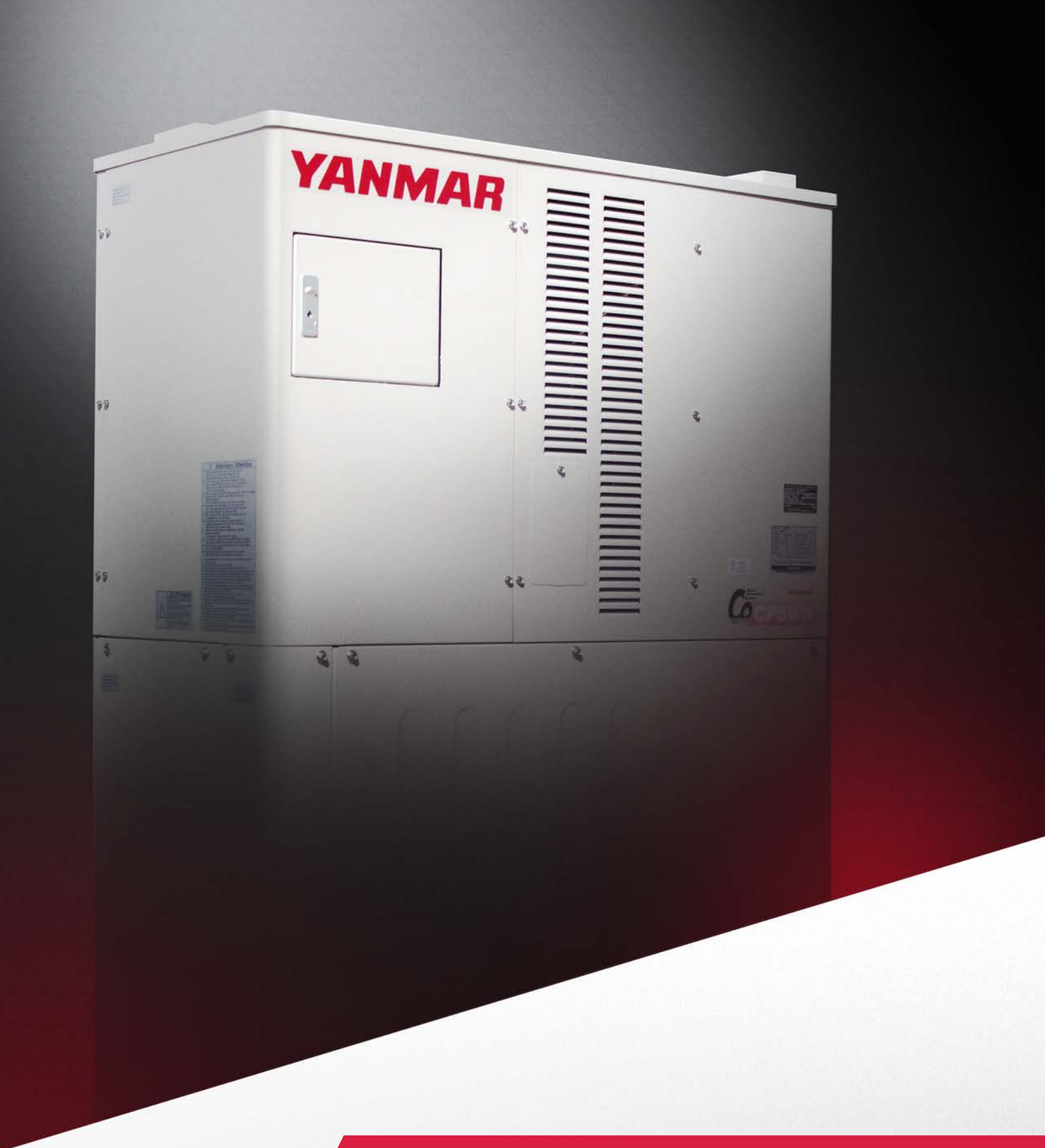


Combined Heat & Power

www.yanmar-es.com

Who is YANMAR?

