



ELECTRICAL POWER, SUPER WI-FI, NOW ACCESSIBLE ANYWHERE

APRIL 2022

INTRODUCING THE WORLD'S FIRST AND ONLY ERR SYSTEM
FOR DECENTRALIZED POWER GENERATION



Challenge, Experience our Future

We have named Ferraris Inc. in memory of Galileo Ferraris.

Ever since the commercialization of electricity, there have been an untapped byproduct in form of electromagnetic field generated by flowing currents in power lines. By harnessing the forgotten and unused electromagnetic energy through energy recycling, Ferraris has opened a new pathway for electric power generation and electric energy recycling technology for the mankind. Ferraris products was developed in a strive to harness the power from a magnetic field produced by power lines and transform it into a reliable and countable power source.

We as human race have reached the pinnacle of modern digital age with constant influx of new and improved electronic goods to improve our everyday life. In order to increase productivity and efficiency, adequate infrastructures such as Smart farms, Smart factories and Smart cities are being constructed.

To match its power consumption, solar, wind, and other renewable energy sources are being developed to meet the ever-growing electric energy demands. Even with the best efforts, the reality is that there are limitations and struggles for the renewable energy sources to meet the demands of increasing power demands. Ferraris pondered whether decentralized power generation could be delivered to better meet the ever-increasing power demands of humanity. In order to whether such technology could be developed and be applied, Ferraris ran a case study on pumped-storage hydroelectric power stations.

Ferraris extracted the Energy Recycling Reservoir concept to Pumped-storage. There are difference between ERR (Energy Recycling Reservoir) System and pumped-storage hydroelectric in their tech-methodology and operational aspects.

Challenge, Experience our Future

The basic flow of ERR System is that it harvests magnetic energy from the incoming power lines of the commercial buildings (or home) to be sent to distribution panel which store and sorts the recycled power and transmits it to building's (or home) load, which save the costs of the building's (or home) utility.

The vision of Ferraris is to mass provide ERR System at economical pricing to extend electrical energy capacity to make our vision of future come true. Ferraris wishes to provide clean energy with no environmental pollution around the world to improve and restore the environment for the benefit of current and future generations to come.

Decentralized power generation

1. What is Decentralized power generation ?

Decentralized power generation is an approach that employs multiple small-scale technologies to produce electricity close to the end users of power. Decentralized power generation technologies often consist of modular (and renewable-energy) generators, and they offer a number of potential benefits. In many cases, decentralized power generators can provide lower-cost electricity and higher power reliability and security with fewer environmental consequences than can traditionally power generators. In contrast to the use of a few large-scale generating stations located far from Load centers – the approach used in the traditional electric power paradigm – Decentralized power generation systems employ numerous, but small plants and can provide power onsite with little reliance on the distribution and transmission grid. Decentralized power generation technologies yield power in capacities that range from a fraction of a kilowatt to about 100 megawatts.

2. What are the potential benefits of Decentralized power generation systems ?

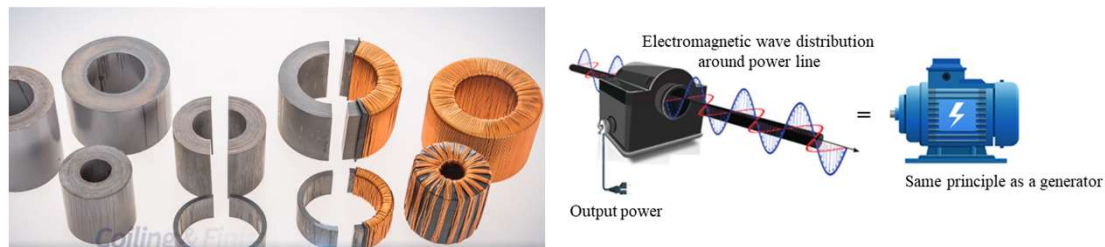
Potential power backup system feature in case of main power failure. Consumer advocates who favor decentralized power generation point out that distributed resources can improve the efficiency of providing electric power. They often highlight that transmission of electricity from a power plant to a typical user wastes of the electricity as a consequence of aging transmission equipment. Environmentalists and academics suggest that decentralized power generation technologies can provide ancillary benefits to society. Large, centralized power plants emit significant amounts of carbon monoxide, sulfur oxides, particulate matter, hydrocarbons, and nitrogen oxides. The US Environmental Protection Agency has long noted the correlation between high levels of sulfur oxide emissions and the creation of acid rain.

Introducing Technology

By harnessing an innovative contactless and magnetic harvesting technology, Ferraris' products enable the conversion of electromagnetic field energy produced by power lines – regardless of the power line voltage – into an electric power source. Our Power supply solution (Tolenoid C® and PH4IoTs) can be used anywhere with nearby power lines to supply electricity for your IoT equipment (CCTV, Super Wi-Fi, access point, and sensors) – even in the absence of transformers or outlets.

The PH4IoTs (Power harvesting for IoT sensor devices) product was designed and developed so that customers may directly connect to an IoT sensor device with DC output; the built-in battery can be charged with the electricity generated internally from the PH4IoTs, so that customers may conveniently supply power to their IoT sensor devices. The PH4IoTs not need to replace the battery. The PH4IoTs.w can remotely monitor the magnetic harvesting power and measure the battery capacity via Wi-Fi transmission.

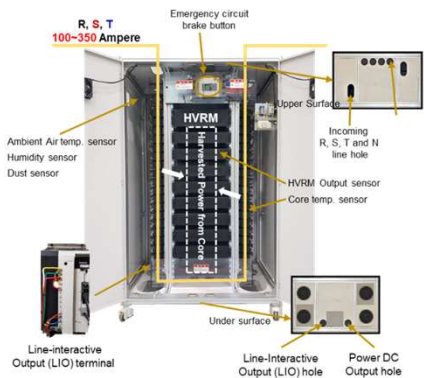
Our products are not current transformers but power transformers which convert magnetic energy into electric energy when near power lines, regardless of the power line voltage. Our PT is operating not only at linear region, but also at saturation region. Our products its safety standards certificated, such as UL, SEC, and KS and waterproof design (IP65–IP68). To better understand our technology, please see the video description. <https://youtu.be/Y3IR5djt5hg>



Ferraris providing a revolutionary paradigm of efficient electric power generation by the ERR System. We proudly introduce world's first and only ERR System created by Ferraris. **The ERR System is decentralized power generator.**

ERR System (Power Added Solution) is designed to be multiple contactless core (Linear power scalability technology) attached to incoming power lines to harness induced electric energy from magnetic energy variation produced from power lines. The harnessed electrical energy then can be stored in the battery to be used when needed or real-time distributed to the load, which means magnetic energy harvesting and using power for load are happened at the same time.

When the ERR System supplying power to low-power factor loads, ERR System can reduce the reactive power (Kvarh) through power factor improvement method. Through experimentation and trial runs using power line current, electrical usage pattern analysis, field environment analysis, application of ERR System has proven its stability in its installation and operation.



