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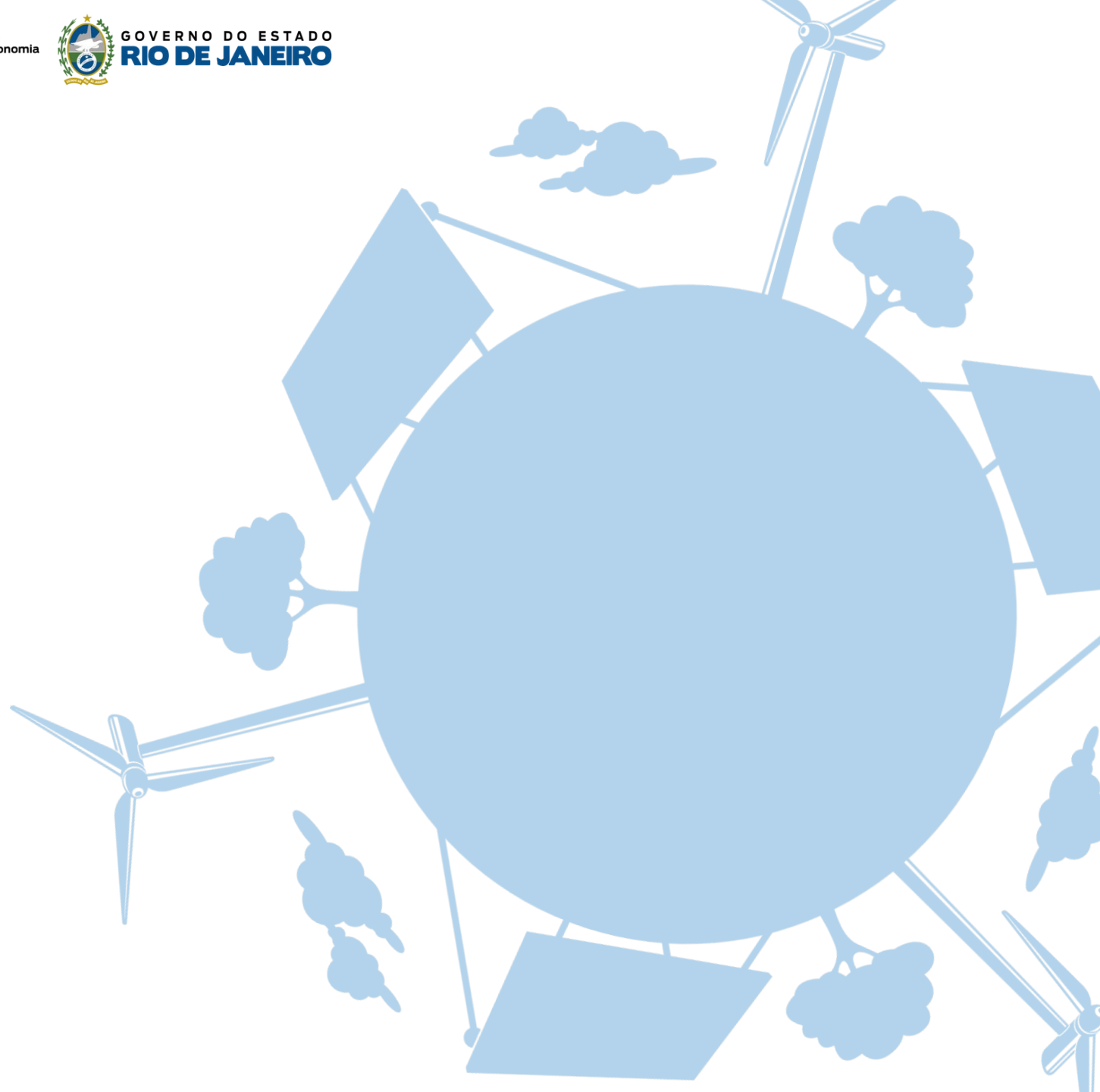
ENERGY TRANSITION STRATEGIC AGENDA OF THE RIO DE JANEIRO STATE



Secretaria de Energia e Economia do Mar

GOVERNO DO ESTADO RIO DE JANEIRO

Rio de Janeiro State Government

Rio de Janeiro, December 20th, 2023

Energy Transition Strategic Agenda of the Rio de Janeiro State

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Hugo Aguiar – Head of Oil and Gas

João Pedro Motta Leal – Nuclear Energy Coordinator

Luiz Gustavo Silva de Oliveira (Coordination) – Special Advisor for Energy Transition and Innovation

Luiza Ferreira da Silva Presta – Energy Advisor

Marco Antônio Vilela de Oliveira – Head of Electricity

Monaliza Barbieri Bresciani – Wind Energy Coordinator

Nathalie Longobardi - Advisor

Sérgio Coelho – Head of Clean Energies

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SUMMARY

I. PUBLIC CONSULTATION OBJECTIVE

PUBLIC CONSULTATION OBJECTIVE

This Technical Report aims to open the public consultation for the Energy Transition Policy of the State of Rio de Janeiro. It seeks inputs for the development of a state policy that will guide actions to ensure that the energy transition is a driver of socioeconomic development. This policy will be aligned with other state and national policies.

I. MISSION, OBJECTIVE AND STAGES OF THE RIO DE JANEIRO STATE ENERGY TRANSITION POLICY

STRATEGIC ENERGY TRANSITION AGENDA FOR THE RIO DE JANEIRO

MISSION

Leverage the energy transition as a driver for socioeconomic development in the state, organizing short-term actions with long-term goals and objectives.

GOAL

Develop a participatory and evidence-informed state public policy on Energy Transition, as well as direct energy transition actions in the State of Rio de Janeiro.

STATE ENERGY TRANSITION POLICY CYCLE

1. Design of the Strategic Energy Transition agenda – Jan/2023

Public consultation to collect ideas for strategic energy transition guidelines

2. Preparation of the State Energy Transition Policy – Apr/2024

Consolidation of strategic energy transition guidelines and development of Law Project for submission to Legislative Assembly

3. Design of Energy Transition Action Plans – Jul/2024

Public consultation for action plans for the energy transition that will guide policies and programs

4. Preparation of instruments for implementing action plans – from Dec/2024

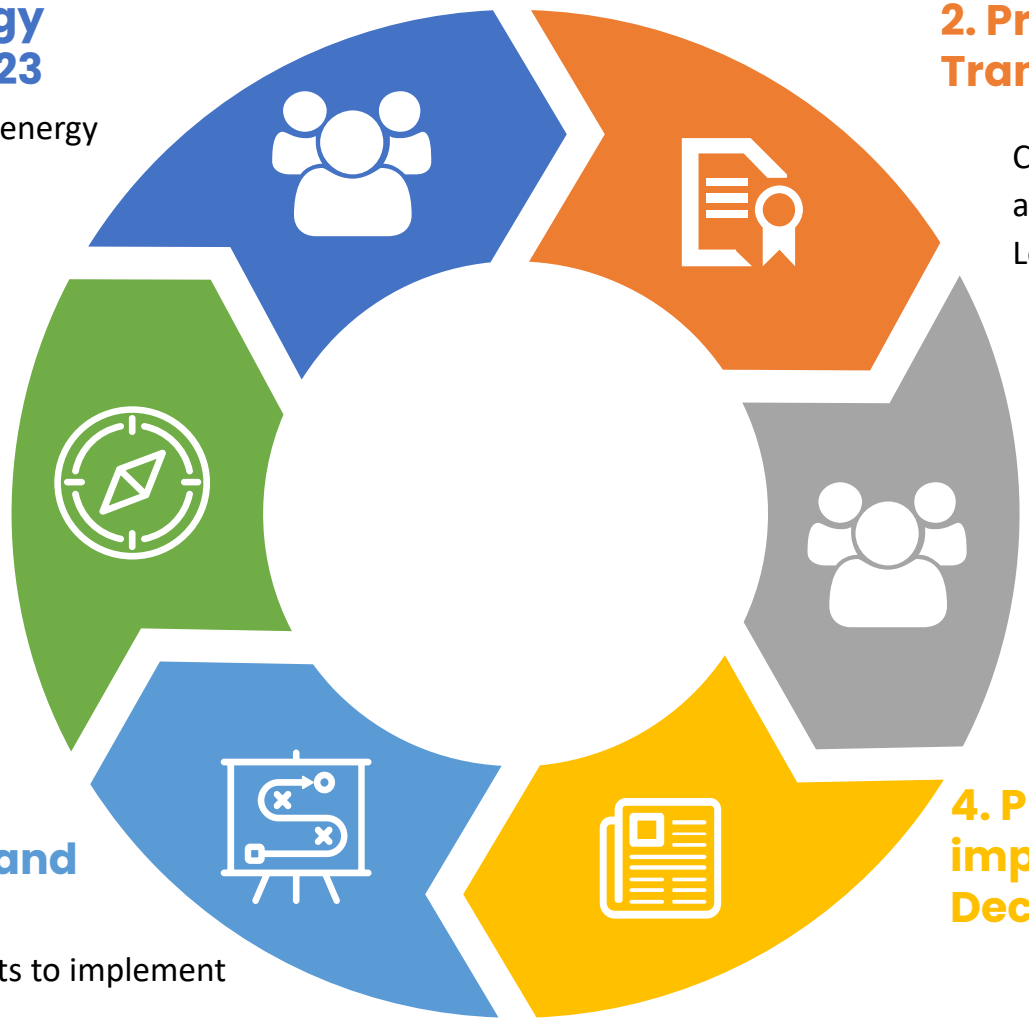
Preparation and discussion of instruments (e.g. Decrees and resolutions) that will establish the planning of energy transition actions.

5. Design of specific programs and projects – from Dec/2024

Coordination between the various secretariats to implement energy transition policy action plans.

6. Assessment of results to review policy and action plans

Assessment of results and goals, after a deadline and with indicators defined in the action plans.



II. JUSTIFICATION – WHAT IS ENERGY TRANSITION

WHAT IS ENERGY TRANSITION?

The world is currently undergoing a significant period of transformation driven by various factors, including the urgency of addressing climate change and the imperative for decarbonization, the ongoing decentralization and digitalization of energy systems, and the growing demand for greater democratization of energy. These factors demand substantial changes in how we both produce and consume energy, collectively known as the energy transition.

Historically, energy transition movements are responsible for major socioeconomic transformations. A classic Brazilian example is the expansion of the bioethanol industry in Brazil in the 20th century. More recently, new energy production and use technologies and new digitalization and communication technologies also indicate socioeconomic transformations. A popular example is neo-industrialization based on new low-carbon energy industries.

WHAT IS ENERGY TRANSITION?

The public debate understands Energy Transition as a process of changing energy systems from an initial condition to a new condition (in general, to a less carbon intensive).

This general definition leaves aside many specific issues of technologies, locations, territories, policies, many actors and various possible trajectories.

This fact becomes evident when we discuss subnational energy transitions, such as the one in Rio de Janeiro:

- Largest producer of oil and natural gas in Brazil;
- More carbon-intensive electricity mix than the Brazilian average;
- Strong offshore and naval industry; and
- Great socioeconomic impact of fossil industries in the state.

