
RT
VRF
VALUE
GAS
A
SUSTAINABLE
NATURAL
BTU
KW
SERVICE
RELIABLE
ENERGY
SYSTEMS
COOLING
MULTI-ZONE
RETROFIT
POWER
DESIGN
BUILD
LIFE
CYCLE
VALUE
VERSATILE
HEATING
INTEGRATION
BLACKOUT
START
CHP
GAS
HEAT PUMP
EFFICIENT
HEAT RECOVERY
RELIABLE
FUTURE
RT COMFORT
ENERGY
ENVIRONMENT
RETROFIT
SYSTEMS
FLEXIBILITY
INNOVATIVE
MULTI
MULTI
ENERGY
ZONE
UNIT
SYSTEMS
RETROFIT
COMFORT
COMMISSIONING
YANMAR

YANMAR America Energy Systems

YANMAR America
Energy Systems Division

YANMAR

Mission Statement

Company History

1912 Founded as Yamaoka Hatsudoki Kosakusho

1933 Developed and produced the world's first small diesel engine

1981 Subsidiary established in the United States

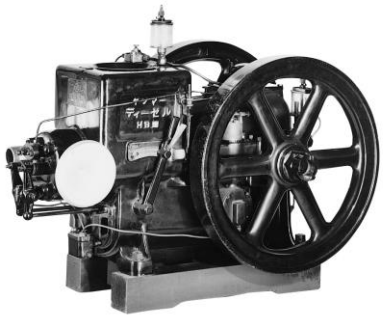
1983 World's smallest air-cooled diesel engine developed

1992 ISO9001 certification for all business operations

1992 Ten millionth diesel engine produced

1997 ISO14001 certification for all plants

2012 YANMAR Co. Ltd. celebrates 100th Anniversary



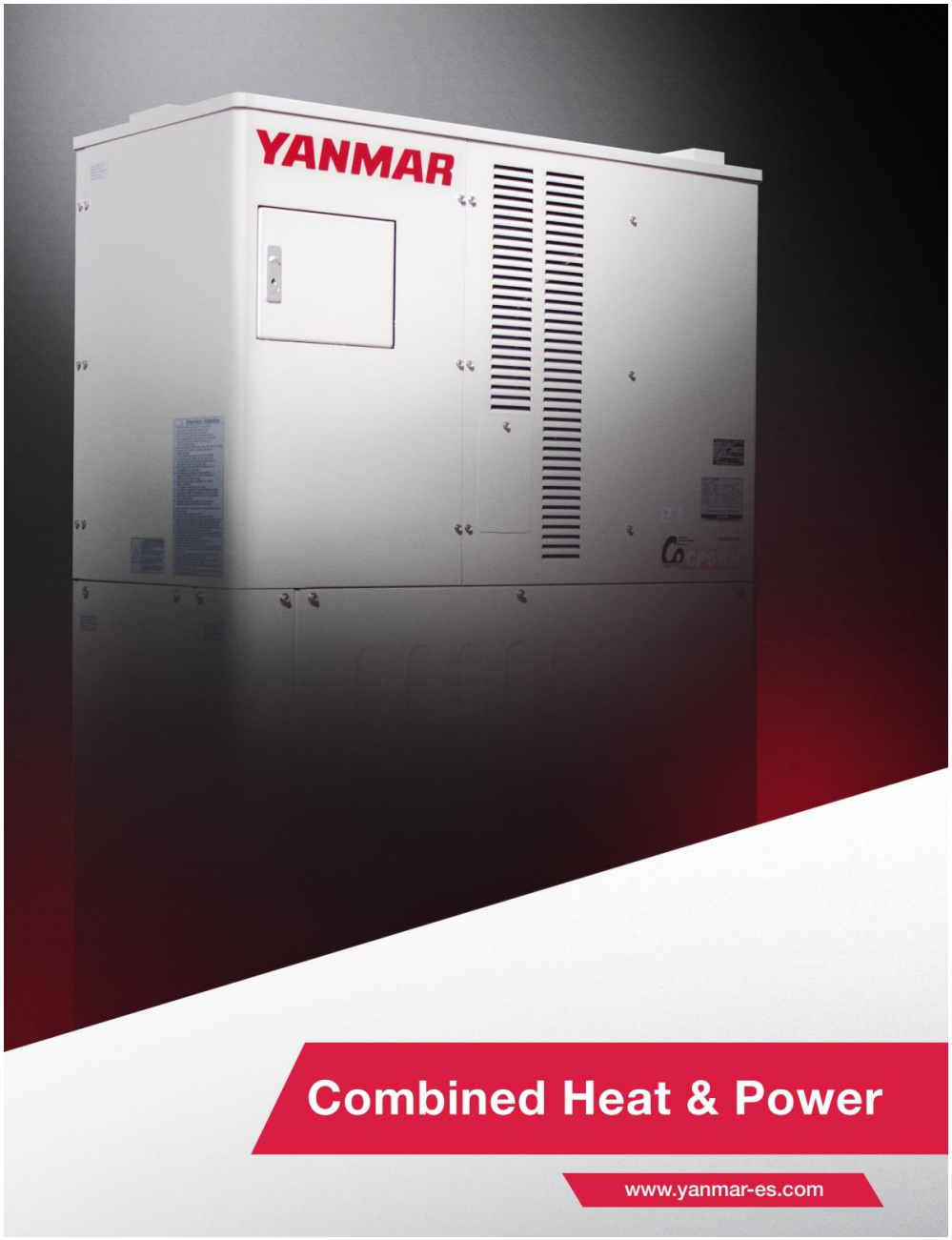
YANMAR America Facility

68 acre site
2-stories, 550,000 sq. ft. office

Sales / Distribution:
Industrial Engines & Generators
Commercial Marine Engines
Energy Systems
UTVs
Parts, Lubes & Accessories

Sales, Final Assembly & Distribution:
Construction Equipment
Agriculture Equipment
REMAN Engines & Components

Customer Service & Training, Marketing, Product Management, IT, Finance / Accounting, Corporate Planning, Logistics, Procurement, Engineering, Factory Support, Warehouse Support, Maintenance, HR, Legal, Compliance


