World Energy Scenarios | 2017

WORLD ENERGY COUNCIL

EXECUTIVE SUMMARY

In Partnership with CAF - Development Bank of Latin America, Eletrobras, UPME and the Paul Scherrer Institute

LATIN AMERICA & THE CARIBBEAN (LAC) ENERGY SCENARIOS

WORKING TOGETHER TO UNLOCK A BETTER ENERGY FUTURE

Regional integration is urgently needed to unlock new sustainable growth opportunities and to improve the resilience of energy systems across the region.

The *Latin America & the Caribbean (LAC) Energy Scenarios* report examines the future of the regional energy context in 2030 and to 2060. Three plausible, relevant and challenging regional scenarios are presented, which provide a clear and enabling framework for decision making under deep uncertainty and a platform to guide the development and consideration of more and better solutions to the challenges of robust energy transition and sustainable energy for all.

A GLOBAL GRAND TRANSITION AND REGIONAL DYNAMICS

Energy systems are in transition. As the pace of global connectivity increases, it is combining with an accelerating and uncertain pace of innovation technology, and wider geopolitical, societal and global environmental changes. The outlook for future energy systems is unclear and unpredictable. Different pathways are possible and already emerging, shaped by many and new actors, within and beyond the global energy system.

The Grand Transition is underway and characterised by four predetermined and four critical, and uncertain, drivers of change. The four predetermined factors shaping energy systems are: a slowing of global population growth; a range of new technologies; increasing appreciation of planetary limits; and a shift in economic and geopolitical power to Asia. The four critical and uncertain factors are below:

- Pace of innovation and productivity
- Evolution of international governance and geopolitical change
- Priority given to sustainability and climate change
- The selected ‘tools for action’ – the balance between the use of markets and state directive policy

Critical Uncertainties in LAC

Critical Uncertainties	Samba	Tango	Rock
Productivity and Structural Reform	▪ Successful reform and innovation ▪ Economic Growth 3.7% p.a. (2014–2030) 3.1% p.a. (2030–2060) ▪ GDP per capita in 2060 US$ 30,175	▪ Growth with focus on sustainability ▪ Economic Growth 2.8% p.a. (2014–2030) 2.7% p.a. (2030–2060) ▪ GDP per capita in 2060 US$ 23,513	▪ Low economic growth ▪ Economic Growth 1.5% p.a. (2014–2030) 1.4% p.a. (2030–2060) ▪ GDP per capita in 2060 US$ 13,095
Climate Challenge and Resilience	▪ Medium priority ▪ Cumulative emissions from fuel combustion 73 Gt CO_2 (2015-60) → 4.9% of the world	▪ High priority ▪ Cumulative emissions from fuel combustion 56 Gt CO_2 (2015-60) → 4.8% of the world	▪ Low priority ▪ Cumulative emissions from fuel combustion 65 Gt CO_2 (2015-60) → 4.3% of the world
Regional Energy Integration	▪ Key projects driven by market economics	▪ Broad-based regional governance	▪ Fractured regional system
Tools for Action	▪ Markets	▪ States	▪ Patchwork of states and markets

Source: World Energy Council and Paul Scherrer Institute

Three Possible Futures for Energy in LAC

Samba

LAC shaped by successful reform and strong innovation and high productivity with market forces

- Innovation and economic diversification beyond commodity exports
- Energy access for all

Tango

LAC shaped by governments to achieve sustainable growth and resilient energy system

- Strong regional integration
- High investment on regional adaptation and mitigation

Rock

LAC shaped by weak economic growth and waning support from global and regional institutions

- Limited infrastructure investment
- Policies inwardly focused and reform process delayed

Source: World Energy Council

Energy transition is not simply a global matter. Regional energy systems are diverse and preparing for new and different energy futures benefits from understanding how global, regional and local energy systems and dynamics are co-evolving.

