

POLICY BRIEF: A DECARBONIZATION PLAN FOR PERNAMBUCO, BRAZIL

- The high vulnerabilities of the Brazilian state of Pernambuco have put climate change in the centre of the state's political agenda.
- A decarbonization plan is being developed for Pernambuco, aligned to the perspectives of zero emission assumed by the country
- Phasing-out deforestation with restoration of native vegetation, production of biofuels for hard-to-abate transport modes, electrification of light-duty vehicles, expansion of renewable electricity generation capacity, recovery and conversion of biogas from landfills and deployment of carbon capture and storage are the main measures for decarbonization of Pernambuco.
- These challenging measures require strong international collaboration for overcoming the different technical, economic, financial, cultural, educational and institutional barriers.



Secretaria de
Meio Ambiente
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Main Strategies for decarbonization of Pernambuco

Pernambuco is a state in the Brazilian Northeast region. It is worldwide known for its rich cultural traditions arising from the diversity of its people. Diversity is also present in Pernambuco's climate. The coastal zone of the state is hot and humid and is occupied by large extensions of sugarcane plantations. The countryside, on the other hand, presents a hot and dry climate, threatened by an ongoing process of desertification. The state's capital, Recife, concentrates around 3.7 million inhabitants in its metropolitan region, being the 6th most populous area in Brazil and the 1st in the Northeast region. The city is located at the sea level and is popularly nicknamed as the "Brazilian Venice", due to its landscape filled with rivers and water channels, and it was pointed in 2007 by the IPCC as one of the 16 most vulnerable cities to climate change. Therefore, the effects of climate change can be particularly devastating to Pernambuco on many fronts.

By recognizing this, climate change has been placed at the centre of Pernambuco's policy agenda since the late 2000's. The foundation of a State Forum on Climate Change with local experts, in 2009, and the establishment by law of a state policy to fight climate change in 2010 were the first steps of Pernambuco towards climate action. More recently, in 2019, Pernambuco launched its first State's Greenhouse Gas Inventory, for better understanding its emissions profile and to identify where to take course of action on mitigation. The current step of action is the development of a State Decarbonization Plan to build an optimal mitigation strategy for Pernambuco to reduce its emissions

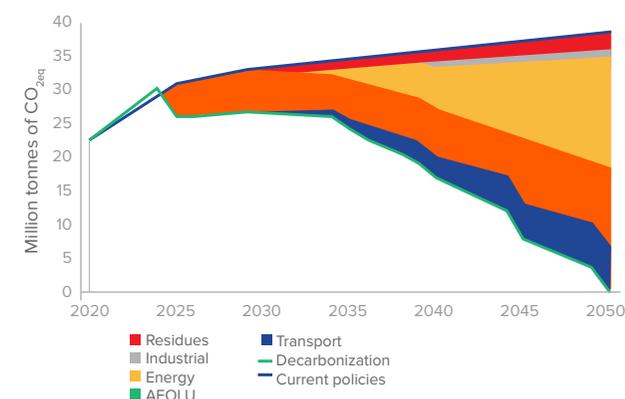
and contribute to preventing global warming and its consequences.

In order to develop an effective mitigation strategy at the subnational level aligned and integrated with the regional and federal context and also avoiding undesirable carbon leakages, Pernambuco partnered up with the best long-term integrated assessment modelling science available in Brazil. A multidisciplinary professional team is working to find the best cost-effective actions that can be implemented to reduce emissions in the State, contributing to a net zero Brazil 2050.

An effective contribution by Pernambuco requires integrated planning of mitigation actions for the energy and land use sectors by 2050, with short- and medium-term targets. First, reducing deforestation and recovering Atlantic Forests and *Caatinga* is essential. Enhancing agriculture productivity, intensifying pasturelands and implementing integrated crop-livestock-forestry systems can provide enough area for that. These measures also leave space for growing sustainable biomass to produce liquid biofuels in the state. Biofuels are relevant for decarbonizing the transport sector, particularly the "hard-to-abate" aviation and long-haul freight. Light duty vehicles emissions are mainly reduced through electrification of the fleet. The high sustainable potential of solar and wind resources in the state also points to an important role for Pernambuco in the generation of renewable electricity for decarbonizing the national electricity grid. Harnessing biogas from landfills is also important for

the state's decarbonization strategy. Finally, carbon capture and storage plays a very important role for reducing emissions of industrial processes and for achieving negative emissions when associated to bioenergy (BECCS) in the long-term.

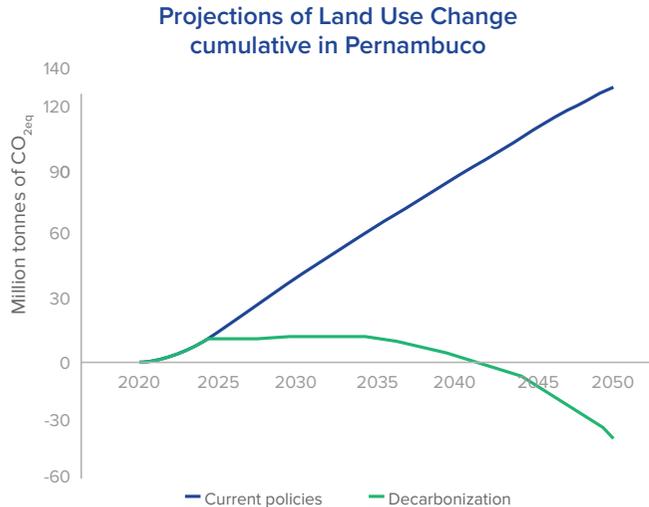
Emissions pathways for Pernambuco - sectoral contributions



Such an ambitious cross-sector decarbonization plan for Pernambuco present multiple challenges for each proposed action. Technology transfer, financing, education/training and effective regulation are some of the challenges that must be faced. They can only be overcome by establishing partnerships with all sectors, with a multi-actor and multi-level action/strategy and with support of the global community.