YANMAR
Combined Heat & Power
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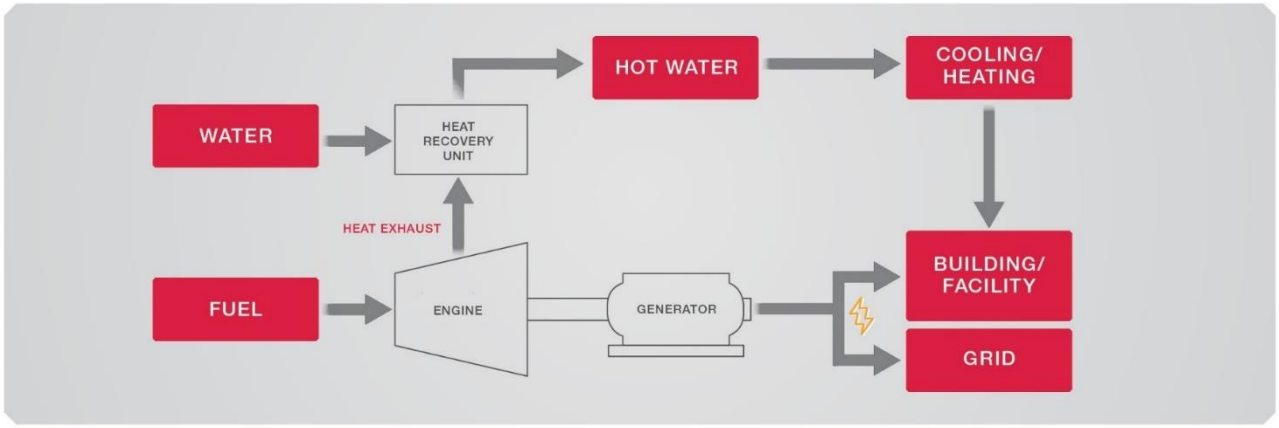
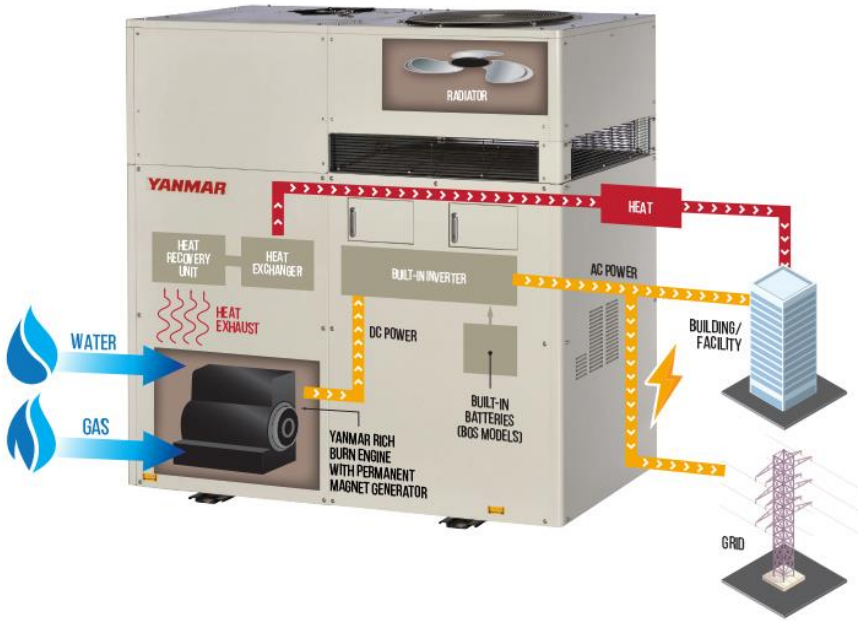
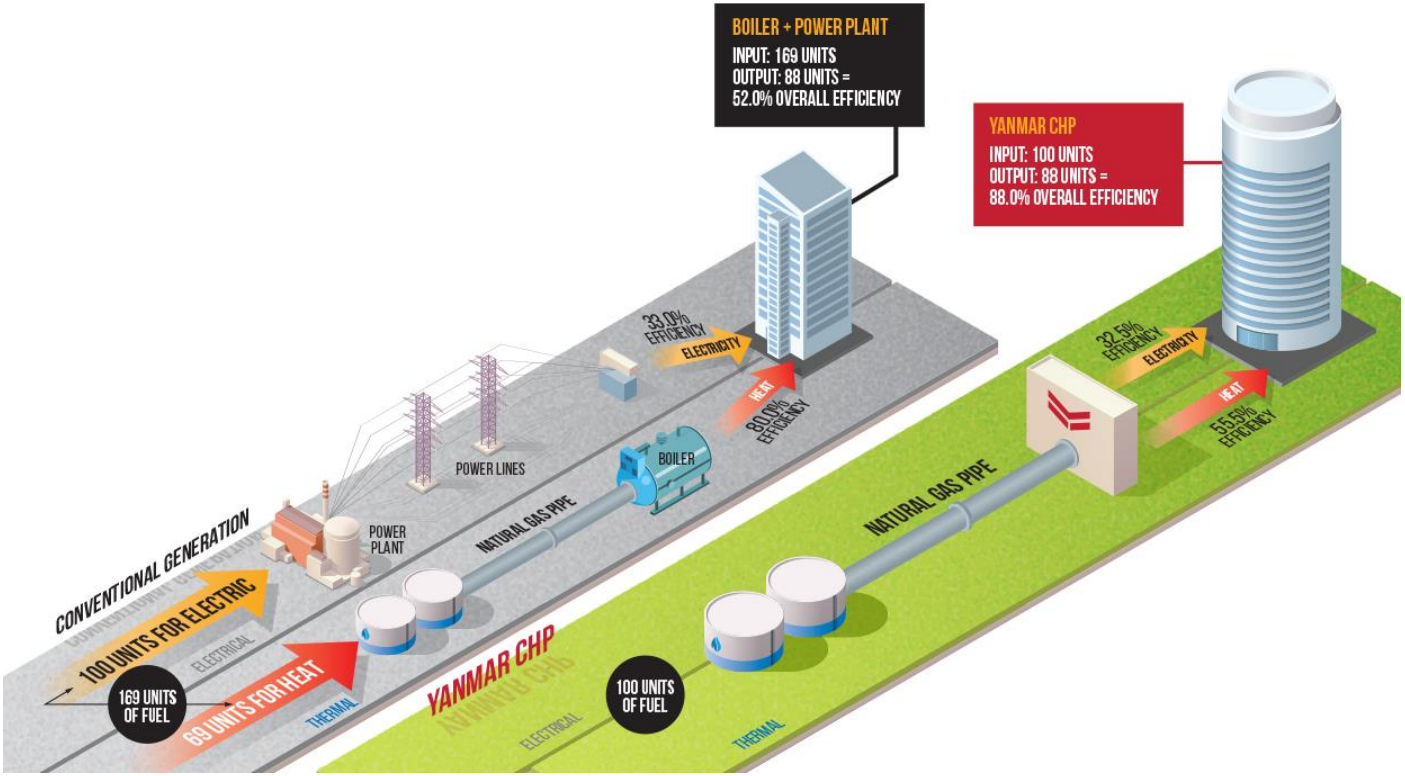
What is CHP?