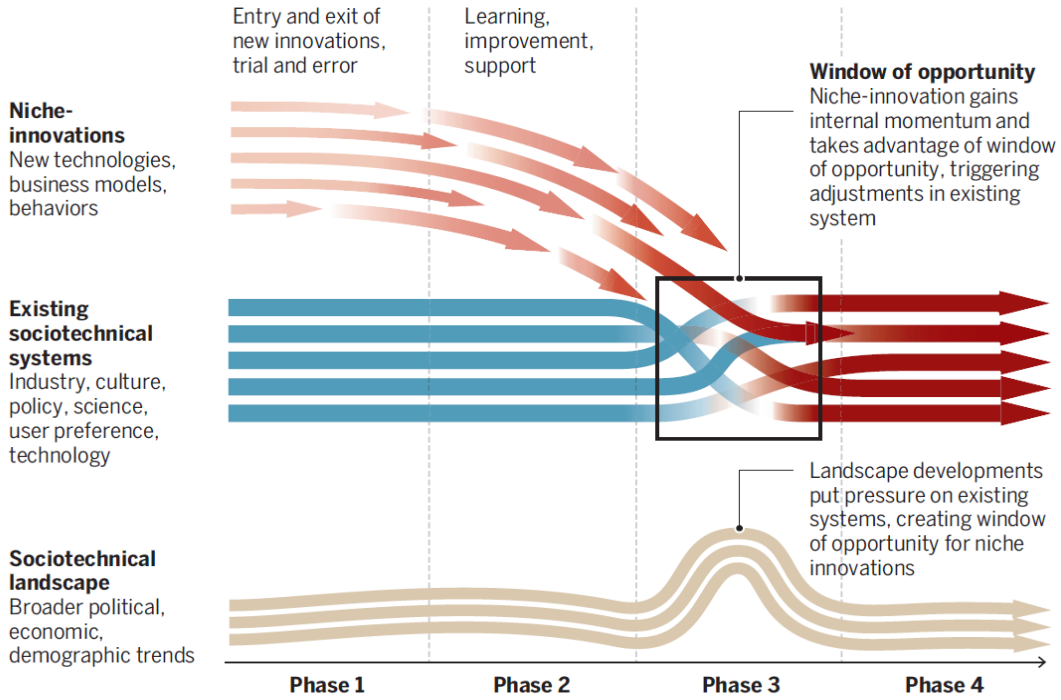
HOW TO ANALYZE ENERGY TRANSITIONS?

Analyzing energy transitions can take various angles, including energy systems, economics, and political and regulatory considerations whether the focus is on challenges or potential solutions. This diversity is evident in multiple theories aimed at explaining transitions[1].

Within this realm of possibilities, the sociotechnical systems perspective encompasses various characteristics, elements, interactions, and properties. Through this lens, systems' configurations involve a combination of agents, technologies, policies, regulations, and sociocultural aspects, ultimately shaping the choices, uses, and impacts of technologies.

Moreover, the sociotechnical systems perspective provides insights into understanding energy transitions as dynamic interactions occurring across different levels, as illustrated in the figure.

Source: 1- SOVACOOL 2017



Fonte: GEELS,2017

WHY TO ANALYZE ENERGY TRANSITIONS?

Analyzing energy transitions is crucial for comprehending their implications on countries, states, cities, organizations, businesses, and societies. Such analyzes also facilitate the coordination of actions, helping identify key areas for intervention, required resources, involved agents, and other essential factors for steering the course of transitions.

These analysis steps are essential for guiding public policy actions. Specifically, they help us to grasp the roles of policies and regulations, the availability of resources (both natural and economic), and the impacts on organizations, communities, and territories. Furthermore, they shed light on the risks, challenges, and opportunities that come with energy transitions.

ENERGY TRANSITION DEFINITION

Considering the specificities of a subnational entity and a systemic perspective, the State of Rio de Janeiro understands Energy Transition as:

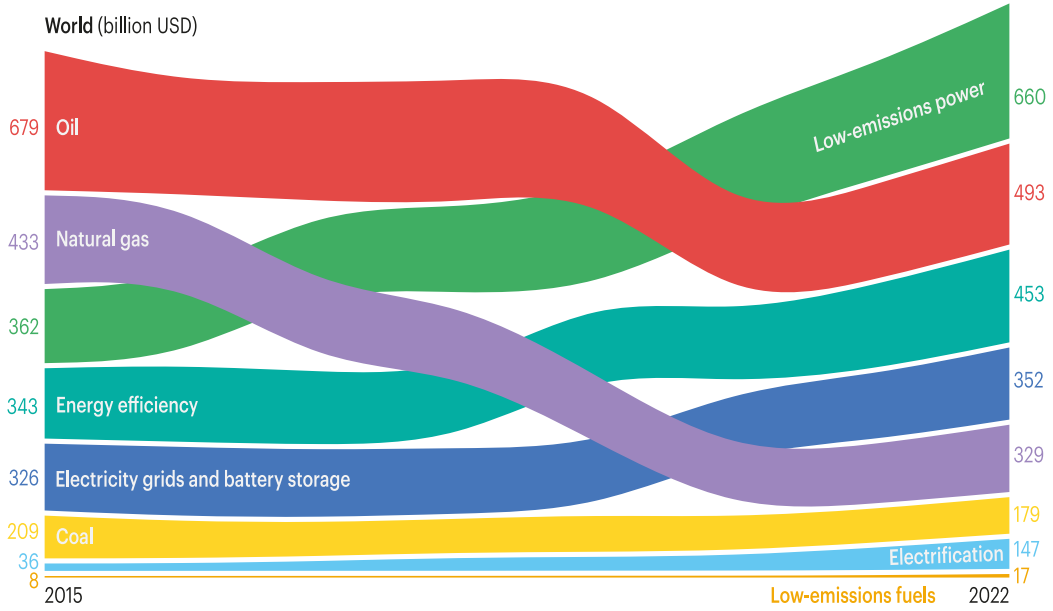
The reconfiguration of energy systems from an established and dominant initial state to a new state over time and within a given context and territory.

While similar, the emphasis on system reconfiguration shifts the conversation towards the elements at play, the rules governing them, and the contextual aspects of these configurations. This discussion is crucial for comprehending the factors influencing and consequences of energy transitions. Therefore, it aids in assessing the potential for a transition that yields greater benefits for the examined areas, creating the foundation for an equitable transition. In simpler terms, this definition enables us to view the energy transition as a driver of socioeconomic development, extending beyond mere technological changes or shifts in energy mixes.

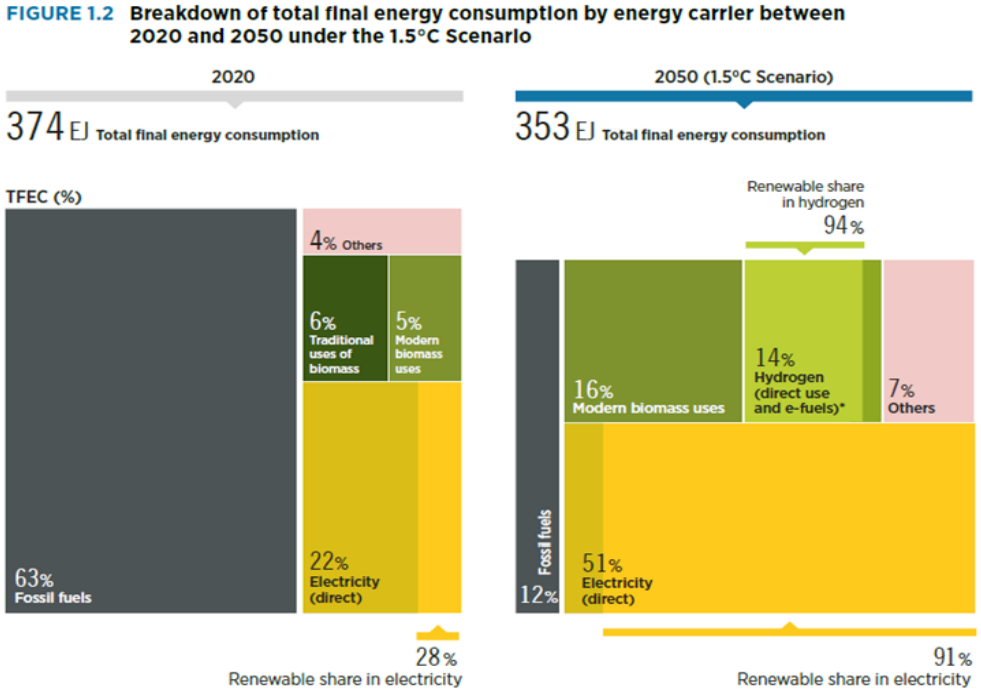
III. JUSTIFICATION – WHY A STRATEGIC STATE ENERGY TRANSITION AGENDA

THE GLOBAL ENERGY TRANSITION

The global energy mix is already undergoing major changes that will accelerate drastically in the coming decades. Analysis from the International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA) illustrate these changes from 2015 to 2022 and through 2050.



