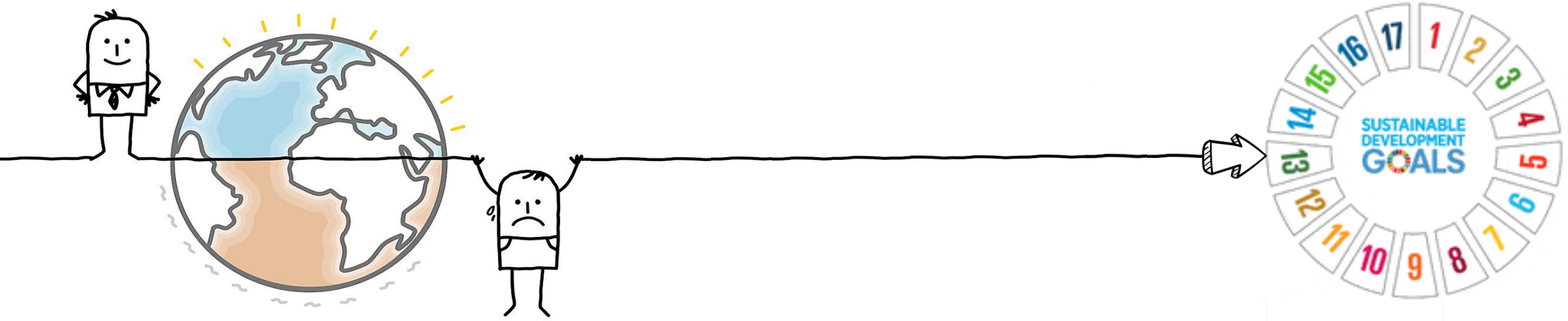
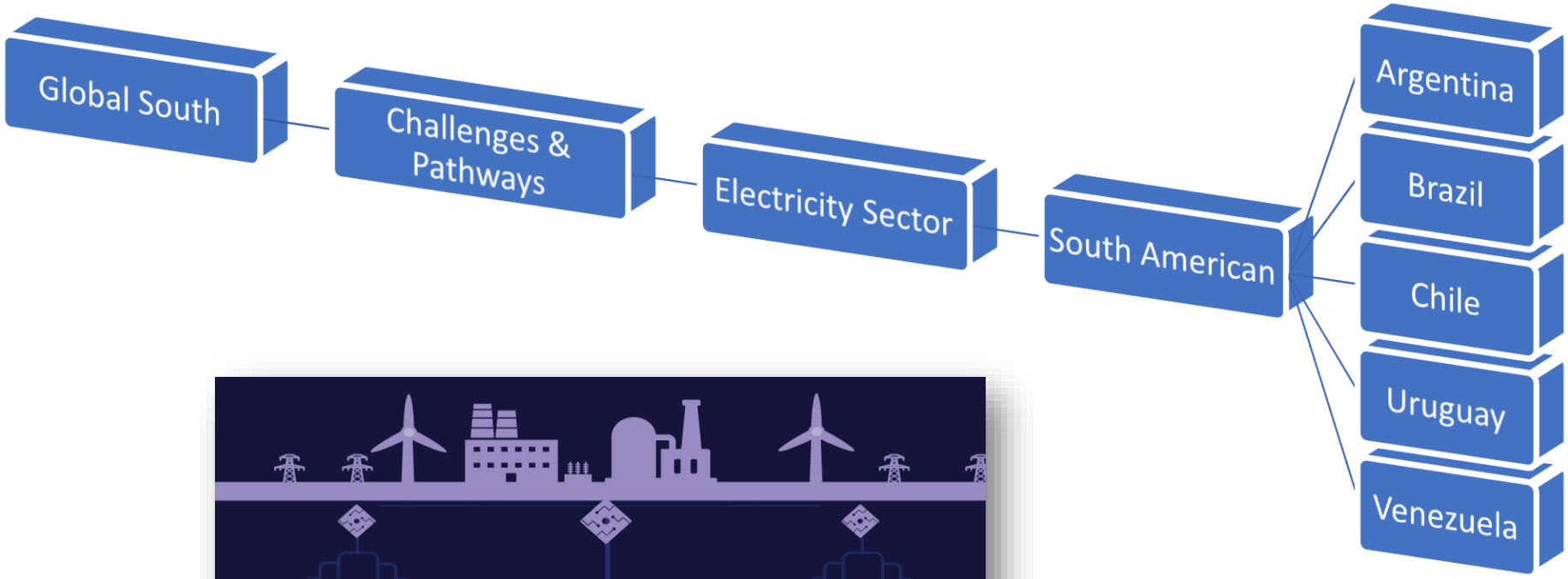
UNIVERSITY
OF AMSTERDAM