Combined Heat and Power (Cogeneration) is the production of heat and electricity from the same device/energy source at the point of use.





What is CHP?



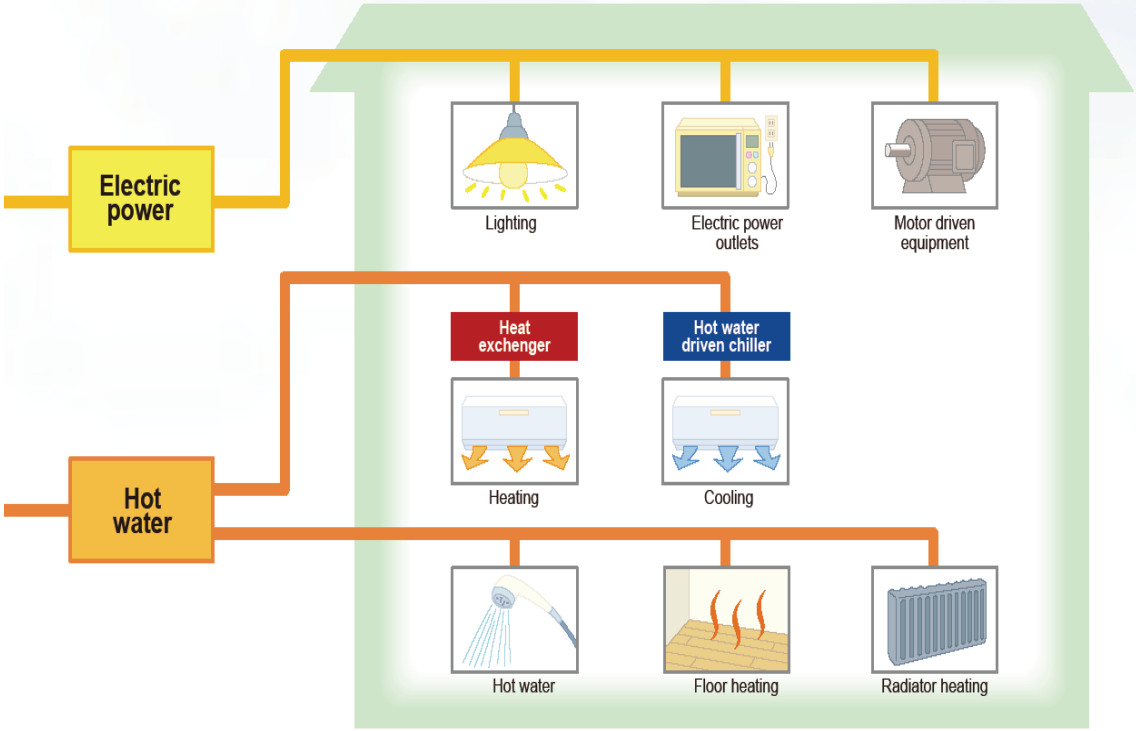
CHP offers significant energy savings by utilizing ‘waste’ heat produced during the production of electricity for purposes such as heating or pre-heating domestic hot water supply, providing radiant heating or assisting with desiccant dehumidification.

What is CHP?

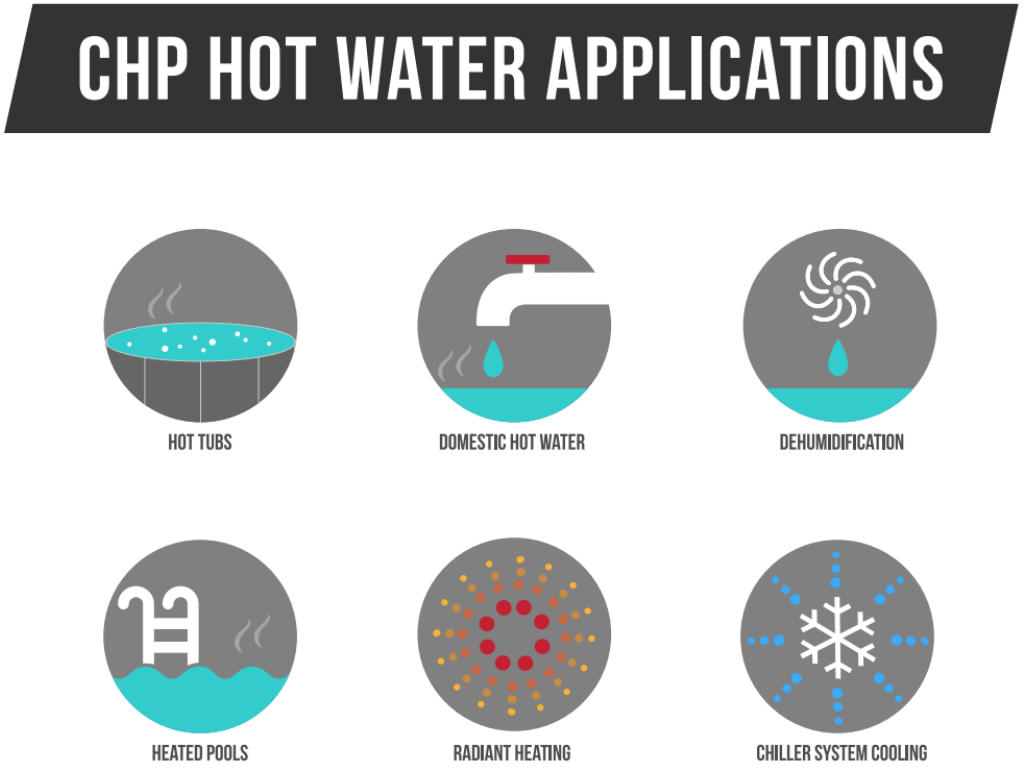
System Configuration

Cogeneration package

Typical loads



Follow the Hot Water…



Successful YANMAR CHP projects maximize the heat output of the units, and deploy them to the facility instead of dumping the heat.