source: World Energy Outlook 2023 - IEA



Source: World Energy Transitions Outlook 2023: 1.5°C Pathway - IRENA

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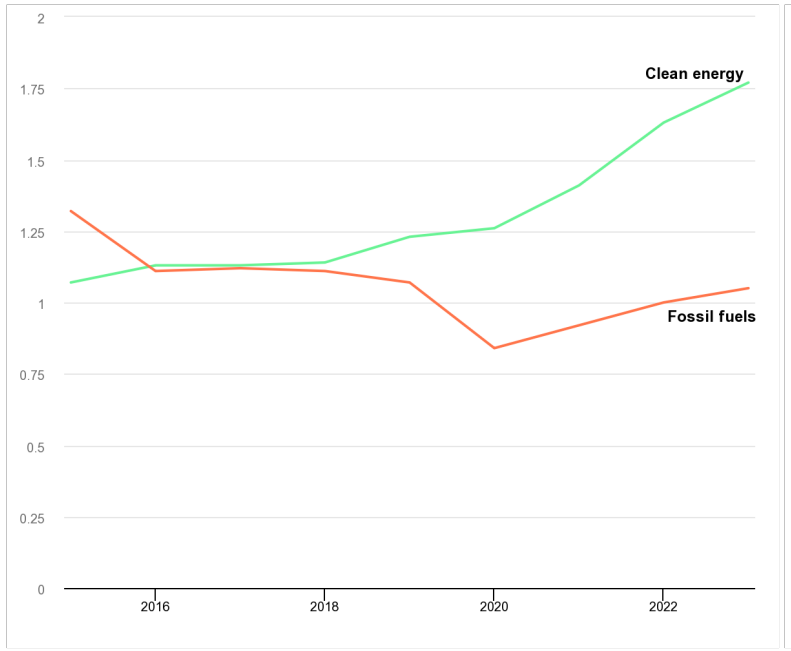
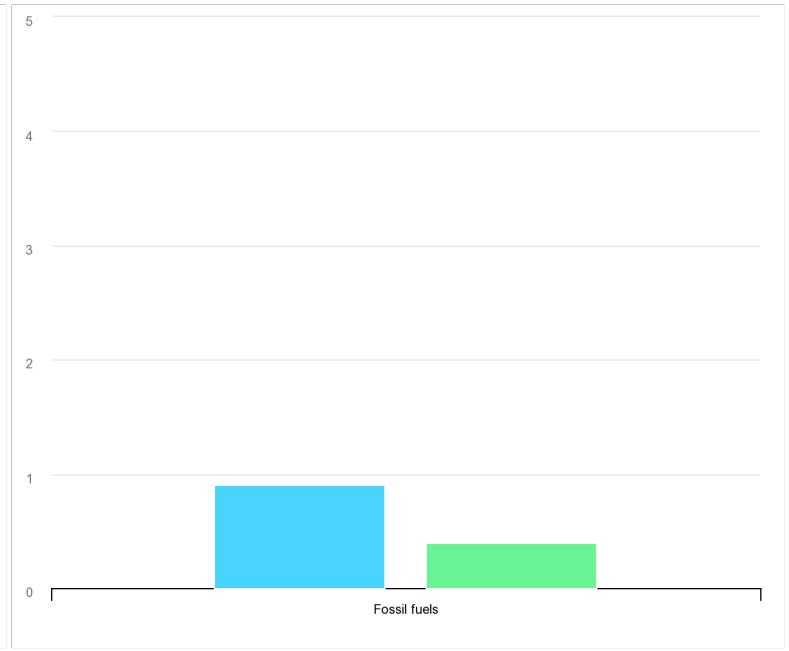
INVESTMENTS ON THE GLOBAL ENERGY TRANSITION

The global energy transition will require large volumes of investments, which will open windows of opportunities for the development of new production chains. IEA analyzes show a reconfiguration of investments between fossil fuels and renewables.

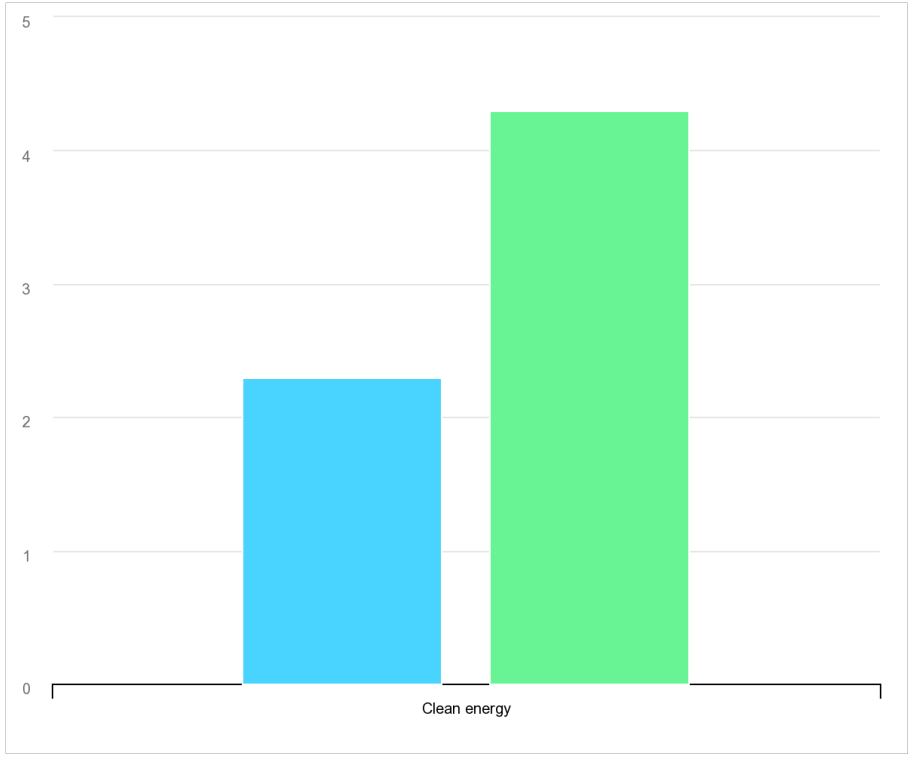
Evolution of investments in clean energy and fossils in recent years (trillion US$ 2022)



Investments in fossil energy in 2030 (trillion US$ 2022)



Investments in clean energy in 2030 (trillion US$ 2022)



Source: World Energy Outlook 2023 – IEA

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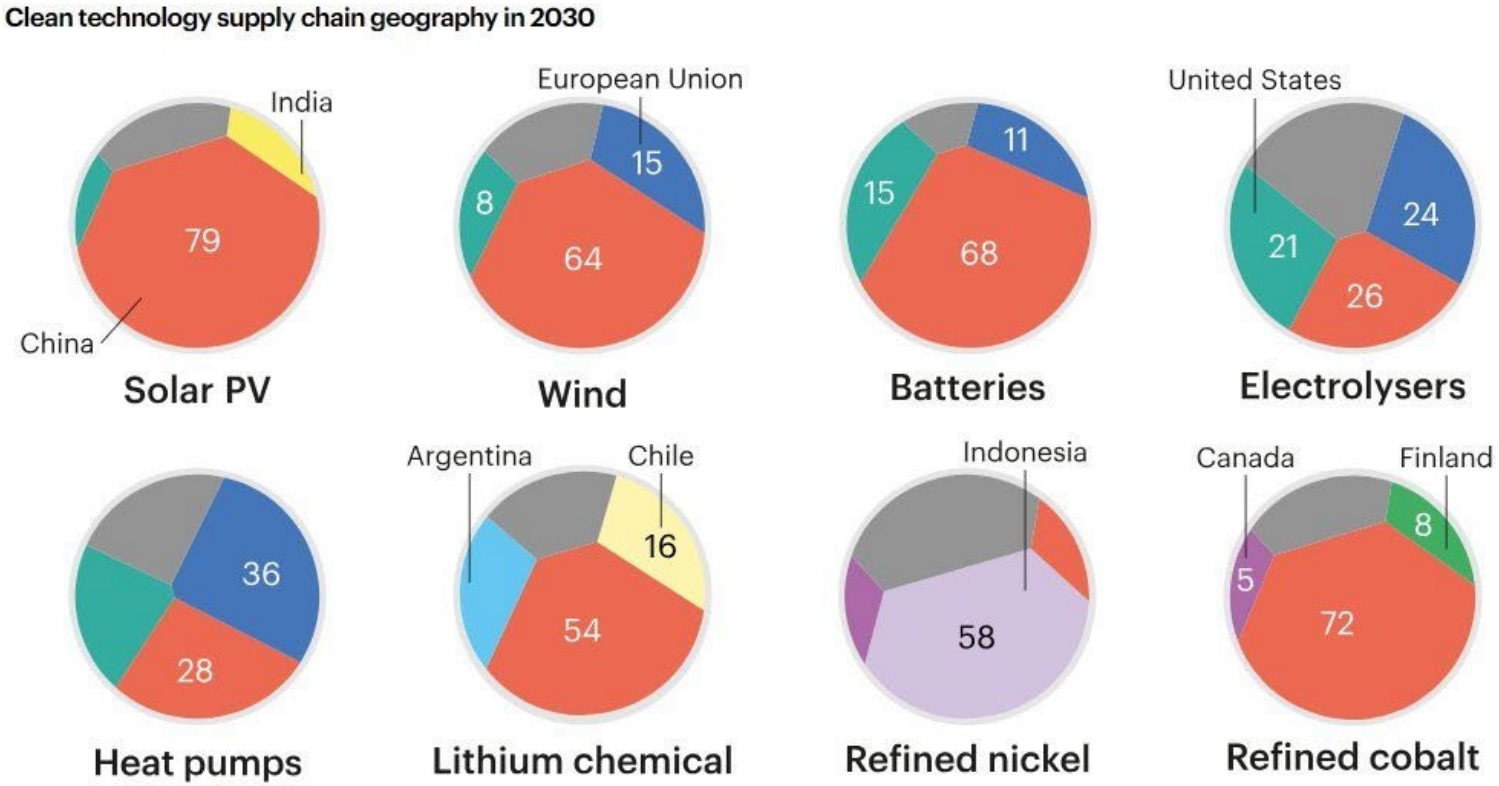
RECONFIGURATION OF PRODUCTION CHAINS IN THE GLOBAL ENERGY TRANSITION

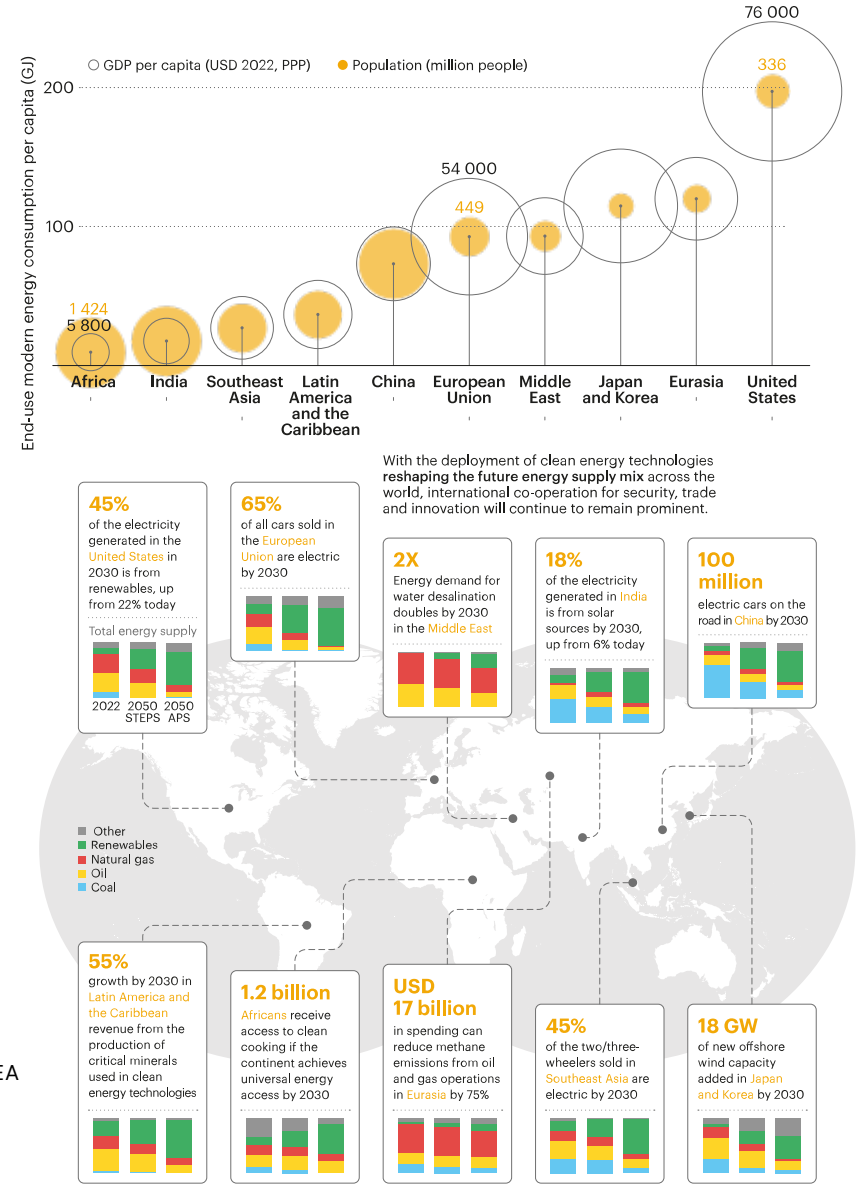
The IEA also highlights that energy transitions are conditioned and influence socio-productive structures and that there will be a redefinition of global value and production chains.