We strive to provide sustainable solutions for needs which are essential to human life. We focus on the challenges our customers face in food production and harnessing power, thereby enriching people's lives for all our tomorrows.

1912 Founded under its original name, Yamaoka Hatsudoki Kosakusho

1933 Launched the world's first commercially viable small diesel engine

1968 Awarded the Deming Prize for outstanding merit in statistical quality control

1984 Operation of three cogeneration system units started at the Antarctica based Showa Station

1987 VRF launched in Japan

1992 10 millionth diesel engine produced

1992 YANMAR VRF Division established, meeting the need for energy efficient and environmentally friendly VRF products

1997 Land Generator Division established at YANMAR Co.

1998 9.8kW CHP unit produced, launching the CHP business

2000 VRF division and Land Generator Division combined, creating the "Energy System Division" at YANMAR Co.

2000 VRF and CHP products introduced into overseas markets

2002 22kW and 5kW CHP units launched in Japan

2003 Sales for CHP reach 1,000 units

2003 YANMAR Energy System Co., Ltd. founded

2005 25kW CHP unit launched in Japan

2007 Unit sales for VRF reach 200,000

2007 25kW CHP for Biogas launched in Japan

2010 First US model of 10kW CHP unit (Natural Gas) launched

2010 First 25kW CHP unit installed in Canada

2011 Unit sales for CHP reach 5,000

2011 US model of 10kW CHP unit (Propane Gas) launched

2012 US model of 5kW CHP (Natural Gas and Propane Gas) launched

2013 Unit sales for VRF worldwide reach 250,000

2014 First 35kW CHP unit installed in Canada

2015 First VRF units installed in U.S. and Canada.

YANMAR Energy Systems

YANMAR Energy System Co., Ltd.
Corporate Profile
Founded: March 2003
President: Naoya Umegaki
Headquarters: Osaka, Japan
Manufacturing Facility: Okayama, Japan
Energy System Employees: 1,000
Business Activities: Development, production, sales, installation and maintenance of company products.

Energy System Products

Combined Heat and Power Systems: Distributed generation CHP systems deliver high onsite efficiency. They are able to generate the right amount of power at the right time, making them much more efficient than the electrical grid. YANMAR CHP units also produce less carbon dioxide, nitric oxide and nitrogen dioxide emissions than typical grid power generation plants.

Variable Refrigerant Flow Systems: Switching from electric driven systems to YANMAR's high efficiency natural gas-powered Variable Refrigerant Flow (VRF) systems reduces electrical load by approximately 90%. These units effectively lower peak demand for electrical power during the summer air conditioning season.

Power Generation Systems: YANMAR's power generation systems maintain the supply of electricity during grid power failures, ensuring that emergency equipment and mission critical systems and hardware continue to operate.

Drive Systems: YANMAR Pump Drive Systems are used in storage and drainage pump facilities, as well as irrigation applications in large and small scale waterworks systems.

Photovoltaic Systems: YANMAR works collaboratively to integrate highly efficient CHP, VRF and emergency power generation products combined together with solar products to provide higher efficiency total energy systems.