CHP Models

CP5WN

CP10WN

CP35D

Key Messages:

- Over 6,000 Units Installed Worldwide.
- YANMAR CHP is #1 in Japan.
- YANMAR America has been selling CHP in the U.S. since late 2010.
- 100+ CHP Installations by YANMAR America to date.

MODEL	DESCRIPTION	FUEL TYPE	
		NATURAL GAS	PROPANE
CP5WN-SNB	5kW mCHP - Natural Gas	●	
CP5WN-SPB	5kW mCHP - Propane*		●
CP10WN-SN	10kW mCHP - Natural Gas	●	
CP10WN-SPB	10kW mCHP - Propane**		●
CP35D-TN (New Model)	35kW mCHP - Natural Gas	●	
CP35DZ-TN (New Model)	35kW mCHP - Natural Gas, BOS	●	

CHP Models

YANMAR CHP can produce a significant amount of heat to meet (and/or) exceed heating requirements, as well as significantly reduce a facility's overall electrical grid usage.

YANMAR CHP Model	Facility Type	Economic Facility Size	Annual Production @ 100% Capacity	
			Electrical	Thermal
CP5 - Natural Gas - Propane	Luxury Residential	3,000 to 7,500 sq. ft.	43,800kW	3,836,880 Gallons of 149°F water
CP10 - Natural Gas - Propane	Luxury Residential Light Commercial	7,500+ sq. ft.	87,600kW	6,675,120 Gallons of 158°F water
CP35 - Natural Gas	Commercial	Hot water usage is primary factor	306,600kW	22,411,584 Gallons of 190°F water

Features & Benefits

YANMAR Engine (Reliability) – YANMAR Energy Systems has provided proven technology with over 300,000 gas engine installed worldwide over the past 30 years.

Long Maintenance Interval (Durability) - 10,000 hours [CP5WN, CP0WN] and 7,500 hours [CP35D1]. The gas engine provides one of the industry's longest maintenance intervals through YANMAR's unrivaled engine technology.

Compact & High Efficiency Generator (Efficiency) - A light and compact permanent magnet generator provides electricity with over 90% efficiency.

Blackout Start (Grid Interconnectivity) - Using external [CP5WN, CP10WN] or internal [CP35D1] inverters, YANMAR'S CHP units can ensure heat and power remain uninterrupted even during a blackout.

Features & Benefits

Multiple-Unit Operation (Flexible Installation) – YANMAR's CHP units can be combined to form a larger CHP system for use across multiple buildings or a variety of configurations.

Remote Monitoring (Peace of Mind) – YES Remote Monitoring Capability provides 24/7/365 monitoring, which reduces time needed for diagnostics and repair, as well as the ability to schedule maintenance using cumulative operation time. Remote monitoring may also improve the customer's ROI by proposing the best operation.

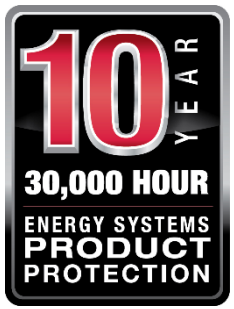
YANMAR CHP Units are quiet. At 3 feet, CHP maximum noise levels

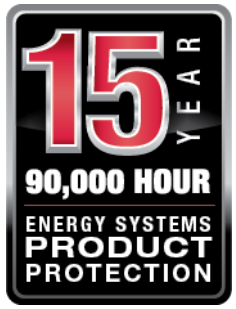
- 54dB(A) CP5WN
- 56dB(A) CP10WN
- 62dB(A) CP35D1

CHP Warranty & Product Protection

- CP5WN/CP10WN: 2 Years/17,600 hours*
- CP35D1(Z): 2 Years/15,000 hours*

**Whichever comes first*





- 10 Years / 30k Hours*
- 10 Years / 60k Hours*
- 15 Years / 90k Hours*(**)

**Whichever comes first*

***Excludes CP35D1(Z) models*

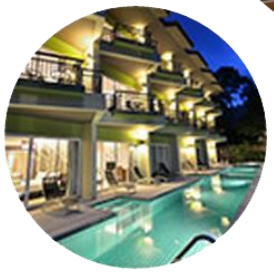
Market Segments

Offices

Education

Healthcare

Multi-unit Housing



Hotels

Restaurants

Why?

- Consistent need for large amounts of heating throughout the year.
- Desire to reduce electric charges to improve financial performance.
- Grid reliability issues, and desire to power facilities consistently.

CHP Performance Summary (ROI)

Customer	Customer Name	YANMAR	**Micro Combined Heat and Power (mCHP) System**	**Estimate Date**	4/27/2015
Site Location	Enter State, US		**Your Facility's Performance Summary**	**Estimator**	Eneter Name
Dealer	Enter Dealer Name		**YANMAR Energy Systems**		

YES Proforma Rev.5.5

System Configuration	
System Output	20 kW
5 kW Units	0
10 kW Units	2
	0
	0
Max. Heat Recovery	1.15 thm/hr
Gas Consumption (LHV)	2.15 thm/hr
Gas Consumption (HHV)	2.38 thm/hr

Utility & Site Data	
Avoided Electric Rate	24.1 ¢/kWh
Electric Escalation Rate	1.05%
Heating Fuel Rate	$1.30 /thm
mCHP Gas Rate	$ 1.10 /thm
Gas Escalation Rate	1.01%
Current Heating System	Nat. Gas
Current Heating Efficiency	60 %

Tax Data	
Sales Tax Rate	8.00%
Fed Bus. Tax Rate	35.00%
State Bus Tax Rate	8.00%

Financing Factors	
Loan Term	0 Years
Interest / Discount Rate	0.00%
Financed Amount	N/A
Estimated Loan Payment	N/A

