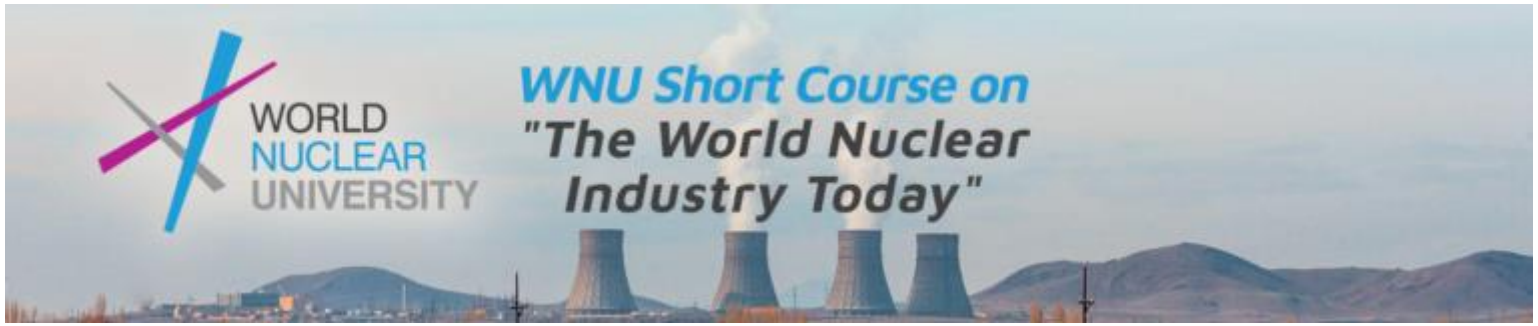
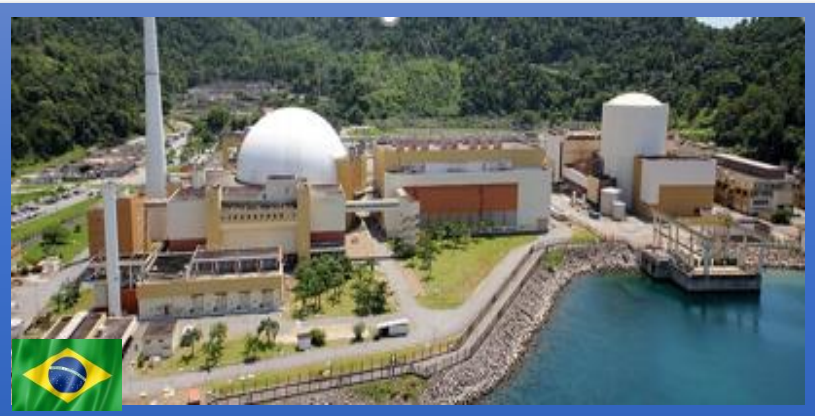