Source: World Energy Outlook 2023 - IEA

THE DIFFERENT REGIONAL IMPACTS OF THE GLOBAL ENERGY TRANSITION

The reconfiguration of energy mixes and value and production chains will be specific according to each context and territory. The IEA's latest World Energy Outlook makes clear the different trajectories and impacts according to each region.



Source:: World Energy Outlook 2023 – IEA

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THE NATIONAL ENERGY TRANSITION

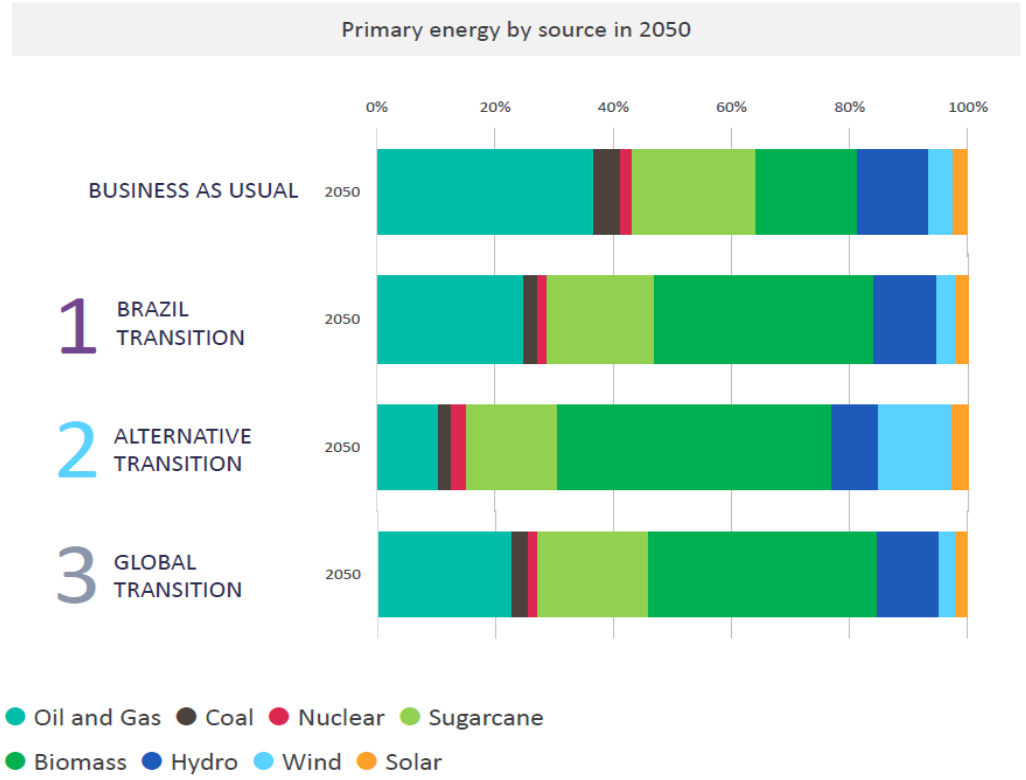
At the national level, the energy landscape strongly aligns with the primary drivers of global energy transitions, particularly the pressing need for climate action. This alignment is attributed to significant historical strides in incorporating renewables into the national electricity grid, including hydroelectric, wind, solar, and biomass sources. Additionally, the notable success of biofuels in the energy mix contributes to this favorable context.

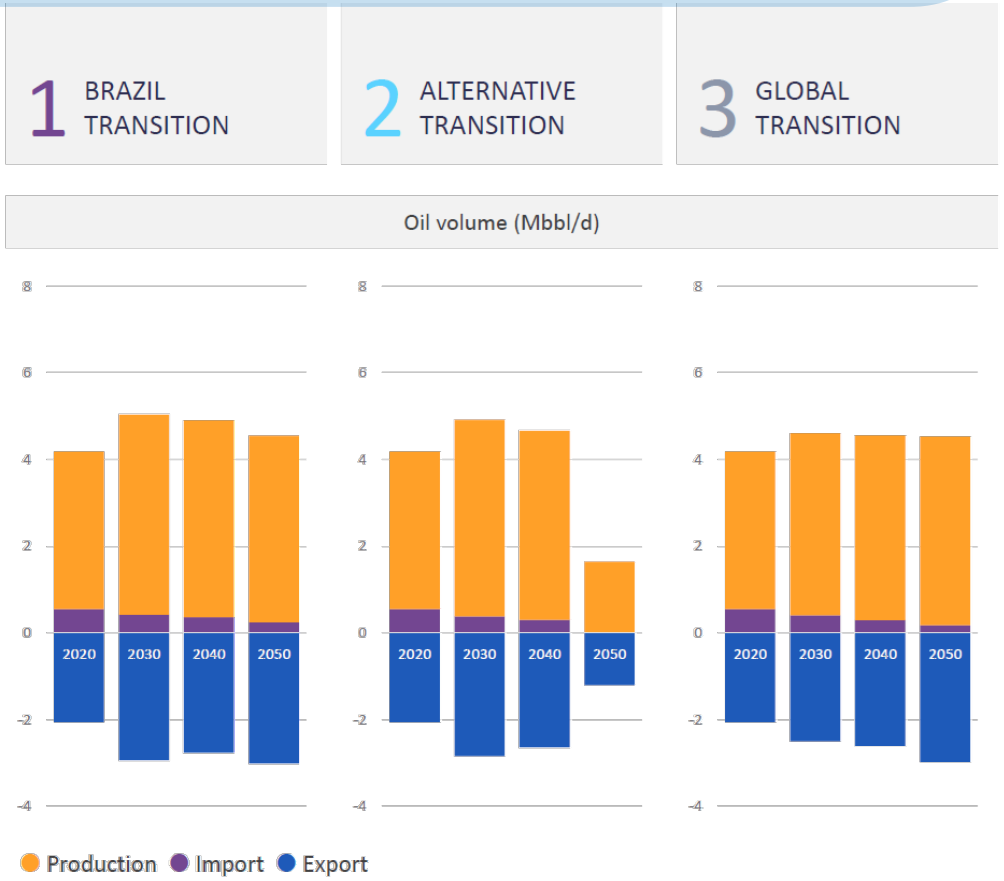
Presently, discussions surrounding the national energy transition predominantly center on advanced energy sources like low-carbon hydrogen and advanced biofuels. These discussions signify a substantial overhaul of infrastructure and energy utilization across various sectors and activities.

Consequently, the national energy transition is being perceived as a pivotal component of a new development model and global integration. This broader perspective also encompasses concurrent processes such as digitalization.

NATIONAL ENERGY TRANSITION SCENARIOS

The primary scenarios for the national energy transition point to significant changes in the overall energy landscape. Nevertheless, these scenarios also suggest a sustained level of oil production. The crucial question pertains to how this transition is distributed geographically across various states and regions.





https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-726/Programa_de_Transicao_Energetica%20Presentation.pdf

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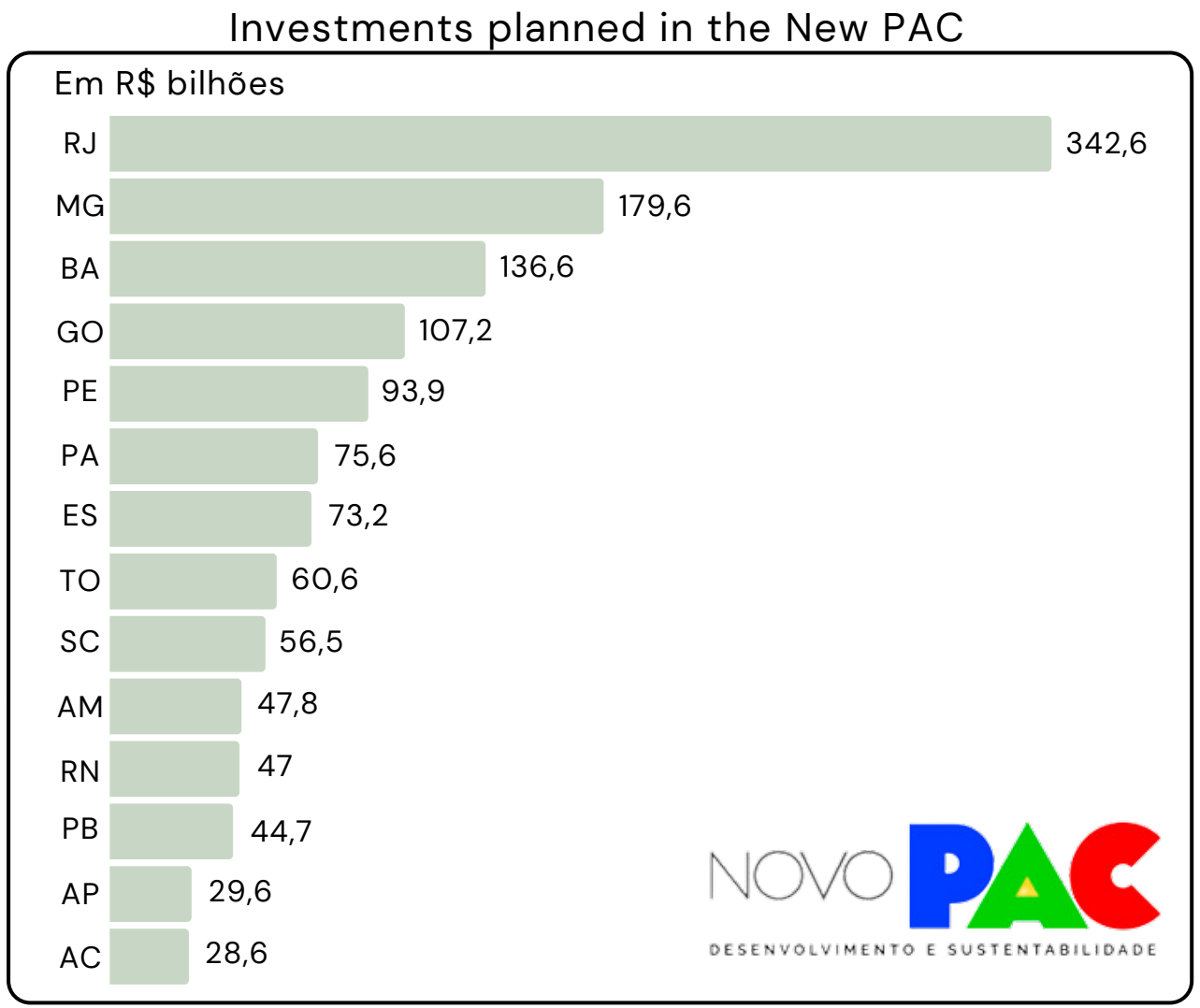
THE NATIONAL ENERGY TRANSITION



Another factor with a major impact on the states is the new Growth Acceleration Program (PAC), which has the potential to unlock a series of investments in the energy sector in the State of Rio de Janeiro

STRATEGIC PLANNING AND STATE PROGRAMS

Looking at it from a state standpoint, the State of Rio de Janeiro currently boasts numerous policies and programs that engage with the energy transition. These include the State Climate Change Policy, the State Plan for Sustainable Rural Development, Agroecology and Organic Production, the State Integrated and Sustainable Waste Management, the Industrial District Program, the BlueRio program, the Offshore Wind Working Group, the Sustainable Corridors Program, among many others.