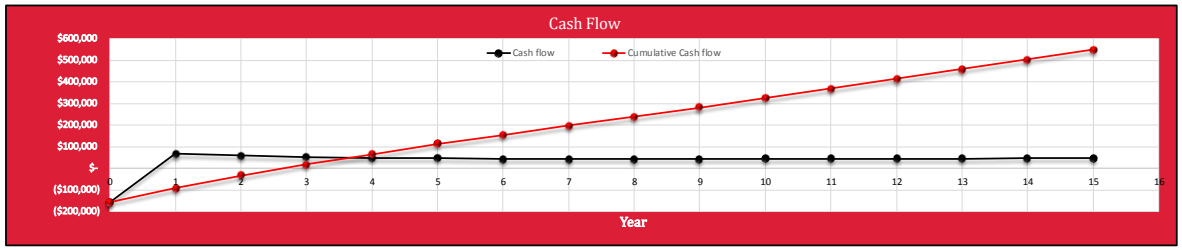
System Operation Pattern			
Net Metering	Available	Annual Hours of Operation	8,760
Schedule Operation	Scheduled	Electrical Utilization	100%
Heat Demand Ctrl	No	Thermal Utilization	100%
Electric Output Ctrl	Full output	Gas Consumption Ratio	100%
Designed Hot water Temp.	Rated Temp		

Re Calculate

Year 1 Savings Summary		
Electric Savings	$40,644	168,367 kWh
Thermal Energy Savings	$21,743	16,725 Therms
Generation Gas Cost	($22,953)	20,866 Therms
Loan Payment	N/A	
Net Savings	**$39,434**	

Financial Summary	
Payback	**2.7 Years**
Project Term	15 Years
IRR	33%
Cum. Savings	$548,400

Project Costs		
Hardware Price	$95,413	4,771 $/kW
Estimated Shipping Costs	$750.00	38 $/kW
Installation Price	$40,000	2,000 $/kW
Sales Tax	$7,693	8.00%
YES Product Protection Package	$15,000	2.50 ¢/kWh
Tax Credit	($15,116)	10%
Incentives/Equipment Offset	$0	0 $/kW
Net Installed Cost	**$143,740**	**7,186.99 $/kWh**



Customer Cash flow	Year	0	1	2	3	4	5	6	7	8	9	10
Capital Cost (Hardware, Shipping, & Install)		($143,856)										
YES Product Protection		($15,000)	Protected	Protected	Protected							
Tax Credit			$15,116									
Electric Savings			$40,644	$41,071	$41,502	$41,938	$42,379	$42,824	$43,273	$43,728	$44,187	$44,651
Generation Fuel Cost			($22,953)	($23,185)	($23,419)	($23,655)	($23,894)	($24,136)	($24,379)	($24,626)	($24,874)	($25,126)
Thermal Fuel Savings			$21,743	$21,962	$22,184	$22,408	$22,634	$22,863	$23,094	$23,327	$23,563	$23,801
MACRS			$11,692	$18,707	$11,224	$6,734	$6,734	$0	$0	$0	$0	$0
Cash flow		($158,856)	$66,242	$58,555	$51,492	$47,425	$47,853	$41,551	$41,988	$42,429	$42,875	$43,326
Cumulative Cash flow		($158,856)	($92,614)	($34,059)	$17,433	$64,858	$112,711	$154,262	$196,249	$238,678	$281,553	$324,879

Customer Cash flow	Year	11	12	13	14	15
YES Product Protection						
Loan Payments		$ -	$ -	$ -	$ -	$ -
Electric Savings		$45,120	$45,593	$46,072	$46,556	$47,045
Generation Fuel Cost		($25,379)	($25,636)	($25,895)	($26,156)	($26,420)
Thermal Fuel Savings		$24,041	$24,284	$24,529	$24,777	$25,027
Cash flow		$43,781	$44,241	$44,706	$45,176	$45,651
Cumulative Cash flow		$368,660	$412,901	$457,608	$502,784	$548,435

CHP Performance Summary with 15-Year Payback Analysis

CHP Case Study – Trans-Alaska Building

QUICK FACTS
Application: Office Building
Location: Wasilla, Alaska
Commissioning Date: July 2016
Product Installed: CP35D1Z-TNUG

KEY RESULTS:

- The CP35D1Z has resulted in an average monthly savings of $2,400 by switching to natural gas driven electric and heat production.
- The unit has provided consistently reliable operation with an average of 695 operating hours per month.

"YANMAR's 35 kW CHP has exceeded expectations, and the reliability is great! I love the fact that the unit reports problems even when it is the grid (not the unit) acting up. The system has protected the building and it tenants during a couple of blackout situations, and the tenants were grateful that they were able to continue working and stay warm during a severe storm."
- Al Tellman, President of KI Holdings Inc.

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CHP Case Study – Hyatt Place Hotel

QUICK FACTS
Application: Hotel
Location: Portland, Maine
Commissioning Date: April 2, 2014
Product Installed: CP10WN-SN

KEY RESULTS:

- The operation efficiency (heat + electricity) is high (98% average) because the CHP system's primary purpose in this application is to provide heat recovery to the facility.

- The heat output efficiency (96% average) is high throughout the year, even during the summer, due to high and consistent thermal demand from the building.

"We are proud to be the first hotel in the United States operating with YANMAR mCHP. The installed 10 kW system has lived up to its expected performance and savings, and has provided our facility with seamless operation." - *Hyatt Place Hotel*

CHP Case Study – 29 Parker Avenue

QUICK FACTS

Application: Office Building and 4 Residential Apartments
Location: Stamford, CT
Commissioning Date: Dec 11, 2015
Product Installed: CP10WN-SN with Blackout Option – 208V - 3 Phase

KEY RESULTS:

- The electrical efficiency is high, and the utilization averages 95% over the last year of operation. This has resulted in peak shaving savings.
- The installation successfully demonstrates the application of YANMAR CHP in an office/apartment. The unit provides high electrical efficiency and dependability while meeting the building's heating demands.

"The YANMAR micro cogeneration unit has operated flawlessly since it was commissioned. It has been reliable and efficient, and we have seen substantial savings in electric and heat costs, including a reduction in electrical purchases from the utility of approximately 70%." - William Calyanis, President, Controlled Temperatures, Inc.