Global, Regional and National Nuclear Developments

Global Nuclear Industry: Latin America

Dr. Javier C. Palacios

INSTITUTO NACIONAL DE INVESTIGACIONES NUCLEARES

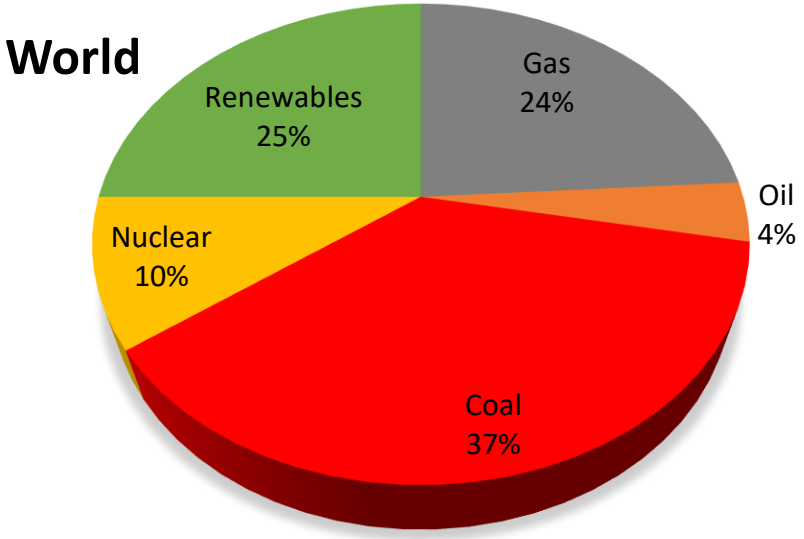


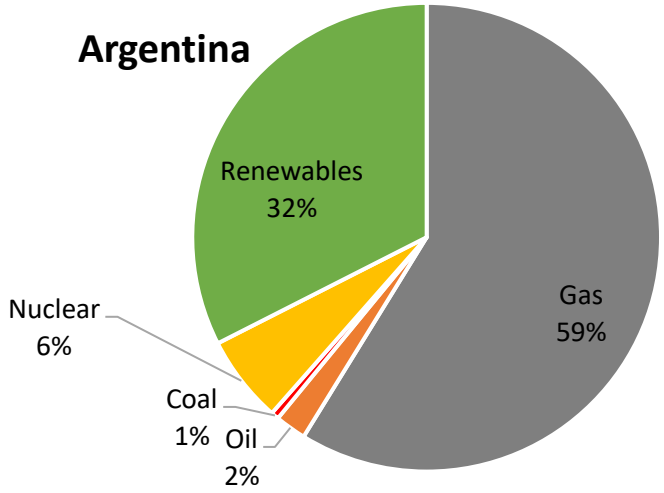
November 17, 2020

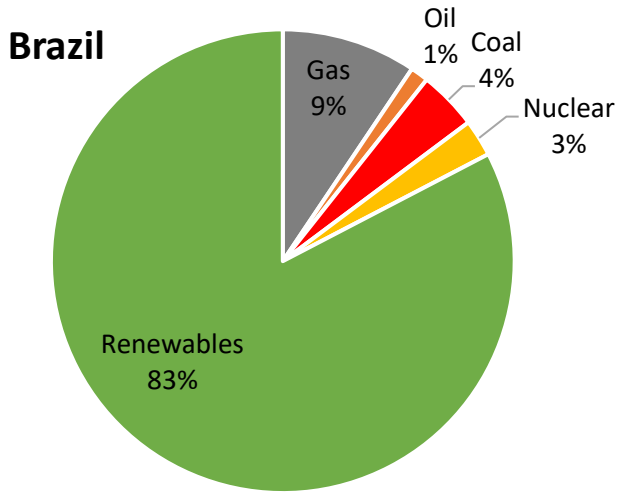