Core/HVRM System & LIO power (High Voltage Regulator Module)



Power Control Subsystem



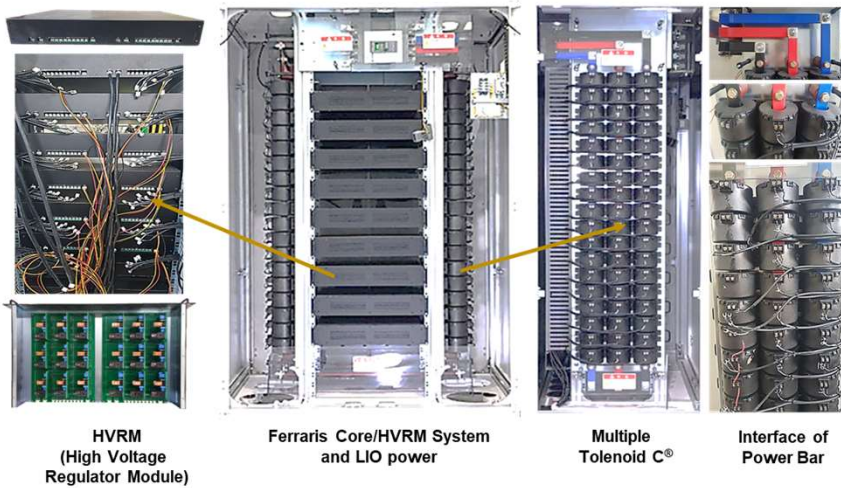
Battery and BMS Subsystem



Remote monitoring power & Control system for Multi-site



The ERR System is normally installed using contactless method on three-phase four-wire power lines (R,S,T, and N). ERR System can be cascade (serially) and/or Parallel connected and is highly scalable with decentralized installation. This scalable feature enables customer decide electric power capacity of ERR System depending on the environment and customer requirement easily.



The ERR System uses high density of vehicle battery or Li-Ion battery system. The stored energy inside battery system can be retrieved by PCS (Power Control System) into the building load. PCS can do normal DC to AC conversion progress and other features which are already included in normal UPS System.

Under assumption that ERR System is installed in 100, 200 or 1,000 different buildings, sudden power outages or shortages arising from emergency situations, the ERR System can be used to provide steady electrical energy to power the building's load.

This could potentially be used to save lives by providing alternative to medical facility's backup generators as the network of buildings (**Inter-Building Power Energy Network**) using ERR System can support such facilities in the direst circumstances.

This is a simple example of ERR System's future use, and Ferraris envisions further application of its ERR System beyond interBuilding power energy network to an **Inter-City Power Energy Network** where City-to-City power energy share where a stable emergency power can be provided to the most critical electric infrastructures such as hospitals in state of emergency. Ferraris have developed ERR System with remote monitoring power and control systems that can simultaneously operate on more 1,000 different sites.

For example, the high power lines, such as commercial building, server operating company, EV charging station (level 3 charging), markets (Whole foods market, Costco, VONS, Ralphs etc.), cold storage, frozen foods storage, factories, solar farm, wind farm and more potential customers can be easily used to harness the magnetic energy constantly from their existing power distribution lines without upgrading power source.

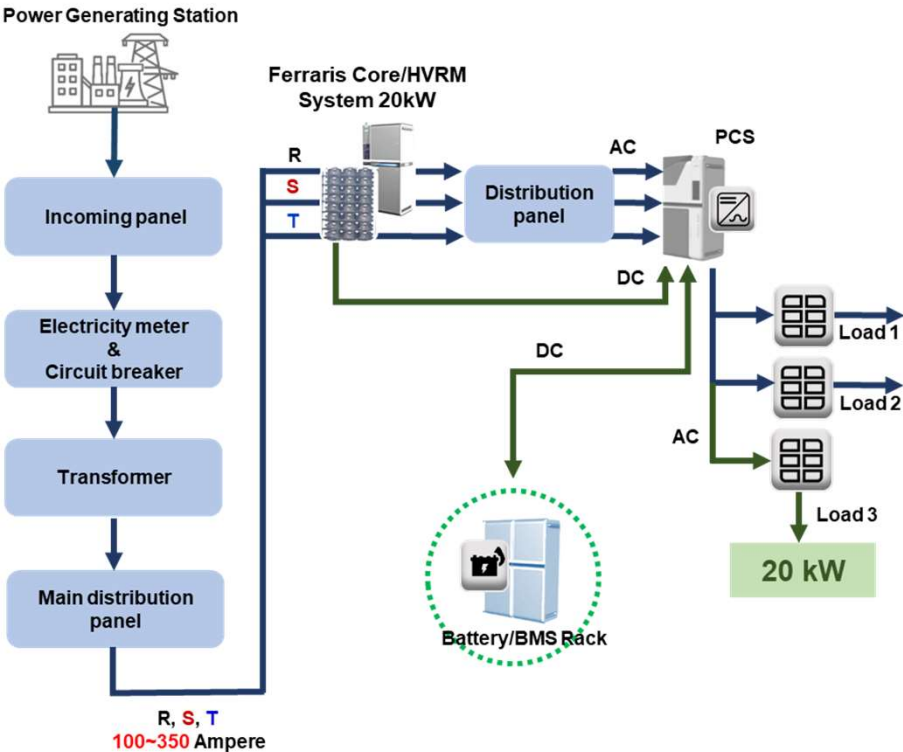
Therefore through ERR System, customers can vastly improve electric energy usage efficiency, such as reducing reactive power and improving power factor and so on, ultimately reducing costs from power consumptions over the long run.

Estimated electricity production by ERR System

Case	Configuration of ERR System	R, S, T line current (Ampere)	Using R, S, T line	Using Core/HVRM System (20kWh)	Total Power supply
1	Cascade	100~350	1 line	1	20 kWh
2	Cascade	100~350	1 line	3	60 kWh
3	Cascade	100~350	4 line split	12	240 kWh
4	Parallel	200~600	2 line split	2	40 kWh
5	Parallel & Cascade	200~600	2 line split	6	120 kWh
6	Parallel & Cascade	200~600	8 line split	24	480 kWh

Configuration of ERR System

Case 1 - Basic Configuration (20kW x 1 load)



Configuration guide

ERR System is designed to be installed and run on incoming power line with current range between 100 to 350 ampere. If the Incoming power line's current range lies between 200 to 600 ampere (or more ampere), ERR System can split & merge R, S, T, and N lines and can be installed and operated in parallel & cascade configuration as shown through Case 5 to 7. The productivity efficiency of ERR System will increase in correlation to the higher line current.

As default power lines are configured in commercial buildings with four sets of R, S, T and N lines with one extra set as a backup. By employing case 4 and 7 where the configuration uses four sets of R, S, T and N lines, power productivity efficiency will increase by 4 times. Core/HVRM system generates electrical energy from the magnetic harvesting modules on R, S, T lines, and also act as a power supplier to the load through PCS.

Battery/BMS is the buffering system for balancing between incoming and outgoing power at PCS point, that is load requirement. If the power generated through Core/HVRM system is required to be used by the load 24 hours non-stop, the minimum quantity of deep cycle battery may be installed for the Battery/BMS. The Green circle (by referencing case 1 to 3) means that Battery/BMS install (small to large scale option) is possible according to the power usage of the load. Battery/BMS, line-interactive power capacity is determined by the power usage of the load which connects to the Core/HVRM system.