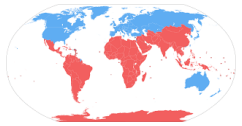
Dr. Drielli Peyerl

# THE PATHWAYS AND CHALLENGES OF ENERGY TRANSITION IN THE GLOBAL SOUTH



# GLOBAL SOUTH



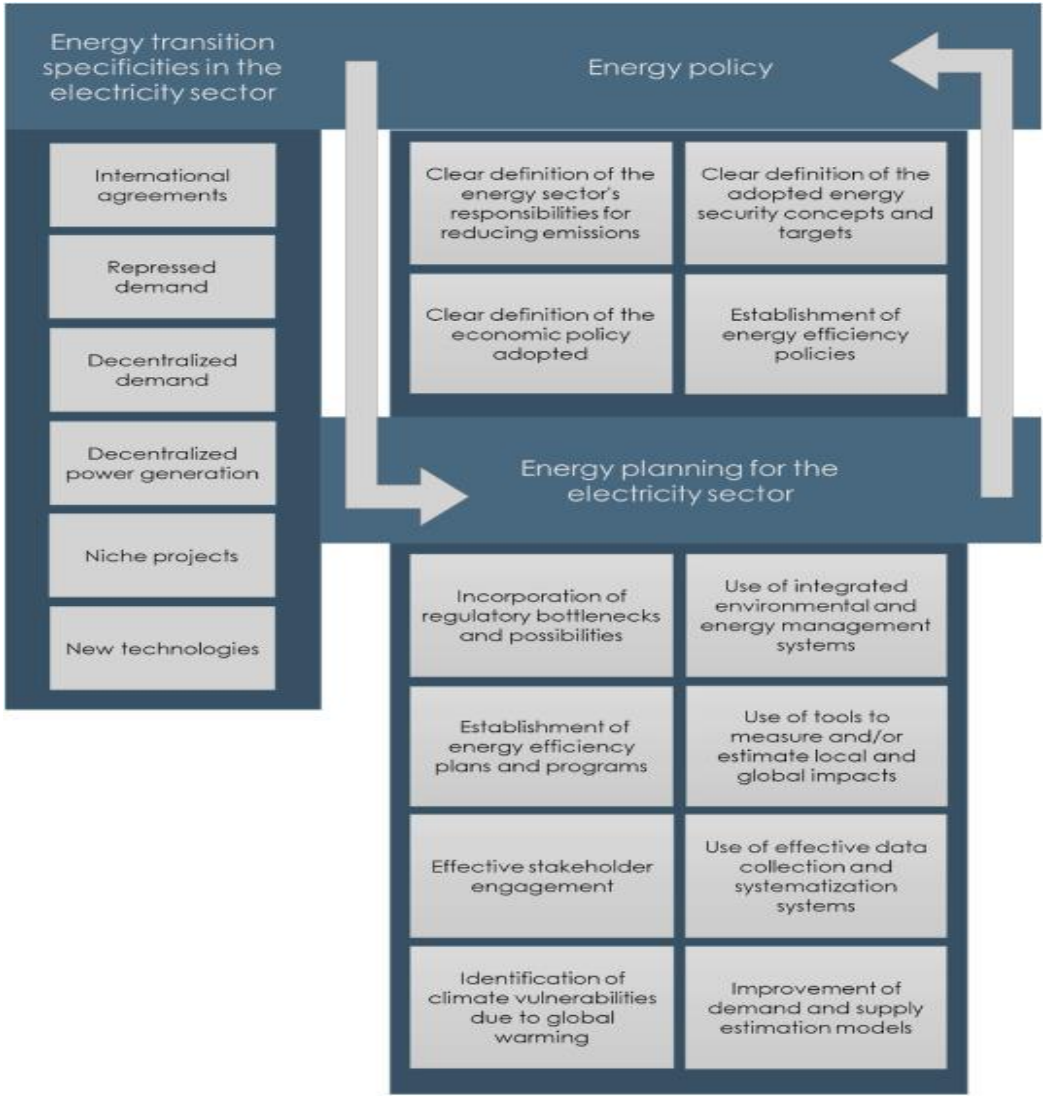


# GLOBAL SOUTH

The challenges:

The use of renewable energy resources is rising fast in the countries of the Global South, mainly in the electricity sector.

(i) a lack of national technology availability and know-how;
(ii) a lack of robust transmission and distribution energy systems, which can accommodate the variable profile of renewable energy resources and impact overall system security; and
(iii) the lack of a regulatory framework and public policies for the promotion of renewable energies and other new technologies to support their implementation.



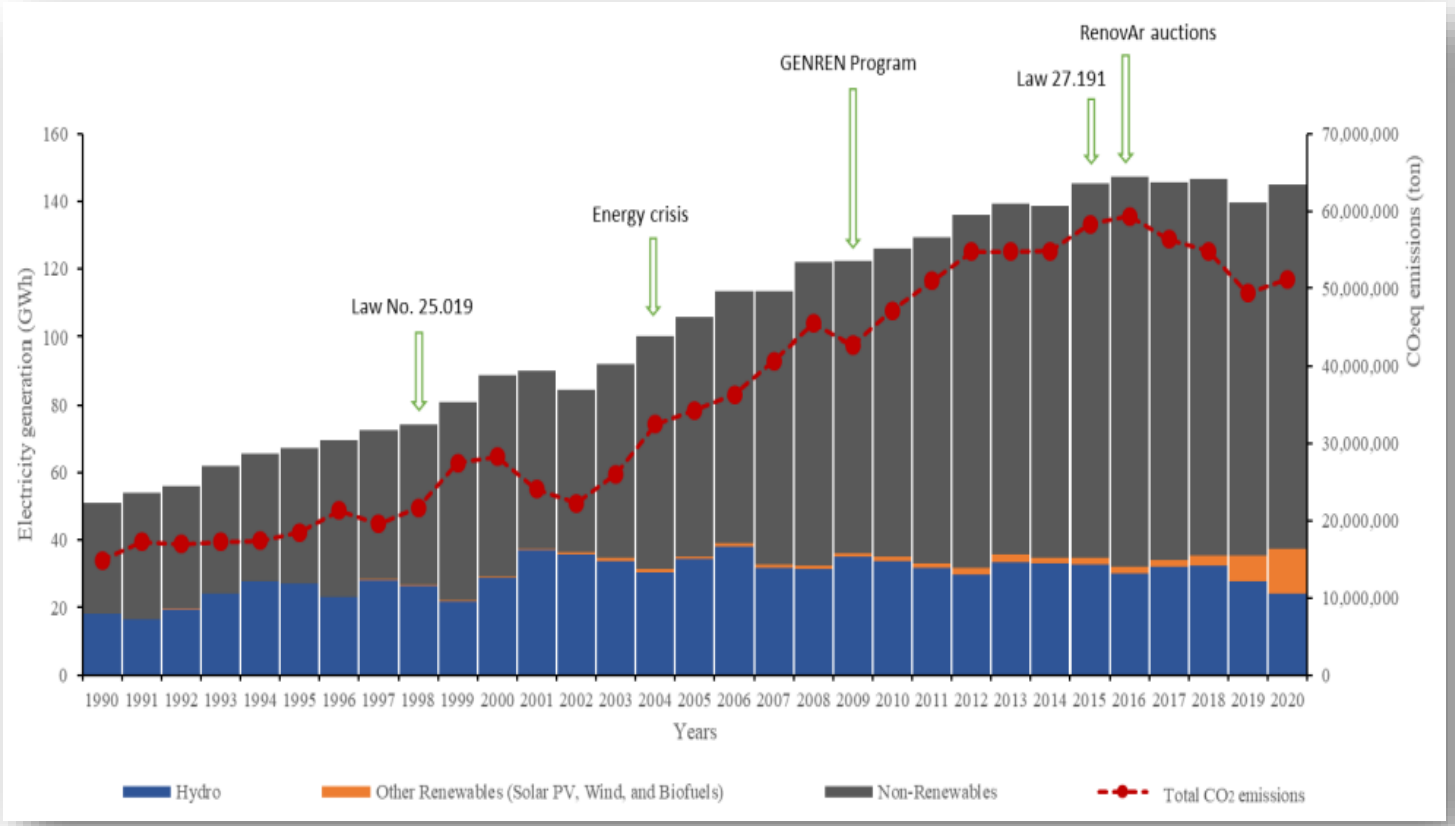

Relva, S. G.; Silva, V. O. da; Gimenes, A. L. V.; Udaeta, M. E. M.; Ashworth, P.; Peyerl, D.. Enhancing developing countries' transition to a low-carbon electricity sector. Energy, v. 220, p. 119659, 2021.