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Installation Example – Propane Gas Bottling Factory

QUICK FACTS

Application: Propane Gas Bottling Factory
Location: Hillside, IL
Commissioning Date: May 2012
Product Installed: CP10WN-SPB
Fuel Type: Propane

Heat Utilization: YANMAR's CHP supplies hot water to the electric boiler tank for the bottle washing machine
Run Hours: 11 hours/day Monday-Friday
Benefits:

- Reduction of electric usage
- Cost savings

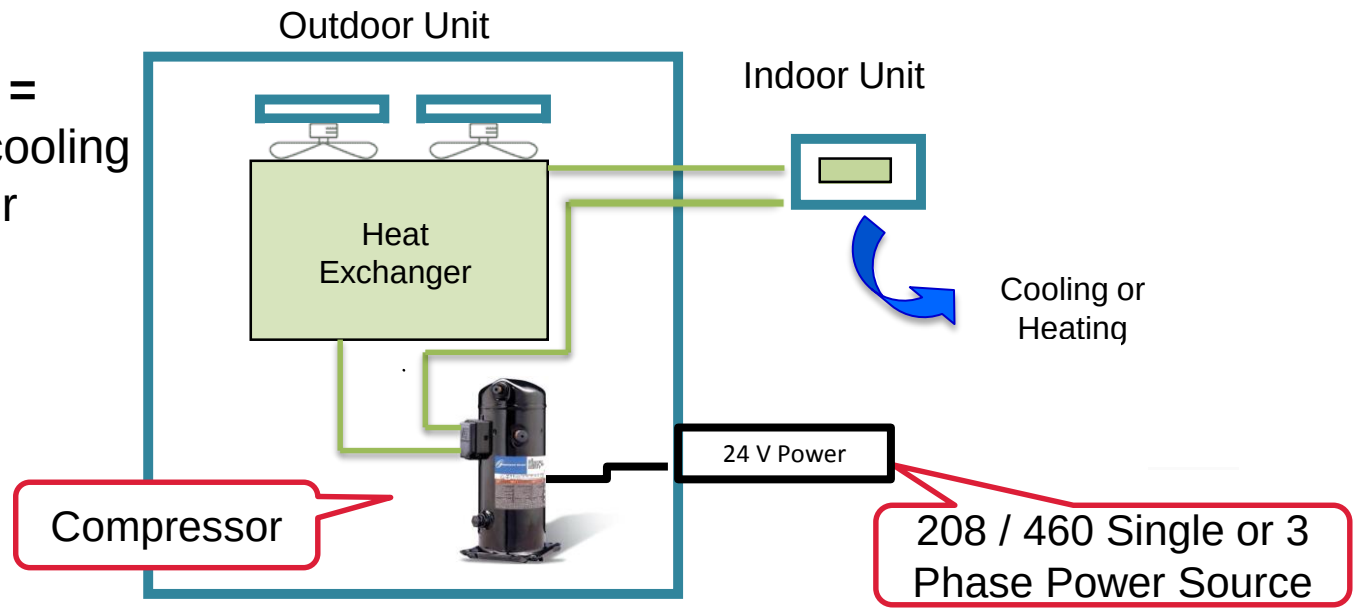
Installation Example – Multi-Unit Rooftop for Multifamily


YANMAR NATURAL GAS-POWERED VRF SYSTEMS
www.yanmar-es.com

Electric Systems

Electric Heat Pump (EHP)
(Conventional Air Conditioner)

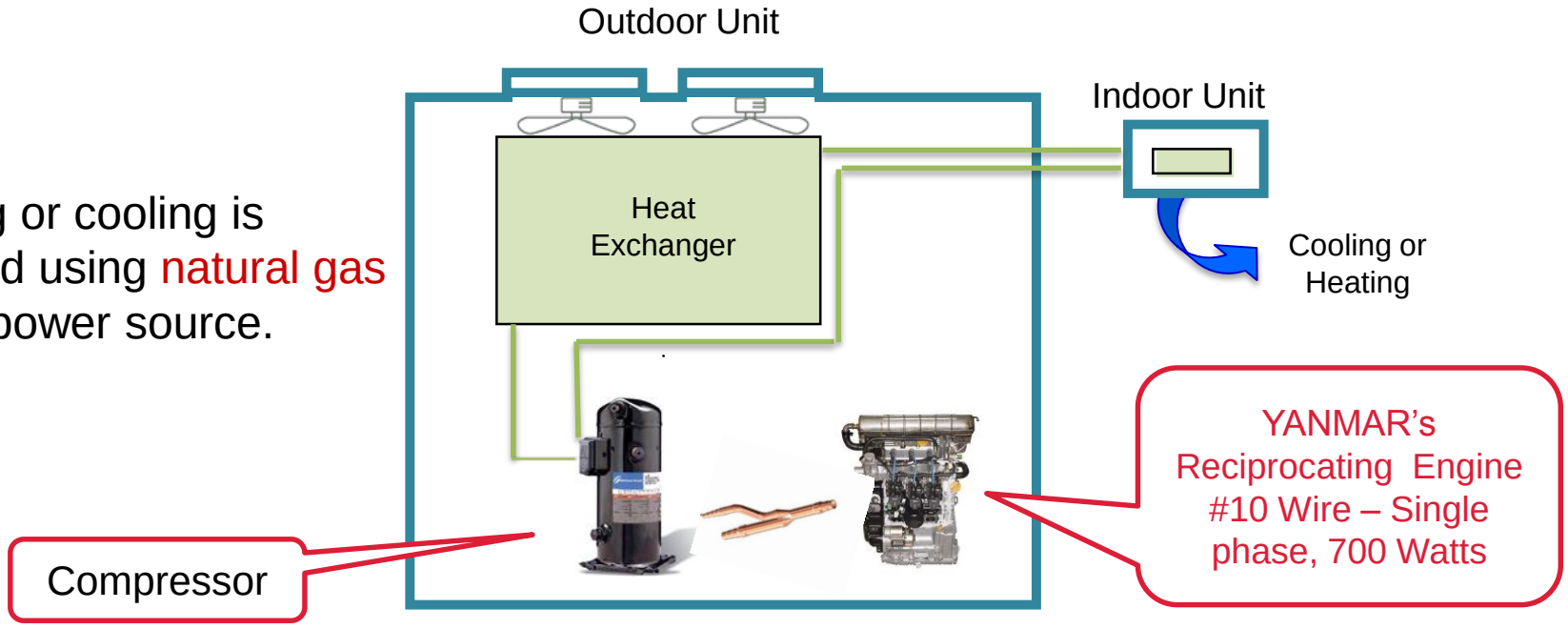
Electric Heat Pump = provides heating or cooling with an electric power source.



