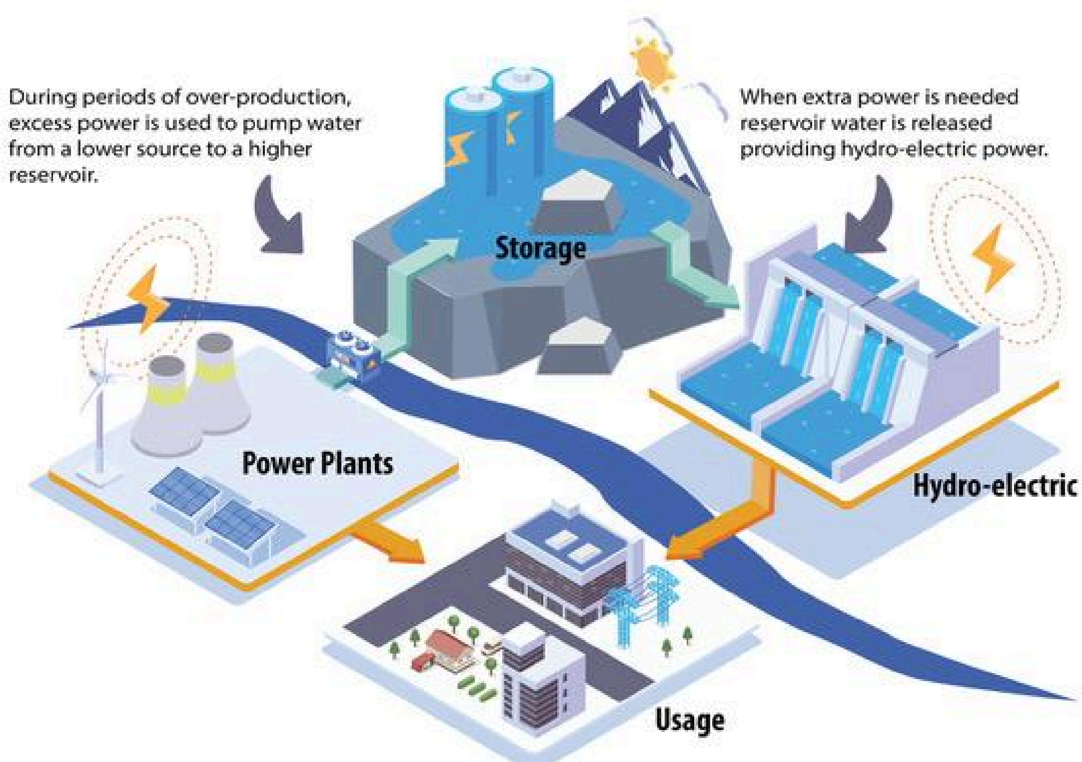
Powering Prosperity and Security: The Economic Battery

By Dr. Jeff Kleck

In an era when reliable, affordable power is vital for economic strength and national security, the Economic Battery should be framed as a production model, not simply as a power plant. It adapts the Battery-of-Europe best practice: high-energy-density nuclear power produces continuous baseload electricity; hydroelectric reservoirs and pumped-storage systems convert that steady output into peaking power; and transmission turns geography into an economic asset.

The France-Switzerland model shows the logic. France's nuclear fleet supplies large volumes of low-carbon baseload electricity, while Switzerland's hydroelectric and pumped-storage resources absorb electricity when it is abundant and release it when demand is high. The result is a practical system for converting baseload power into dispatchable peak electricity.



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

The Power of Collaboration:
The Economic Battery borrows from this proven model. Switzerland's Nant de Drance pumped-storage plant is a useful example: it has 900 MW of capacity, 20 million kWh of storage, can switch from using electricity to store water to using stored water to generate electricity rapidly, and reports a storage yield of more than 80 percent. The lesson is not only that pumped hydro works; it is that baseload generation, storage, transmission, and market timing can be coordinated as one production system.

In North America, the best starting point is the Canada-U.S. relationship. Canada generates roughly 60 percent of its electricity from hydropower, and all Canadian electricity trade is with the United States. Canadian water is stored and cycled in Canadian watersheds, while dispatchable hydroelectricity is delivered south through interties and contracts.

Producing the Economic Battery:
Production occurs in three steps. First, nuclear reactors provide continuous baseload power. Nuclear fuel is exceptionally dense: one uranium fuel pellet can produce as much energy as one ton of coal, 149 gallons of oil, or 17,000 cubic feet of natural gas. Nuclear plants also have the operating profile needed for baseload production, with U.S. nuclear capacity factors above 90 percent in recent data.

Second, hydroelectric assets convert that baseload into peaking power. During low-demand periods, surplus nuclear electricity can be used to pump water uphill. During high-demand periods, stored water is released through turbines, turning steady nuclear output into flexible clean power without relying on fossil peaker plants.