In this context, a key goal of a State Energy Transition Policy is to streamline the alignment of existing objectives, instruments, and mechanisms concerning the state's energy transition.

With the aim of achieving convergence, the state has revitalized strategic planning and crafted the Strategic Plan for Economic and Social Development. This plan outlines the primary missions and strategic directions for the state in the long run, with the energy transition being identified as one of the key strategic initiatives to be pursued.

ENERGY INNOVATION SYSTEM BASED IN THE STATE OF RIO DE JANEIRO

Innovation stands as a significant catalyst for driving energy transitions. Consequently, the presence of regional innovation systems, equipped with capabilities, resources, and readiness to operate in the energy sector and related domains, becomes a critical factor for harnessing the positive impacts of energy transitions.

The State of Rio de Janeiro has a robust innovation system, encompassing companies, research centers, universities, open innovation ecosystems, and other entities with the potential to spur the development of new industries and services within the state.

Notable institutions within this framework include the UFRJ Technological Park, CENPES, CEPEL, several universities and federal institutes (UFRJ, UERJ, PUC, UFF, UENF, IFF, IFRJ, etc.), MIT REAP, the Energy Hub SDP, and numerous major energy companies.

POSITIONING IN TRANSITION MOVEMENTS

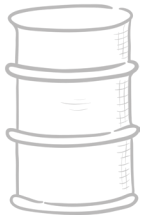
Given all these contexts of global and national energy transitions, subnational entities must structure strategies on how they will position themselves in these movements. It is in states and municipalities that some of the fundamental conditions and consequences of energy transitions are anchored:

- Energy resources
- Industries, services and jobs
- Positive and negative impacts of changes in production chains and energy services
- Capabilities and resources for decision-making and implementation

Rio de Janeiro has comparative and competitive advantages due to the chains already established in the state, port structures, proximity to large consumer centers, robust energy industry and innovation system. The question that arises is how to take advantage of the many possibilities for investment, job creation and development of production chains derived from energy transitions.

IV. JUSTIFICATION – CHARACTERISTICS OF THE ENERGY TRANSITION IN THE RIO DE JANEIRO STATE

RIO DE JANEIRO STATE ENERGY SCENARIO



OIL AND NATURAL GAS

national leadership in its productions, with 86% and 73%, respectively

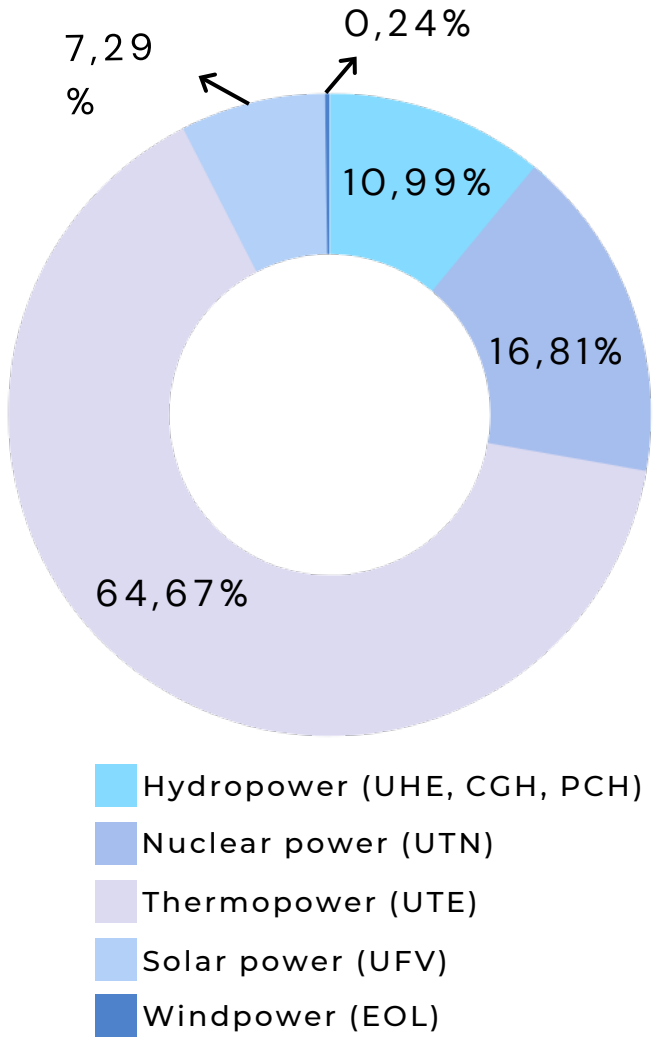
THERMOPOWER

2nd in installed power, around 7 GW

NUCLEAR ENERGY

national protagonism of the State - Angra 1 and 2 have an installed capacity of 1.9 GW. In the future, Angra 3 will have a power of 1.4 GW

ELECTRICITY MIX



Source: ANEEL, 2023

RIO DE JANEIRO STATE ENERGY SCENARIO – NATURAL GAS

Source: Petrobras, 2022

ROUTE 2

Start of operations: 2016

It takes natural gas from the Pre-Salt of the Santos Basin to Praia de Lagomar (city of Macaé)

Capacity of 20 million m³/day

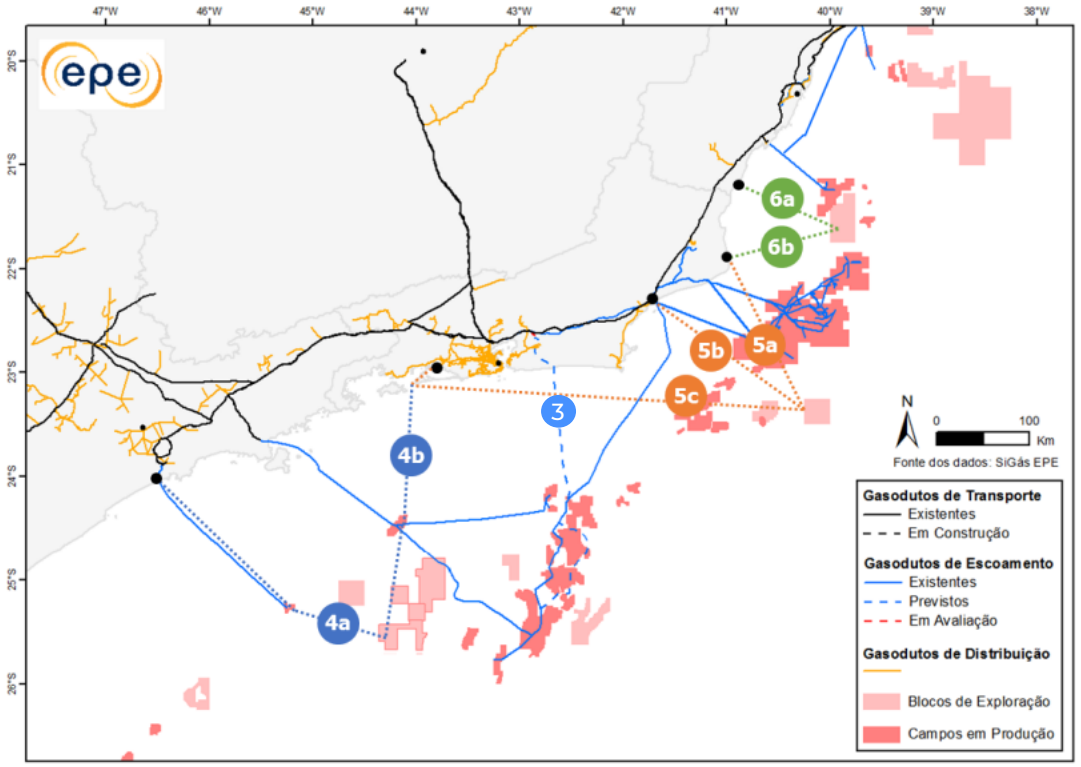
ROUTE 3

Expected start of operations: 2024

It will take natural gas from the Santos Basin Pre-Salt to the Polo GasLub facilities (municipality of Itaboraí)

Capacity of 21 million m³/day

RIO DE JANEIRO STATE ENERGY SCENARIO – NATURAL GAS



ROUTE 4b

It will take natural gas from the pre-salt fields of the Santos Basin to the Port of Itaguaí