The electric power source drives the compressor.

Natural Gas VRF

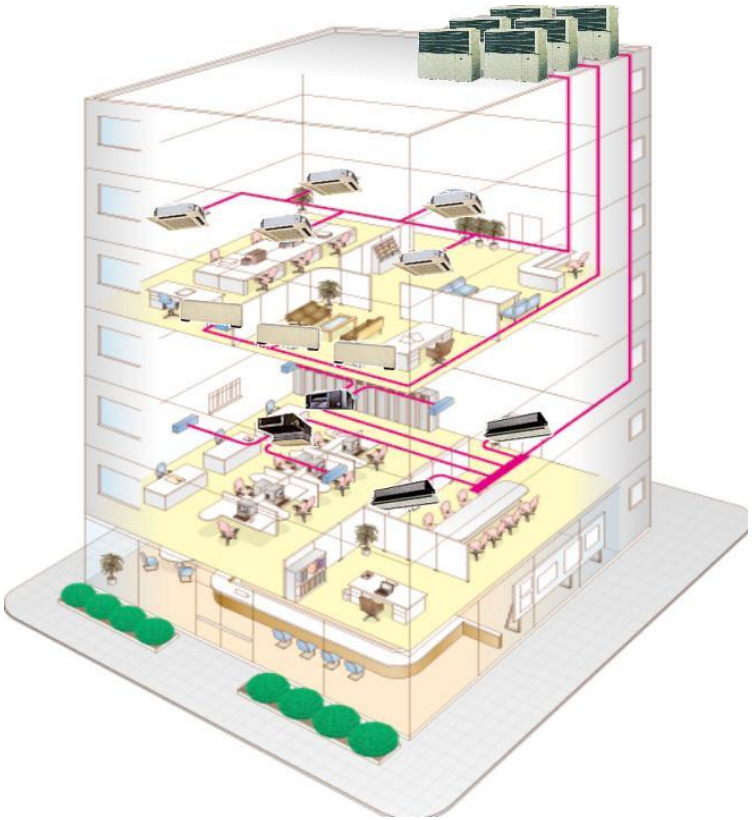
Heating or cooling is provided using natural gas as the power source.



The natural gas-fueled engine drives the compressor.

YANMAR's VRF reduces electricity usage by ~ 90%

Variable Refrigerant Flow (VRF) Systems



- Uses refrigerant to heat and cool
- One outdoor unit can run multiple indoor units
- Ducted or non-ducted applications
- Heat and cool different zones simultaneously (3-pipe/heat recovery)

VRF Basic Elements

Outdoor Unit

+

Indoor Unit

+

Piping

+

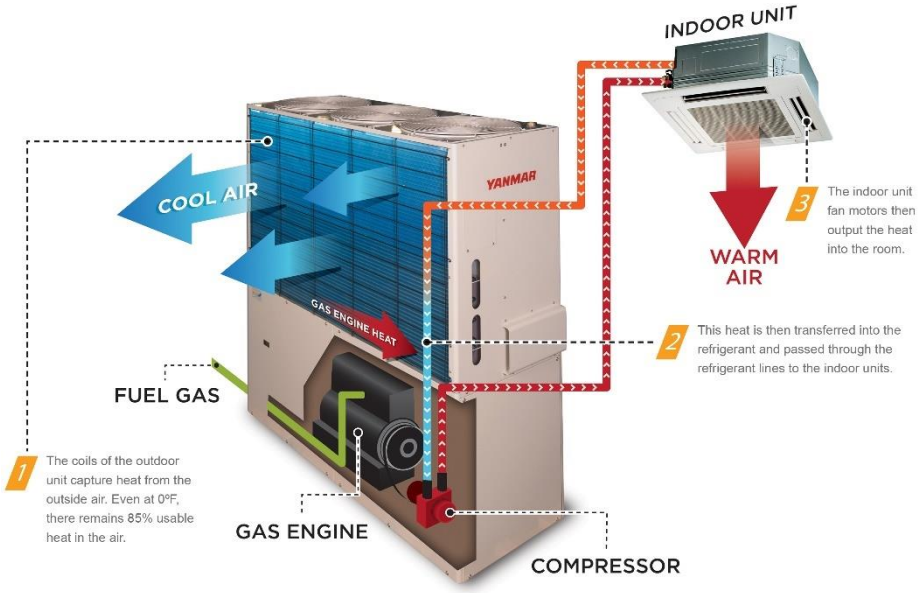
Controls

YANMAR VRF Overview

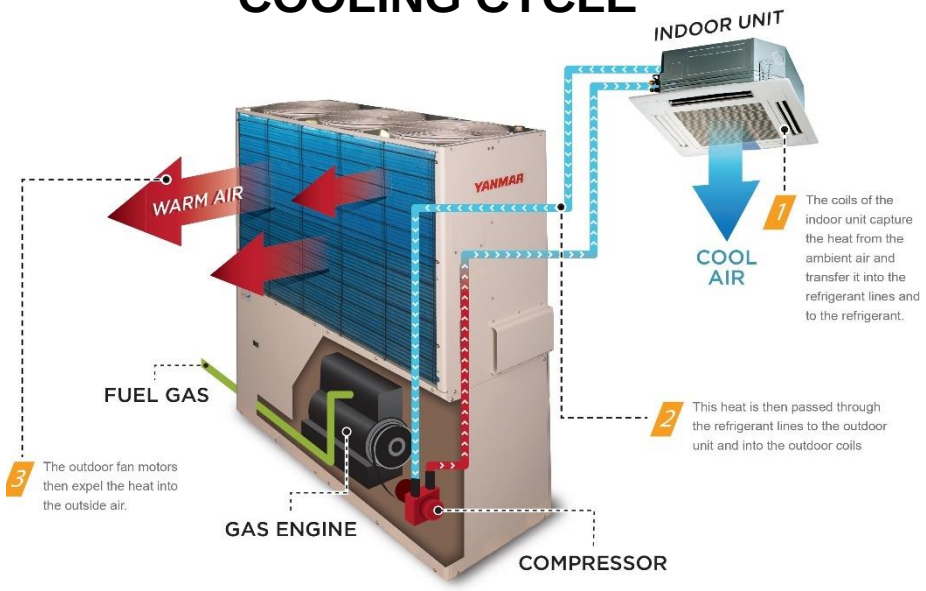
YANMAR's VRF system has a reverse cycle, which allows for heating or cooling using just one system.

