FERRARIS POWER

A Shift in the Power Generation Paradigm

for Decarbonization and Environment Protection

August 2023

The Proposition:

State-of-the-art power generation solution for additional electricity generation capacity.

Preface

In recent years, decarbonization, environmental protection, and insufficient electricity are among the most difficult tasks mankind has been facing without a doubt. This proposal describes how we may diligently cross these hurdles and be one step closer in accomplishing these undertakings.

Some may consider our novel power generation method as a less-than-ideal solution to the highlighted problems; however, we believe that it is the most realistic and feasible solution in which the United States government can take immediate action on at the current time.

BACKGROUND I: Present Climate and Efforts

We are reaching the pinnacle of modern digital age with a constant influx of new electronic goods to improve our environment and everyday life. In light of recent efforts to fully adopt electric vehicles (EVs) around the world, we will face an unimaginable burden of accelerated increase in electricity consumption when this effort becomes a reality.

In recent years, decarbonization, environmental protection, and insufficient electricity are among the most difficult tasks mankind has been facing without a doubt. As a logical countermeasure, it is in our best interest to close fossil fuel-type power plants and replace them with renewable energy-type power plants to promote decarbonization and environmental protection for the future.

In an effort to achieve such goals, the US is making a transition from fossil fuel-type power plants to renewable energy-type power plants: aging nuclear plants are slated for closure in many parts of the country.

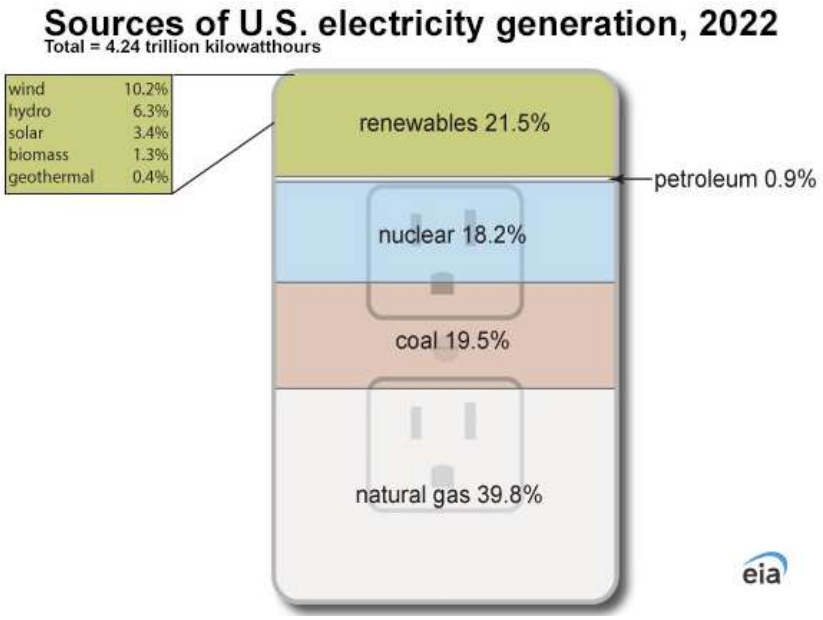

Fig. 1: U.S. Energy Information Administration, Electric Power Monthly, February 2023

In 2022, net generation of electricity from utility-scale generators in the US was about 4,243 billion kilowatt hours (kWh; about 4.24 trillion kWh). The Energy Information Administration estimates that an additional 58.51 billion kWh (or about 0.06 trillion kWh) were generated with small-scale solar photovoltaic systems.

In 2022, about 60% of US utility-scale electricity generation was produced from fossil fuels (coal, natural gas, and petroleum), about 18% was from nuclear energy, and about 22% was from renewable energy sources [1].

In 2021, coal-fired power plants with total generating capacity of 6,000 megawatts (MW) have closed; additionally, coal-based power plants with total capacity of more than 40,000 MW are planned to be closed by 2026 [2].

[1] Ref. U.S. Energy Information Administration, June 30, 2023, with data from the February 2023 edition of the Electric Power Monthly; data for 2022 are preliminary

[2] Ref. Policy Research and Analysis American Public Power Association March 2022

BACKGROUND II: Current Issues

Thus far, consumers have been delivered electricity produced via electricity generation and transmission methods that are readily utilized.

Considerable investment in costs, approval and development times, installation spaces, stable supplies of water and resources, and more are required to develop fossil fuel-type power plants with the current power generation technology.

Consistent with the general consensus, we are well-aware that fossil fuel-type power plants destroy the environment during both development and post-development operations; naturally, therefore, our primary objective is to strive for zero emissions of harmful substances when operating power plants to protect the environment.