# ARGENTINA

Historically, the organization of the electricity sector was closely linked to Argentina's political background and several economic crises.

The increase in fossil fuels is linked to the availability of natural gas on-site, commitments to investments in efficiency in central thermoelectric plants, and the understanding of natural gas as a transition fuel for emitting less CO2 than other fossil fuels.

Recently, Argentina has replaced coal and petroleum with natural gas and promoted renewable energy.




Argentina's electricity generation from renewable (colored scale bars) and non-renewable (grayscale bars) sources and the total CO2eq emissions.

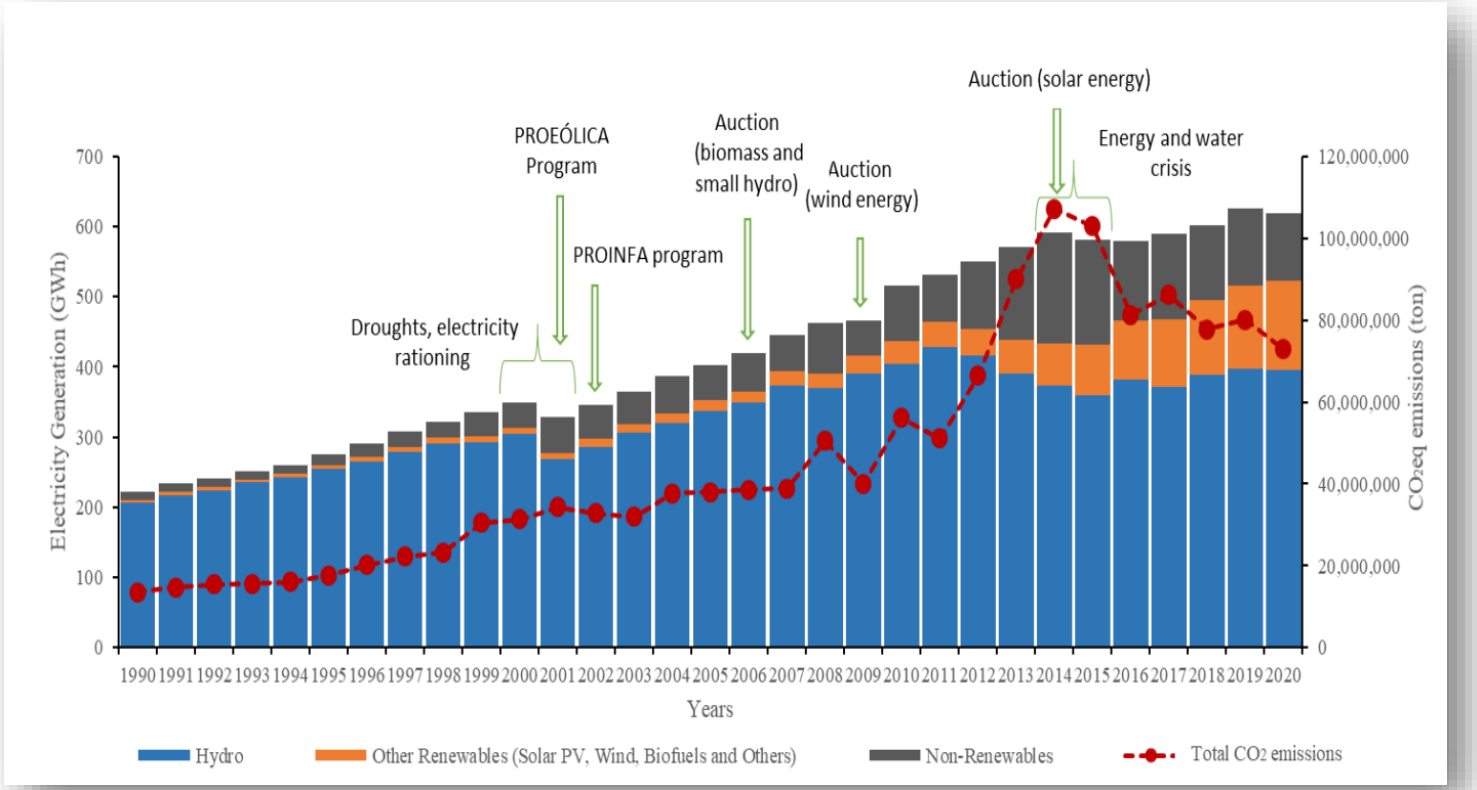
Peyerl, D.; Barbosa, M. O.; Ciotta, M. R.; Pelissari, M. R.; Moretto, E. M.. Linkages between the promoting renewable energy policies and low-carbon transition trends South America's electricity sector. *Energies*. v. 15, p. 4293, 2022.

# BRAZIL

Fossil fuel non-availability and water resource availability boosted the construction of hydroelectric plants over time to respond to Brazil's energy demand, reaching 93% of electricity generation in 1990.

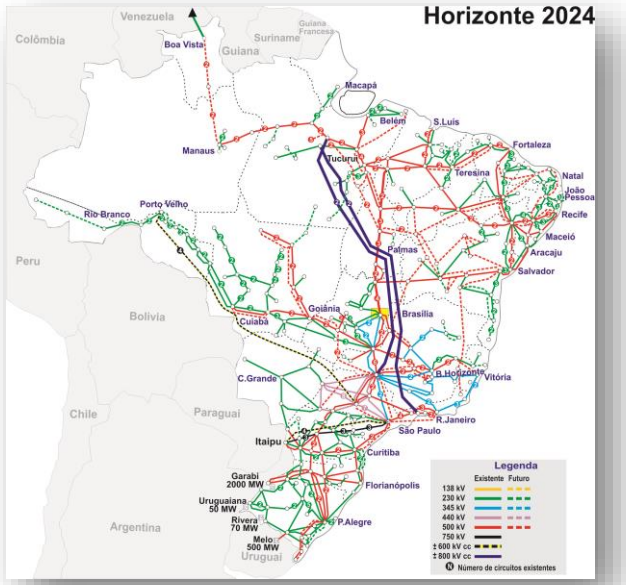
The introduction of renewable sources (wind and solar) and the governmental support for them have not succeeded in replacing fossil sources yet.