Nuclear Industry in Latin America

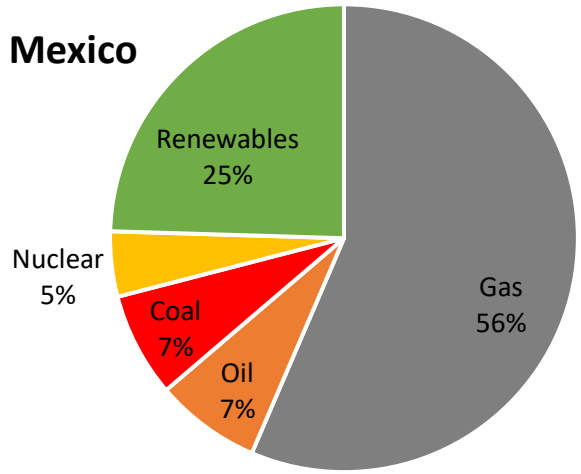
Current Satus

Electricity Generation Mix 2019









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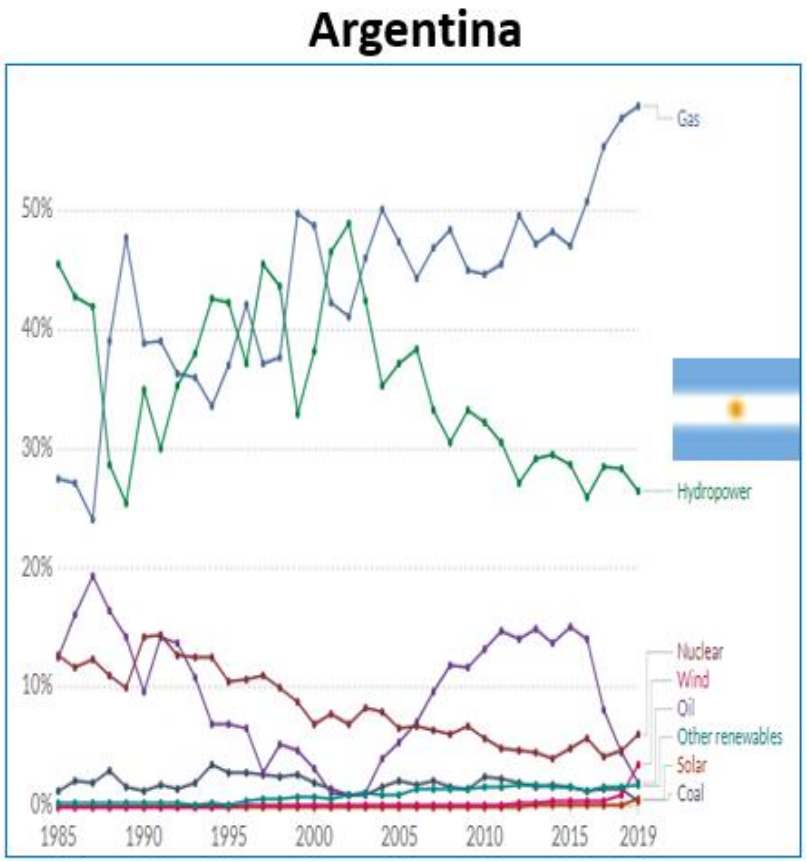
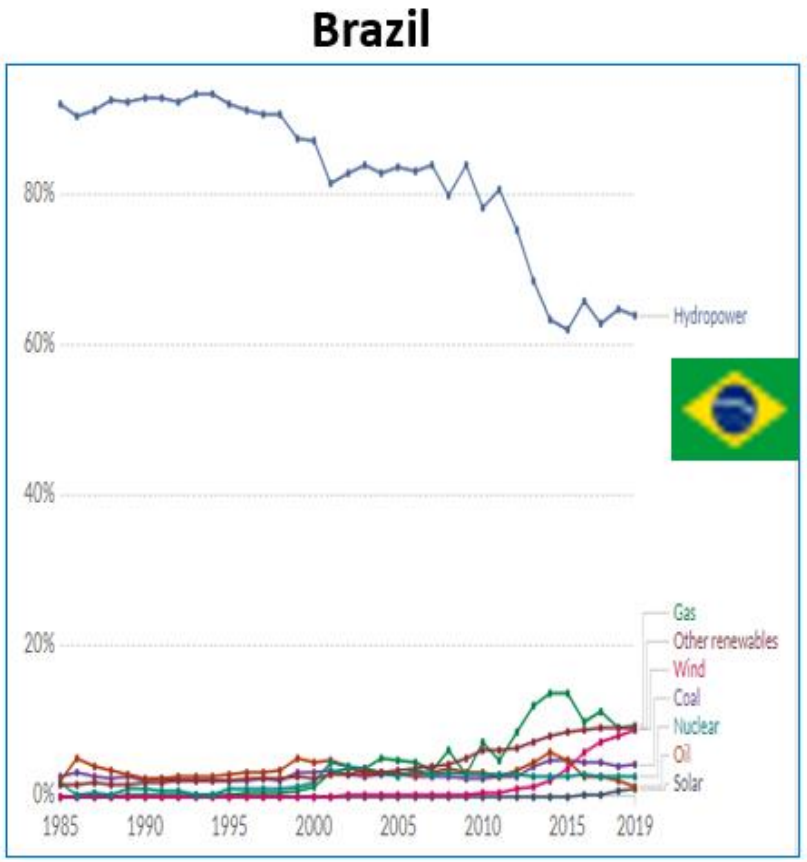
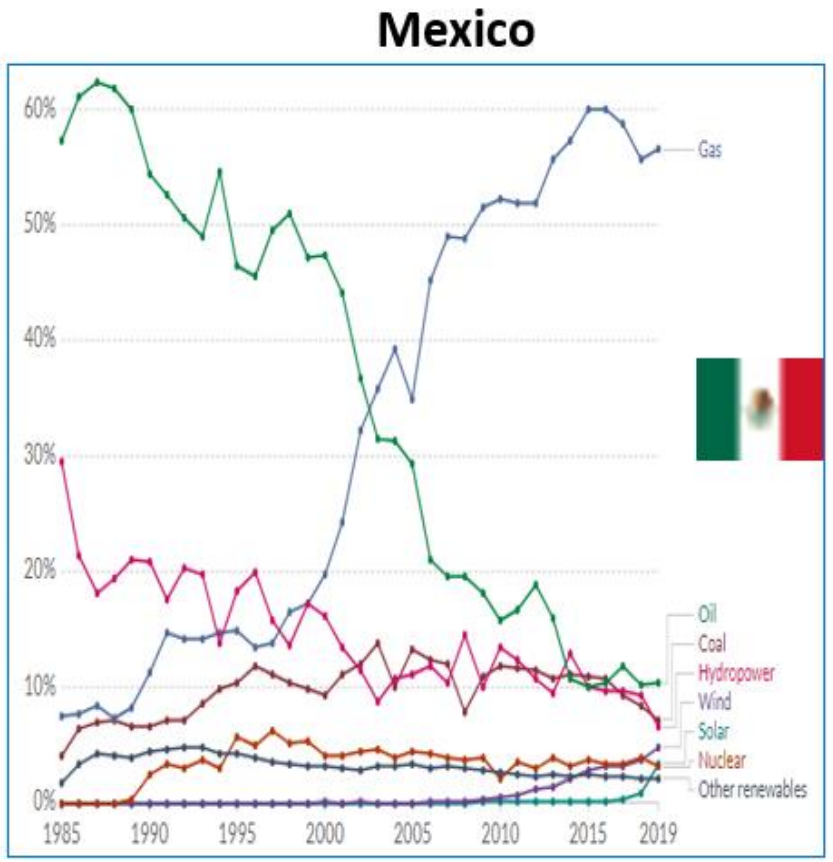
Source IAEA, IEA, CFE, BP

