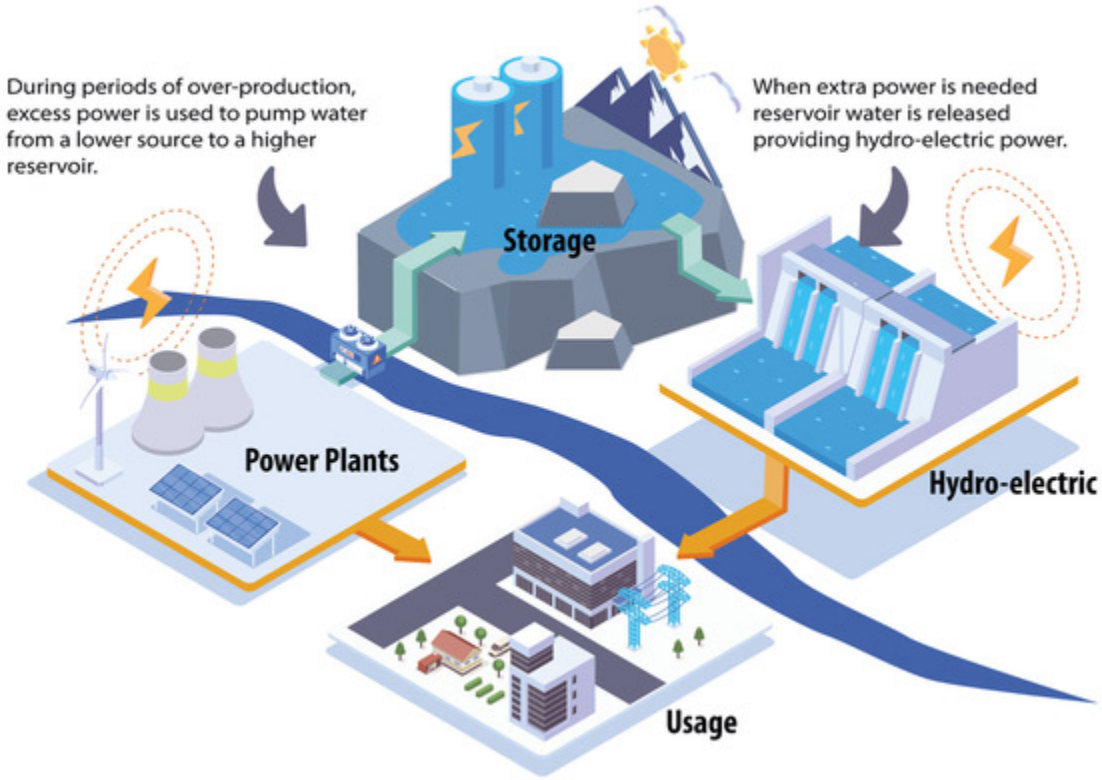
Powering Prosperity and Security: A Vision for Cross-Border Collaboration in Clean Energy