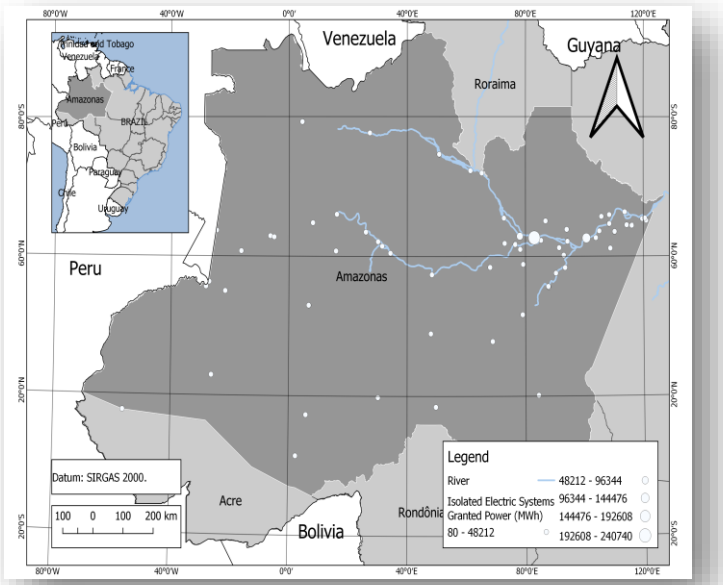
Natural gas is considered an additional source mainly due to increased national electrical consumption, backup of non-conventional renewables, droughts, and energy crises.



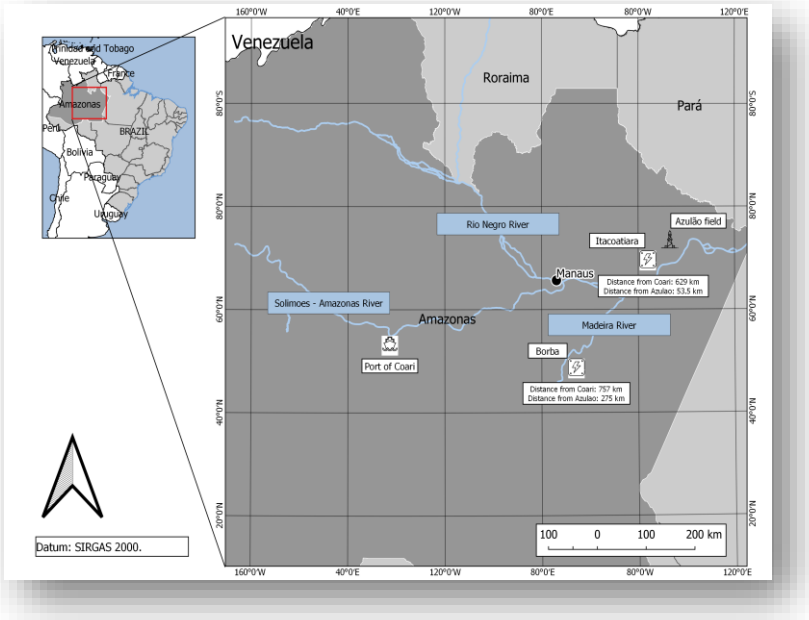

Brazil's electricity generation from renewable (colored scale bars) and non-renewable (grayscale bars) sources and the total CO2eq emissions.

# BRAZIL




Peyerl, D.; Cachola, C. S.; Alves, V. H.; Mondagron, M.; Macedo, S. F.; Guichet, X.; Moutinho dos santos, E.. Applying small-scale liquefied natural gas supply chain by fluvial transport in the isolated systems: the case of Amazonas, Brazil. Energy for Sustainable Development. Volume 68, June 2022, Pages 192-202.