Share of electricity by source

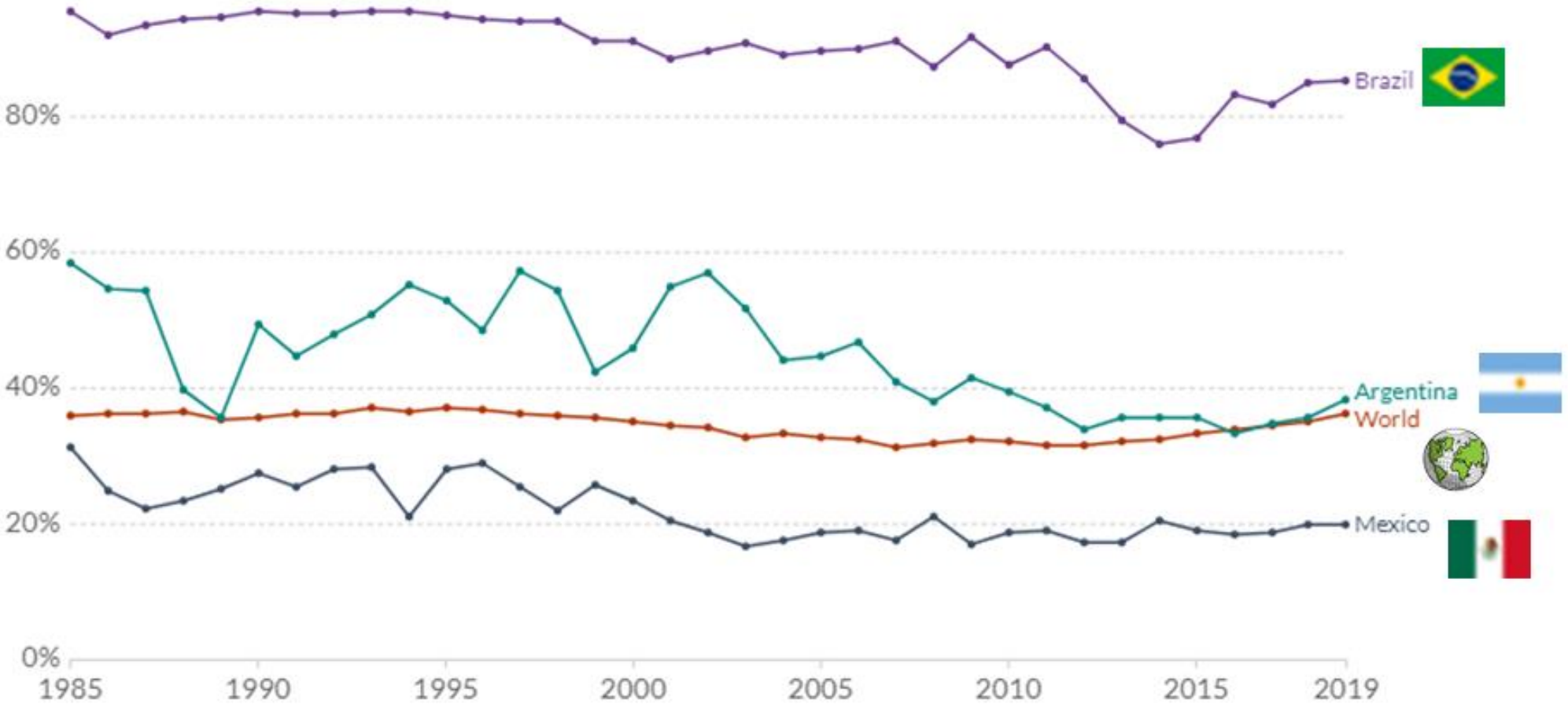






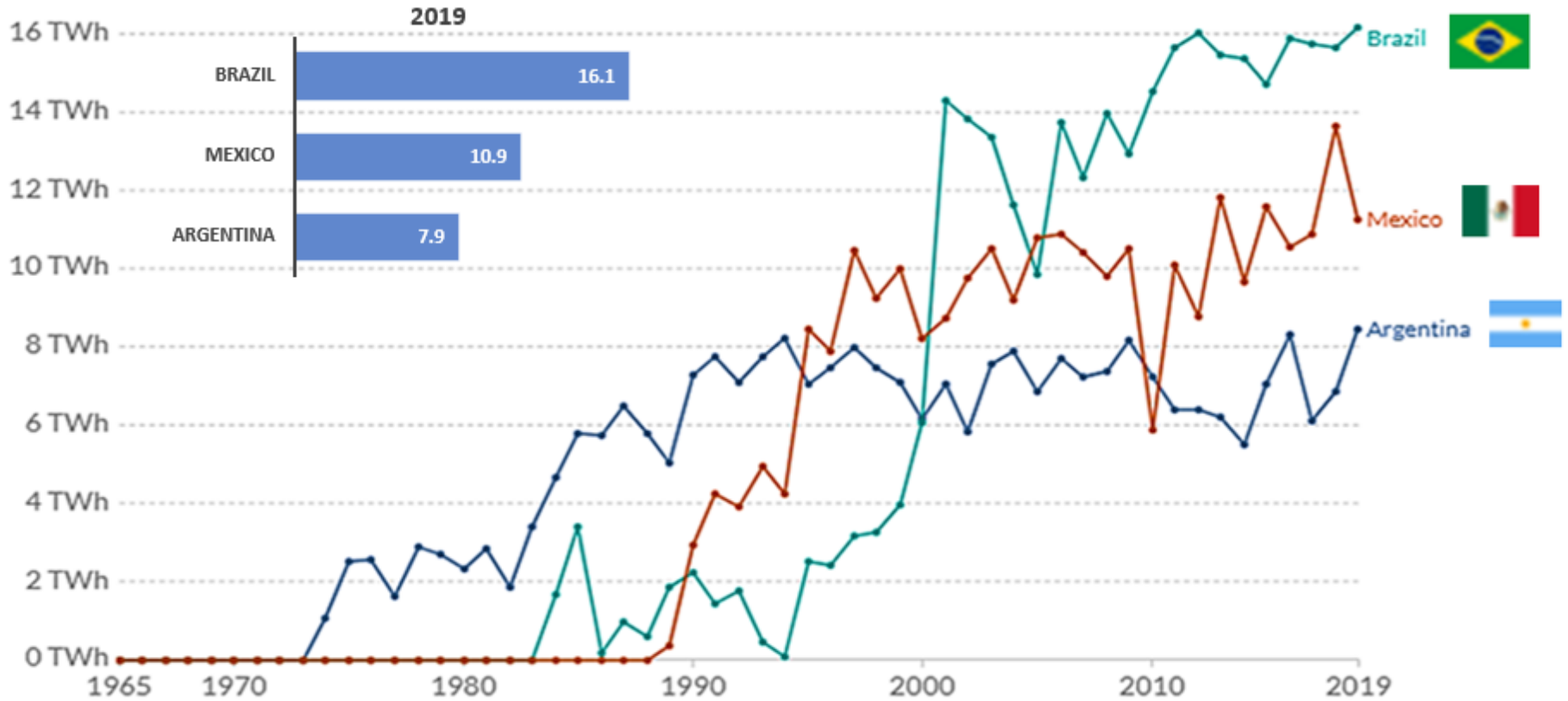
Source : Our World in data 2020

Shares of electricity generation from low carbon sources



Source : IAEA-PRIS & Our World in data 2020

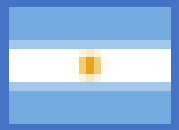
Nuclear Electricity Generation in Latin America



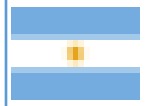
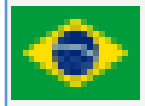
Source : IAEA-PRIS & Our World in data 2020

Nuclear Power Plants in Latin America

Nuclear Power by Country

Country	Name	Technology	Status	Location	Reference Unit Power [MW]	Gross Electrical Capacity [MW]	First Grid Connection	Commercial Operation Date
 Argentina	ATUCHA-1	PHWR -Siemens KWU	Operational	LIMA	340	362	19/03/1974	24/06/1974
	ATUCHA-2	PHWR -Siemens KWU	Operational	LIMA	693	745	25/06/2014	26/05/2016