By Dr. Jeff Kleck

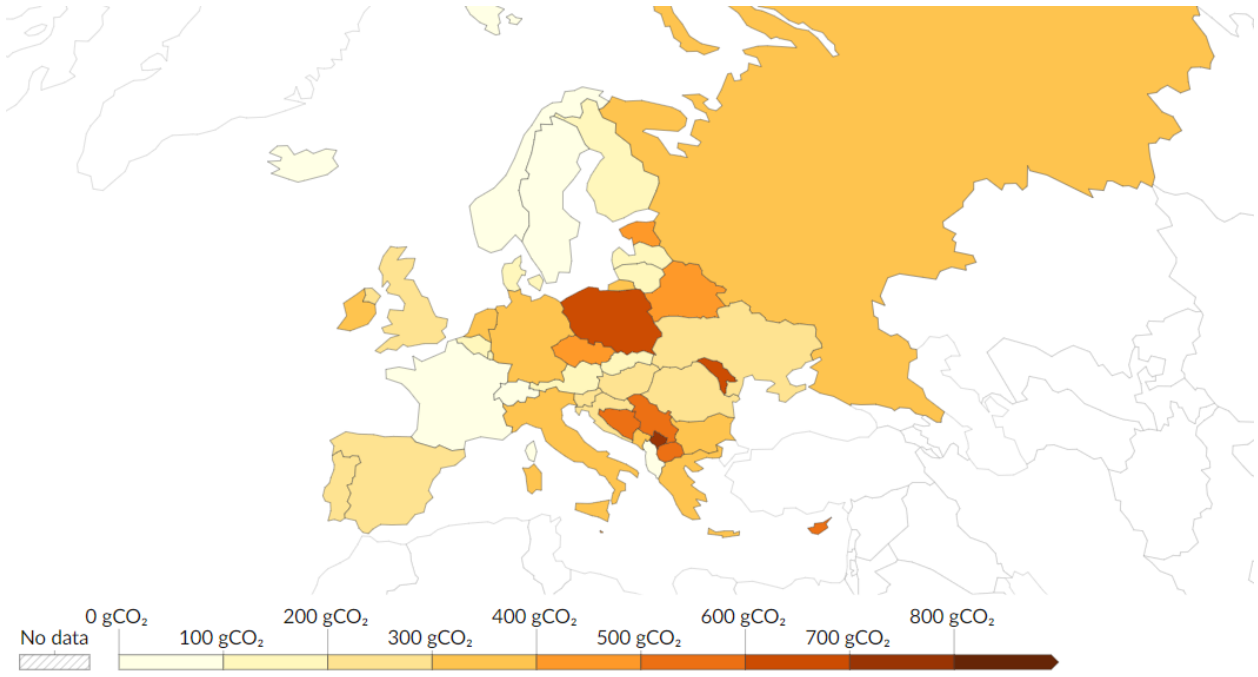
In an era marked by technological innovation and the pursuit of sustainable solutions, a groundbreaking opportunity emerges at international borders, providing an excellent strategy to revitalize the underperforming and inadequate Texas power grid and take a bold step towards net zero emissions. Cross-Border Collaboration in Clean Energy would combine recent technology, clean energy, geographic opportunities, and economic collaboration, drawing inspiration from successful models such as the "Battery-of-Europe", Nuclear and Hydroelectric collaboration between France and Switzerland, to help us meet our growing energy demands while building a greener future (SwissInfo, 2021).



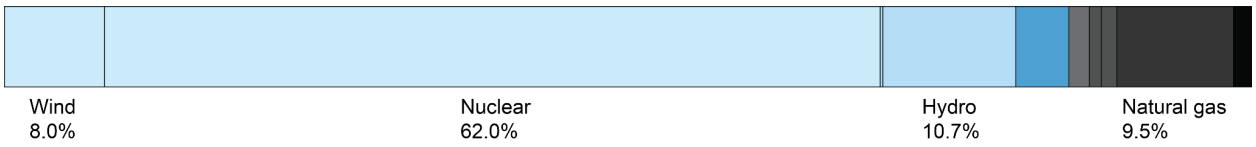
The Battery-of-Europe Nuclear and Hydroelectric collaboration between France and Switzerland (SwissInfo, 2021)

The Power of Collaboration:
Our vision centers on the concept of an "Economic Battery," enhancing and extending a successful European model to a broader and larger scale. Here, clean energy and economic collaboration become catalysts for solving multifaceted challenges. This collaborative approach leverages advanced technology, differences in regulatory requirements, materials, labor costs, and market demands on either side of the border to strategically place clean energy power plants in international border cities between nations and their neighbors (Frontiersin, 2023).

In Europe, countries use a variety of different technologies to produce power with near-zero carbon emissions, but unfortunately many of these are not readily available across the world. However, France produces near-zero carbon emission power from globally available nuclear power plants. These plants operate continuously at their maximum efficiency, supplying both France and Switzerland. France sends surplus Nuclear power to Switzerland during periods of lower energy demand. Switzerland, in turn, utilizes this surplus power generated during low-demand periods to pump water from lower elevation to higher elevation lakes, and then releases water downstream, generating hydro-electric power during peak energy demand, creating an ecologically friendly massive hydro battery known as the “Battery-of-Europe.” Translating this model to other countries could significantly contribute to stopping climate change and reversing its effects without having to decrease standards of living.