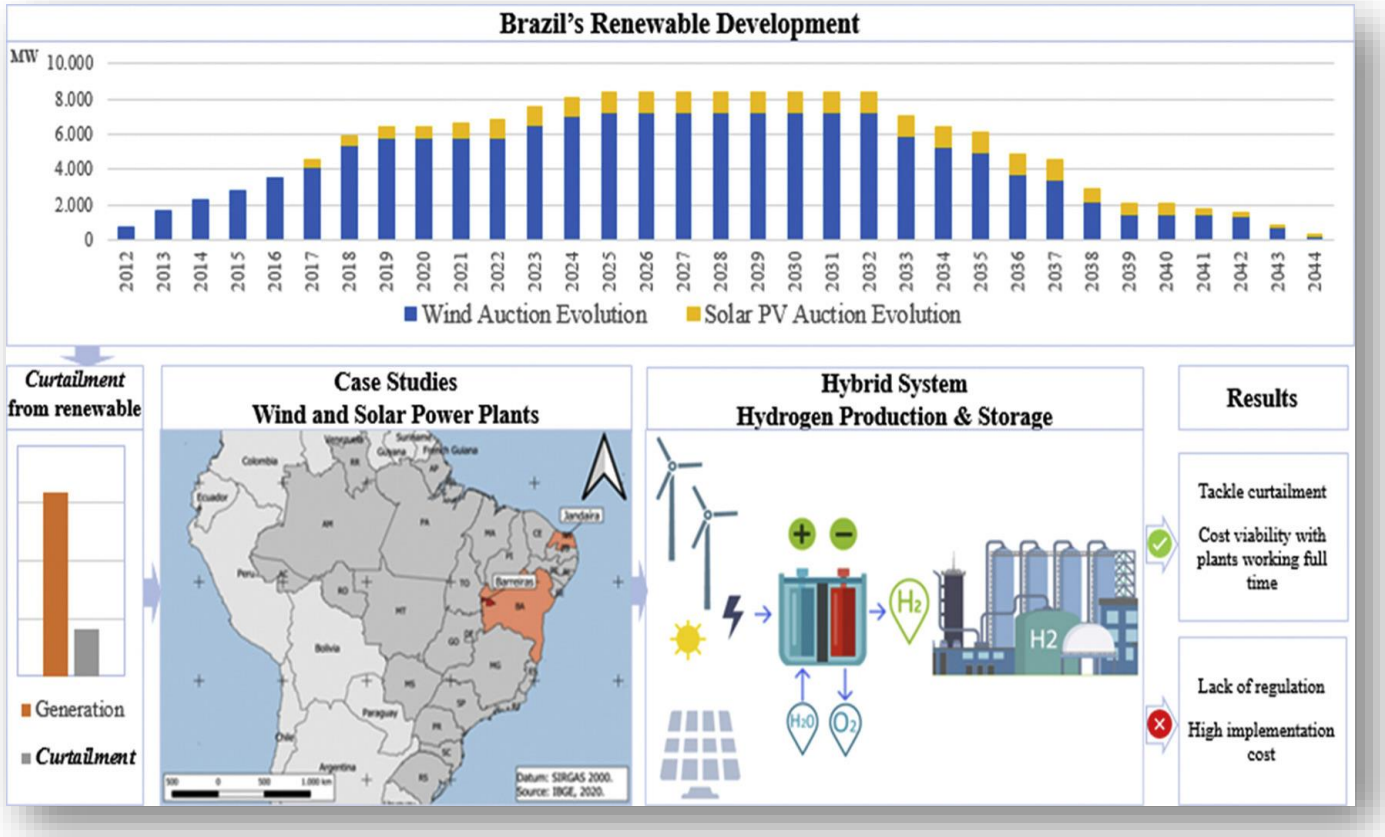

This work has indicated that the replacement of diesel power plants in the Amazon state with natural gas can be one of the solutions to contribute to the decrease of local carbon emissions in the energy sector.

- ✓ Environmental benefit and low cost to the consumer.

The energy security of remote areas (e.g. IS) becomes a challenge even for the Brazilian government's compliance with the right of access to energy for all by 2030 (SDGs - Goal 7).

# BRAZIL

- Renewable hybrid systems with hydrogen are current economic unviable in Brazil.
- Green hydrogen produced from curtailment events are current economic not feasible.
- To produce hydrogen economically viable, the plants should operate above 3000 h.
- The CAPEX should cost less than USD 650/kWe to store hydrogen economically viable.
- It is more profitable trading hydrogen than transforming it back into power.



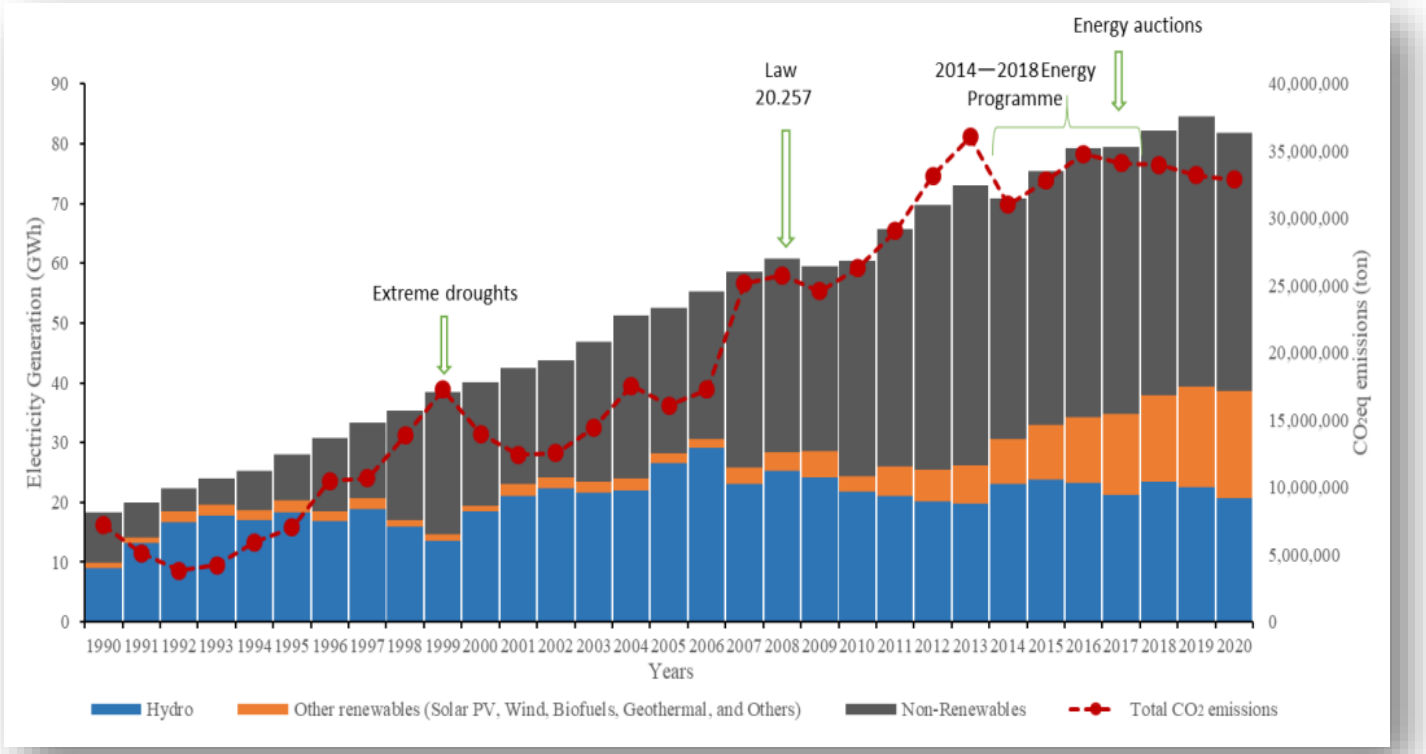

Macedo, S. F.; Peyerl, D.. Prospects and economic feasibility analysis of wind and solar photovoltaic hybrid systems for hydrogen production and storage: A case study of the Brazilian electric power sector. International Journal of Hydrogen Energy. Volume 47, Issue 19, 2022, Pages 10460-10473.

# CHILE

Despite the high dependence on fossil fuels, mainly coal and natural gas, Chile has invested heavily in renewable sources—primarily wind and solar.

The aim of producing green hydrogen has also joined the country's potential to generate solar power.

The country already has laws for carbon taxation, these still need to be fully implemented; however, this already represents one more of the government's actions to mitigate CO2.