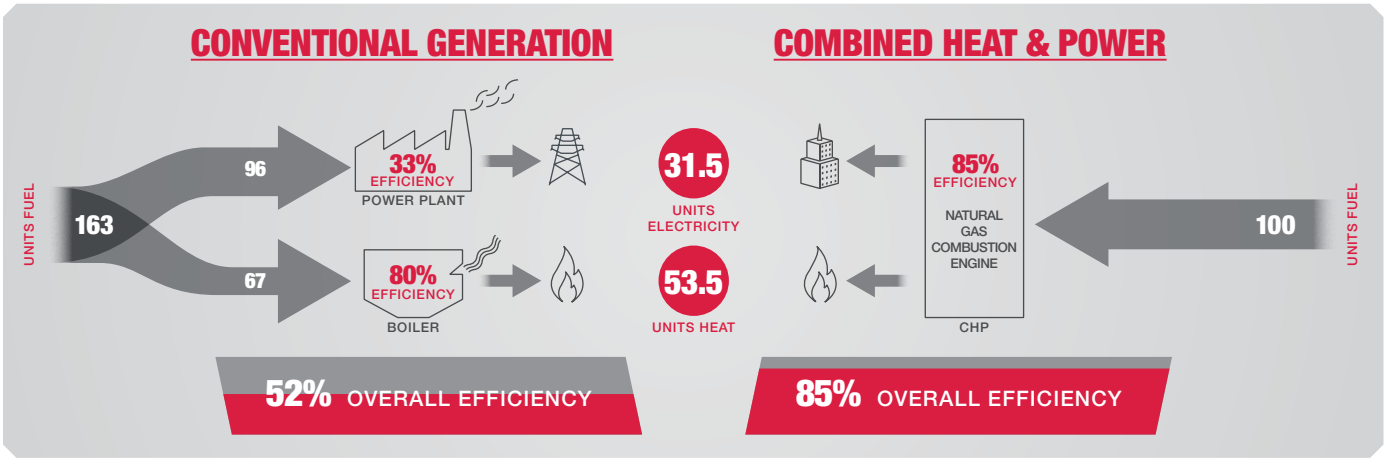
Remote Monitoring Systems: YANMAR enhances the precision and reliability of maintenance support services through the integration of YANMAR's Remote Monitoring System and certified dealer network.

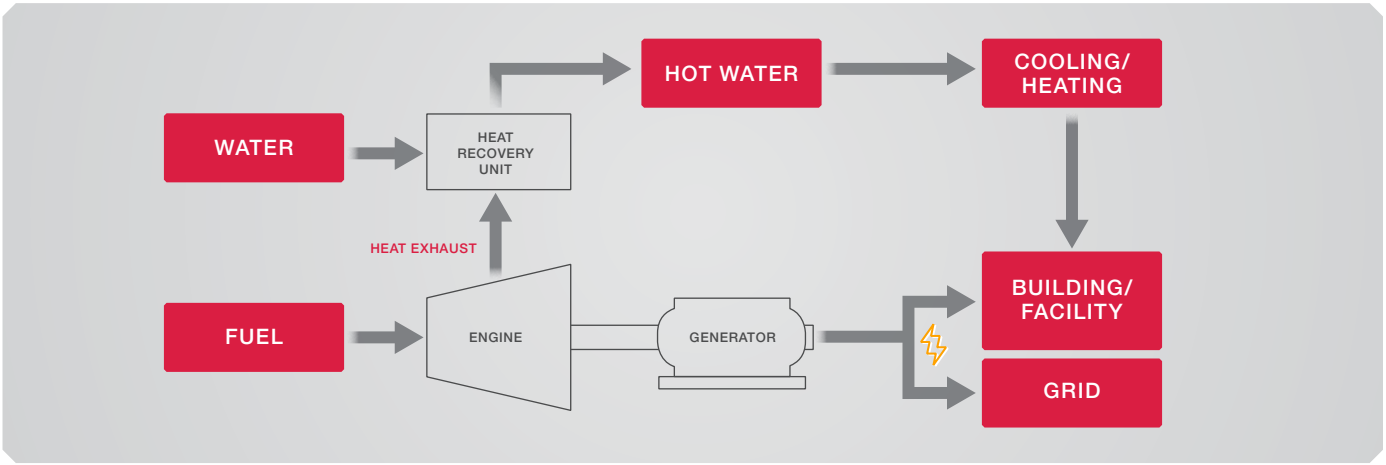
What is CHP?

CHP, an abbreviation for Combined Heat and Power also called "Cogeneration," is the use of a single fuel source such as Natural Gas or Propane to simultaneously generate electricity and useful heat close to the point of use.