After a period of prosperity, the Latin America and the Caribbean (LAC) region is facing a more difficult external context and slower economic growth. Regional population has doubled between 1970 and 2014. Based on the UN median projections, population growth is expected to slow due to lower fertility rates, reaching 627 million in 2060. Brazil's population is expected to peak around 2050, reaching 238 million.

Although a few countries have started structural economic and energy reform programmes to raise productivity and competitiveness, it is clear that the recent slowdown of economic growth has made the reform process more difficult. Meanwhile, the increased frequency and severity of extreme weather events are of particularly concern to the resilience of energy systems in the LAC region. The extensive use of hydro power, particularly in Brazil and Colombia, has enabled lower CO_2 emissions and faster electrification rates. However, the region's strong reliance on hydro power is also a risk in a future in which climate change impacts will combine with resource scarcities and intensify the challenges of an energy-water-food resource stress nexus.

Whilst the future shape, mix and price of the global and LAC regional energy system are unpredictable, world energy leaders and their organisations can prepare for the new, different and faster moving energy landscapes by using a set of plausible, alternative and memorable scenarios.

THREE LAC ENERGY SCENARIOS: SAMBA, TANGO AND ROCK

Scenario planning is an approach used by world energy leaders to better prepare in uncertain times and to identify new and better options for action. Scenarios are not the same as a strategy but can be used to test, challenge and inform the strategic planning process. Scenarios are also not the same as the vision of a better future. A set of scenarios describes new and different stories of energy futures that are already emerging, whether or not anyone wants them to happen.

Three regional energy scenarios – *Samba, Tango and Rock* – have been developed by the Word Energy Council in collaboration with the Council's National Member Committees, regional energy partners and experts to examine plausible pathways for robust energy transition in the LAC region.

The three regional scenarios use the Council's World Energy Scenarios 2016 archetype framework – *Modern Jazz (Samba), Unfinished Symphony (Tango), and Hard Rock (Rock) – a*s their starting point. Through enrichment with regional dynamics, the customised regional scenarios reflect the diversity and different political and economic realities across the region. Samba resembles the market-based flexibility of Modern Jazz; Tango represents the top-down coordination found in Unfinished Symphony; Rock describes the difficult possibility of a return to national security interests and how these constrain new opportunities for robust national transition and the role of regional integration in enhancing energy resilience.

In SAMBA, the LAC region undergoes successful structural reform with high levels of innovation and productivity gains, enabled through the stronger role of energy markets. The combined effects of structural reform and digitalisation stimulate new forms of economic diversification, beyond commodity exports. Open economies are well positioned for global competition and new regional growth prospects.

Chile's current structural reform programme provides an illustrative example of what success looks like in a Samba world. There are more opportunities to promote renewable energy, diversify the national energy mix, and meet Chile's clean energy mandate of 20% of electricity generation by 2025. Chile has opened its energy future to the involvement of over 100 international companies. In a Samba world, other countries attract private sector investment to meet new national energy visions and finance long-term energy goals. According to Climatescope 2016, Chile ranks second in an assessment of clean energy market conditions and opportunities in 58 emerging counties.

In TANGO, governments across the LAC region and beyond work together to achieve sustainable growth. An effective system of broad-ranging global and regional energy governance emerges, founded on strong collective climate change policies and the promotion of regional integration to enable the enhanced resilience of national energy systems.

Uruguay's wind policy provides an illustrative example of what success looks like in a Tango world. In Uruguay, 1,455 MW wind power is being installed in 2017, which is enough to meet in excess of 35% of electricity demand. Energy policy is cornerstone for rapid wind energy development in Uruguay, introducing goals and clear actions to achieve them.

In ROCK, the region is impacted by weak economic growth and a decline in trust and support for global and regional institutions. Pulled by populism, national governments focus on energy self-sufficiency policies. Despite the promise of medium- and long-term structural reform, volatility in commodity prices and financial markets and the threat of recession contribute to political and policy risk.

