is echter niet mogelijk omdat de staat ondergeschikt is aan de privésector. De particuliere sector heeft de Braziliaanse staat veroverd.

Het gedrag van belanghebbende partijen brengt ook de ontwikkeling van nieuw beleid in het land in gevaar. Als de publieke en particuliere partijen eenmaal gewend zijn om op een bepaalde manier over overheidsbeleid na te denken, bestaat de neiging dat deze individuen beslissingen blijven nemen die in dezelfde richting leiden. Niet alleen de traditionele machtsrelatie strategieën, maar ook het specifieke gedrag van partijen die betrokken zijn bij zowel besluitvormings- als beleidsvormingsprocessen die nodig zijn om het antropogene effect op het milieu te verminderen zijn van invloed. Gedragseconomie legt uit dat het gedrag van individuen bepalend is bij het onderzoek, de voorstellen, de keuze, de implementatie en de handhaving van overheidsbeleid inzake mitigatie van klimaatverandering maar ook beleid inzake enig ander onderwerp. De tekortkomingen van individuen die door gedragseconomen zijn bestudeerd, zoals hyperbolische kortingen en verliesaversie, schenkingseffect en status-quo bias, bevestigingsbias, delusion of competence, overmoed en planningsfout, zijn in dit onderzoek nuttige hulpmiddelen geweest voor het analyseren van beleidskeuzes in de Braziliaanse energiesector.

Machtsrelatie strategieën die worden toegepast door belangengroepen en het persoonlijke gedrag van beleidsmakers zijn de obstakels die de noodzakelijke veranderingen in de Braziliaanse energiesector in de weg staan. Om een significante bijdrage te leveren aan de klimaatproblematiek is verbetering van beleid en gedrag hard nodig. Op technologische gebied is de energietransitie in Brazilië al mogelijk. Het gebrek aan politieke wil is echter een enorm obstakel dat moet worden overwonnen. Om hernieuwbare energie te stimuleren, is het noodzakelijk om de gevestigde industrie en beleidsmakers te spenen die het gebruik van traditionele energiebronnen versterken in plaats van innovatie in de sector te bevorderen.

Wil Brazilië zijn belofte aan internationale afspraken over klimaatverandering kunnen waarmaken, dan moet de energietransitie in het land worden geïntensiveerd. Hiervoor zijn sterke instellingen nodig. Brazilië heeft sinds het midden van de jaren tachtig een aanzienlijke verbetering van zijn instellingen laten zien. Na de afzetting van president Dilma Rousseff en de verkiezing van de huidige president, Jair Bolsonaro, hebben de Braziliaanse instellingen echter een algemene verzwakking doorgemaakt, wat de uitvoering van het beleid en met name de bescherming van het milieu bemoeilijkt. De verkiezing van 2022 was een beslissende factor om het land weer op de rails te krijgen. Net als wat er in de Verenigde Staten gebeurde met de verkiezing van de huidige president Joe Biden, de verkiezing van de progressieve president Luiz Inácio Lula da Silva heeft Brazilië ertoe aangezet zijn beleid ter beperking van de klimaatverandering te hervatten.

CURRICULUM VITAE

Anaide Luzia Ferraço was born in Brazil on October 16th, 1967. She earned her Art Education degree in 1991 from the Federal University of Espirito Santo. Additionally, in her hometown, she successfully completed a specialized programme in Education. As an educator, she has imparted knowledge to students across various levels, spanning from elementary school to college. In 1999, Anaide embarked on a journey to The Netherlands, where she continued her career as an art teacher, contributing to special projects within different elementary schools. However, in 2013, recognizing the pressing need for action on climate change, she decided to return to academia and redirected her studies. On January 29th, 2016, Anaide achieved her Master of Arts degree in Latin American Studies at Leiden University, culminating in her master's thesis entitled "Energy Transition in Brazil: Barriers and Possibilities within the Institutional Framework." Presently, she serves as a specialist in policy and sustainability at the OFGV environmental agency. Her professional portfolio includes the successful implementation of the national energy-saving policy for companies. Anaide is currently engaged in research focused on the role of environmental agencies in shaping government sustainability policies. Her work specifically emphasizes energy transition and the promotion of a circular economy.