CHP has the following advantages over traditional energy delivery methods of centralized power plants and onsite gas use:

- **Onsite generation (or distributed generation)**: Electricity is generated close to the point of use, helping to avoid transmission and distribution losses that occur when electricity travels over power lines. Electricity can also be available even when the grid has failed due to storms or other factors.
- **Waste heat recovery**: Thermal energy from space heating, domestic hot water heating, pool/spa heating dehumidification or process applications goes unused in centralized power plants as waste, but in a CHP application, it is used to offset boiler or other heating device usage.
- **Simple integration**: CHP can be easily integrated into various electrical and thermal systems in residential or small commercial applications. This applies to both new construction and retrofitting into existing homes or buildings.





CHP Applications

Restaurants

- Lowered utility costs
- Consistent hot water supply for cleaning and cooking
- Scheduled operation
- Blackout start keeps refrigerators and freezers from shutting down during power outages

Hotels

- Lowered utility costs, especially during peak hours
- Supports domestic hot water requirements at a lower cost, including heated pools, hot tubs and laundry facilities
- Lower greenhouse gas emissions

Office Buildings

- Scheduled operation
- A reliable energy source that can operate when the grid goes down
- Supplies domestic hot water at a lower cost

Multi-Unit Housing

- Can be sized to support an entire building or just common areas
- Lowered utility costs, especially during peak hours
- Perfect fit for domestic hot water uses including pool heating and laundry facilities
- Increased building value

Schools & Educational Settings

- Lowered utility costs through grid independent operation
- Can be sized to support an entire building or just common areas
- Reduced heating costs for domestic hot water use, including large pools
- Blackout start keeps the power on during outages

YANMAR CHP

FAN INSIDE CP10

Time-honored and award winning, YANMAR adds even more value to CHP energy solutions.

YANMAR has been perfecting its products and business practices for over 100 years. Some units in Europe and Japan have been in service for more than 15 years, and the Showa Station unit in Antarctica has been in use for 30 years. YANMAR systems have been recognized globally; the 25kW and 35kW CHP Systems received the Japan Gas Associations Technology Prize in 2009 and 2010, respectively.

Energy Efficient

By utilizing a highly efficient engine and capturing nearly all of the remaining energy as heat, the YANMAR CHP system can be up to 2.6 times as efficient as your current centralized power.

Environmentally Friendly

By using energy efficiently, your carbon footprint can be reduced by as much as 50% over conventional means. According to U.S. EPA CHP Partnership calculations, a YANMAR 10kW CHP system can reduce enough greenhouse gases to offset the carbon footprint of seven cars on U.S. roads.

Economic Savings

As electric prices continue to increase, you can gain significant utility bill cost savings by switching to abundant natural gas or propane.

Energy Independence

By using a YANMAR CHP system as your primary power source, you are no longer solely reliant on the grid for your company's viability or personal comfort. You now have the option to have power when the grid fails, or in remote areas not currently served.

Standard Features / Benefits

Energy & Cost Savings

- High efficiency contributes to energy and cost savings
- Electricity + effective waste heat usage system
- High efficiency Lean-burn Miller cycle GAS ENGINE (powered by YANMAR-designed high performance gas engine)
- High efficiency electrical POWER GENERATOR (permanent magnetic high-frequency power generator)
- High efficiency INVERTER
- Reverse power type (standard)
- Non–reverse power type (option)

Environmental

- Contributes to a reduction in greenhouse gas emissions
- Powered by clean, natural gas
- Reduces the amount of primary energy consumption
- Reduction in CO_2 emissions

Low Operation Noise

- CP5 operates at 51dB(A)
- CP10 operates at 54dB(A)
- CP35 operates at 62dB(A)
- Anechoic environment conversion value measured at a distance of 1M and a height of 1.2M with the radiator fan stopped

High Reliability

- High quality
- Long maintenance intervals: 10,000 hours for CP5 & CP10 units; 7,500 hours for CP35
- Over 6,000 CHP units installed worldwide