Argentina's energy market reform provides an illustrative example of how to avoid a Rock world. The government is determined to rebuild markets and enable a return to effective and sustainable regulatory frameworks. But the task is not easy. The law of economic emergency and the tangle of subsidies and regulations that followed since 2002 cause great uncertainty as to what rules to apply.

KEY FINDINGS FROM LAC ENERGY SCENARIOS

1. Energy demand in LAC is expected to grow at a slower rate. However, LAC energy demand growth will stay at a relatively high level, compared to most other regions. LAC economic growth is expected to be relatively slow, but the energy intensity improvement will be also limited.

2. Demand for electricity in LAC will rise more than double by 2060 in line with global developments that see an increasing electrification of society. Corresponding investment needs for electricity generation in LAC between 2010 and 2060 range from US$ 2.0-2.5 trillion (based on the 2010 market exchange rate).

3. Hydro power in LAC is expected to dominate new electricity generation growth by 2030. Beyond 2030, wind and solar power generations will increase significantly, but their shares will stay below the world averages as the share of hydro power in LAC is far higher than the world average.

4. In transport, the use of biofuels in LAC is expected to grow 5-6 times from 2014 to 2060, leading to a substantial diversification of the transport fuels. Beyond 2030, the electricity of transport energy is also expected to grow dramatically. However, its share will stay below the world average as biofuels play a more significant role within the LAC region compared to other regions of the world.

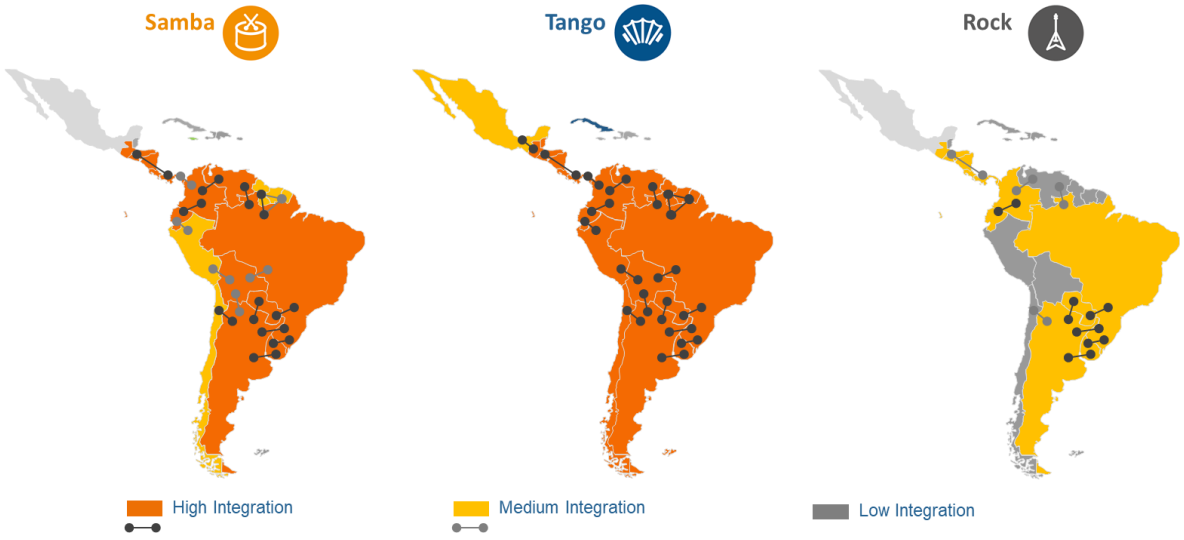
5 Demand for oil in LAC will peak or reach a plateau after 2040. In Tango, it is expected to peak between 2030 and 2040 at 7.0 mb/d. In Samba, it will peak in 2040 at 8.1 mb/d. In Rock, demand for oil will reach a plateau after 2050, settling at 7.9 mb/d in 2060. Natural gas plays a key role in LAC, but its growth varies broadly across scenarios.