Capacity of 16 million m^3/day

ROUTE 5b

It will take natural gas from the Campos Basin fields to the Cabiúnas Terminal

Capacity of 14 million m^3/day

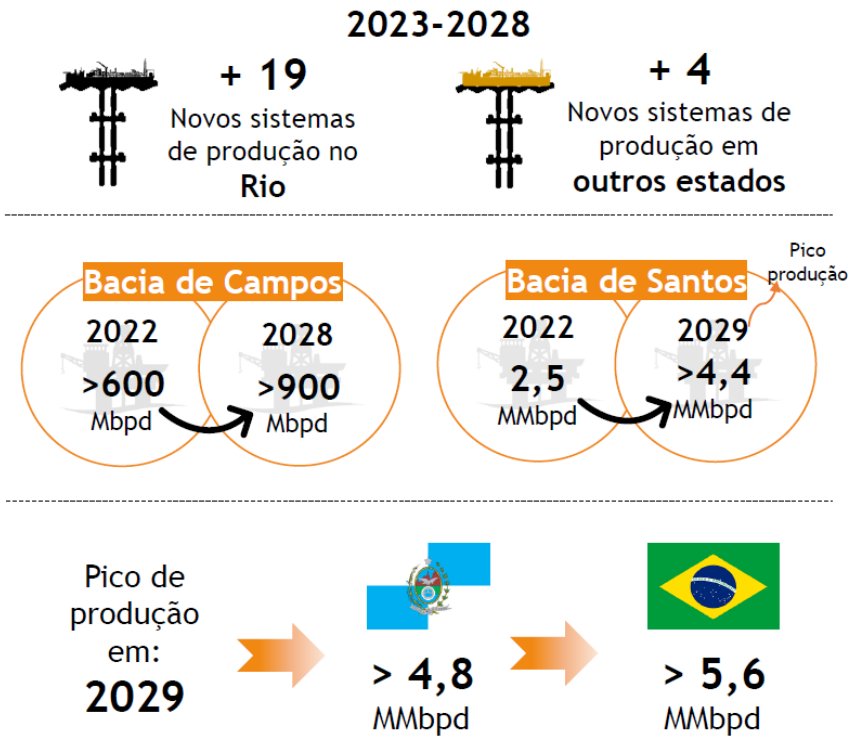
ROUTE 6b

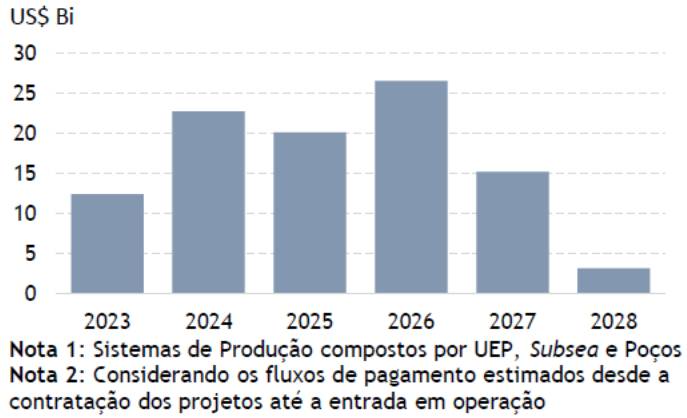
It will take natural gas from the Campos Basin fields to Porto do Açu

Capacity of 12 million m^3/day

RIO DE JANEIRO STATE ENERGY SCENARIO – OIL

The oil sector has great potential for expansion, leveraging large volumes of investment in the coming years



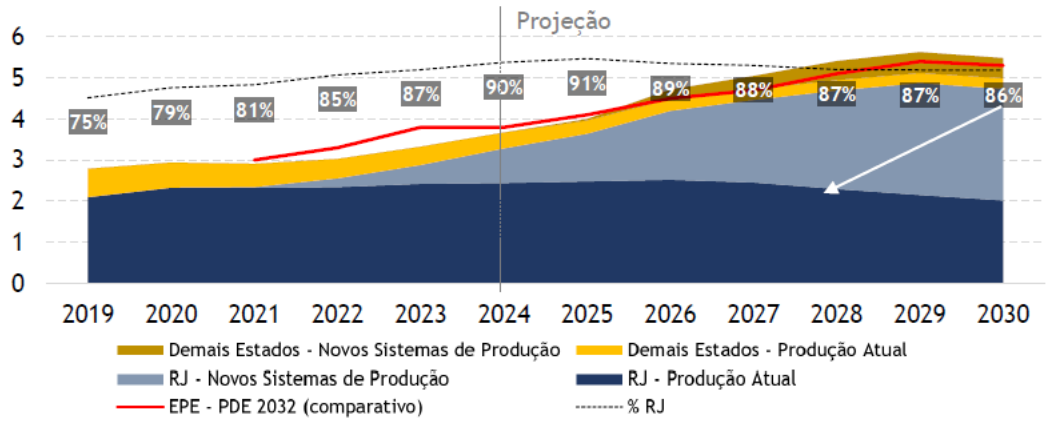


Nota 1: Sistemas de Produção compostos por UEP, *Subsea* e Poços
Nota 2: Considerando os fluxos de pagamento estimados desde a contratação dos projetos até a entrada em operação

2023-2028

~ 100 Bi US$
Investimento total em sistemas de produção

> 20 Bi US$
Investimento mínimo no Brasil via cláusulas de CL



% RJ
+ 11 %
2019-2030

Source: Anuário de Petróleo no Rio 2023 - FIRJAN

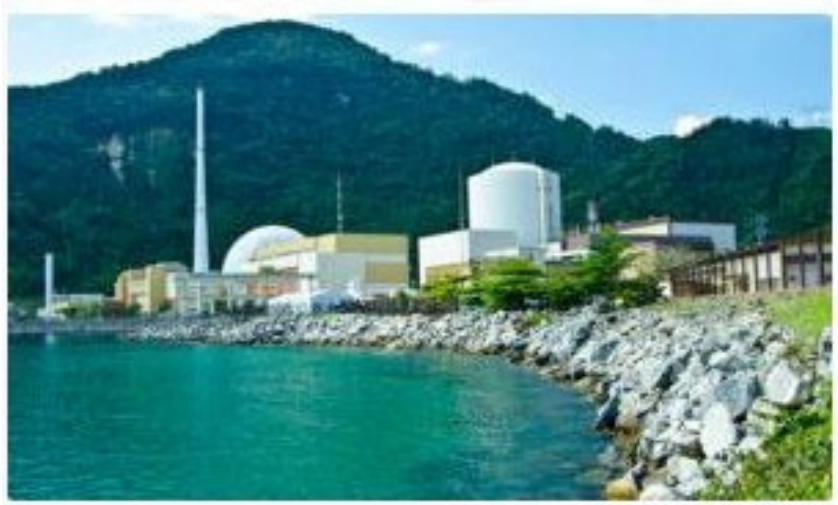
RIO DE JANEIRO STATE ENERGY SCENARIO – NUCLEAR ENERGY

The state of Rio de Janeiro stands as the sole nuclear power generator in Brazil, with an installed capacity of 1.99 GW.

There is a notable alignment of efforts towards the completion of Angra 3, contributing with an additional 1.35 GW.

Nuclear power generation plays a crucial role in sustaining the nuclear value chain and production in Brazil.

Also, the nuclear power generation technology has seen significant advancements, especially in Small Modular Reactors (SMRs), creating new opportunities for the sector.



Capacidade Instalada Nuclear em operação (2022)	
1,99 GW	1% da capacidade instalada total

Plantas de Geração Termonuclear			
Planta	Capacidade Instalada	Estágio	Construção
Angra I	640 MW	Operação	1972/1985
Angra II	1.350 MW	Operação	1981/2001
Angra III	1.350 MW	Construção	1984/...

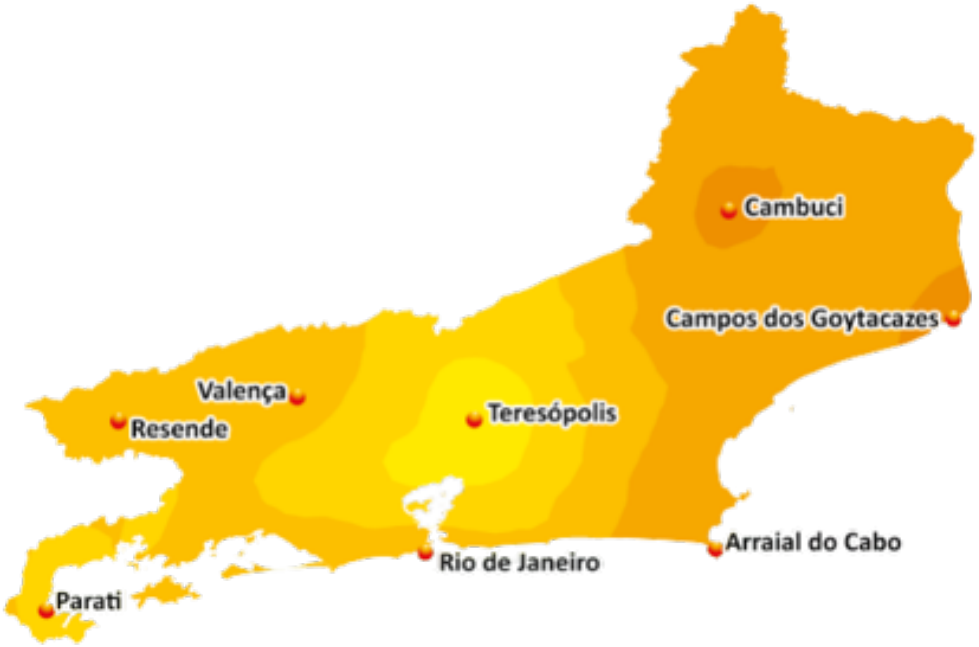
RIO DE JANEIRO STATE ENERGY SCENARIO – SOLAR ENERGY

STATE POTENTIAL

Installed capacity of 974.7 MW

IRRADIAÇÃO SOLAR

varies between 1,460 and 2,010 kWh/m²



Fonte: Atlas Solarimétrico do Estado do Rio de Janeiro

The darkest areas are those with the greatest solarimetry. Therefore, they are the most attractive for solar energy generation.

RIO DE JANEIRO STATE ENERGY SCENARIO – BIOGAS AND BIOMETHANE

BIOGAS

second largest national producer – with annual production of 199.66 million m³

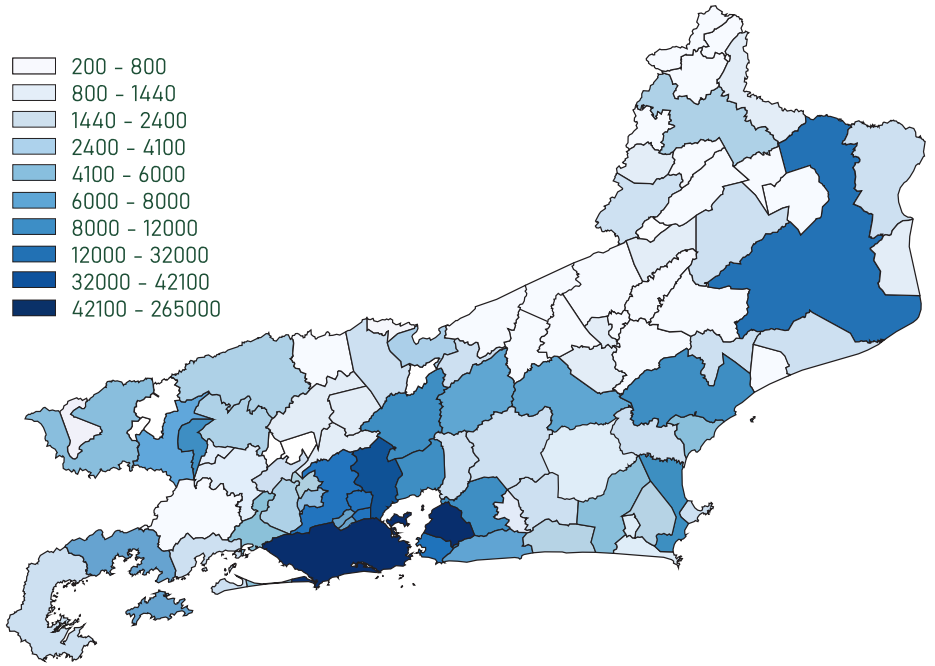
BIOMETHANE

largest national producer – with annual production of 29 million m³

12 PRODUCTION FACILITIES

for self-production, self-generation of electrical energy and self-consumption - Electrical energy generation of 415.31 GWh/year

