Workshop Summary: "Petrobras' Role in the Energy Transition"

On December 8, 2025, the Center for Energy, Finance and Development (CEFD), the E+ Energy Transition Institute, and the Institute for Strategic Studies of Petroleum, Natural Gas and Biofuels (Ineep) organized a workshop in Rio de Janeiro to discuss Petrobras' role in the energy transition.

With strong technological capabilities, access to capital, and significant political influence, the company is well positioned to lead low-carbon energy value chains and contribute to national climate goals. However, most of its investments remain directed toward expanding oil production, while energy transition projects account for only a small share of its investment portfolio.

The workshop brought together researchers, government representatives, Petrobras staff, and energy-sector experts to discuss how the company can position itself more strategically in the transition toward a low-carbon economy. The meeting took place amid a moment of structural tension: on one hand, Petrobras continues to deliver exceptional results from oil production; on the other, it must respond to ongoing changes in the global energy system.

From the outset, it was clear that Petrobras operates in an environment marked by contrasts. The pre-salt fields are experiencing a phase of high productivity and low costs, securing Brazil a central position in the global expansion of oil supply. At the same time, climate pressures, new international regulations, and transformations in energy value chains require the company to look beyond the immediate horizon. The challenge is to balance the weight of the present with the urgency of the future but without losing competitiveness or jeopardizing national energy security.

The main issues addressed during the workshop included:

1. **Technology and innovation**: How can Petrobras leverage its innovation capacity to foster the development of new low-carbon technologies?
2. **Financial viability of low-carbon activities**: In the face of internal and external financial pressures, how can investments in new sectors be made viable?
3. **Petrobras in the context of public transition policies**: In a context where Brazil has accumulated multiple energy transition strategies, how can Petrobras' investments be better aligned with government actions?

Below is a summary of the main themes discussed during the workshop.

The global context of the energy transition

A cross-cutting element of the discussions was the assessment that **the energy transition remains marked by profound uncertainty**. There is currently no clear international consensus on which technological mix will prevail over the next 20 to 30 years. Expectations regarding electrification, hydrogen, synthetic fuels, biomass, and energy efficiency vary widely across countries, sectors, and institutions. For oil companies, this

scenario makes it difficult to define technological bets, structure long-term investments, and build portfolios that are consistent with climate goals and market pressures.

This uncertainty interacts with Petrobras' own specific characteristics. As a state-controlled company with mixed ownership, Petrobras operates under **governance constraints** that, on the one hand, protect the public interest and corporate integrity, but, on the other, limit its ability to take risks, create new markets, or operate in segments outside its traditional value chain. These constraints make it particularly difficult to enter nascent technologies, which require untested business models, partnerships with smaller firms, and tolerance for experimental failure — elements that are common in innovation processes but less accepted in Brazil's institutional environment.

The persistent centrality of upstream activities and their implications

It was widely acknowledged that **Brazil's upstream sector remains extraordinarily competitive and profitable**, thanks to the productivity of the pre-salt fields, Petrobras' technological leadership in deepwater operations, and favorable geological conditions. While global supply faces structural decline — approximately 5 to 6 million barrels per day are lost annually due to natural depletion — global demand has not yet shown a consistent downturn. As a result, Brazil's incremental contribution becomes increasingly important from both a geopolitical and market perspective.

These conditions reinforce the idea that oil will remain Petrobras' economic core for many years, even under scenarios of accelerated energy transition. However, this does not mean that upstream activities will remain static. The global trend is for exploration and production operations to incorporate new low-carbon activities, such as carbon capture and storage (CCS), responsible decommissioning, and potential methods for storing geological hydrogen. Despite their potential, these routes do not offer the same profitability as oil, nor do they yet have well-structured markets. The challenge lies in integrating these technologies in ways that complement the core business without compromising financial returns.

From a strategic standpoint, Petrobras faces the need to reconcile the expansion of its production — currently essential for public finances and the balance of payments — with the build-up of technological foundations that will ensure its relevance in a future of lower fossil fuel dependence.

Refining as a structuring axis of Brazil's energy transition

One of the most significant contributions of the workshop was the argument that **refining should be viewed as an energy-industrial complex capable of playing a central role in the transition**. Existing infrastructure — fluid catalytic cracking (FCC) units, storage facilities, hydrogen production, and integration with petrochemicals — enables several transition pathways considered fast and relatively low-cost, such as:

- Coprocessing of vegetable oils in existing FCC units, producing lower-carbon "drop-in" fuels.
- Production of sustainable aviation fuels (SAF) and renewable diesel in dedicated or retrofitted units.
- Pathways combining low-carbon hydrogen and biogenic CO_2 to generate synthetic fuels.

This perspective challenges the narrative that the energy transition is limited to electrification and renewable power generation. For sectors such as aviation, shipping, and petrochemicals, molecule-based solutions are likely to prevail. Brazil, with its strong agro-energy base and existing industrial infrastructure, has natural advantages in this space.

Nevertheless, practical challenges remain. In Brazil, there is institutional resistance to coprocessing, often based on misinterpretations regarding carbon traceability. This prevents the country from advancing in a relatively simple, low-cost technology aligned with immediate market needs. It was also observed that biorefining is currently less profitable than fossil-based refining, reinforcing the need for regulatory and market arrangements that make these value chains certifiable and commercially viable.