6 The LAC energy sector is the least carbon intensive within the developing world due to a high share of hydro power. Accelerated carbon intensity reductions will drive CO_2 emissions (from fuel combustions) to peak around 2030 at 1.4 Gt CO_2 in Tango, and between 2040 and 2050 at 1.7 Gt CO_2 in Samba. In Rock, CO_2 emissions (from fuel combustions) will continue to grow and reach 1.7 Gt CO_2 in 2060.

7 In all scenarios, LAC countries should work on improving its energy system's resilience, while at the same time improving energy equity and security. Diversifying energy mix is critical and regional integration of energy systems is a further key element that can balance the Energy Trilemma and enhance energy system's resilience.

8 Regional integration in LAC can be shaped by the presence of strong regional governance structures. Regional interconnection is already a focus of attention in the LAC energy sector, as evidenced through projects like Arco Notre, SINEA, SIEPAC II and others. Regional integration is expected to be strongest in Tango and weakest in Rock.

The Potential of LAC Regional Integration Development across Scenarios



- Progress on Arco Norte and SIEPAC II interconnection projects
- More progress on gas integration projects
- Mexico develops its relationship with the US

- All countries of LAC are integrated as a result of full progress on projects like Arco Norte, SINEA and SIEPAC II
- Mexico wants electricity interconnection to the Caribbean

- Risk increases in the existing regional integration
- Less progress on new regional integration projects
- Mexico explores new export / collaboration opportunities with LAC

Source: World Energy Council

ACTION IS NEEDED TO ADDRESS EMERGING RISKS AT THE REGIONAL SCALE

THE HEAVY COSTS OF A ROCK SCENARIO

In the face of economic adversity and low commodity prices, some countries across the world are experiencing a rise of populism and resorting to nationalistic approaches, which prioritise energy security and self-sufficiency at the heart of their policies. In turn, less economic cooperation results in lower economic growth, undermines energy resilience, and increases vulnerability to unwelcomed global changes, including climate change impacts. A Rock world will increase the already significant level of social inequity across the region and leave many more people, as well as energy systems, vulnerable to extreme weather events. To avoid this scenario, leaders in the LAC region should use the other scenarios – Tango and Samba – to explore new options for more effective energy policy, cooperation and regional integration which are becoming possible due to wider developments within and beyond the region and conventional energy system.

LARGE SCALE INVESTMENTS IN ENERGY INFRASTRUCTURE

Over the next decades, LAC governments will need to make massive investments in infrastructure – energy, roads, ports and communications – in order to promote economic growth in their fast growing urban areas, as well as avoid energy poverty in rural areas. Decisions taken by governments on issues like structural reforms and private sector participation will play a crucial role in determining the sources of funding and the total amounts available for making those investments. Failure to raise the necessary funds will lead to a continuation of social inequity, lack of easy access to energy, and a generally lower level of resilience of existing energy systems. This is a particular risk in the Rock.

CLIMATE CHANGE VULNERABILITY

According to the Council's annual *World Energy Issues Monitor*, LAC energy leaders worry more than others about climate change, since the region is already prone to natural disasters and extreme weather events. Ensuring the resilience of energy systems – to emerging financial-, cyber-, environmental-, climate-related risks and shocks – will require new frameworks and tools and unprecedented cooperation between the energy industry and policymakers. Policies to bolster resilience include: increasing regional integration, using smart energy solutions for urban areas, and increasing the share of decentralised power generation.

POTENTIAL FOR "STRANDED RESOURCES"

Oil demand is expected to peak in LAC, as well as globally, by 2040 – which requires regional oil producers to address the risk of "stranded resources" now, given the interim of sunk costs and the increase in climate change momentum. Compared to producers in the Middle East, production costs of oil are significantly higher in the LAC region, and the closest export market, the US, is set on achieving energy self-sufficiency by increasing domestic production of unconventional hydrocarbon resources and maintaining coal production and generation. It is also set to become a net exporter of oil and gas. The still emerging contours of new energy geopolitics will require a significant strategic shift of LAC oil and gas producers, putting more emphasis on expanding positions along the hydrocarbon value chain into refining and integrated petrochemicals, also increasing inter-regional trade of petroleum and chemical products.