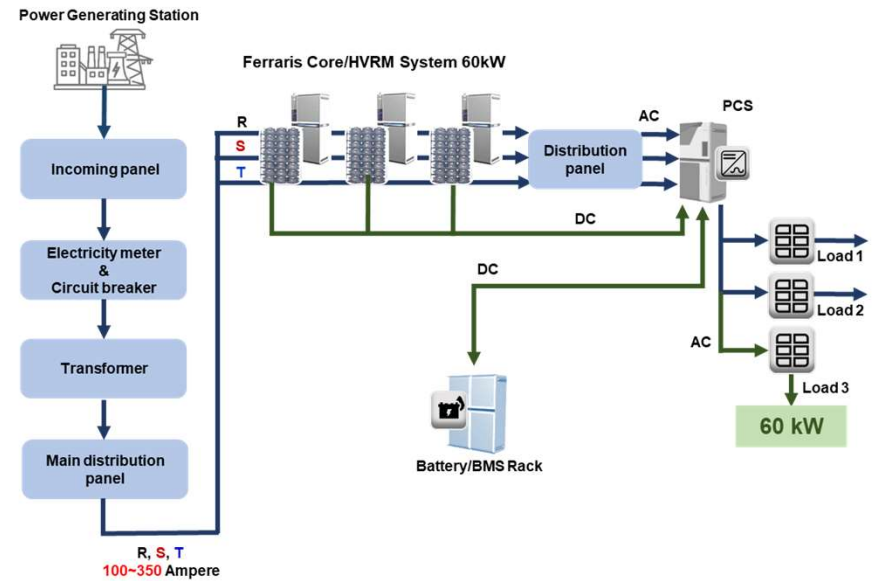
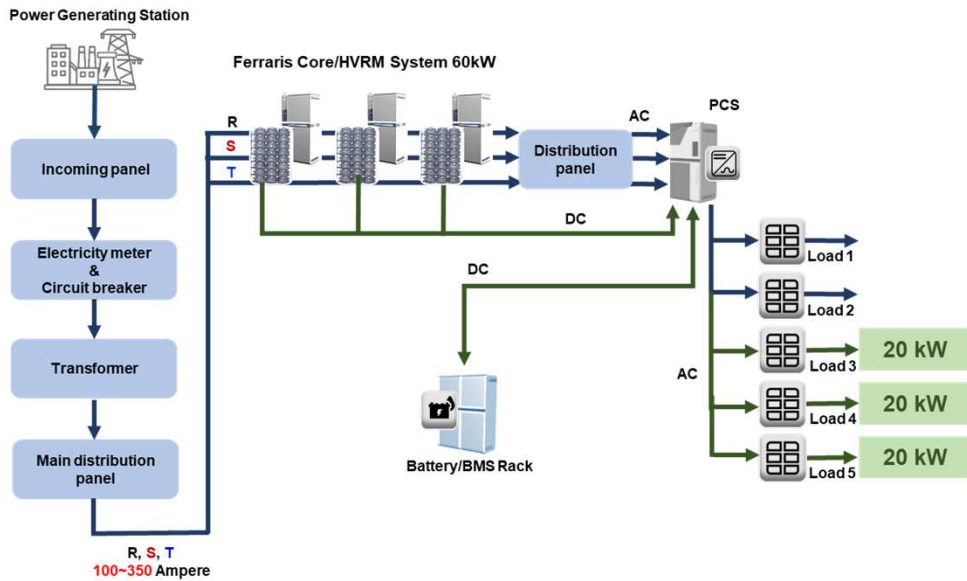
The line interactive power module monitors power usage of the load in real time to redirects the load's unused (or underused) power generated by Core/HVRM system to other loads connected to the distribution panel, resulting in further increase in power efficiency and reduce cost.

Normally PCS line input circuit is going to compensate potential voltage variation compared to normal (in this case 380Vac) due to Core/HVRM system at R, S, T and N lines.

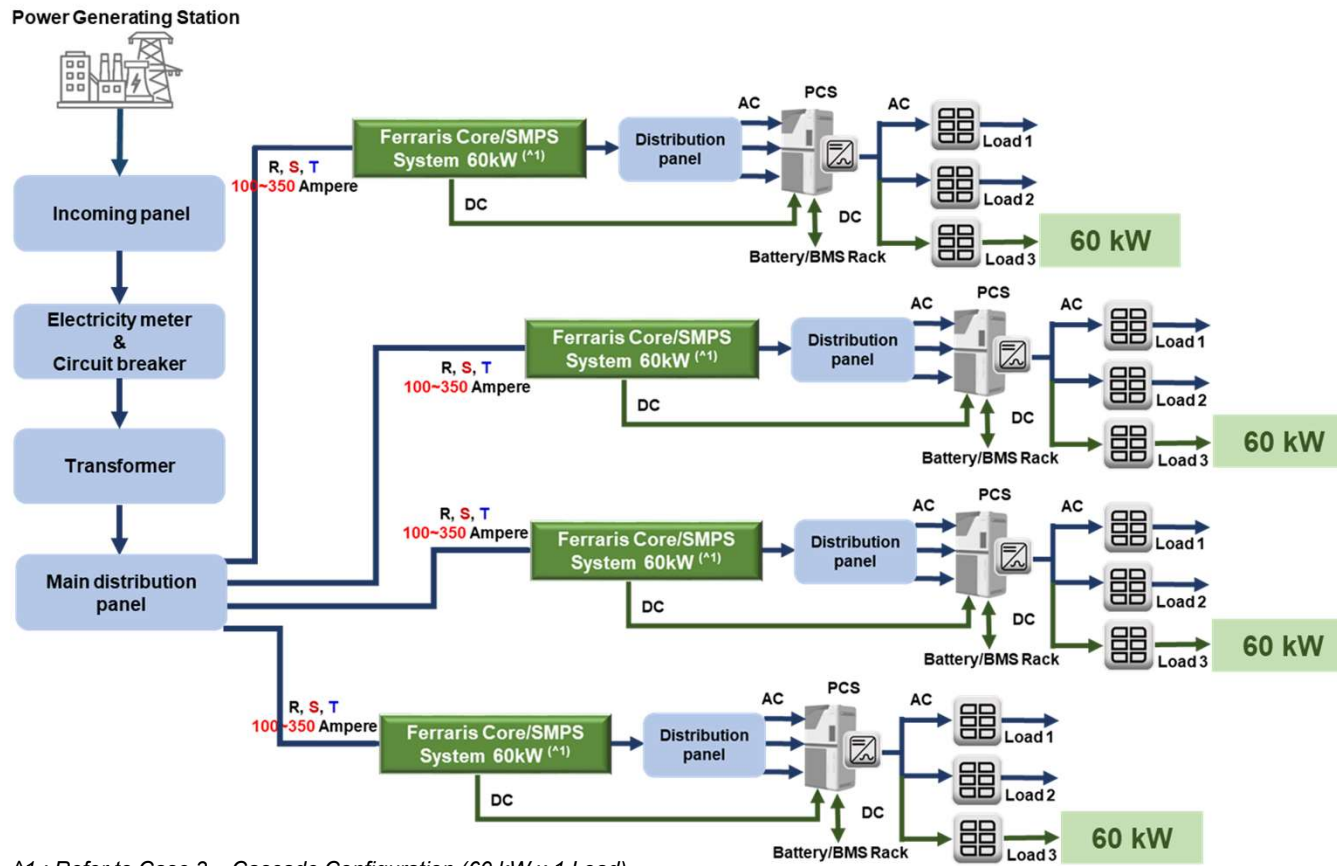
Appendix I. Configuration of ERR System

▪ Case 2 - Cascade (20kW x 3 Load)