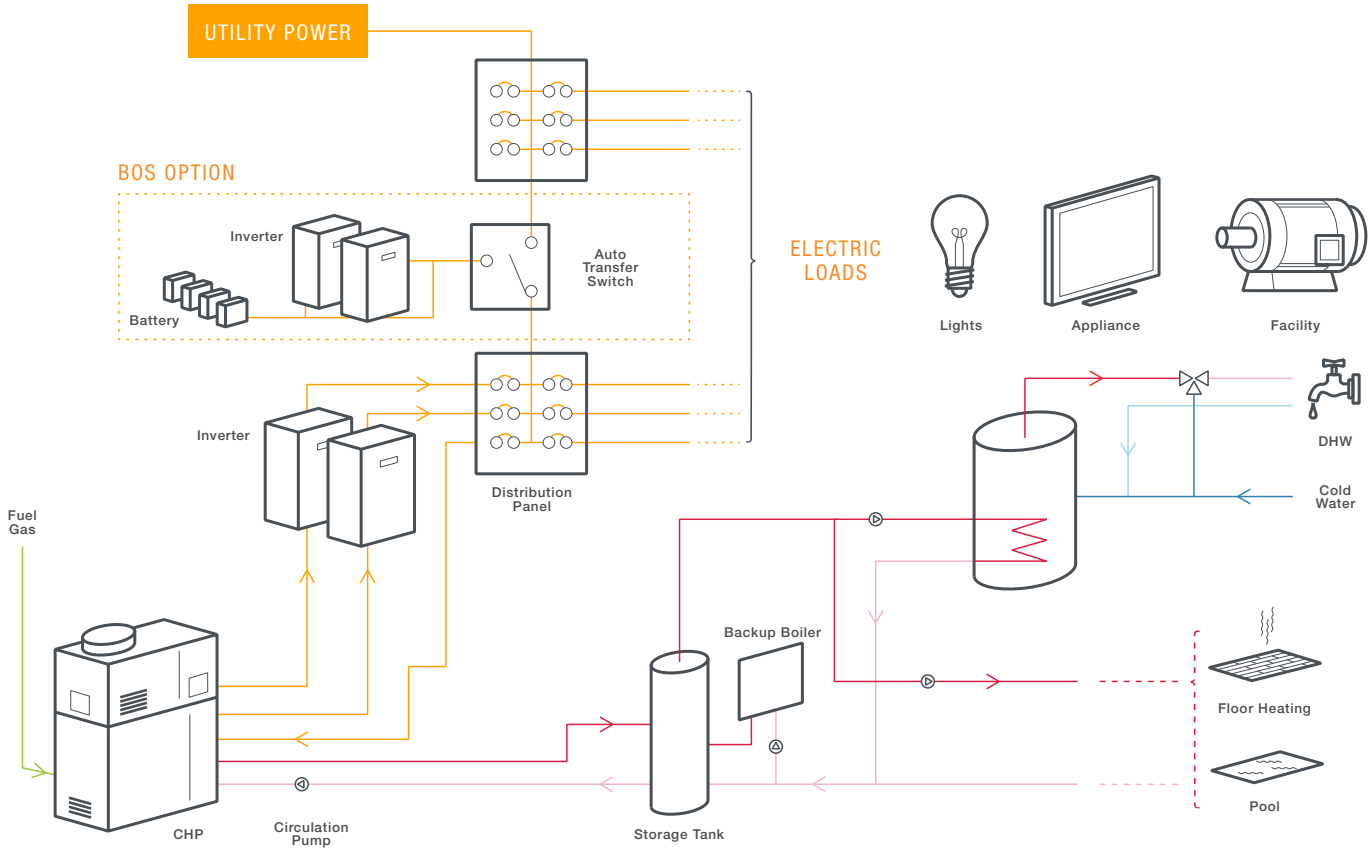
Easy Installation

- Easy grid connection using inverter
- 35 kW model includes built-in inverter
- Grid connection relay and synchronization device
- 5, 10 & 35 kW models comply with EPA, UL1741, UL2200, CSAC22.2 No. 14, CSAC22.2 No. 100 and IEEE1547 requirements.
- Wide range of installation accessories available for site customization