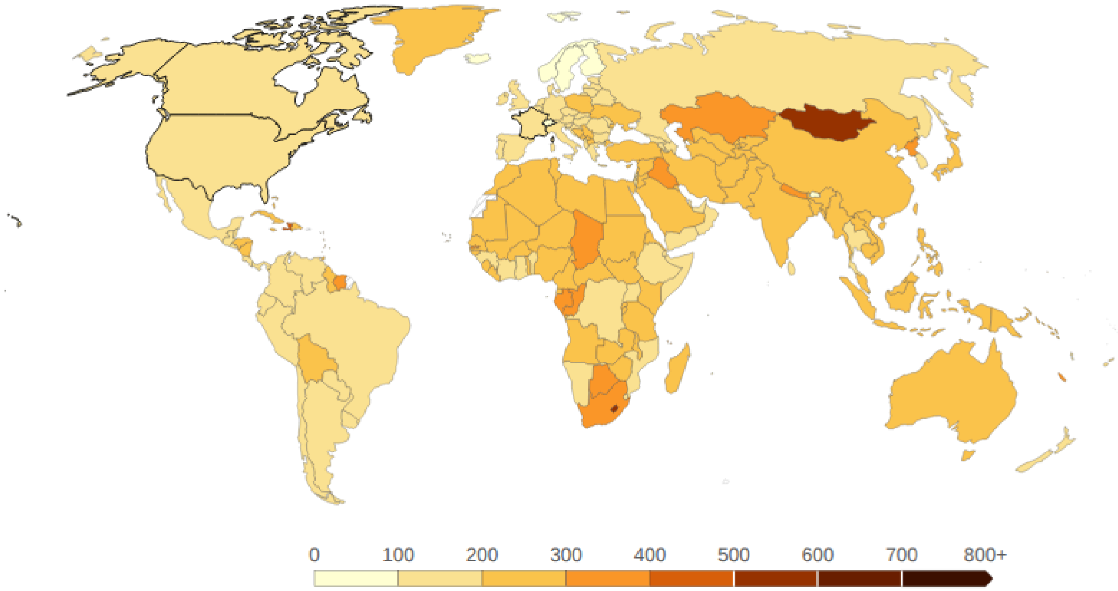
Third, transmission and long-term contracts convert the engineering system into an economic product. The Economic Battery sells reliability, not just kilowatt-hours: baseload supply, peak supply, grid-stabilizing flexibility, low-carbon industrial attraction, and resilience during periods of stress.

References and Data Sources:
Swissinfo, Switzerland’s Giant Water Battery, 2021; Our World in Data, Carbon Intensivity of Electricity Generation, 2025; Nante-De-Drance, Nante-De-Drance Power Plant, 2025; Nuclear Energy Institute, Nuclear Fuel, 2026

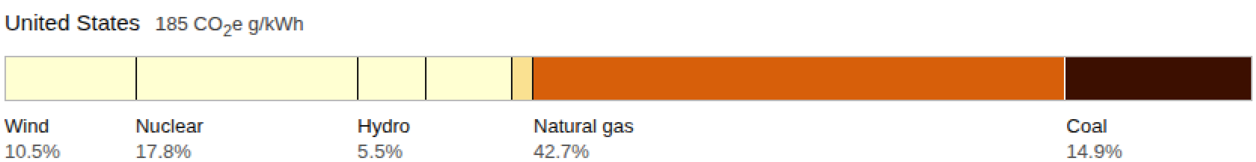
Where Hydroelectric Storage is Not Available: Hydrogen Fuel:
The model is also replicable for locations without major hydroelectric geography. In those regions, off-peak nuclear or other clean baseload power can produce hydrogen. The hydrogen can then be stored in tanks, salt caverns where available, pipelines, or carriers, and used later for fuel cells, turbines, industrial heat, transportation fuel, ammonia, fertilizer, metals, or chemical production. Hydrogen is less efficient than pumped hydro for electricity-to-electricity storage, but it is more portable and geographically flexible.

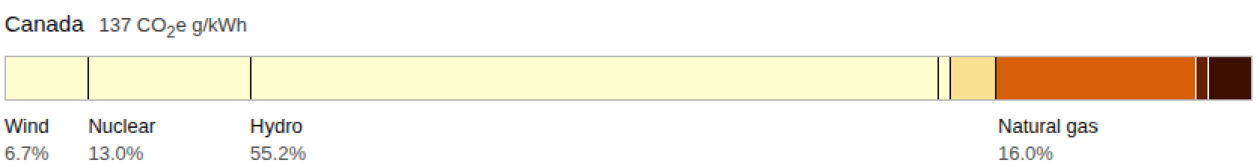
Economic Prosperity:
Economic Battery communities are industrial hubs supported by abundant, reliable, low-carbon electricity. Stable power attracts advanced manufacturing, data centers, artificial intelligence infrastructure, defense production, critical minerals processing, desalination, and other energy-intensive industries. Public and private investment then ripples outward through jobs, tax base, infrastructure, and supply chains.