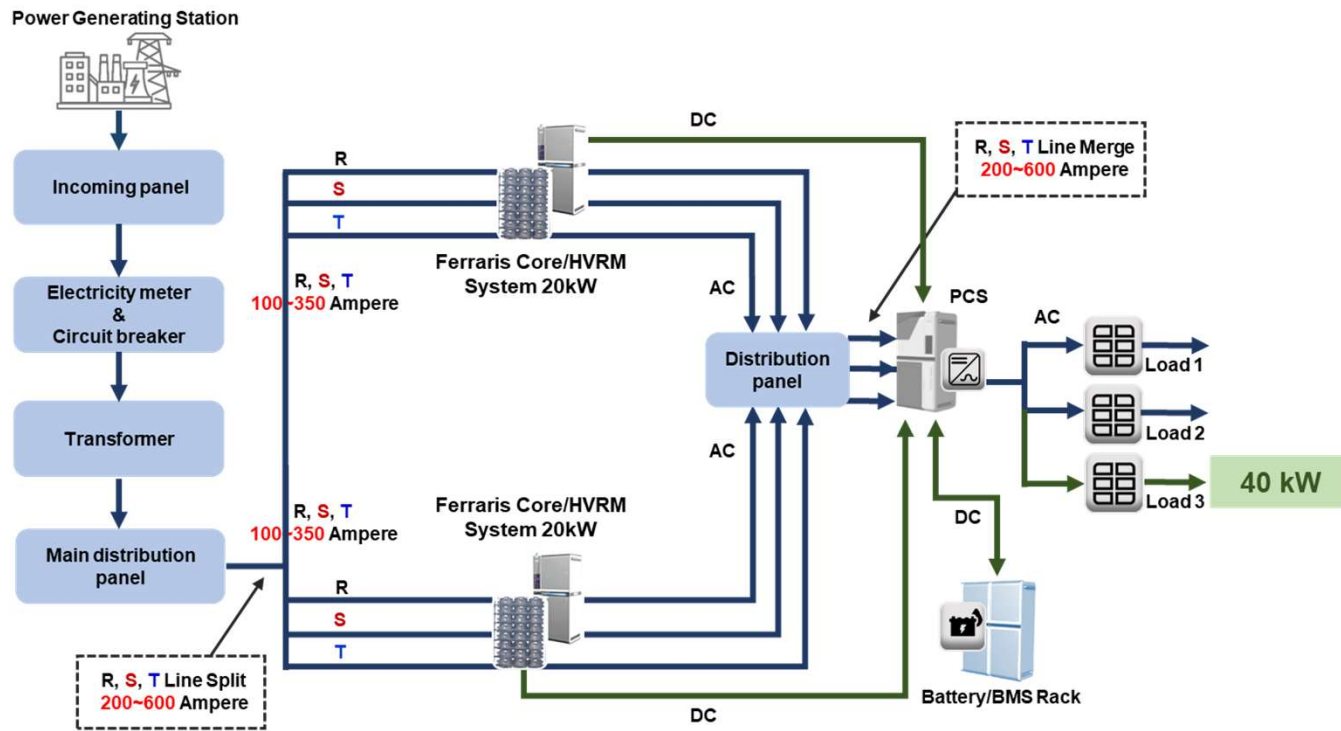
▪ Case 3 - Cascade (60kW x 1 Load)



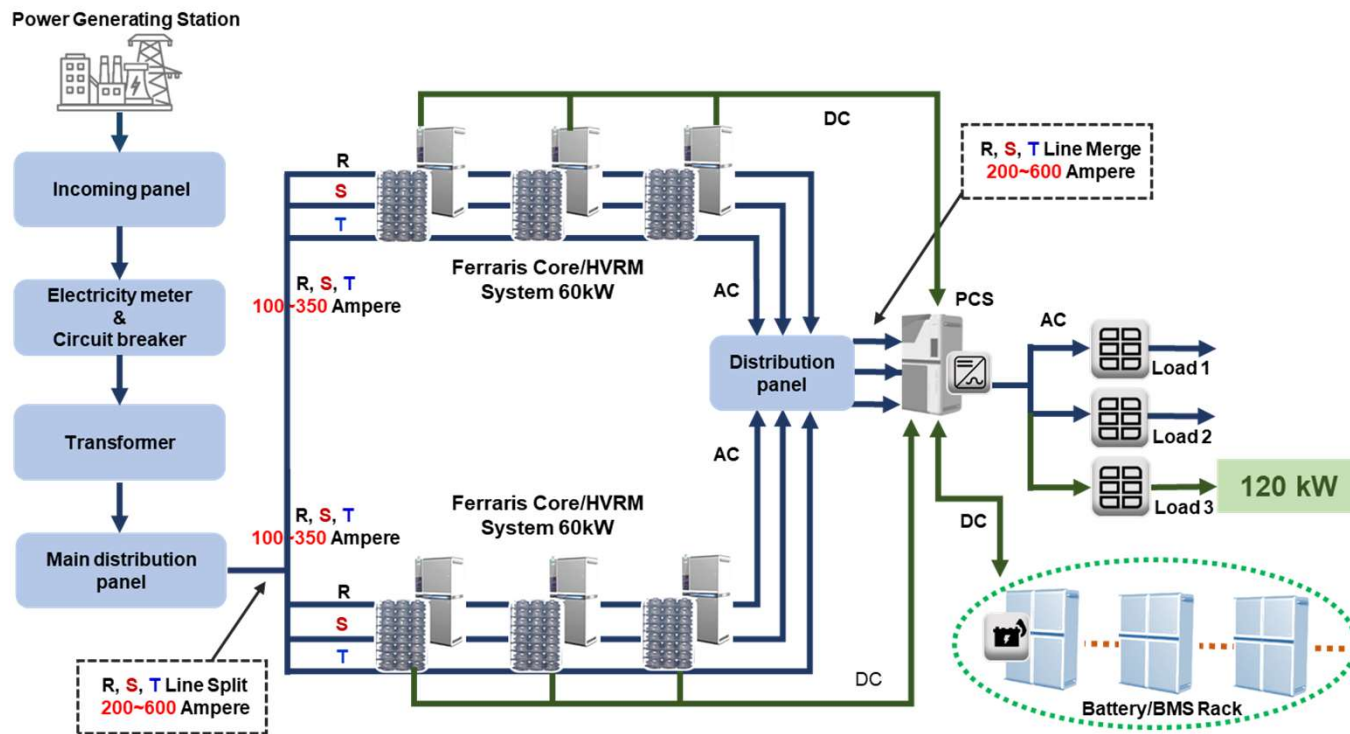
▪ Case 4 - Cascade (60kW x 4 Load)