High Functionality

- Advanced System Controller delivers energy balance by constantly monitoring power demand and controlling the CHP system output to achieve the optimum balance between power demand and CHP power output
  - Scheduled operation
  - Manual operation schedule control
  - Rotation control for multiple unit operations
  - Start and stop power demand control
  - Monitoring functions
- Remote monitoring system
  - Operating condition confirmation
  - Operational data confirmation
  - Operation reports
- Blackout start

Building Integration



NOTE

This example is for illustrative purposes. There are many ways to integrate YANMAR CHP, including BOS (Blackout Start), Multiple Unit Operation, Load Following, Reverse Power Protection, etc. Please consult with your YANMAR CHP representative to discuss integration options that work for your specific application and site requirements.

Accessories / Options

Available Installation Accessories	CP5	CP10	CP35
System Controller	✓	✓	✓
Remote Monitoring System	✓	✓	✓
Inverters	SMA Sunny Boy (Grid Tied) SMA Sunny Island (Off Grid)	SMA Sunny Boy (Grid Tied) SMA Sunny Island (Off Grid)	Built-In Inverter Standard
Heat Exchanger	✓	✓	✓
Transducer / CT Kit	✓	✓	✓
Anti-Salt Protection	✓	✓	✓
Heater Kit	✓	✓	✓
Exhaust Adaptors	✓	✓	✓
Anti-Vibration Mount	✓	✓	✓
Air Direction Adjuster	✓	✓	✓

Flexible Installation Options

BATTERY CONDITION
Shows battery condition for Blackout Start from the controller (no need to check at the inverter).

SYSTEM PERFORMANCE
Shows the performance of the system on the main screen.

ALARM MENU
Improves YANMAR CHP Dealer troubleshooting accuracy and efficiency, resulting in minimal system operation interruptions.

SYSTEM CONTROLLER

FLEXIBLE SCHEDULING
Various calendaring options are available to schedule system operation around your holiday/vacation schedules, as well as for Peak Shaving.

SYSTEM OPERATING PARAMETERS
Allows you to decide on either electrical or heat operation to maximize your savings and benefits.

CONTROLS LEAD LAG OPERATION
Allows for systems to rotate on a daily basis. This guarantees that multiple units stay within 100 hours of run time of each other to allow for synchronized service.

NOTIFIES SERVICE PROVIDER
Enables YANMAR CHP representatives to provide rapid service for system alarms.

REMOTE TROUBLE SHOOTING
Allows troubleshooting to be conducted off site by your YANMAR CHP representative and YANMAR.

REMOTE MONITORING SYSTEM

SEE THE SAVINGS
Allows you and YANMAR CHP representatives to optimize system operation, as well as calculate cost savings and greenhouse gas emission reductions over time.

MONITORS RUN HOURS
Signals YANMAR CHP representative of when to schedule maintenance.