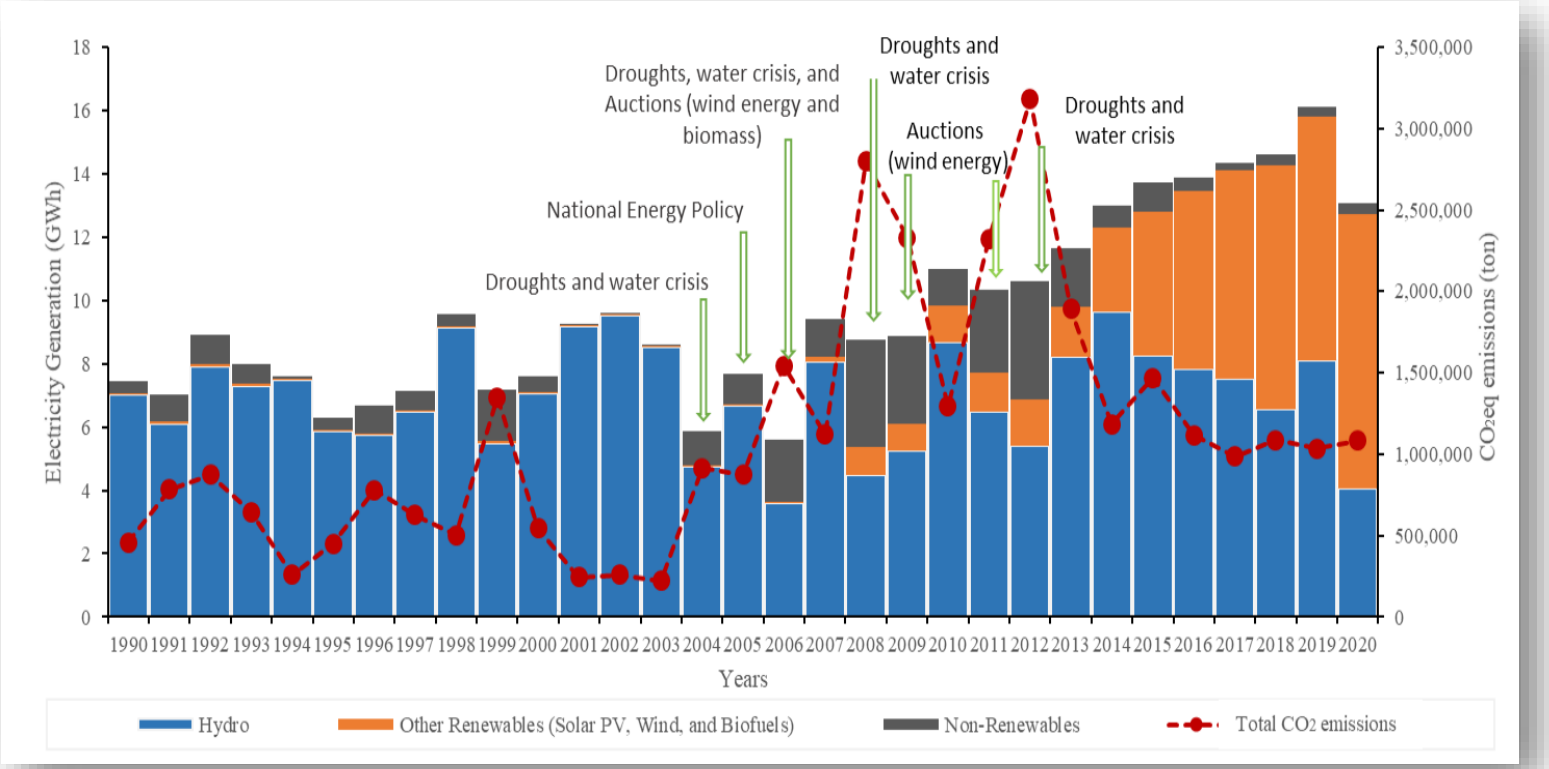

Chile's electricity generation from renewable (colored scale bars) and non-renewable (grayscale bars) sources and the total Co2eq emissions.

# URUGUAY

The historical energy background of Uruguay is based on the use of hydropower with complementary generation from thermoelectric.

Since the 2000s, the government's roadmap of investments has focused on renewable energy (wind, solar and biomass) to reverse dependence on fossil fuel imports and search for solutions for periods of drought, guaranteeing a safe energy supply.

The hydroelectric generation has been replaced by other renewable sources.




Uruguay's electricity generation from renewable (colored scale bars) and non-renewable (grayscale bars) sources and the total Co2eq emissions.