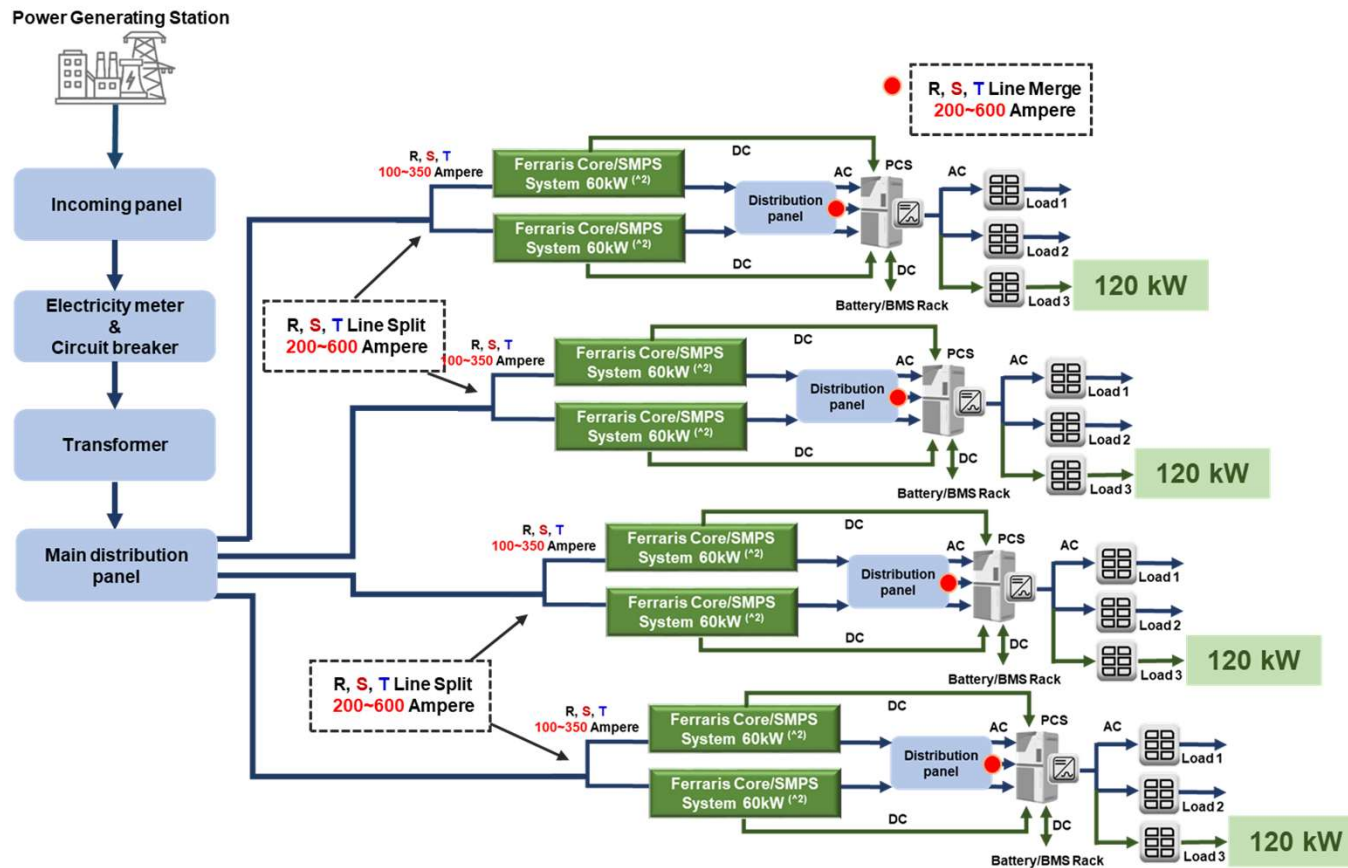
▪ Case 5 - Parallel (40kW x 1 Load)



▪ Case 6 - Parallel & Cascade (120kW x 1 Load)



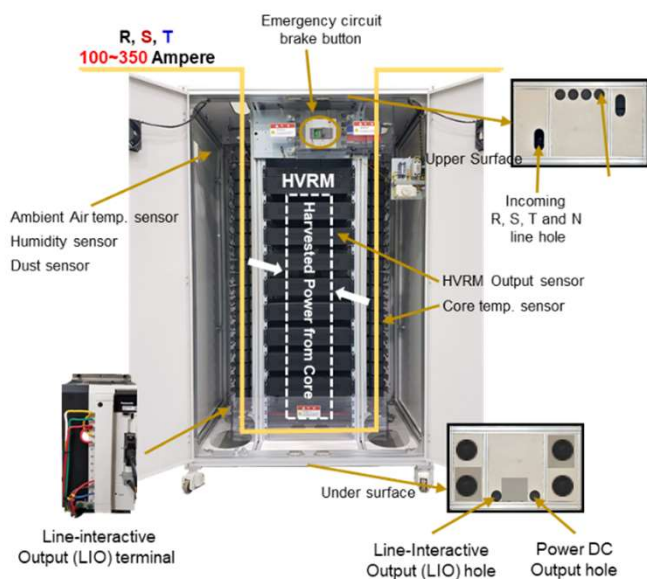
▪ Case 7 - Parallel & Cascade (120kW x 4 Load)



^{^2} : Refer to Case 6 – Parallel & Cascade Configuration (120 kW x 1 Load)

Appendix II. Spec Sheets of ERR System

■ Core/HVRM (High Voltage Regulator Module) system



Basic Operation

- Core/HVRM system is doing Magnetic Energy Harvesting Function from R, S, T, and N power lines.
- R, S, T, and N power lines are passing thru inside hole of Core (normally more than 100 to 200 cores).
- Collected power by Cores is sent to HVRM (High Voltage Regulator Module) and leveled for the Battery/BMS interface.
- HVRM output is sent to Battery/BMS as a DC power format.
- LIO (line-interactive Output) power is the redundant output power in case harvested power is more than that of required output power. This extra power can be connected to other distribution panel to supply extra power.

Basic Features

- Emergency Shutoff Function. (R, S, T, and N power line bypass)
- Core Shutoff Function. In case of Core malfunction, Core output is shutoff to protect other subsystem.
- In case of Malfunction of HVRM, connected Cores are shutoff to prevent harvesting function.
- Real-time checking Ambient condition.(Temperature, Humidity, Dust) inside Rack. In case of abnormal condition Emergency Shutoff Function (bypass) will be acting.
- For each harvested output by HVRM are monitored in real-time and these status data are sent to the host monitoring system via RS-232 or I2C.
- This system can be cascaded by connecting R, S, T, and N power line to the next input R,S,T, and N power lines.

Primary R, S, T, and N power line electrical specification

Voltage range	380 ~ 420 Vac
Current range	100 ~ 350 A

Harvested power electrical specification

Voltage range	380 ~ 420 Vdc
Current range	13A ~ 53A
Output power	5kW ~ 22.5kW

Line-interactive Output electrical specification

Voltage range	380 ~ 420 Vac
Current range	4 ~ 5 A (2kW)

Ambient operating specification

Temperature range	- 4 ~ 167°F	
Humidity range	30 ~ 80 %	
Cooling function	Type A	Type B
	21 Watt	46 Watt

Physical Specification

Dimension (W*L*H)	48 * 30 * 75 (inches)
Weight	640 ~ 772 (lb)
Material	AL
Primary line terminal size	0.43 * 1.38 (inches)
Primary line cable thickness	Ø95 ~ Ø450

▪ PCS (Power Control System) Subsystem



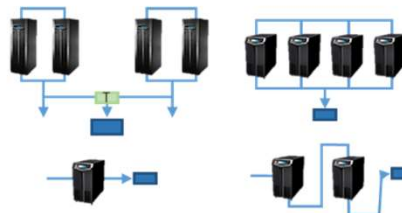
PCS Modules are stackable.