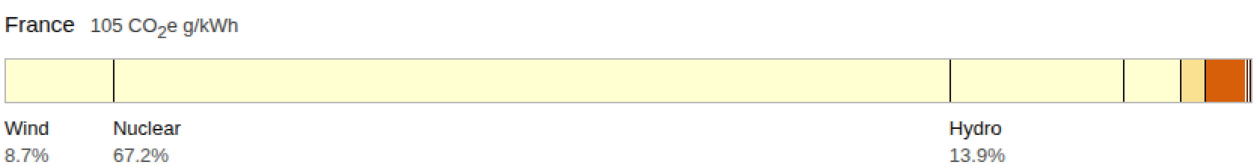
Positive Waste and Carbon Benefits:
The Economic Battery also improves the waste profile of the power system. Fossil generation releases much of its waste into the atmosphere as carbon dioxide and other pollutants. Nuclear-hydro systems instead shift the waste profile toward contained, regulated, and much smaller physical streams: nuclear spent fuel is solid and managed; hydroelectric power uses moving water rather than combustion; pumped hydro cycles the same water repeatedly; and hydrogen produced from clean electricity can create a storable fuel without direct carbon emissions at the point of production.

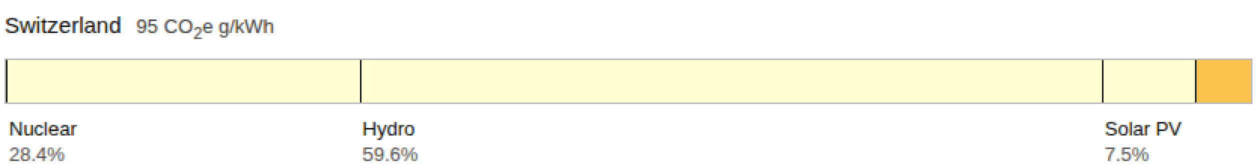


Grams of carbon dioxide equivalents emitted per Kilowatt-Hour (CO_2e g/kWh) of electricity generated in 2024.









Percentages of total electricity generation in 2024 by source: Wind, Nuclear, Tide, Hydro, Geothermal, Solar PV, Solar Thermal, Biofuels, Waste, Oil, Natural gas, Coal.

References:

U.S. Energy Information Administration (EIA), *Electric Power Monthly*, 2024; Statistics Canada, *Electricity Supply and Disposition*, 2024; RTE (Réseau de Transport d'Électricité), *Bilan électrique 2024 / Annual Electricity Review 2024*, 2024;

Swiss Federal Office of Energy (SFOE), *Schweizerische Elektrizitätsstatistik 2024 / Swiss Electricity Statistics 2024*, 2024

A Blueprint for Success:
The repeatable sequence is concise: identify the baseload source; identify the storage counterpart; secure transmission and market rules; anchor demand with industrial customers; then measure success by reliability, delivered cost, peak capacity, carbon reduction, and industrial output. Where hydroelectric storage exists, pumped hydro is the proven peaking mechanism. Where it does not, hydrogen production, or another location specific option, extends the model into a complete geography-independent system.

Regional applications can include Quebec and Labrador hydro serving Northeast U.S. demand, Ontario and Manitoba resources supporting the Midwest and Great Lakes, and British Columbia hydro supporting the Pacific Northwest.

Conclusion:
The Economic Battery turns geography into grid reliability and industrial advantage. Derived from the Battery-of-Europe, the model uses nuclear power for dense baseload production, hydroelectric systems for efficient peaking where available, and hydrogen fuel production where hydroelectric storage is not available.

The Canada-U.S. border is the strongest North American starting point because the core ingredients already exist: abundant Canadian hydropower, north-to-south electricity trade, U.S. nuclear expertise, integrated transmission, and large industrial demand centers. With hydrogen as the non-hydro alternative, the Economic Battery becomes a complete model for any location that needs reliable, low-carbon, strategically valuable power.

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

Citations:

- Swissinfo, *Switzerland's Giant Water Battery*, 2021
- Our World In Data, *Carbon Intensity of Electricity Generation*, 2025
- Nant-De-Drance, *Nante-De-Drance Power Plant*, 2025
- Nuclear Energy Institute, *Nuclear Fuel*, 2026
- Energy Information Agency, *Nuclear Explained*, 2026
- Energy Information Agency, *Hydrogen Explained*, 2025

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
Colors and shades present power sources from left to right in order of increasing grams (g) of carbon dioxide (CO_2) equivalents emitted per Kilowatt-Hour (kW h) of electricity generated to include: Wind, Nuclear, Tide, Hydro, Geothermal, Solar PV, Solar Thermal, Biofuels, Waste, Oil, Natural gas, Coal.

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