Fig. 2: Fossil fuel-type and renewable energy-type power plants

While eco-friendly operational capabilities of renewable energy-type power plants (such as solar and wind powers) cannot be discredited, installing new facilities are still destructive to nature in reality. Importantly, electricity generated by such power facilities are not efficient enough under current technologies.

Furthermore, while scientists warn that solar and wind power systems can be harmful to the Earth, environmentalists also emphasize that recycling or disposal of solar panels must be regulated by the government. As such, important issues that we should prioritize are stated in the following.

The limitations of development and installation times, as well as electricity generation capacity from renewable energy-type power plants, remain to be an issue. Most power specialists caution that electricity supplies will not meet the demands amid the transition to renewable energy-type power plants.

Additionally, when the electricity usage booms, we must not overlook the possibility of experiencing unexpected outages, due to:

i) Insufficient electricity net generation.
ii) Destruction or blockage of transmission grids from natural disasters, such as the recent wildfires.
iii) Disturbances caused by EV charging infrastructures that are directly connected to the transmission lines [3].

Therefore, our priority is the ability to generate sufficient electricity while protecting the environment and safely supply it to consumers, ultimately attaining the common goal of all. Along with the decarbonization and environmental protection efforts, it is vital to implement timely measures to sufficiently supply the rapidly growing electricity consumption.

[3] Ref. Electric Vehicle Charging Station: Cause and Solution to Grid System. IEEE Bulletin 2019.

INNOVATION I: Introducing Our Novel Power Generation Technology

Ever since the commercialization of electricity, there has been an untapped by-product in the form of magnetic fields generated by flowing currents in power lines. By harvesting and harnessing this unused, wasted magnetic energy, Ferraris has opened a new pathway for electric power generation and electrical energy recycling technology.

Specialists from the energy sector may contest the above statement with their impressions of the typical current transformer (CT) sensors or question the viability of large-scale electrical energy production with CT-like ring cores or simple transformer; on the contrary, Ferraris proudly introduces world's first and only Energy Recycling Reservoir (ERR) system [4].

We developed the ERR system to allow for large-scale electrical energy production, as evidenced by a beta test that was successfully completed at a small hydroelectric power plant (Korea Midland Power). The beta test included evaluations on the integrity and reliability of the ERR system, and was assessed for 2.5 years upon installation [5].

These favorable results were possible with our unprecedented, patented technologies (high-power ring cores manufacturing and power-focusing technologies).

We are confident that this system will revolutionize the power generation solution for additional electricity generation capacity. The installation and operation of the ERR system (a fully developed novel system, not yet applied worldwide) is comparable to small- or medium-scale decentralized power plants.

In time, substantial implementation of the ERR system would amplify and provide sufficient electricity generation capacity and consequently better compensate for the ever-increasing electricity demands of modern societies.

[4] Supp. The ERR system: see https://ferrarispower.com/the-err-system

[5] Supp. Beta test results on the integrity and reliability of the ERR system: see https://ferrarispower.com/best-test-results

INNOVATION II: Advantages and Limitations

The ERR system is indirectly connected to power lines and makes use of the magnetic field around a flowing current to generate electric power, thus potentially the most optimal solution for decarbonization and environmental protection as it does not further expend natural resources.

Moreover, installations of the ERR system will not further harm the environment: vacant spaces in present operational facilities will be utilized, with approximately 500-1,000 ft^2 of installation space required per site; it is also a system that is fundamentally competitive in regard to development and installation period (approximately 4-6 months per site).

The electric power generation of ERR system is similar to the output of fossil fuel-type power plants, and far superior to renewable energy-type power plants. In comparison to existing power plant types regarding development and O&M cost, the ERR system can be installed and operated with an economical advantage, such that it even has the greatest potential to change the future growth of the electricity market.

However, the ERR system is not without limitations: if an outage occurs in a power line that is indirectly connected to the ERR system, the magnetism is lost and thus electricity would no longer be generated.

APPROACH: New Pathway for Maximal Electricity Generation Capacity

The following outlines potential strategic approaches that can further contribute to environmental protection efforts and efficiently maximize electricity generation capacity using the ERR system.

By current estimations, there are more than 60,000 distribution substations, more than 205,000 distribution circuits, and six million miles of distribution lines operating within the US[6].

Our approach would entail installing and operating the ERR system at distribution substations from the mentioned distribution networks. The ERR system can be installed in vacant spaces of the distribution substations to harvest the most important resource (e.g., power line current).