Basic Operation

- PCS deliver the powers either from the Battery/BMS or Core/HVRM System to the load.
- In case of Emergency, outside normal AC power line can be supported to the Load in real-time.
- **PCS capacity ranges from 20kW and increased up to 120kW by six stacking 20kW module and up to two 120kW module can be connected in parallel (240kW) depending on their configuration.**
- Support Remote monitoring and control feature for easy maintenance.

Several different kind of configuration of PCS



Plug & Play Module Maintenance



Reduce maintenance time

Basic Features

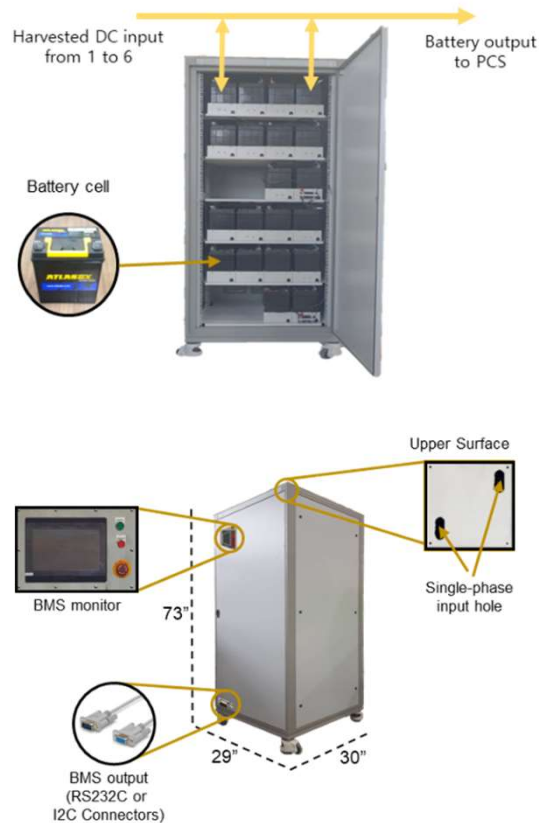
- Support Input bypass breaker for emergency situation.
- **Wide range of input Voltage (208Vac ~ 477Vac) and frequency range (45Hz ~ 65Hz).**
- **N+X Redundancy feature from 20kW module base to unit base, system reliability is increased dramatically.**
- **In multi-module or unit configuration, output power are self synchronizing itself.**
- The PCS monitor consists of buttons with functions such as data settings, menu movements, warning when errors occur, and system settings for different configuration.
- With remote access power based on RS232 and I2C interface protocols, remote monitoring and control are possible.

Input / Output electrical specification	
Typical Input voltage	380 ~ 420 Vdc + N + PE
Input current	Max. 52 A per Module
Backup input power	380/400/415 Vac + N + PE
Output capacity	20kW per Module
Output voltage range	380/400/415 Vac + N + PE
Output frequency	50/60 Hz ± 0.1 %
Output rate of change (Slew Rate)	1 Hz / Sec

Ambient operating specification	
Temperature range	32 ~ 167°F
Humidity range	30 ~ 95 %
Cooling function	Air-cooled (Multi-FAN with adjustable speed depending on load)

Physical specification	
Dimension (W*L*H)	45 * 18 * 74 (inches)
PCS terminal size	0.22 * 0.4 (inches)
Material	AL

■ Battery Subsystem with Battery Management System



Basic Operation

- This system is storing magnetic energy into Battery rack for the buffering and pass them into PCS.
- Battery cell composed of 11 battery has one more extra battery for the redundancy feature (Urgent replacement, Plug in Play).
- It has its own BMS including several types of sensors together and it BMS detects malfunction of certain battery, then automatically that battery will be replaced with redundancy one and send emergency signal to the host monitoring and control system.
- This system can accept up to 6 input from Ferraris Core/HVRM systems depending on the configuration.
- Two battery subsystem Outputs can be connected in parallel (Doubling battery capacity) for future backup.
- Harvested input can pass thru to PCS directly when it is needed. Pseudo battery operation of magnetic Core.
- Excellent local communication features with BMS monitors..

Basic Features

- Emergency shutoff function support (Bypass input to output without battery).
- Support Urgent swap from battery to cell level for minimum MTTR and easy maintenance.
- With extended capacity of battery, Emergency backup power supply configuration is possible with proper PCS features together.
- With BMS monitoring system, customer can monitor all of internal battery's operation in real-time thru BMS output line.
- Has Internal ambient temp. sensor, humidity sensors.

Input / Output electrical specification

Input voltage range	380 ~ 420 Vdc
Output voltage range	380 ~ 420 Vdc

Battery specification

Battery type (Deep cycle)	Lead-Acid Battery
	24Vdc 40AH
Amount of battery per cell	11 EA +1EA (Redundancy)
Capacity of battery per cell	10 kW
Usage by capacity	Depend on power usage 10kW ~ 2kW
Extensibility	Basic 10kW, expandable up to 6 racks (20kW x 6 ea = 120kW)

Input / Output line specification

Input/output method	Single-phase
Input channel quantity	Max 6 channel
Output channel quantity	1 Channel