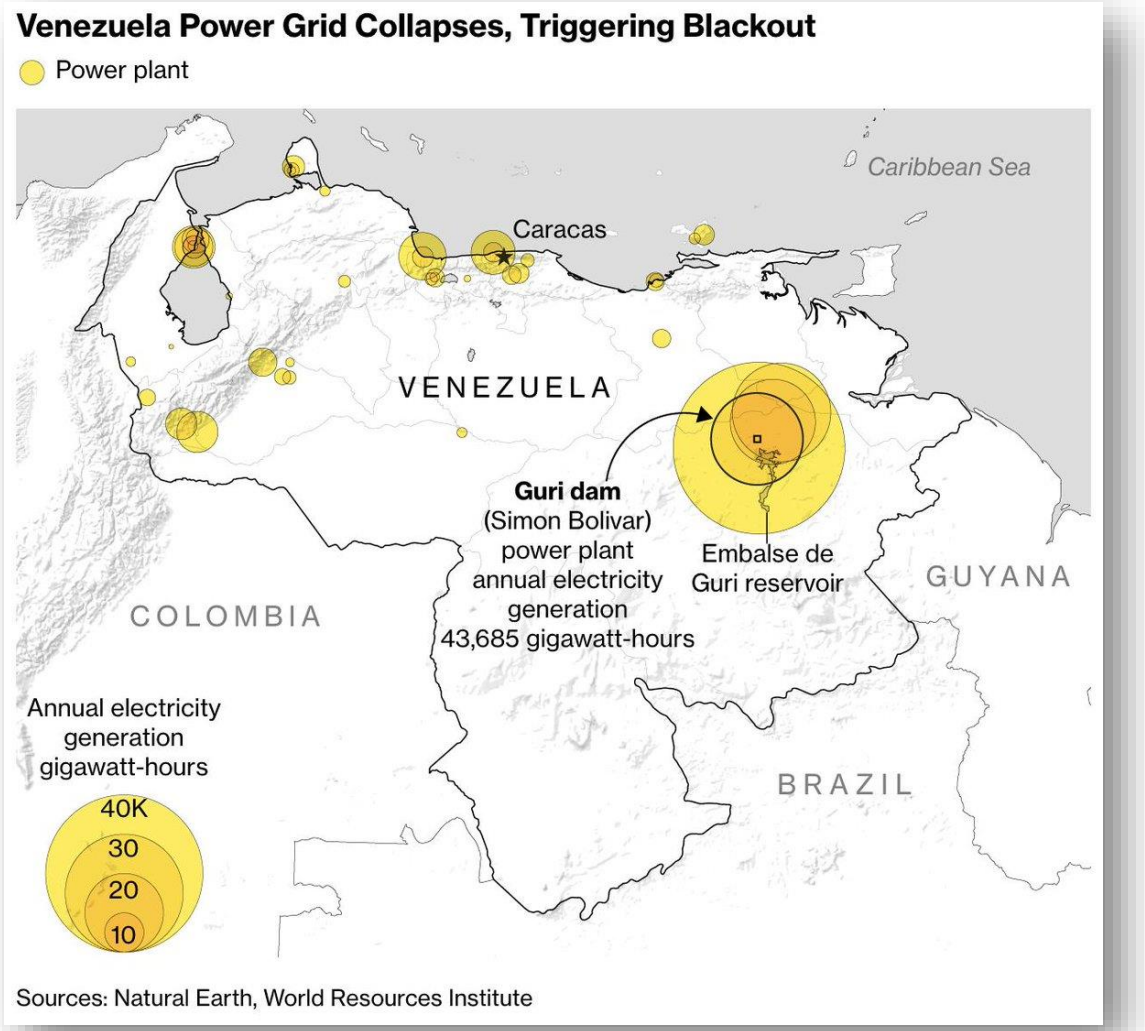


# VENEZUELA

Venezuela has invested heavily in the hydroelectric potential to supply the demand of the electricity sector since 1940.

Despite the large fossil fuel reserves, part of the fuel production is destined for exportation. In 2019, the oil reserves of Venezuela corresponded to 17.5% of the world's total share and ranked seventh in natural gas reserves.

The government's actions have not reinforced the use of renewable sources on a wide scale.

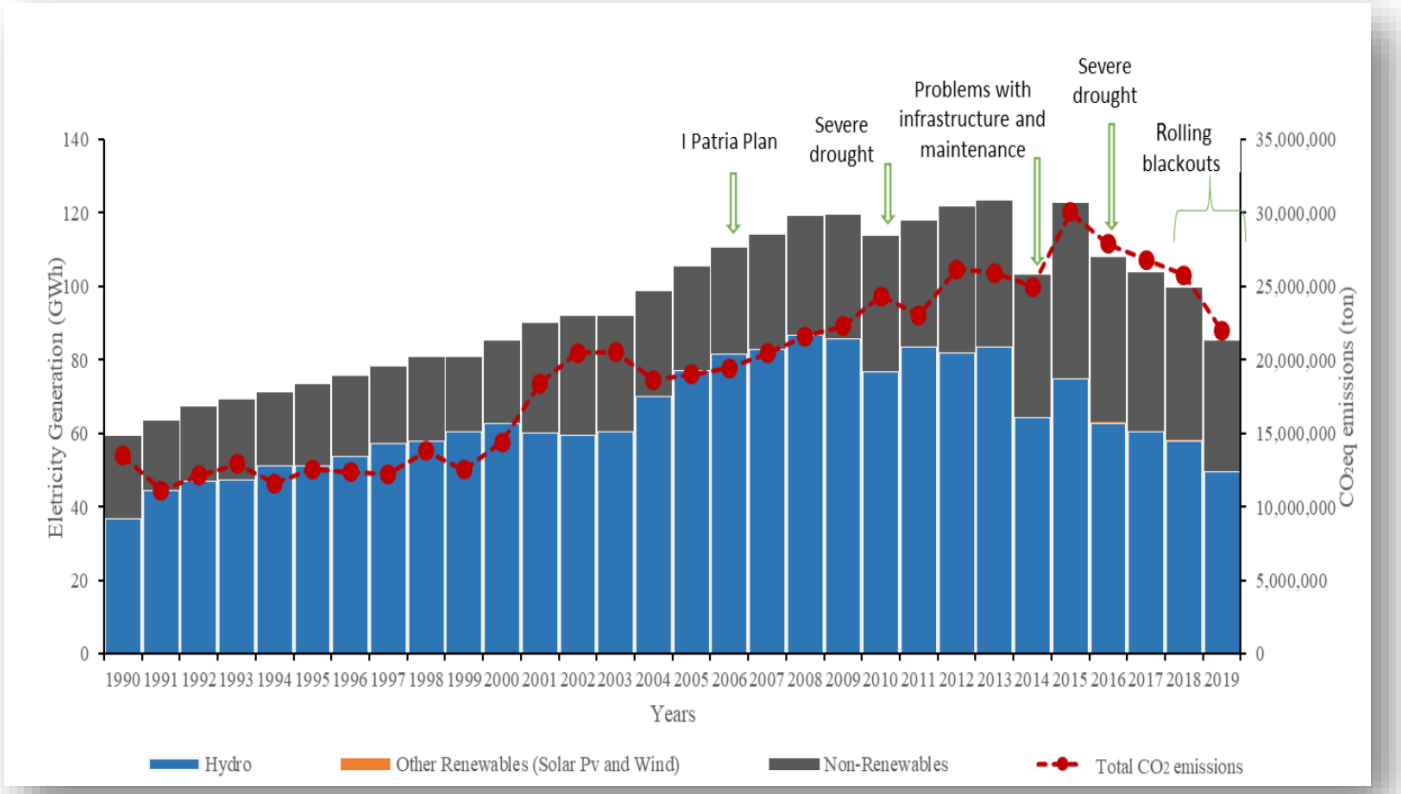




# VENEZUELA

The Venezuelan National Interconnected System has faced severe problems with a lack of investments in infrastructure, technology, workforce, and maintenance, as well as periods of drought, and the geographic distribution of their power plants, leading to a drop in electricity consumption followed by rolling blackouts.