CP5WN/CP10WN Specs

Model			CP5WN		CP10WN	
			CP5WN-SNB (*5)	CP5WN-SPB	CP10WN-SNB	CP10WN-SPB
Power	Output	Rated Output	5 kW		10 kW	
		Voltage	240/120 V, 60 Hz (208 V, 277 V)		240/120 V, 60 Hz (208 V, 277 V)	
		Phases/Wires	Single phase, 3 wire		Single phase, 3 wire	
		Modulation	0.3 to 5 kW with optional CT/Transducer kit (*1)		0.3 to 10 kW with optional CT/Transducer kit (*1)	
Fuel	Gas type		Natural gas	Propane gas	Natural gas	Propane gas
	Pressure	Standard	8 in WC (2 kPa)	11 in W/C (2.8 kPa)	8 in WC (2 kPa)	11 in WC (2.8 kPa)
		Range	4 - 10 in WC (1 - 2.5 kPa)	8 - 13 in WC (2 - 3.3 kPa)	4 - 10 in WC (1 - 2.5 kPa)	8 - 13 in WC (2 - 3.3 kPa)
	Consumption (LHV)		60,700 BTU (17.8 kW)		107,500 BTU (31.5 kW)	112,800 BTU (33.1 kW)
			0.61 therms/hr	0.72 Gallon (*3)	1.08 therms/hr	1.34 Gallon (*3)
	Consumption (HHV) (*3, *4)		67,300 BTU (19.7 kW)	66,000 BTU (19.3 kW)	119,100 BTU (34.9 kW)	122,800 BTU (36.0 kW)
			0.67 therms/hr	0.72 Gallon (*3)	1.19 therms/hr	1.34 Gallon (*3)
Heat output	Rated recovered heat		34,100 BTU/h (10 kW)		57,300 BTU/h (16.8 kW)	65,200 BTU/h (19.1 kW)
	Rated hot water temp.	Inlet	140°F (60°C)		149°F (65°C)	
		Outlet	149°F (65°C)		158°F (70°C)	
	Rated Hot water flow rate		7.3 GPM (27.6 L/min)		12.7 GPM (48.2 L/min)	
	Maximum hot water temp. (Outlet)		163°F (73°C)		172°F (78°C)	
Input power	Voltage, Frequency		240V, 60Hz		240 V, 60 Hz	
	Starting current		12.5 A		21.7 A	
	Power consumption	Radiator fan stop	0.23 kW		0.39 kW	
		Radiator fan run	0.33 kW		0.71 kW	
Gross Efficiency (LHV)	Overall efficiency		84%		85%	88%
	Electrical generation efficiency		28%		31.5%	30%
	Exhaust heat recovery ratio		56%		53.5%	58%
Sound level	Radiator fan stopped		51 dB (A)		54 dB (A)	
	Radiator fan operating		54 dB (A)		56 dB (A)	
Dimensions	Width		43.3 in (1,000 mm)		57.9 in (1,470 mm)	
	Depth		19.7 in (500 mm)		31.5 in (800 mm)	
	Height		59.1 in (1,500 mm)		70.5 in (1,790 mm)	
	Net weight		882 lb (400 kg)		1,653 lb (750 kg)	1,664 lb (755 kg)
Maintenance Interval			10,000 hrs		10,000 hrs	
Standard Warranty			2 Years / 17,600 hours		2 Years / 17,600 hours	
YES Product Protection	5 Years / 30,000 hrs		Optional		Optional	
	10 Years / 60,000 hrs		Optional		Optional	
	15 Years / 90,000 hrs		Optional		Optional	
Emissions & Certifications			EPA Certified UL2200 Certified CSAC22.2 No 14 Certified CSAC22.2 No 100 Certified UL1741/IEEE1547 Certified (*2)		EPA Certified UL2200 Certified CSAC22.2 No 14 Certified CSAC22.2 No 100 Certified UL1741/IEEE1547 Certified (*2)	

*1: The minimum modulation amount is dependent on the CT and Transducer specifications.
*2: External inverter models
*3: Propane gas calculations for fuel consumption are based on converting LHV to HHV: LHV=84,250 BTU/Gallon, HHV=91,420 BTU/Gallon
*4: Natural gas calculations for fuel consumption are based on converting LHV to HHV: LHV= 983 BTU/scf, HHV = 1,089 BTU/scf
*5: CP5WN-SNB model no longer available