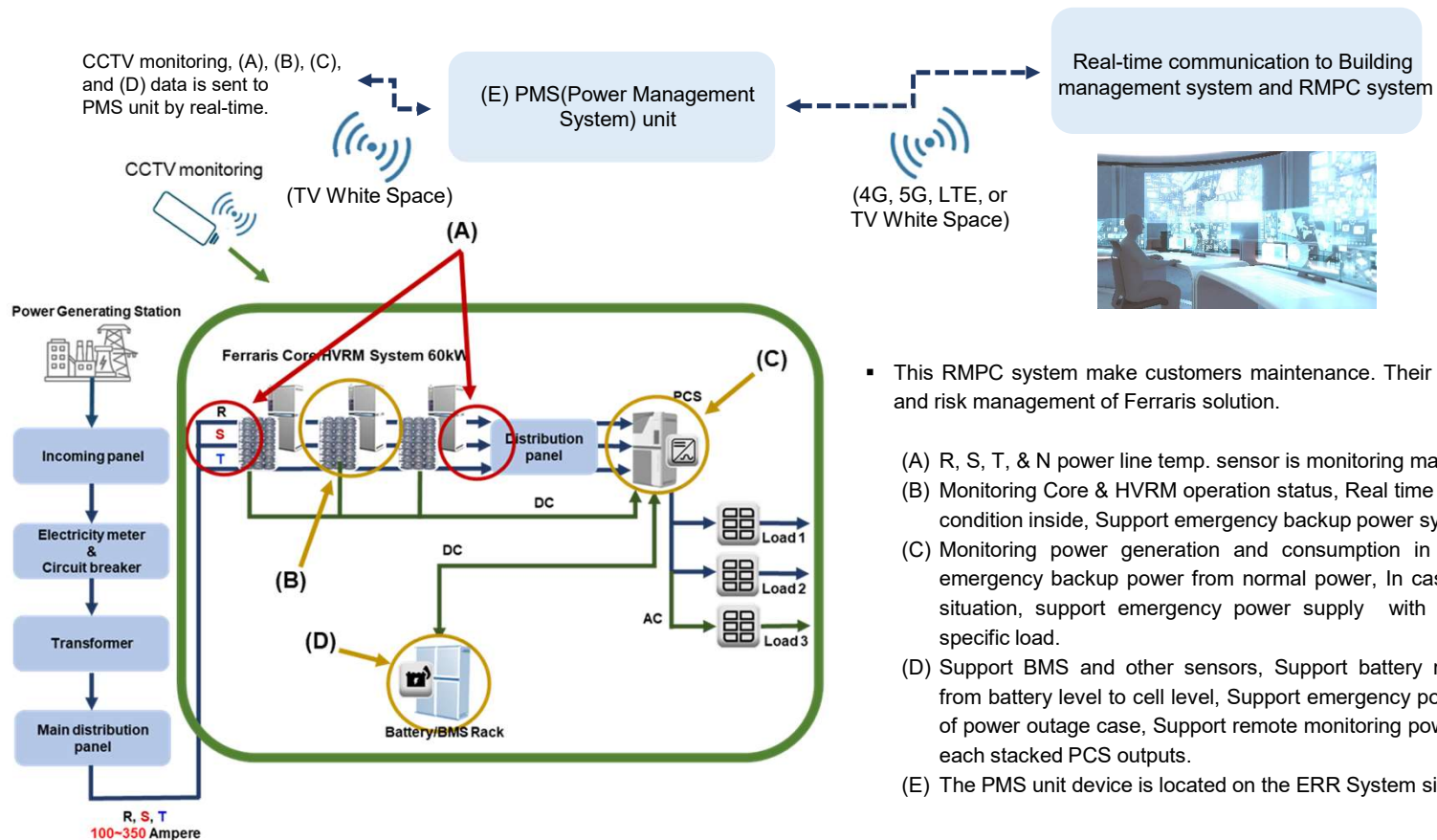
Ambient operating specification

Temperature range	- 4 ~ 167°F
Humidity range	30 ~ 80 %

Physical specification

Dimension (W*L*H)	Basic rack : 29*30*73 (inches)
	Customized
Weight	Customized
Material	AL

▪ RMPC (Remote Monitoring Power and Control) system for Multi-site



- This RMPC system make customers maintenance. Their multi-site operation and risk management of Ferraris solution.

- (A) R, S, T, & N power line temp. sensor is monitoring main power line status.
- (B) Monitoring Core & HVRM operation status, Real time monitoring ambient condition inside, Support emergency backup power system.
- (C) Monitoring power generation and consumption in real-time, Support emergency backup power from normal power, In case of power outage situation, support emergency power supply with battery system for specific load.
- (D) Support BMS and other sensors, Support battery redundancy feature from battery level to cell level, Support emergency power source in case of power outage case, Support remote monitoring power generation from each stacked PCS outputs.
- (E) The PMS unit device is located on the ERR System site.

Appendix III. Operating result of β Test and reference

ERR System 3kW β Test at KOMIPO (Korea Midland Power Co., Ltd.), ERR System installed at small Hydro power plant on August, 2016

▪ **The purpose of test**

1. ERR System would run stable safely with primary power line in any aspect.
2. Any power quality changes on primary power line when ERR System is tested.
3. Test possibility of ERR System as power generation at 3.3 kV primary power line environment.



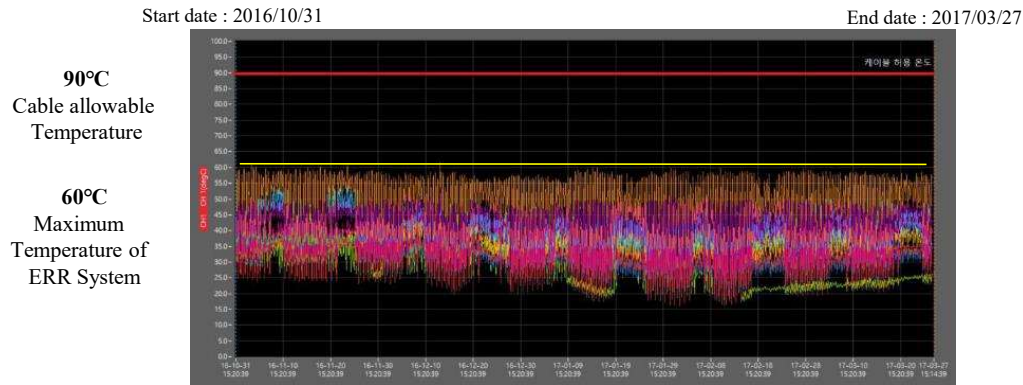
Method	Source	Capacity	Total power generation (MW)
Steam Power Plant	Bituminous coal	# 1 ~ 8 500 MW × 8ea	4,000
Combined Cycle Power Plant	LNG	#1 G/T : 150 MW × 2ea S/T : 150 MW × 1ea	1,350
		#2 G/T : 150 MW × 2ea S/T : 150 MW × 1ea	
		#3 G/T : 150 MW × 2ea S/T : 150 MW × 1ea	
Renewable Energy	Small Hydro Power Plant	1.25MW × 6ea * β Test field	7.5
	Solar Farm	0.53 MW × 1ea 0.05 MW × 1ea	0.5712
	Fuel Battery	0.3 MW × 1ea	0.3
Total Capacity		5,358.3712MW	

Test Result Summary from 1st ~ 3rd Report

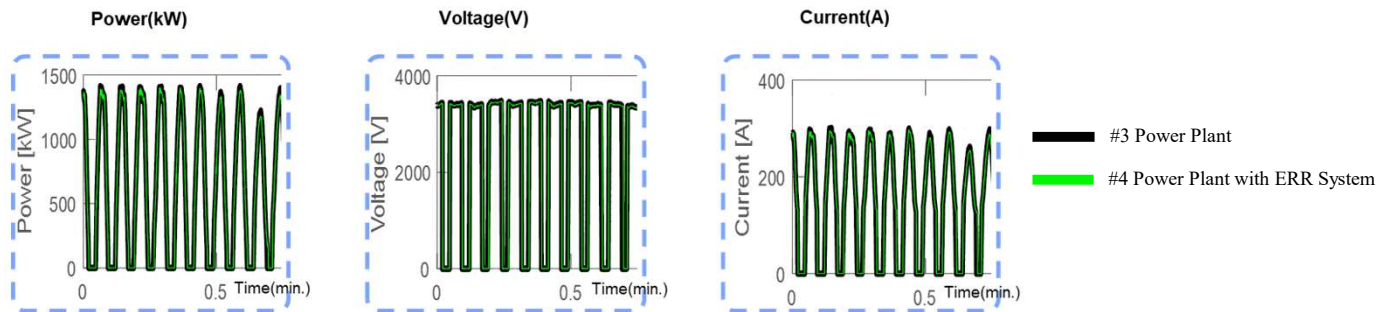
1. ERR System 3kW doesn't effect to primary power line in terms of heat problem by ERR System.
2. No impact to Primary power line by power line voltage and current distribution.
3. Power quality is Normal, No distortion on wave of active power, Inactive power, power factor and apparent electric power.
4. No impact to power plant performance.
5. Measured Max. 2.7kW of power from magnetic Field of primary power line at 24 months normal power plant environment.
6. The Ferraris linear power scalability technology has been proved to be perfect.