Competition for global green molecule markets

The workshop highlighted that the world is rapidly moving toward the creation of global markets for green molecules. Sustainable aviation fuels (SAF), green methanol, renewable diesel, synthetic gasoline, and hydrogen derived from low-carbon pathways are emerging as central vectors of the transition—yet without clear standardization and amid intense competition among countries.

This perspective again challenges the idea that the energy transition is restricted to electrification and renewable electricity. For aviation, shipping, and petrochemicals, molecule-based solutions will dominate. Brazil, with its strong agro-energy base and installed industrial infrastructure, has natural advantages in this arena.

Brazil holds important comparative advantages:

- Abundant biomass.
- A large ethanol industry with decades of know-how.
- Significant biogenic CO_2 potential.
- Installed hydrogen capacity for refining.
- Mastery of FCC and coprocessing technologies.

However, one condition is universally identified as essential: internationally recognized environmental certification. Without the ability to certify that fuels meet emission standards in Europe, the United States, and global markets, there is no demand and, therefore, no long-term investor interest.

Likewise, it is necessary to integrate currently fragmented policies. Hydrogen, fertilizers, biofuels, carbon markets, and innovation policy are still evolving in isolation. This lack of coordination prevents the creation of robust business cases. Green methanol is one example: prototypes exist, as do natural resources and technical knowledge, but structured demand and offtake guarantees are lacking.

Innovation and Petrobras' institutional constraints

Petrobras has significant innovation instruments—well-funded research centers, partnerships with public agencies, and corporate venture capital funds. However, recurring challenges remain:

- Limited interaction with small and innovative companies.
- Low flexibility to assume risk.
- Difficulties in transforming research into marketable products.
- Regulatory barriers to operating in new areas.

These factors reduce the company's speed of adaptation at a time when the global energy sector is undergoing a paradigm shift. International companies that have successfully advanced in renewables or low-carbon fuels have largely done so by creating specialized units with greater autonomy, an approach that Petrobras, in its current structure, finds difficult to replicate.

The role of the State and the need for systemic coordination

By definition, the energy transition is a process that depends heavily on industrial policy, regulation, and public planning. The workshop emphasized that Petrobras can and should function as a strategic instrument of the State, but within clear limits: the company cannot replace entire sectors of the economy, such as agriculture, steel, fertilizers, or chemicals. Its role is to serve as a technological and financial anchor for specific value chains, not as the universal implementer of the transition.

To fulfill this role, the government must provide:

- Consistent signals regarding technological priorities.
- Regulatory frameworks that enable certification of new fuels.
- Coordination mechanisms among ministries, agencies, and companies.

At the same time, it was acknowledged that the Brazilian state does not operate as a homogeneous entity. Divergent views, sectoral interests, and internal political cycles hinder the adoption of a unified strategy. Institutional coordination will therefore be the result of political processes, rather than purely technocratic planning.

Petrobras' strategic dilemmas: between the short and the long term

Petrobras faces the classic dilemma of global oil companies: whether to be the first to exit or the last to turn off the lights. Exiting too early may undermine profitability and the company's ability to finance its own transition. Exiting too late may result in missing out on new markets and losing strategic relevance.

Currently, the company is betting on biorefining as a short-term pathway. This choice is consistent with its industrial base and hydrogen production capacity. However, bioenergy routes face physical and agronomic limits — competition for land, nitrogen requirements, environmental vulnerabilities, and logistical challenges. The experience of biodiesel in Brazil's Northeast is often cited as a warning.

At the same time, interest in synthetic fuels — dependent on green hydrogen and CO_2 capture — is growing. These pathways offer potentially greater scale and compatibility with international carbon standards, but they remain costly and immature. Carbon capture in basalt formations, for example, is expected to become commercially viable only in 20 years.

The recovery of degraded land emerges as an alternative capable of expanding biomass supply without increasing pressure on deforestation, while also generating environmental benefits. However, its implementation requires institutional capacities that are currently not present.

The need for strategic choices and alignment with public policies

Although the energy transition does not allow for a single solution, Petrobras cannot remain neutral in the face of available options. The multiplicity of technological pathways, combined with hundreds of projects under evaluation, requires the company to establish clear priorities. Recent public policies — such as those related to biofuels, hydrogen, and carbon markets — are increasing pressure on Petrobras to take a position.

At the same time, there is growing convergence around the idea that Brazil is likely to assume a prominent position in global biomolecule value chains. Other pathways, such as pure hydrogen or vehicle electrification, involve greater uncertainties.

Key messages emerging from the workshop

From the sum of the discussions, three structuring messages stand out:

1. **Petrobras should gradually build the industrial and technological foundations of the transition, using existing assets such as biorefining and offshore engineering.** Brazil has natural and technological advantages that place it in a unique position to lead sustainable fuel segments, based on the integration of advanced refining, biomass, and industrial hydrogen.

2. **The main obstacle is not financial, but regulatory and institutional.** Without certification, market design, government signaling, and policy integration, innovation cannot scale. At the same time, Petrobras can expand the commercialization of technologies within existing corporate governance rules.

3. **Petrobras can be a key player, provided that governance adjustments, strategic clarity, and coordination with the State are in place.** Unlocking the company's contribution will require the construction of a political consensus that provides clearer direction for Brazil's energy transition.