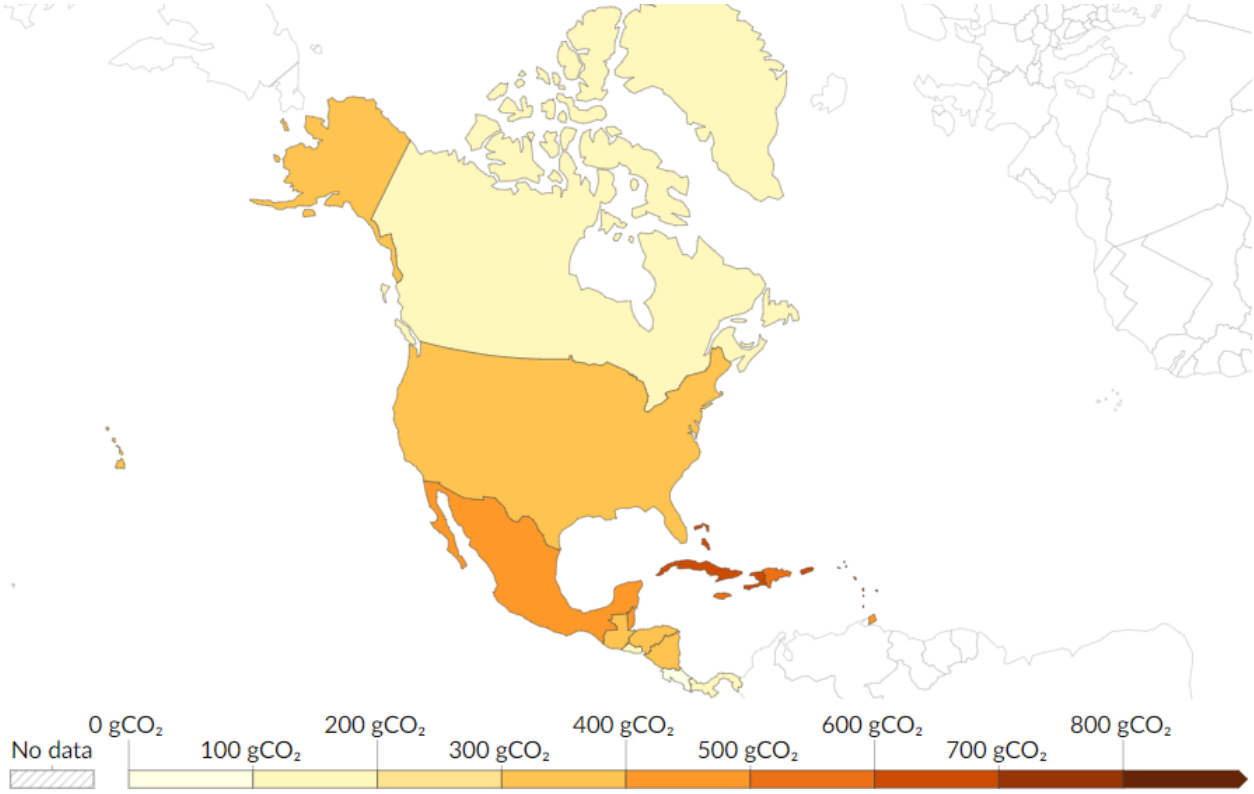
Grams of carbon dioxide equivalents emitted per Kilowatt-Hour of electricity generated in 2022 (Our World in Data)



Percentages of total France electricity generation in 2022 by source (IEA)

Percentages of total Switzerland electricity generation in 2022 by source (IEA)

At the United States' Texas border with Mexico, the construction of a 4th generation nuclear power plant is a compelling proposition. Mexico can contribute lower costs of materials and labor, while the United States can contribute advanced design, financing, and fuel production facilities. Additionally, Mexico offers a shorter regulatory cycle for new nuclear plants. Through collaborative efforts, both Mexico and the United States can contribute technologies and capabilities for demand-driven power, utilizing resources such as Hydrogen, Batteries, or reversible chemistry, and leveraging existing infrastructure and investment in super battery factories located in Texas. Moreover, Texas A&M University is able to provide advanced power engineering education for both American and Mexican engineers, thereby fostering a skilled workforce in the clean energy sector. This model mirrors the 'Battery-of-Europe' approach, where both sides contribute and benefit mutually (Kairos Power; Terra Power; IEEE Xplore, 2020; Bloomberg, Europe’s Green Battery).