CALL TO ACTION FOR LAC ENERGY LEADERS

The LAC region is unique in energy terms – keywords are “heterogeneity and complexity.” Not surprisingly, many different types of solutions are emerging at local and national levels. However, the future of the regional energy system requires greater cooperation in three areas:

ACCELERATE REGIONAL INTEGRATION TO ENHANCE ENERGY RESILIENEC OF ALL

The scenarios clearly demonstrate that the LAC region has enormous potential to benefit economically from regional integration and cooperation, but the region is slow to reap the long-term benefits in the face of short-term political and economic priorities. LAC’s success in adapting to changing weather patterns and the energy-water nexus will impact its path to greater energy sustainability. Regional integration is also expected to play an increasingly important role in the region’s ability to improve energy system’s resilience.

FOCUS ON NEW OPPORTUNITIES FOR WIND, SOLAR AND ELECTRIC VEHICLES

The LAC region’s impressive clean energy share in the energy mix is boosted by an abundance of hydro power. However, big hydro dams are increasingly controversial. In recent years, Brazil and Chile have blocked hydro power projects in environmentally sensitive areas. Alternative energy sources, such as wind and solar, account for only 2% of LAC electricity generation, compared to the world average of 4%. Nonetheless, the LAC scenarios show that this share will grow quickly, also offering investment opportunities for the private sector. Additionally, biofuels dominate transport energy shares in LAC, but electric vehicle is expected to grow dramatically.

PROMOTE NEW ENERGY GOVERNANCE WITH GOVERNMENT LEADERSHIP

The role of governments and policymakers to resolve critical uncertainties is crucial in the LAC region, more so than in some other areas of the world. Full understanding and a strong focus on balancing the objectives of the Energy Trilemma will be needed to ensure effective policymaking on a local and regional level. LAC cities will most likely be testbeds for new energy technologies and a source of new regulatory approaches to energy policy.

ABOUT THIS REPORT

The *Latin America & the Caribbean (LAC) Energy Scenarios* report is a first exploration of regional deep-dive scenarios that provide the basis and framework for the Latin America and the Caribbean region.

The framework which consists of Modern Jazz, Unfinished Symphony and Hard Rock – *World Energy Scenarios 2016: The Grand Transition*, which has been produced by the World Energy Council in collaboration with Accenture Strategy and the Paul Scherrer Institute – is used as a lens to test and explore how the key driving forces manifest and to investigate possible development trajectories for the LAC region, resulting in three scenarios: *Samba, Tango and Rock*.

The report is the product of a three-year process, which was developed by the very active involvement of the World Energy Council's LAC National Member Committees and Project Partners – CAF, Eletrobras and UPME. Feedback was also gathered at the Council's World Energy Leaders' Summit and workshops / conference calls around the region ensuring the inclusion of key insights from industry, governments, experts and civil societies.

The Paul Scherrer Institute (PSI) quantified the scenario storylines using its global multi-regional energy system model. The iteration between development of the narratives and the quantification provided the foundation for a set of scenarios.

The full report can be found at www.worldenergy.org/publications.

Note: The World Energy Scenarios are designed to be useful. The Council reviews its scenarios work on a regular basis to check for continued relevance, plausibility and challenge.

ABOUT THE WORLD ENERGY COUNCIL

The World Energy Council is the principal impartial network of energy leaders and practitioners promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all.

Formed in 1923, the Council is the UN-accredited global energy body, representing the entire energy spectrum, with over 3,000 member organisations in over 90 countries, drawn from governments, private and state corporations, academia, NGOs and energy stakeholders. We inform global, regional and national energy strategies by hosting high-level events including the World Energy Congress and publishing authoritative studies, and work through our extensive member network to facilitate the world's energy policy dialogue.

Further details at **www.worldenergy.org** and **@WECouncil**

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