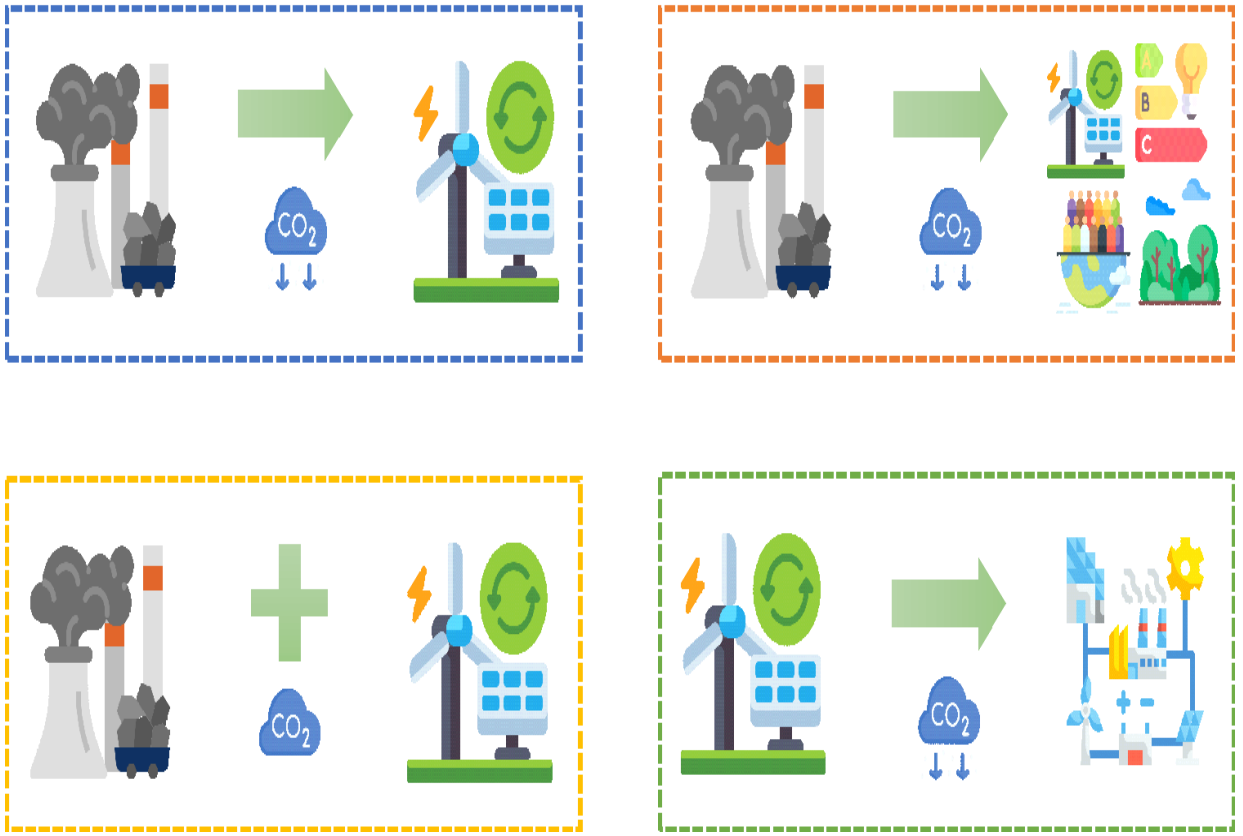
The country is going through a forced reduction in consumption without evident strategic measures, including the lack of investment in renewable sources and electricity sector infrastructure.




Venezuela's electricity generation from renewable (colored scale bars) and non-renewable (grayscale bars) sources and the total Co2eq emissions.

# FINAL REMARKS

- There is a general trend of **low-carbon reverse transition with increased CO2eq emissions**, mainly related to a growing share of natural gas in the electricity sector (e.g., Argentina and Brazil), boosted by consecutive water crises in recent decades.
- In Venezuela, there is a **reduction in emissions disassociated with the insertion of renewable**s, which is linked to a **decrease in electricity generation.**
- It should be noted that some case studies are **adding (renewable) energy rather than replacing fossil fuels**. This fact is mainly due to energy security issues and increased consumption.



# FINAL REMARKS

The pathways:

- The success of renewable energy in the countries analyzed has been through **auctions** and **short-term energy policy measures**.
- Energy policies focusing on **quantifiable emission reduction** should be a target of the electricity sector to achieve net zero emissions by 2050.
- **Sustainable Developing Agenda**, through initiatives such as Agenda 21 and 2030, provides a series of goals and targets to support decarbonization and improve quality of life conditions in the Global South.



# REFERENCES


Macedo, S. F.; Peyerl, D.. Prospects and economic feasibility analysis of wind and solar photovoltaic hybrid systems for hydrogen production and storage: A case study of the Brazilian electric power sector. International Journal of Hydrogen Energy. Volume 47, Issue 19, 2022, Pages 10460-10473. 10.1016/j.ijhydene.2022.01.133.

Peyerl, D.; Cachola, C. S.; Alves, V. H.; Mondagron, M.; Macedo, S. F.; Guichet, X.; Moutinho dos santos, E.. Applying small-scale liquefied natural gas supply chain by fluvial transport in the isolated systems: the case of Amazonas, Brazil. Energy for Sustainable Development. Volume 68, June 2022, Pages 192-202. doi.org/10.1016/j.esd.2022.03.010

Peyerl, D.; Barbosa, M. O.; Ciotta, M. R.; Pelissari, M. R.; Moretto, E. M.. Linkages between the promoting renewable energy policies and low-carbon transition trends South America's electricity sector. *Energies*. v. 15, p. 4293, 2022.

Relva, S. G.; Silva, V. O. da; Gimenes, A. L. V.; Udaeta, M. E. M.; Ashworth, P.; Peyerl, D.. Enhancing developing countries' transition to a low-carbon electricity sector. Energy, v. 220, p. 119659, 2021.

Venezuela – Electric grid. https://www.bloomberg.com/toaster/v2/charts/0d5e8c0e6ea445989006de5894e55668.html?brand=business&webTheme=default&web=true&hideTitles=true


*This presentation is based on the articles above and the references quoted in them.




**Thank you!**
**Bedankt!**
**Obrigada!**

Drielli Peyerl
d.peyerl@uva.nl