Grams of carbon dioxide equivalents emitted per Kilowatt-Hour of electricity generated in 2022 (Our World in Data)

Percentages of total Mexico electricity generation in 2022 by source (IEA)

Percentages of total United States electricity generation in 2022 by source (IEA)

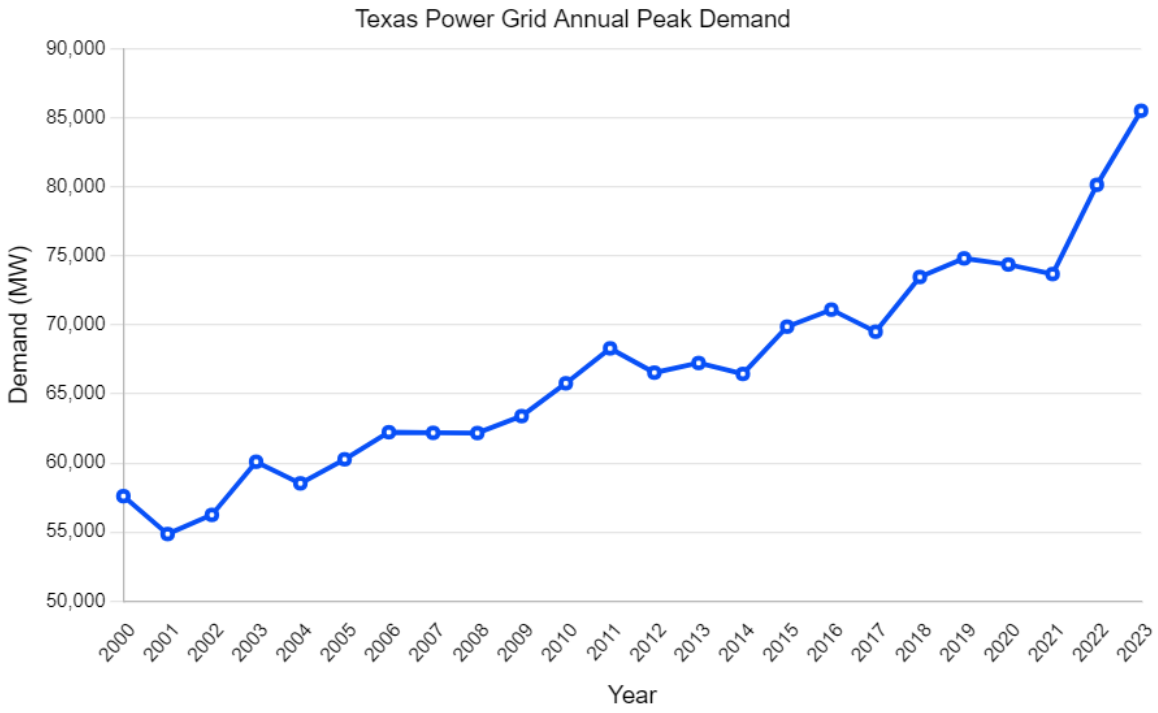
Economic Prosperity:

The establishment of Economic Battery communities, supported by zero-emission clean energy power plants and energy storage, holds the key to carbon neutral economic prosperity. These communities become hubs of economic activity, attracting industries and creating a surplus of

clean power that benefits the cities and nations on both sides of the border, driving international cooperation. The resulting economic boom has the potential to reduce illegal migration in countries sharing borders with large standard-of-living disparities by fostering local economic prosperity in each nation (White House, 2022; Carnegie Endowment, 2023).

Educational Opportunities and Cultural Exchange:
The strategy also envisions cross-border collaborations in education, offering advanced opportunities in disciplines critical to the future of clean energy. The United States could extend educational programs to students from Mexico, promoting cultural exchange and fostering a skilled workforce in the clean energy sector. Texas A&M University is the largest power engineering program in the United States and is an international university in close proximity to its southern neighbor Mexico, making it an ideal choice. (ASEE, 2022).