Biogas and Biomethane Potential (m³/day) with the main input being Urban Solid Waste (MSW)



RIO DE JANEIRO STATE ENERGY SCENARIO – OFFSHORE WIND

13 PROJECTS

in the licensing phase at IBAMA, wtih 32.222 GW of installed power

INVESTIMENTS

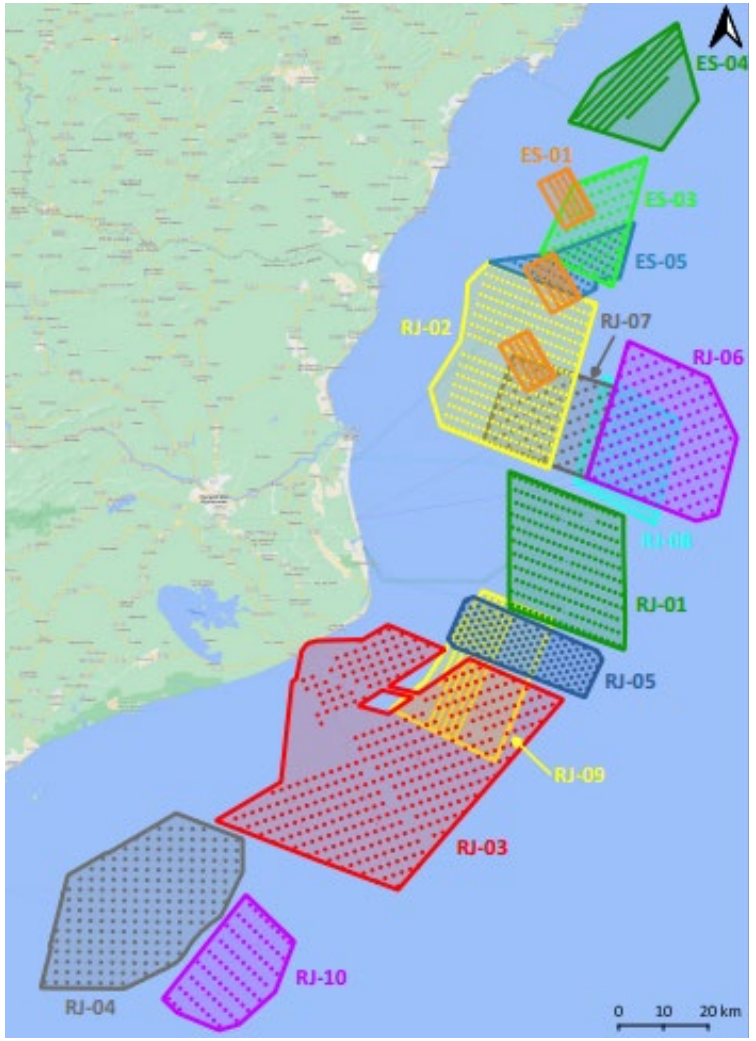
potential of US$ 93.768 billion in the next ten years

COASTLINE EXTENSION

636 km and approximately 255 thousand km² of Continental Shelf (territorial sea and Exclusive Economic Zone)

PILOT PROJECT

SEENEMAR is developing an offshore wind pilot project, which will be implemented in North Fluminense, using the infrastructure of Porto do Açu



Fonte: IBAMA, 2023

RIO DE JANEIRO STATE ENERGY SCENARIO – HYDROGEN

HYDROGEN FROM RENEWABLE SOURCES

- Synergy with solar or wind development potential
- State of Rio de Janeiro has a project between Porto do Açu and Shell.

HYDROGEN OBTAINED FROM NATURAL GAS WITH CCUS

- Synergy with the gas market developed in the state
- Monetization of one of the most abundant resources in the state: Natural Gas

HYDROGEN OBTAINED BY THE COOLING PROCESS OF THE TURBINES OF ANGRA 1 AND 2 NUCLEAR PLANTS:

Eletronuclear has an entirely Brazilian system that produces sodium hypochlorite and hydrogen at the Angra 1 and 2 plants, producing around 150kg of hydrogen per day (which can reach 300kg with small adjustments to the process).

THE RIO DE JANEIRO WAY FOR ENERGY TRANSITION

The State of Rio de Janeiro has distinct characteristics that will lead to unique energy transition pathways, potentially diverging from the national average.

As the largest producer of oil and natural gas, the sole generator of nuclear energy, with a rich history and experience in the offshore industry, and boasting the largest fleet of vehicles powered by natural gas, Rio de Janeiro holds significant potential to drive technologies such as carbon capture, utilization, and sequestration (CCUS), explore various applications of low-carbon hydrogen, promote the offshore wind sector, and develop low-carbon technologies for the oil and natural gas industry, among other opportunities.

Therefore, a strategic energy transition agenda for the state should not only identify these strategic potentials but also outline areas for action.

V. STRATEGIC AGENDA FOR THE ENERGY TRANSITION OF THE RIO DE JANEIRO STATE

PILLARS OF THE ENERGY TRANSITION IN THE STATE OF RIO DE JANEIRO

The strategic energy transition agenda for the State of Rio de Janeiro hinges on three main pillars: ***decarbonizing the state's energy mix, fostering the growth of low-carbon energy industries and services, and championing a fair and inclusive energy transition.***

- ***Decarbonizing the state's energy mix*** – Includes activities such as encouraging the use and production of low-carbon energy, focusing on increasing energy efficiency, integration and planning with other areas, etc.
- ***Fostering the growth of low-carbon energy industries and services*** – Focuses on mapping and synergy activities with competitive advantages, stimulating energy innovation and improving the environment for small and medium-sized energy companies (startups), etc.
- ***Championing a just and inclusive energy transition –*** Comprises the work of public participation requirements, the prioritization of projects and programs with the greatest positive social impact (such as job and income generation and worker retraining) and the development of energy community programs, etc.

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY

Strategic guidelines will guide the state's actions in defining policies, programs and projects aligned with the energy transition.

The strategic guidelines are presented in four large groups: ***structuring actions, cross-cutting actions, supply actions and demand actions***

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – STRUCTURING ACTIONS

The structuring actions aim to restore state energy governance and planning, so that the state establishes its own capabilities for the development of evidence-informed and participatory energy transition policies, programs and projects.

I – Energy Governance

I.1 – Reestablishment of the State Energy Policy Council

I.2 – Special Advisory on Energy Transition

I.3 – Definition of standards for prioritizing energy transition projects

I.4 – State capacity development

II – Energy Planning

II.1 – State Energy Balance

II.2 – Energy Transition Scenarios

II.3 – Energy Intelligence

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – STRUCTURING ACTIONS

I –Energy governance – corresponds to the strategic lines that enable the analysis, monitoring and management of the energy transition in the State of Rio de Janeiro

I.1 – Reestablishment of the State Energy Policy Council – corresponds to actions to establish a governance structure to guide energy policies in the State of Rio de Janeiro

I.2 – Special Advisory on Energy Transition – corresponds to the specific structure for analyzing and monitoring energy transition actions in the State of Rio de Janeiro

I.3 – Definition of standards for prioritizing energy transition projects – corresponds to actions to create a decision-making methodology for priority projects for the energy transition in the State of Rio de Janeiro

I.4 – Development of state capabilities – corresponds to actions to hire, train and retain people and technologies for energy planning and transition in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – STRUCTURING ACTIONS

II – Energy Planning – corresponds to the strategic lines that enable the recovery of energy planning activities in the State of Rio de Janeiro

II.1 – State Energy Balance – corresponds to actions to prepare energy statistics (balance sheets and related statistics) for the State of Rio de Janeiro

II.2 – Energy Transition Scenarios – corresponds to actions to develop energy transition scenarios for the State of Rio de Janeiro

II.3 – Energy Intelligence – corresponds to actions to develop indicators and analyzes that support energy planning and decisions in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – CROSS-CUTTING ACTIONS

Cross-cutting actions correspond to those initiatives that cross different energy systems and have an impact on different areas.

I – Hydrogen

I.1 – Development of pilot and demonstration projects

I.2 – Establishment of the Hydrogen Innovation System

II - CCUS

II.1 – Mapping CCUS chain synergies

II.2 – CCUS Hub development support

III – Innovation

III.1 – Support for innovation systems

III.2 – Alignment of state STI policies and programs

IV – Just and Inclusive Transition

IV.1 – Definition of participation mechanisms

IV.2 – Energy justice criteria

IV.3. – Capacity building for just transition

V – Ocean Economy

V.1 – Planning of infrastructures for new energies

V.2 – Decarbonization of the Maritime Fleet and Ports

VI – Financing

VI.1 – Analysis for alignment of state funds and resources

VI.2 – Mapping of national and international resources

VII – Partnerships

VII.1 – Partnerships with private companies and civil society

VII.2 – Partnerships with ICTs and Universities

VII.3 – Partnerships with other federative entities

VII.4 – International Partnerships

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – CROSS-CUTTING ACTIONS

I – Hydrogen – corresponds to the strategic lines for the development of the low-carbon hydrogen economy in the State of Rio de Janeiro

I.1 – Development of pilot and demonstration projects – corresponds to actions that guarantee and promote the expansion of new demonstration projects for the production and use of low-carbon hydrogen in the State of Rio d Janeiro

I.2 – Establishment of the Hydrogen Innovation System – corresponds to actions that encourage the development of research, industry and services in the low-carbon hydrogen economy in the State of Rio de Janeiro

II – CCUS – corresponds to the strategic lines for the development of technologies and the CCUS sector in the state of Rio de Janeiro

II.1 – Mapping synergies of the CCUS chain – corresponds to actions that allow identifying and quantifying potential, markets, industries and services associated with CCUS technologies in the State of Rio de Janeiro

II.2 – Support for the development of a CCUS Hub – corresponds to actions that seek to encourage the development of a CCUS hub in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – CROSS-CUTTING ACTIONS

III – Innovation – corresponds to the strategic lines that seek to structure the energy innovation system in the State of Rio de Janeiro

III.1 – Support for innovation systems – corresponds to actions that seek to encourage the different structures and activities of energy innovation systems in the State of Rio de Janeiro

III.2 – Alignment of state STI policies and programs – corresponds to actions that seek to identify and converge Science, Technology and Innovation policies and programs for the energy transition in the State of Rio de Janeiro

IV – Just and inclusive transition – corresponds to the strategic lines that seek to guide energy transition movements in the State of Rio de Janeiro towards the promotion of energy justice

IV.1 – Definition of participation mechanisms – corresponds to actions that increase and qualify society's participation in the definition of energy transition policies, programs and projects in the State of Rio de Janeiro

IV.2 – Energy justice, gender equity and social inclusion criteria for projects – corresponds to actions that help define databases, indicators and criteria for energy justice, gender equity and social inclusion in energy transition policies, programs and projects in the State of Rio de Janeiro

IV.3. – Capacity building for just transition – corresponds to actions that seek to qualify workers and the community for the new economies derived from the energy transition in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – CROSS-CUTTING ACTIONS

V – Ocean economy – corresponds to the strategic lines for aligning the energy transition and the economy of the sea in the State of Rio de Janeiro

V.1 – Planning of infrastructures for new energies – corresponds to actions that seek to prepare port and maritime infrastructures in the State of Rio de Janeiro for the energy transition

V.2 – Decarbonization of the Maritime Fleet and Ports and Port Terminals – corresponds to actions that promote the development of alternatives for the decarbonization of the Maritime Fleet and Ports and Port Terminals in the State of Rio de Janeiro

VI – Financing – corresponds to strategic lines that seek to enable the allocation of economic and financial resources in the energy transition of the State of Rio de Janeiro

VI.1 – Analysis for alignment of state funds and resources – corresponds to actions that seek the convergence of different state funds with regard to the energy transition of the State of Rio de Janeiro

VI.2 – Mapping of national and international resources – corresponds to actions that seek to enable the use of different resources in energy transition policies, programs and projects in the State of Rio de Janeiro.