Specifically, the ERR system is installed by passing a split three-phase four-wire power line (from a switchgear of the distribution substation) through it in a contactless manner (i.e., indirect connection).

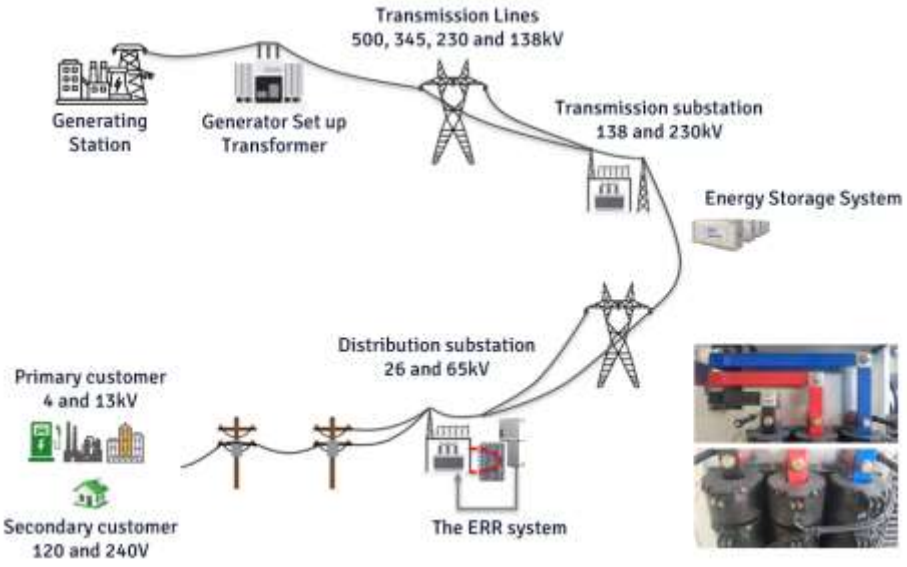

Fig. 3: Our approach; the ERR system can be installed at the distribution substation

If the power line current at a distribution substation is over 900 amperes, it is possible to further split the three-phase four-wire power lines to build the system. Additional line splits are necessary because the ERR system is optimized for power generation at 250-300 amperes (see illustrated in Table 1 below).

Electricity generated from the ERR system can be either directly delivered to the distribution substation or stored in the Energy Storage system designated for the distribution substation.

As illustrated in figure 3, we can foresee the following benefits by fully adopting and implementing the ERR systems at distribution substations across the US.

Firstly, the US government (at all levels: Federal, State, and local) could supply additional electricity by **0.53-1.58 terawatts**[7] to consumers in the most economical fashion (both cost and lead time), especially considering the indirect connection method of the ERR system.

Used power line current	Used 3-phase 4-wire power line	Install method	The ERR system (UH-10)	Electricity net generation
900 Amperes	3 line-split	Parallel	3 ea	75 MW
		Parallel & Cascade	6 ea	150 MW
			9 ea	225 MW

Table 1: Estimated electricity net generation from the ERR System

Second, the estimated cost of installation to the ERR system is just one hundred fifty US dollars ($150.00) per kilowatt; in time, the ERR system is economically advantageous with the expectation to have favorable knock-on effects in the future when comparing the development costs of different types of power plants as illustrated in Table 2 below.