Addressing Climate Change through Clean Energy:
Following the France and Switzerland model, siting Nuclear Power Stations, or other high-yield clean power plants, at border cities delivers clean energy in a manner that simultaneously delivers positive environmental impact and economic growth. This Economic Battery approach helps stop climate change by replacing carbon-emitting fuels currently supporting the population. Such strategic placement can also contribute to the ailing and under-producing Texas Power Grid by supplementing much-needed power through a partnership with Mexico. Of the scalable sources of power Nuclear has the highest energy density, the lowest waste volume, and near-zero atmospheric carbon. France and Switzerland have built a remarkable model, setting the best direction for our future, and the Americas should incorporate this power cooperation into the next generation of electricity production. Currently, Mexico's sole nuclear power plant, Laguna Verde Nuclear Power Plant, has been in operation since 1990 and is currently planned to produce power until at least the year 2050, signaling Mexico's commitment to clean, efficient energy production. American capital and educational investment can facilitate the construction of more modern 4th generation reactors to fulfill the growing demands of the Texas power grid. Peak demand in Texas has been trending upwards for over 20 years, with recent years witnessing particularly notable increases. This advancement leads both countries towards carbon neutrality (ERCOT, 2024; OWID 2022).



A Blueprint for Success:

By capitalizing on cross-border economic and cultural benefits, the Economic Battery model not only strengthens national security but also serves as a beacon for bilateral prosperity and collaboration. The success of sustained nuclear power from France and the utilization of Switzerland's hydro-electricity to “recharge” by pumping water into higher elevation lakes during lower-use times, then releasing the water during peak use to supplement the nuclear power with hydro-electric power, is the cleanest atmospheric climate solution with high-density power available globally (Bloomberg, 2023; Swissinfo, 2021). As we translate this to other nations and cities, each particular site would define which clean energy storage systems would be optimal. Implementing a battery model on a broader scale can effectively reduce atmospheric pollution from power and give us the best chance to begin reversing global climate change (IEA, 2021).

Conclusion:

Our vision for cross-border collaboration in clean energy and economic development transcends borders and aims to create thriving international commerce with clean energy. In one fell swoop, this singular example fortifies the power-starved Texas power grid, forms an international partnership powering the electricity and industry of both countries and their border cities, and creates an educational and cultural exchange partnership. By implementing this comprehensive strategy in other nations, we envision a future where the term "border" transforms from a barrier into a bridge, fostering economic, cultural, and environmental harmony between nations. OPEN

is building a community of partners to assist us in developing this blueprint. As we all embark on this journey, let us seize the opportunity to build a sustainable future that powers prosperity and fortifies security on a global scale.

For more information on Open Power & Energy Network Collaborations please contact Dr. Kleck at Jeff@OpenPowerEnergy.Net.

Citations:

- Swissinfo - Switzerland's Giant Water Battery
- Frontiersin - Cross-Border Collaboration
- Kairos Power - 4th Gen Nuclear Power
- Terra Power - 4th Gen Nuclear Power
- IEEE Xplore - Cross-Border Engineering Collaborations
- Bloomberg - Europe's Green Battery
- White House - Clean Energy Deployment
- Carnegie Endowment - Clean Energy Supply Chains
- ASEE - Cross-Border Collaborative Learning
- ERCOT Peak Demand Records, 2024
- Our World In Data - Carbon Intensity of Electricity Generation, 2022
- IEA - World Energy Transitions Outlook 2022
- IEA - Countries 2022

Data Citation Details:
Our World in Data - Maps
Ember - Yearly Electricity Data (2023); Ember - European Electricity Review (2022); Energy Institute - Statistical Review of World Energy (2023) – with major processing by Our World in Data
IEA - Graphs
Blue shades present power sources in order of increasing grams (g) of carbon dioxide (CO_2) equivalents emitted per Kilowatt-Hour (kW h) of electricity generated levels from left to right including Wind, Nuclear, Tide, Hydro, Geothermal, Solar PV, Solar Thermal
Gray shades present power sources in order of increasing grams (g) of carbon dioxide (CO_2) equivalents emitted per Kilowatt-Hour (kW h) of electricity generated levels from left to right including Biofuels, Waste, Oil, Natural gas, Coal

The Author:

Dr. Jeff Kleck, Professor and Dean of Academics, and Chairman of Entrepreneurship and Technology Commercialization at the Catholic Institute of Technology in Cambridge, Massachusetts, United States, and Castel Gandolfo, Italy, also Chairman of the Open Power & Energy Network (OPEN), brings extensive expertise across technology, academia, government, and industry. Dr. Kleck concurrently serves as an Adjunct Professor at Stanford University and as a Senior Advisor to the United States Government.

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