Check point		Test results	Test method
Primary power line temperature		Max. 60°C / Under cable allowable temperature (90°C)	Temperature sensor
Impact of ERR System on power plant performance	Power generation(W)	Max. -1%~5% deviation	DEWETRON data comparison between Small hydro power plant #3 and Small hydro power plant #4
	Voltage (V)	Max. 9V (0.24%) drop	
	Current (A)	Max. -1% ~ 5% deviation	
Impact of ERR System on power quality		Power factor 0.8/Normal range	
Power generation from magnetic energy harvesting		Max. 2.7kW(DC 100V, 27A)	

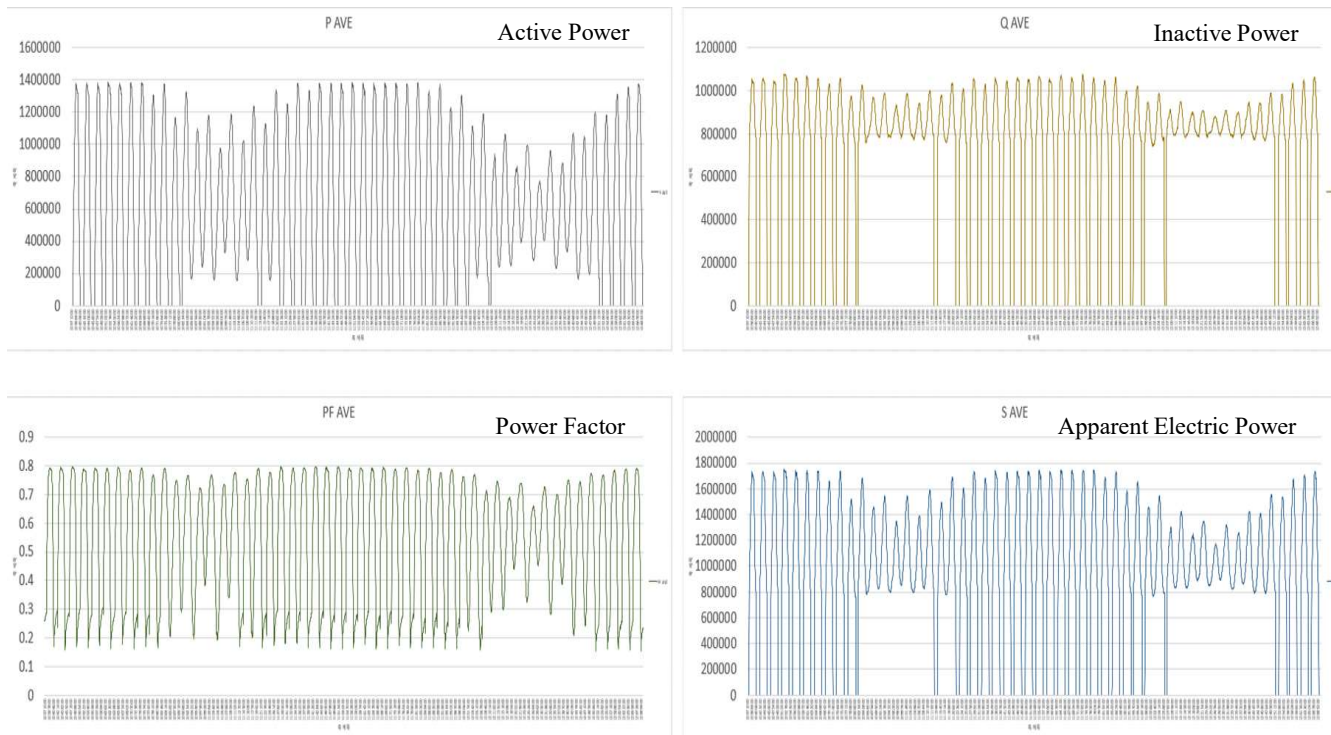
- Primary power line temperature test results : No impact to primary power line by ERR System



- Impact of ERR System on Power plant performance : No impact to power plant performance



- Impact of ERR System on power quality : Power quality is normal, No distortion on wave of active power, Inactive power, power factor and apparent electric power



- Power generation from ERR System :

(Primary)

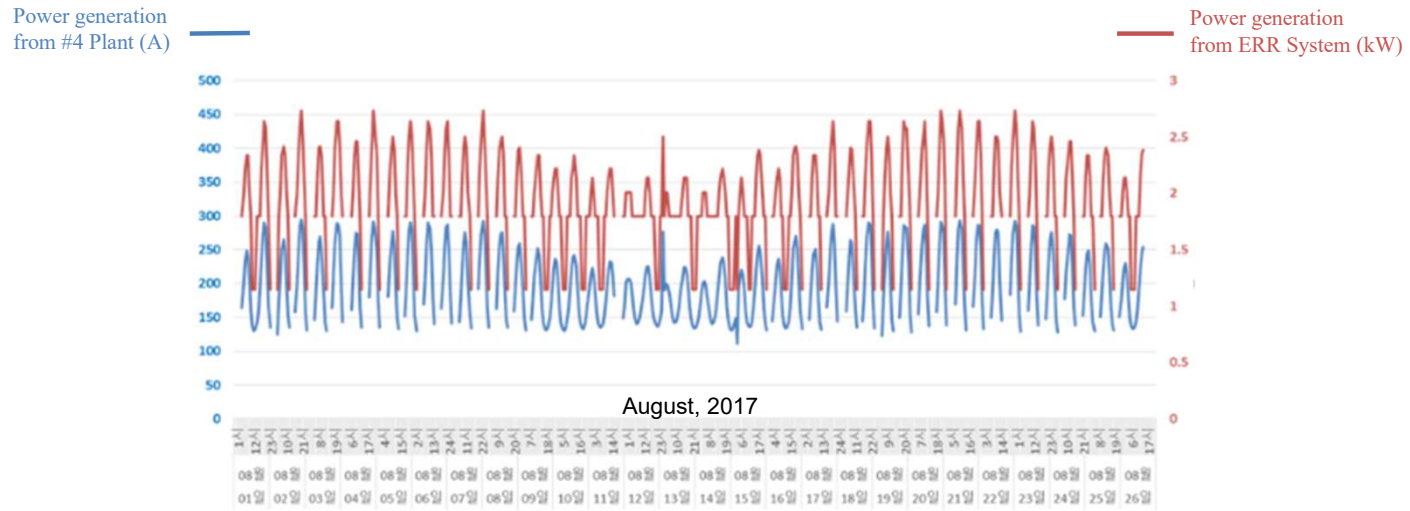
Power generation from #4 Plant

- Voltage : 3.3 kV
- Current : 130A ~ 270A

(Secondary)

Power generation from ERR System

- Voltage : DC 65V ~ 100V
- Current : 17A ~ 26A
- Power generation : 1.1kW ~ 2.7kW





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