CP35D1 Specs

Model			CP35D1	
			CP35D1-TNUG	CP35D1Z-TNUG
Power	Output	Rated Output	35 kW	
		Voltage	208 V, 60 Hz	
		Phases/Wires	Three phase, 3 wire	
		Modulation	0.5 to 35 kW with optional CT/Transducer kit (*1)	
Fuel	Gas type		Natural Gas	
	Pressure	Standard	9 in WC (2.25 kPa)	
		Range	8 - 10 in WC (2 - 2.25 kPa)	
	Consumption (LHV)		367.487 BTU (107.7 kW)	
			3.67 therms/hr	
	Consumption (HHV) (*2)		407,114 BTU	
			4.07 therms/hr	
Heat output	Rated recovered heat		204,040 BTU/h (59.8 kW)	
	Rated hot water temp.	Inlet	167°F (75°C)	
		Outlet	176°F (80°C)	
	Rated Hot water flow rate		46.5 GPM (176 L/min)	
	Maximum hot water temp. (Outlet)		190°F (88°C)	
Input power	Voltage, Frequency		208 V, 60 Hz	
	Starting current		46 A	
	Power consumption	Radiator fan stop	0.72 kW	0.75 kW
		Radiator fan run	0.97 kW	1.00 kW
Gross Efficiency (LHV)	Overall efficiency		88%	
	Electrical generation efficiency		32%	
	Exhaust heat recovery ratio		55%	
Sound level	Radiator fan stopped		62 dB (A)	
	Radiator fan operating		64 dB (A)	
Dimensions	Width		78.7 in (2,000 mm)	
	Depth		31.5 in (800 mm)	
	Height		76.9 (1,995 mm)	
	Net weight		3,064 lb (1,390 kg)	3,284 lb (1,430 kg)
Maintenance Interval			7,500 hrs	
Standard Warranty			2 Years / 15,000 hours	
YES Product Protection	5 Years / 30,000 hrs		Optional	
	10 Years / 60,000 hrs		Optional	
	15 Years / 90,000 hrs		n/a	
Emissions & Certifications			EPA Certified UL2200 Certified CSAC22.2 No 14 Certified CSAC22.2 No 100 Certified UL1741/IEEE1547 Certified (*2)	

*1: The minimum modulation amount is dependent on the CT and Transducer specifications.

*2: Natural gas calculations for fuel consumption are based on converting LHV to HHV: LHV= 983 BTU/scf, HHV = 1,089 BTU/scf

YANMAR Warranty Programs

YANMAR Standard Limited Warranty

- ✓ CP5WN/CP10WN: 2 Years/17,600 hours*
- ✓ CP35D1(Z): 2 Years/15,000 hours*
- ✓ Real 100% direct “factory-backed” non-declining warranty

YES Product Protection

- ✓ Available coverages include scheduled preventive maintenance and extended warranty for
  - 10 Years / 30k Hours*
  - 10 Years / 60k Hours*
  - 15 Years / 90k Hours*(**)
- ✓ Real 100% factory-backed, non-declining extended warranty
- ✓ Coverage includes SMA Inverters and other YANMAR CHP Installation Accessories purchased as part of a YANMAR CHP system

* whichever comes first ** excludes CP35D1(Z) models

YANMAR Advantages

All YANMAR CHP customers require servicing dealers that are focused on providing excellence in customer service. YANMAR is committed to working with all dealers to upgrade service capabilities, and provides incentives to those who demonstrate the highest levels of technical proficiency. YANMAR encourages all dealerships to continuously make critical evaluations of their service operations, then use this information to implement changes that will improve service in all areas. From day one, we have been dedicated to ensuring that our engines and CHP systems are the best in the industry, which means precise control over research, development, engineering, manufacturing, sales, distribution and service. If you want a CHP system that you know is truly supported inside and out by the company who built it, choose YANMAR.

- ✓ Fully transferable standard and extended warranties, even when a building or home changes owners
- ✓ Warranty administration is handled by YANMAR experts, rather than insurance company claims adjusters
- ✓ No monetary value cap restricting warranty coverage
- ✓ Non-declining coverage means that the product protection on the last day of the warranty period is the same as the first day of coverage
- ✓ YANMAR Energy Systems dealers are staffed with highly trained & certified technicians

YANMAR
ENERGY SYSTEMS

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online at www.yanmar-es.com

CHP
EPA COMBINED HEAT AND POWER PARTNERSHIP

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