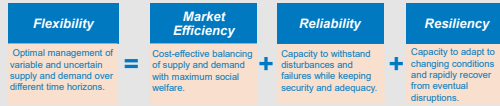


Josue Prado¹, Jeffrey Logan^{1,2}, and Francisco Flores-Espino²

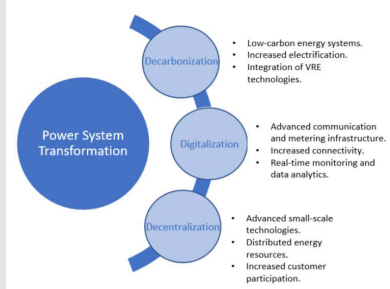
¹Joint Institute for Strategic Energy Analysis (JISEA), ²Strategic Energy Analysis Center

Motivations

- Power systems around the globe are changing rapidly due to a confluence of technological, social, meteorological, and economic drivers.



- Select countries in South America that rely heavily on hydropower are facing increasing risk and reliability concerns during drought (El Niño/La Niña) years.
- VRE and natural gas (NG) are becoming important generation options in many South American power markets, especially in drought years.
- There is an increasing need to expand emphasis on flexibility due to reliance on hydropower and VRE supplies.
- In this study, special attention is placed on the potential role for natural gas to help ensure flexible and resilient power.



- This transformation has significantly changed the way power systems are designed, planned, and operated and are highlighting the need for flexibility in different time scales.

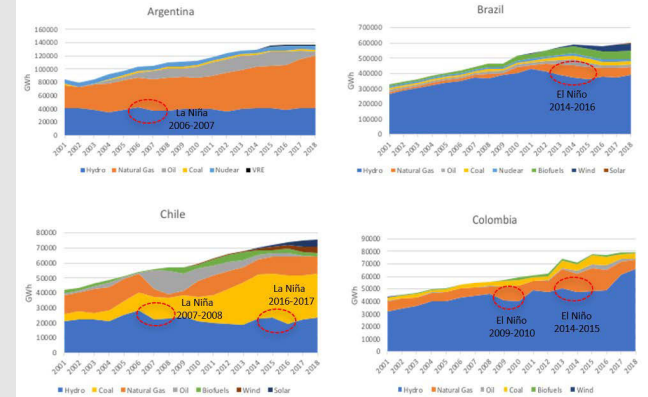
Need for Flexibility and Resiliency

- Primary countries of focus:

- Argentina
- Brazil
- Chile
- Colombia

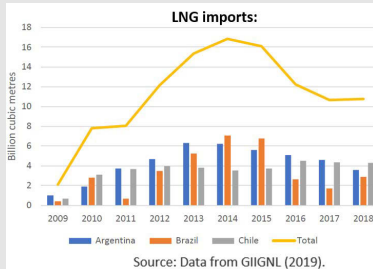
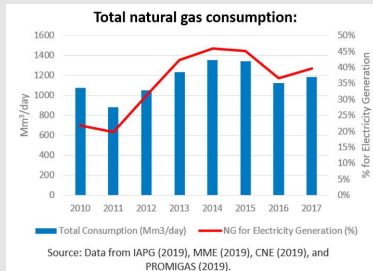


Evolving generation mixes in Argentina, Brazil, Chile, and Colombia:

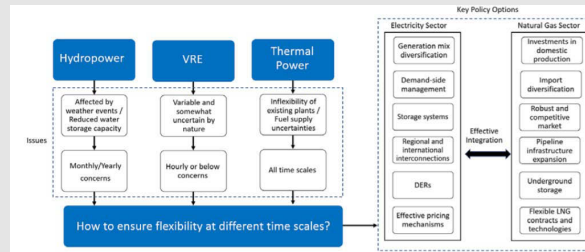


Source: Data from CAMESA, CNE, EPE, IEA, and XM.

The importance of Natural Gas



Summary of Findings



	Critical Issue	Argentina	Brazil	Chile	Colombia
Relative barriers and challenges in the electricity sector	Aging infrastructure	X			
	Transmission capacity limitations		X	X	X
	Insufficient revenue for investment	X			
	Public opposition to large hydropower plants	X	X	X	X
	Limited international interconnections			X	X
	Lack of market mechanisms to promote greater flexibility	X	X	X	X
Relative barriers and challenges in the natural gas sector	Demand concentration in specific regions	X		X	
	Techno-economic challenges associated with domestic production		X		
	Insufficient long-term domestic gas reserves			X	
	Lack of underground storage infrastructure	X	X	X	X
	Pipeline capacity limitations	X	X	X	X
	Insufficient revenue for investment	X			

		Argentina	Brazil	Chile	Colombia
Flexibility Catalysts	Weather events affecting hydropower	Medium	High	Medium	High
	Increasing adoption of run-of-the-river power plants	Medium	High	Medium-High	High
	Increasing VRE integration	Medium	High	High	Low
	Thermal power generation inflexibility	High	Low	High	High
	Fuel-supply uncertainties	High	Medium	Medium	Medium

- All countries face unique challenges in building out their respective electricity sectors to achieve a resilient, reliable, and sustainable electricity system.
- All have goals to rapidly boost domestic VRE generation, and all except Chile have significant natural gas resources to be developed over the long-term.
- Argentina's Vacca Muerta formation may be the biggest uncertainty in all of South America's evolving electric power sector calculus.
- In the meantime, imported LNG may be the most expedient option for Brazil, Chile, and Colombia on the margins given the recently improved liquidity, and contract terms, of that fuel.
- While technology and market innovations in the form of rapidly falling costs for VRE, LNG contracting, battery storage, and other distributed energy options are sometimes outpacing the institutional and policy capacity to effectively guide them, other breakthroughs could occur.
- On a positive note, each of these countries is building from a strong base of renewable hydropower into a diverse portfolio of solar, wind, and natural gas, targeting a clean and resilient power system.