Technology	First available year[a]	Size (MW)	Lead time (years)	Base overnight cost[b] (2021$/kW)	Techno-logical optimism factor[c]	Total overnight cost[d,e] (2021$/kW)	Variable O&M[f] (2021 $/MWh)	Fixed O&M (2021$/ kW-y)	Heat rate[g] (Btu/kWh)
Ultra-supercritical coal (USC)	2025	650	4	$4,074	1.00	$4,074	$4.71	$42.49	8,638
USC with 30% carbon capture and sequestration (CCS)	2025	650	4	$5,045	1.01	$5,096	$7.41	$56.84	9,751
USC with 90% CCS	2025	650	4	$6,495	1.02	$6,625	$11.49	$62.34	12,507
Combined-cycle—single-shaft	2024	418	3	$1,201	1.00	$1,201	$2.67	$14.76	6,431
Combined-cycle—multi-shaft	2024	1,083	3	$1,062	1.00	$1,062	$1.96	$12.77	6,370
Combined-cycle with 90% CCS	2024	377	3	$2,736	1.04	$2,845	$6.11	$28.89	7,124
Internal combustion engine	2023	21	2	$2,018	1.00	$2,018	$5.96	$36.81	8,295
Combustion turbine—aeroderivative[h]	2023	105	2	$1,294	1.00	$1,294	$4.92	$17.06	9,124
Combustion turbine—industrial frame	2023	237	2	$785	1.00	$785	$4.71	$7.33	9,905
Fuel cells	2024	10	3	$6,639	1.09	$7,224	$0.62	$32.23	6,469
Nuclear—light water reactor	2027	2,156	6	$6,695	1.05	$7,030	$2.48	$127.35	10,443
Nuclear—small modular reactor	2028	600	6	$6,861	1.10	$7,547	$3.14	$99.46	10,443
Distributed generation—base	2024	2	3	$1,731	1.00	$1,731	$9.01	$20.27	8,923
Distributed generation—peak	2023	1	2	$2,079	1.00	$2,079	$9.01	$20.27	9,907
Battery storage	2022	50	1	$1,316	1.00	$1,316	$0.00	$25.96	NA
Biomass	2025	50	4	$4,524	1.00	$4,525	$5.06	$131.62	13,500
Geothermal[i, j]	2025	50	4	$3,076	1.00	$3,076	$1.21	$143.22	8,813
Conventional hydropower[i]	2025	100	4	$3,083	1.00	$3,083	$1.46	$43.78	NA
Wind[e]	2024	200	3	$1,718	1.00	$1,718	$0.00	$27.57	NA
Wind offshore[i]	2025	400	4	$4,833	1.25	$6,041	$0.00	$115.16	NA
Solar thermal[i]	2024	115	3	$7,895	1.00	$7,895	$0.00	$89.39	NA
Solar photovoltaic (PV) with tracking[e, i, k]	2023	150	2	$1,327	1.00	$1,327	$0.00	$15.97	NA
Solar PV with storage[i, k]	2023	150	2	$1,748	1.00	$1,748	$0.00	$33.67	NA

Table 2: Cost and performance characteristics of new central station electricity generating technologies [8]

In addition, if the ERR system is integrated with EV charging infrastructures, we can expect this system to supplement and accelerate EV adoption policy of the US government by enabling rapid increase in the number of EV charging stations, all while maintaining grid stability [9].

[6] Ref. National Academies of Sciences, Engineering, and Medicine. 2009. America's Energy Future: Technology and Transformation.

[7] Assumptions: i) the installed ERR systems have electricity net generation of either 75 or 225 MW per site; and ii) are installed in 7,000 distribution substation sites.

[8] Ref. The tables presented below are also published in the Electricity Market Module chapter of the U.S. Energy Information Administration's (EIA) Annual Energy Outlook 2022 (AEO2022) Assumptions document.

[9] Supp. Solution to the transition of indirect connections in EV charging infrastructures for grid stability: see https://ferrarispower.com/level-3-ev-proposal

As a result, we anticipate that the government could achieve the following:

i) Implement decarbonization and environmental protection.
ii) Maximal increase of electricity net generation capacity in a short period of time while providing stable electricity supply to consumers.
iii) Astronomically reduce cost and lead time in developing current power plants. Change distribution substations from cost centers to profit centers.
iv) Install EV charging stations across multiple areas to expand viability of absolute EV adoption with sustained grid stability.

Advantages of using the ERR system:

i) The space required to install the ERR system already exists in distribution substations.
ii) Stable electricity can be supplied by continuously recycling resources (e.g., power line current) that are harmless to the environment.
iii) Ferraris can continue to research and develop technologies and optimize power generation efficiency through system monitoring with government officials.

CONCLUSION

In regard to the "electricity generation capacity maximization" dilemma, which we must solve in limited time, a radical change of thinking in power generation methods must be our top-priority.

Ferraris believes that we must collectively resort in finding new angles to tackle the climate-electricity dilemma: it is surely worthwhile in examining novel power generation technologies that does not impact the environment while providing sufficient electricity generation capacities, which we must not overlook. Concurrently, however, Ferraris also believes that no matter how innovative and remarkable a piece of technology may be, it is but a dime a dozen if it is not applicable nor usable.

In closing, Ferraris hopes that the US government (Federal, State, and local) will pay a particular interest towards our newly developed methods and applications of the ERR system presented in this proposal. We believe that it is the most logically and economically sound next steps for the government to be the project owner as well as the operating entity that employs our novel technologies and initiatives.

Ferraris is ready to discuss and execute this project when called upon. We sincerely appreciate all the reviewers for their time in considering our proposition.

Ferraris Power, Inc.
6671 S Las Vegas Blvd, BLDG D, STE 210, Las Vegas, NV 89119
www.ferrarispower.com