	EMBALSE	PHWR-CANDU6 AECL	Operational	EMBALSE	608	656	25/04/1983	20/01/1984
 Brazil	ANGRA-1	PWR - Westinghouse	Operational	ANGRA DOS-REIS	609	640	01/04/1982	01/01/1985
	ANGRA-2	PWR -Siemens KWU	Operational	ANGRA DOS-REIS	1275	1350	21/07/2000	01/02/2001
 Mexico	LAGUNA VERDE-1	BWR – General Electric	Operational	ALTO LUCERO	777	805	1989-04-13	24/Jul/1990
	LAGUNA VERDE-2	BWR – General Electric	Operational	ALTO LUCERO	775	803	1994-11-11	10/04/1995

Nuclear Power by Country 2019

Country	Reactors		Capacity Net-total (MW_e)	Nuclear Electricity Generated (GWh)	Nuclear Share
	Operational	Under Construction			
 **Argentina**	3	1	1,641	7,927	5.9%
 **Brazil**	2	1	1,884	15,224	2.7%
 **Mexico**	2	0	1,552	10,881	4.5%
 **Latin America**	**7**	**2**	**5,077**	**34,032**	**1.32**
 **World**	**442**	**53**	**392,779**	**2,586,000**	**---**

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Source PRIS–IAEA, 2020-11-11