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – CROSS-CUTTING ACTIONS

VII – Partnerships – corresponds to the strategic lines to enable interaction with agents from different areas related to the energy transition in the State of Rio de Janeiro

VII.1 – Partnerships with private companies and civil society – corresponds to actions that enable partnership activities with companies and civil society organizations aligned with the energy transition strategies of the State of Rio de Janeiro

VII.2 – Partnerships with ICTs and Universities – corresponds to actions that enable partnership activities with research, development, innovation, teaching and extension organizations and institutions aligned with the energy transition strategies of the State of Rio de Janeiro

VII.3 – Partnerships with other federative entities – corresponds to actions that enable partnership activities with the union, other states and municipalities aligned with the energy transition strategies of the State of Rio de Janeiro

VII.4 – International Partnerships – corresponds to actions that enable partnership activities with international and multilateral bodies and organizations aligned with the energy transition strategies of the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – SUPPLY ACTIONS

The supply actions aim to develop the potential of energy resources in the State of Rio de Janeiro

I – Bioenergy

I.1 – Recovery of sugarcane potential

I.2 – Developing the potential of energy forests

I.3 – Development of the potential for energy use of waste

II – Offshore Wind

II.1 – Development of the offshore wind innovation system

II.2 – Support for the development of the supply chain and services

II.3 – Development of pilot and demonstration projects

III – Nuclear Energy

III.1 – Maintenance and expansion of the nuclear chain in the state

IV – Oil and Natural Gas

IV.1 – Support the decarbonization of the O&G sector

IV.2. – Mapping and supporting O&G chain synergies and new low-carbon industries

V – Solar Energy

V.1 – Support the democratization of solar energy

V.2 – Integration of solar energy with productive sectors

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – SUPPLY ACTIONS

I – Bioenergy – corresponds to the strategic lines to expand the energy recovery of the biomass resources in the State of Rio de Janeiro

I.1 – Recovery of sugarcane potential – corresponds to actions aimed at recovering the potential of ethanol and other bioenergies derived from sugarcane in the State of Rio de Janeiro

I.2 – Development of the potential of energy forests – corresponds to actions for the development of energy forest projects and their products in the State of Rio de Janeiro

I.3 – Development of the potential for energy use of waste – corresponds to actions that enable the development of projects for different routes of energy use of waste (including biogas, biomethane, Residue Derived Fuel from Waste-RDF, combustion, pyrolysis, gasification, etc. .) in the state of Rio de Janeiro

II – Offshore Wind – corresponds to the strategic lines for the development of offshore wind potential and associated industries and services in the State of Rio de Janeiro

II.1 – Development of the offshore wind innovation system – corresponds to actions to establish structures for research, development, innovation and production of offshore wind in the State of Rio de Janeiro

II.2 – Support for the development of the supply chain and services – corresponds to actions that seek to encourage the offshore wind value chain in the State of Rio de Janeiro

II.3 – Development of pilot and demonstration projects – corresponds to actions that seek to expand pilot and demonstration projects in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – SUPPLY ACTIONS

III – Nuclear Energy – corresponds to the strategic lines that maintain the relevance of the nuclear chain in the State of Rio de Janeiro

III.1 – Maintenance and expansion of the nuclear chain in the state – corresponds to actions that enable the maintenance and expansion of the production chain and nuclear generation in the State of Rio de Janeiro

IV – Oil and Natural Gas – corresponds to strategic lines that develop the potential of oil and natural gas while supporting the decarbonization of the State of Rio de Janeiro

IV.1 – Support for decarbonization of the O&G chain – corresponds to actions that foster the reduction of greenhouse gas emissions (mainly carbon dioxide and methane emissions in the O&G chain) in the State of Rio de Janeiro

IV.2. – Mapping and supporting O&G chain synergies and new low-carbon industries – corresponds to actions that identify potential levers that the O&G industry can promote for new low-carbon technologies (such as hydrogen and offshore wind) in the State from Rio de Janeiro

V – Solar Energy – corresponds to the strategic lines for the development of solar potential and the respective value chain in the State of Rio de Janeiro

V.1 – Support for the democratization of solar energy – corresponds to actions that foster the expansion of photovoltaic generation to population groups with less access in the State of Rio de Janeiro

V.2 – Integration of solar energy with productive sectors – corresponds to actions that promotes the integration of solar energy in different stages of the production chains in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – DEMAND ACTIONS

Demand actions aim to stimulate energy transition and efficiency on the consumption side, consumers and energy services

I – Energy management and efficiency

I.1 – Energy Efficiency Program in Public Buildings

I.2 – Support to municipalities for energy management

I.3 – State energy management program (public sector)

I.4 – Fostering energy management in the industrial and commercial sectors

I.5 – Promoting smart buildings

I.6 – Definition of mechanisms to guarantee access to modern energy services for the entire population of Rio de Janeiro

II Transport

II.1 –Decarbonization of the heavy transportation

II.2 – Promoting electromobility infrastructures

II.3 – Support to municipalities for urban planning

III – Infrastructures and Digitalization

III.1 – Mapping and supporting the modernization of electricity networks

III.2 – Mapping for expansion and modernization of the gas network

III.3 – Fostering smart energy networks, including new management models (microgrids, aggregators, energy communities, etc.)

III.4 – Support the creation of ecosystems of digital solutions for energy systems

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – DEMAND ACTIONS

I – Energy management and efficiency – corresponds to strategic lines that promote better management and increasing energy efficiency in the State of Rio de Janeiro

I.1 – Energy Efficiency Program in Public Buildings – corresponds to actions that develop a state energy efficiency program in public buildings in the State of Rio de Janeiro

I.2 – Support to municipalities for energy management – corresponds to actions that facilitate the creation of a support structure for municipalities in the state of Rio de Janeiro regarding energy management

I.3 – State energy management program (public sector) – corresponds to actions that enable the development of a state energy management program to optimize resources in the State of Rio de Janeiro

I.4 – Fostering energy management in the industrial and commercial sectors – corresponds to actions that foster energy management and increase energy efficiency in the State of Rio de Janeiro

I.5 – Promoting smart buildings – corresponds to actions that encourage the development of smart building projects in the state of Rio de Janeiro

I.6 – Definition of mechanisms to guarantee access to modern energy services for the entire population of Rio de Janeiro – corresponds to actions that promote greater access to modern energy services for the most vulnerable populations in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – DEMAND ACTIONS

II Transport – corresponds to strategic lines that promote greater efficiency and the promotion of low-carbon transport systems in the State of Rio de Janeiro

II.1 – Decarbonization of the heavy transportation – corresponds to actions that promote the replacement of fuels for energy sources with lower carbon intensity options in the State of Rio de Janeiro

II.2 – Promoting electromobility infrastructures – corresponds to actions that encourage the development of infrastructures for electromobility in the State of Rio de Janeiro

II.3 – Support to municipalities for urban planning - corresponds to actions that encourage municipalities to develop urban planning that focuses on lower carbon intensity transport and mobility systems in the State of Rio de Janeiro

STRATEGIC GUIDELINES FOR STATE ENERGY TRANSITION POLICY – DEMAND ACTIONS

III – Infrastructures and Digitalization – corresponds to the strategic lines that promote the modernization of energy infrastructures in the State of Rio de Janeiro

III.1 – Mapping and supporting for the modernization of electricity networks – corresponds to actions that promote the identification of bottlenecks and points for improvement and encourage the improvement of quality and modernization of electricity distribution and transmission systems in the State of Rio de Janeiro

III.2 – Mapping for expansion and modernization of the gas network – corresponds to actions that promote the identification of bottlenecks and points for improvement and encourage the improvement of quality and modernization of natural gas distribution and transportation systems in the State of Rio de Janeiro

III.3 – Fostering smart energy grids, including new energy systems management models – corresponds to actions that identify potential and encourage the development of smart grid alternatives and new energy infrastructure management models (e.g. smart meters, microgrids , aggregators, energy communities, etc.) in the State of Rio de Janeiro

III.4 – Support for the creation of ecosystems of digital solutions for energy systems – corresponds to actions that encourage the development of an innovation ecosystem for the development of digital solutions and products for energy systems in the State of Rio de Janeiro

VI. NEXT STEPS – INITIAL PROPOSAL FOR ENERGY TRANSITION ACTION PLANS IN THE RIO DE JANEIRO STATE

NEXT STEPS OF THE STATE ENERGY TRANSITION POLICY OF THE STATE OF RIO DE JANEIRO

This document seeks to gather input to strengthen the strategic energy transition agenda for the State of Rio de Janeiro, aiming to inform the development of the State Energy Transition Policy. Nevertheless, translating this strategy into actionable plans, along with the corresponding policies, programs, and projects, will inherently entail discussions on the methods of action and the various instruments and mechanisms to be implemented.

NEXT STEPS OF THE STATE ENERGY TRANSITION POLICY OF THE STATE OF RIO DE JANEIRO

Five axes of action are being considered for the implementation of the State Energy Transition Policy

01

Improving the policy and regulatory environment

02

Definition of priority programs and projects

03

Coordination in the use of resources

04

Capacity Building and training

05

Intermunicipal coordination

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NEXT STEPS OF THE STATE ENERGY TRANSITION POLICY OF THE STATE OF RIO DE JANEIRO

Similarly, there are ongoing internal discussions about specific missions related to the implementation of the State Energy Transition Policy. These missions adhere to the principles of mission-oriented policies, in alignment with PEDES guidelines, seeking to facilitate coordination and integration across various areas, resources, and projects toward predefined objectives.

Some of the missions being considered are:

- The implementation of 5 energy transition Hubs in the state of Rio de Janeiro by 2040
- 1000 efficient public buildings by 2040
- Implementation of 3 sustainable corridors with biomethane, electricity and hydrogen by 2045

Nevertheless, these concepts of action axes, missions, and the instruments to be implemented are preliminary ideas that will undergo thorough discussion and refinement during the formulation of action plans for the State Energy Transition Policy of Rio de Janeiro.

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