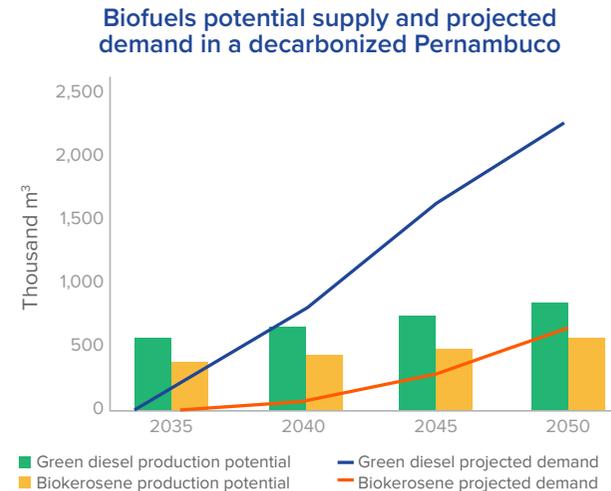
1 Land Use Change

Controlling human disturbance in the areas of the natural biomes of Pernambuco, Atlantic Forest and *Caatinga*, is crucial for the state's decarbonization strategy. The recovery of these ecosystems would remove up to 38 million tonnes of CO₂ by 2050. It also guarantees the provision of essential environmental services while conserving these ecosystems. This requires political action for reducing the socio-economic pressure on the natural areas. That can be achieved through monitoring the deforestation, capacity building and promoting best practices for enhancing the productivity of agriculture and livestock.



2 Biofuels – tradition and the future

Brazil is traditionally a major player in the production of biofuels in the World, mainly because of its large sugarcane-based ethanol industry. Although most of the Brazilian sugarcane is nowadays produced in the Southeast region, the crop was first introduced in the country in Pernambuco, back in the XVI century. This bioenergy tradition must be employed in favour of the deployment of a sustainable production of other biofuels, in particular green diesel and green jet fuels. These biofuels are the best options for Brazil to decarbonize the heavy-duty transport sectors, referred to as “hard-to-abate”.



Fischer-Tropsch synthesis is identified as an interesting route, with a potential to produce up to 800,000 m³ of green diesel (for trucks) and 500,000 m³ of biokerosene (for aviation) per year from residual biomass feedstocks in Pernambuco by 2050. The production of biofuels must rely on political action mainly for assuring a sustainable biomass supply and for establishing international partnerships to develop and transfer biorefining technologies.



3 Electrification with renewable electricity

Electrification of light vehicles is a trend seen globally. It is the main measure for the decarbonization of road passenger transport in Pernambuco, capable of reducing 22 million tonnes of CO₂ by 2050. For this development, there are challenges that require political action, such as the design and implementation of an electricity supply infrastructure for vehicles and adjustments in the electrical network for the new load profiles. Furthermore, for a real mitigation impact, the electrical supply must be provided by renewable sources. As Pernambuco has an outstanding sustainable potential of solar (730 GW) and wind (60 GW) resources, investments to increase the state's electricity generation capacity are of great importance in the decarbonization process.

4 Biogas – harnessing the power from waste

Residues management can be considered a social problem. Part of the solid waste generated are still destined to dumping grounds. Fortunately, this panorama is consistently changing, with higher shares of residues being adequately destined each year in Pernambuco. In terms of greenhouse gas emissions, residues are one of the highest emitting sources in the state, and since landfills produce relatively more methane than dumping grounds, these emissions tend to become more representative over the years. Hence, the main strategy for reducing emissions in Pernambuco's residues sector is to capture the biogas from landfills and also from the wastewater treatment. Apart from reducing the direct methane emissions, this biogas can be used as an energy carrier. The biogas production in the state can reach up to 500 million m³ per year by 2050. It can be burned to generate heat and/or electricity or upgraded to biomethane, allowing it to be injected in the natural gas pipelines network or be used for hydrogen generation in the idle process units of the state's petroleum refinery. This would require deploying and investing in the biogas capture and upgrading technologies in Pernambuco, as well as political action to establish an adequate set of regulations to the products.

5 Carbon capture and storage (CCS) – the necessary challenge

Although costly, the investment in systems to capture CO₂ is the most effective measure for some industries to deeply reduce its emissions. The implementation of CCS in steel, cement, ammonia and iron production in Pernambuco is capable of reducing the emission of 4,5 million tonnes of CO₂ by 2050. In particular, CCS associated to biofuels production leads to a net removal of CO₂ from the atmosphere, what is known as negative emissions. These are important for offsetting residual emissions in other sectors that could not be easily avoided. Combining the full potential production of green diesel and biokerosene to CCS lead to a net removal potential of more than 21 million tons of CO₂ per year in Pernambuco by 2050. CCS is vital for achieving climate neutrality in 2050 in Brazil, and its implementation is very challenging. For instance, there is a need for testing and financing the CO₂ capture technology in the industries. Also, a new CO₂ transport infrastructure must be financed and built for moving CO₂ from sources to sinks. Further, adequate CO₂ geologic reservoirs must be determined, assuring that the gas will remain there permanently. Other barriers such as business models for the CO₂ supply chain and regulatory frameworks for the CCS activities, which are currently inexistent anywhere in Brazil, provide an idea of how challenging the implementation of CCS is for Pernambuco. It can only be made possible with a strong political will and the engagement of the main stakeholders of CCS in the World.