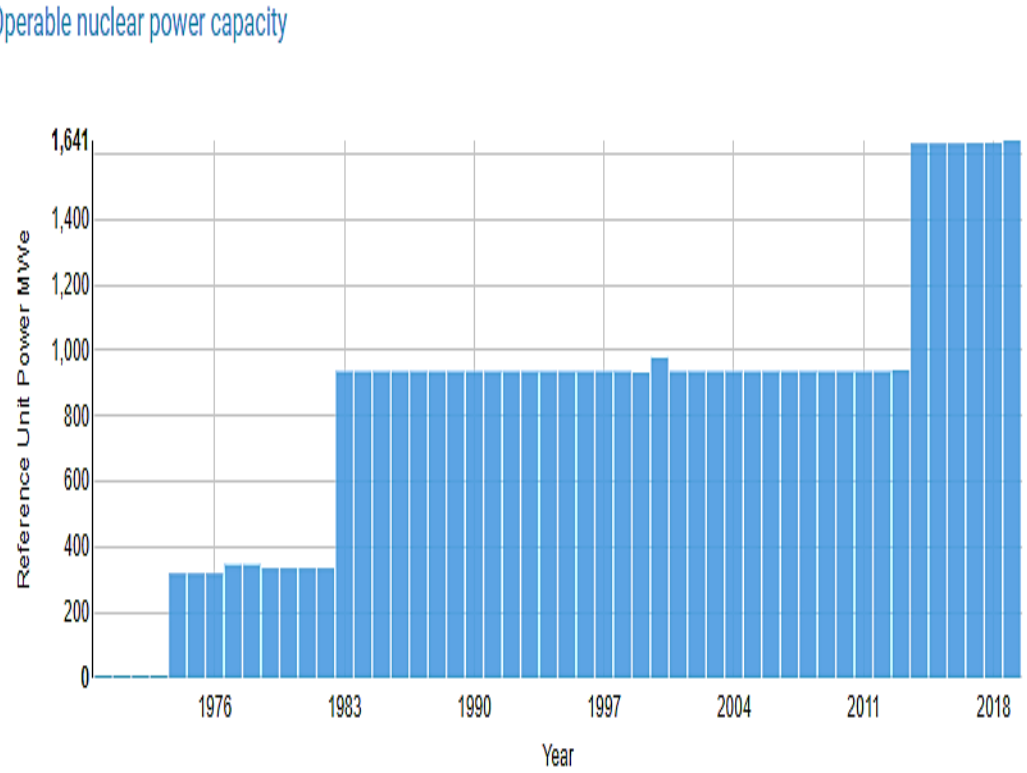
Latin America power reactors under construction and proposed

ARGENTINA					
Reactor	Location	Model	Gross capacity	Construction start	Commercial operation
Under construction					
CAREM25	Lima, Buenos Aires province	CAREM	29	Feb 2014	2022 ?
Proposed:					
Unit IV (Atucha 3)	Lima, Buenos Aires province	Hualong One?	1150	?	?
?	Lima, Buenos Aires province	CANDU-6?	750	?	?
BRAZIL					
Reactor	Location	Model	Gross capacity	Construction start	Commercial operation
Under construction					
Angra 3	Angra Dos-Reis	PWR	1405 MWe (1340 MWe net)	June 2010 (restarted)	
Proposed:					
Northeast, Pernambuco	Pernambuco	PWRx4	6000-6600 MWe	?	?
Southeast, Minas Gerais	Minas Gerais	PWRx4	4000-6000 MWe	?	?
MEXICO					
Reactor	Location	Model	Gross capacity	Construction start	Commercial operation
Proposed:					
La Paz	Baja California	SMR (PWR) x 2	120-200 MWe	?	?
Laguna Verde 3 & 4	Veracruz	PWR or BWR x 2	2800 MWe	?	?
Pacífico	Sonora	2 PWR	2800 MWe	?	?

Source PRIS–IAEA, 2020-11-11, WNA 2020, ININ 2020

Argentina

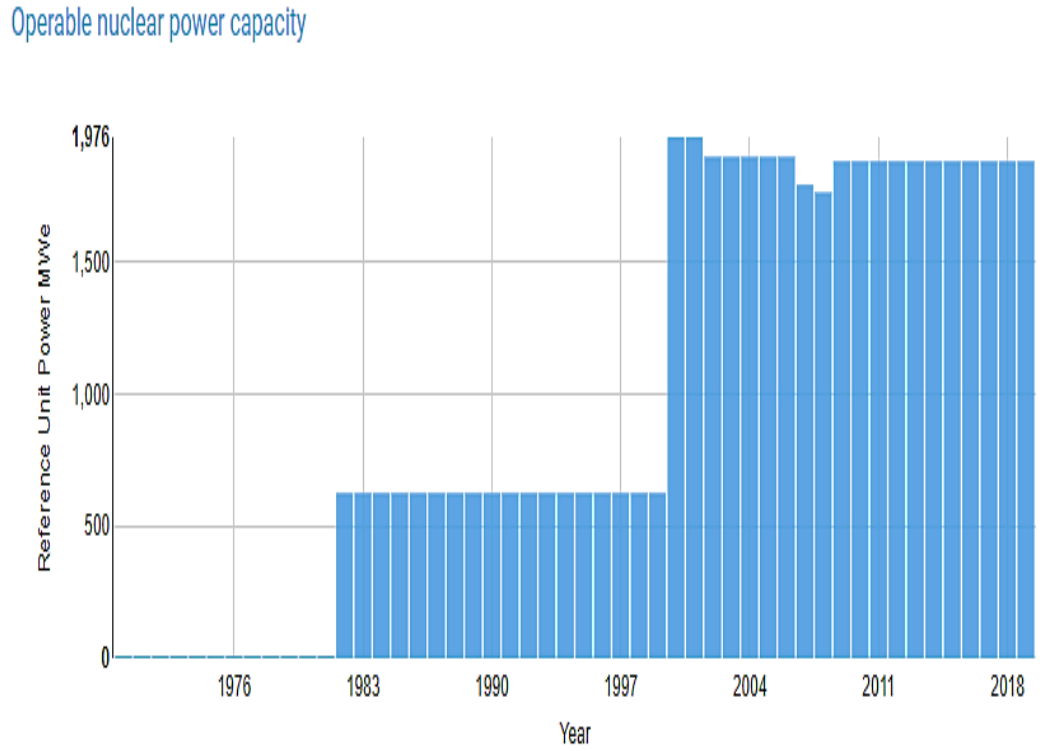
- In 2010, an agreement was signed to refurbish the Embalse plant and increase its power by up to 7%.
- The refurbishment, undertaken in partnership with Candu Energy, commenced in December 2015 and was completed in December 2018, with return to service in May 2019.
- The refurbishment extended the plant's operational lifetime by 30 years and increased power by 35 Mwe
- In April 2018 the Atucha I operating licence was extended to 2024.



Source PRIS–IAEA, 2020-11-11, WNA 2020

Brazil

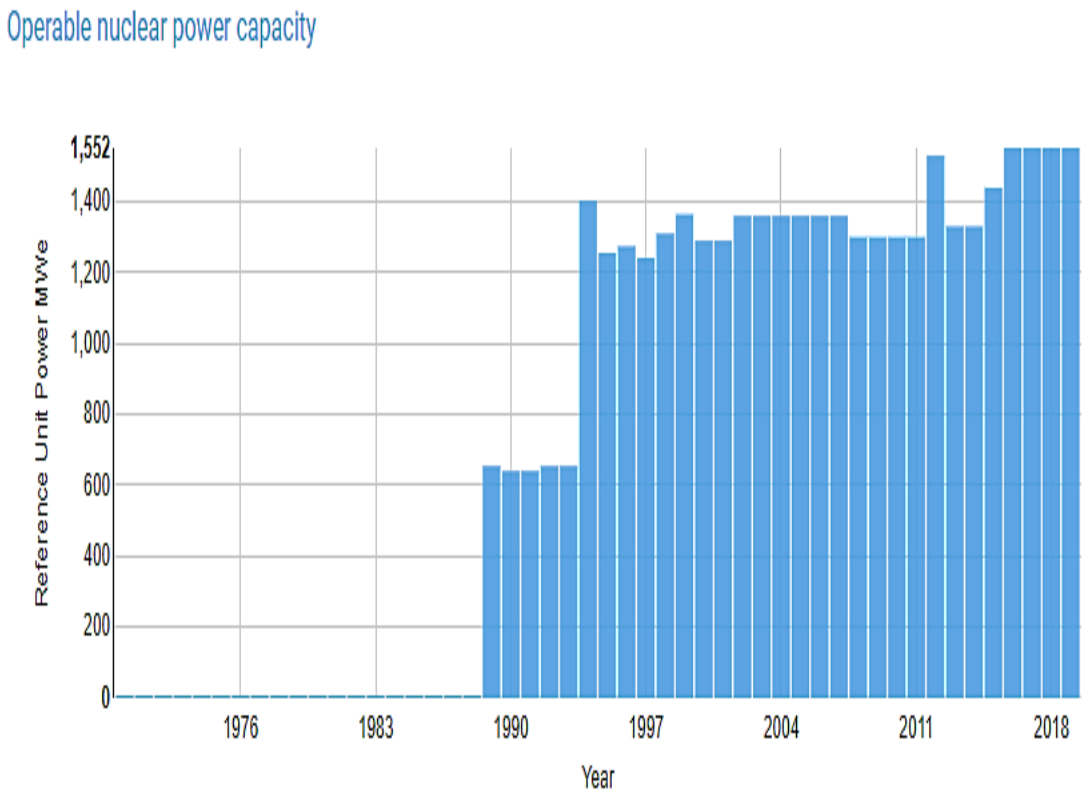
- The Anga I operating license expires in 2024, and Eletronuclear has already started working on plant life extension and license renewal.
- As of February 2020, Eletrobrás is working with Westinghouse to extend the operating lifetime of Angra 1 from 40 to 60 years.
- In October 2020 Westinghouse signed a contract with Eletronuclear to conduct engineering analyses to support the long-term operation programme.



Source PRIS–IAEA, 2020-11-11, WNA 2020

Mexico

- The original power for Laguna Verde reactors, was 1931 MWth, in 1999 it increased the power of both units to 105% (2027 MWth)
- In 2015 it increased the power of both units to 120% of the original power (2317 MWth)
- After 30 years of operation, on July 25, 2020, Unit 1 renewed his operating license for another 30 years
- Unit 2 operating license expires in 2025

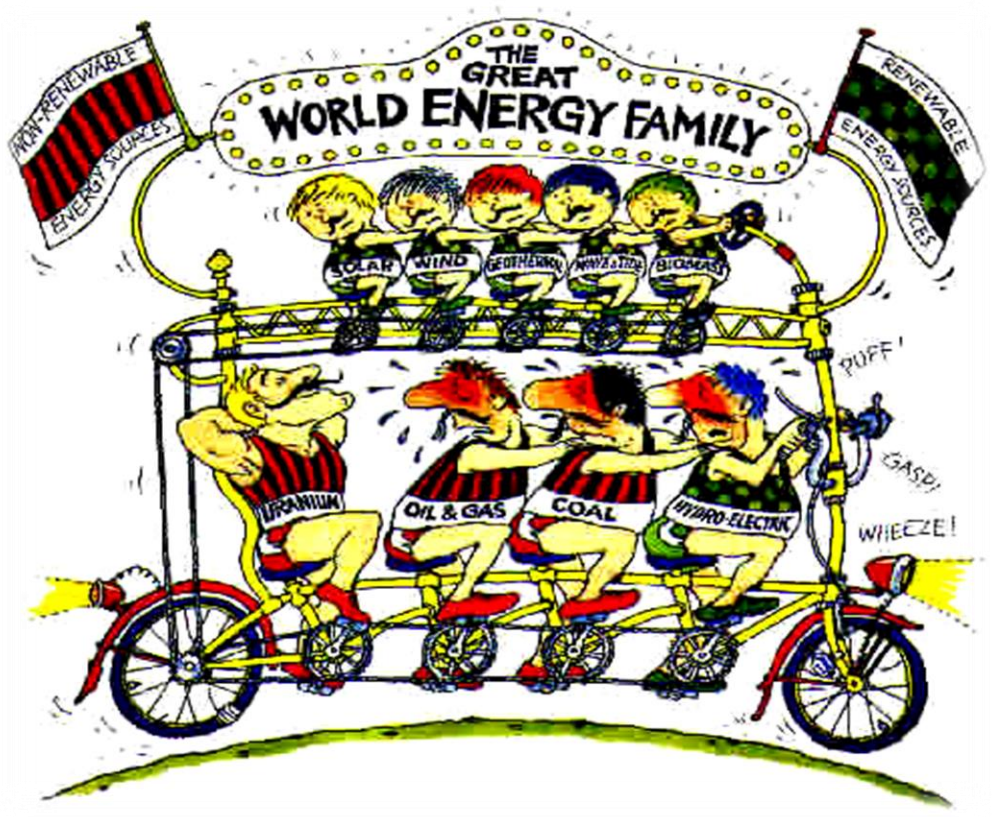


Source PRIS–IAEA, 2020-11-11, WNA 2020

Final Remarks

- Latin America relies on hydropower and fossil fuels as its main sources of electrical generation.
- The nuclear power share in terms of total electrical generation was 1.32% in 2019, and concentrated in only three countries: Argentina, Brazil, and Mexico.
- Plans to expand nuclear capabilities in these 3 countries have been announced
- Today, 7 nuclear power plants operates in Latin America: Laguna Verde I and II in Mexico, Angra I and II in Brazil and Atucha I and II and Embalse in Argentina.
- These seven plants, with 5GWe in total, stand for about 1.29% of the world nuclear installed capacity.
- On a country basis, in 2019 nuclear energy represents the 5.9 % of the total electrical generation in Argentina, about 4.5% in Mexico, and 2.7% in Brazil
- Embalse in Argentina and Laguna Verde in Mexico has extended the operational lifetime by 30 years, in 2019 and 2020 respectively.
- The World's commitment to reduce global warming by 2° by 2050 will not be easy to fulfill if nuclear energy does not play an important role in the electricity generation portfolio.

Than you



"Not everything that can be counted counts,
and
Not everything that counts can be counted"

Albert Einstein