Cost savings for one system instead of an AC Unit + Heating Unit

HEATING CYCLE



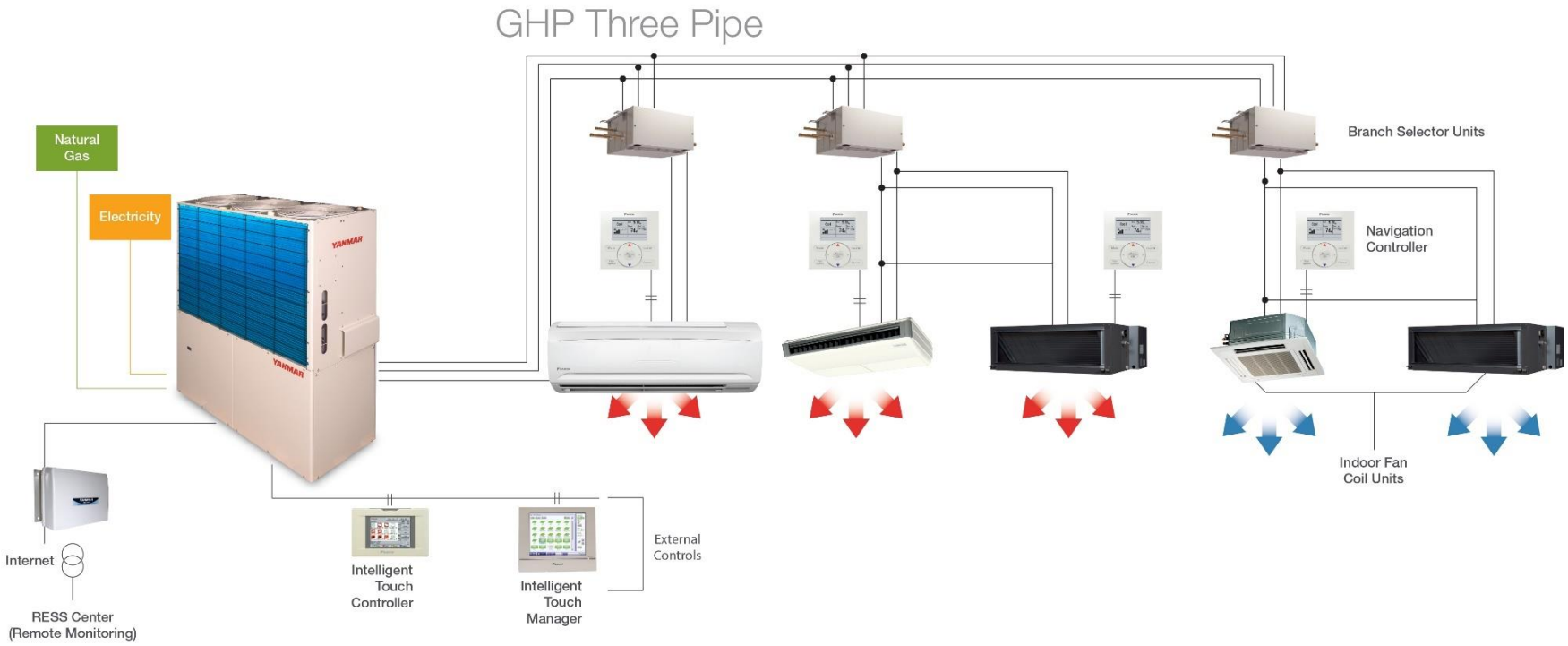
COOLING CYCLE



NATURALLY RELIABLE, ECO-EFFICIENT

YANMAR VRF Overview

Basic Layout of a Heat Recovery (3-Pipe) System:



Features & Benefits

COST SAVINGS – Reduced electrical usage ~ 90%

RELIABILITY – YANMAR Engine

DURABILITY – 10,000 Operating Hours Maintenance Interval

Features & Benefits

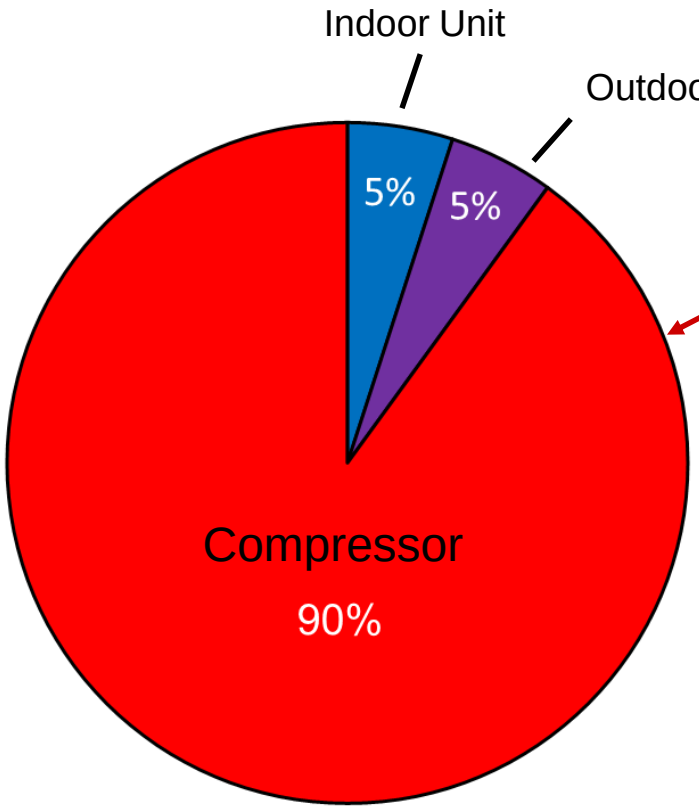
CONFIGURABILITY – Individual zone control

PERFORMANCE – Quiet

NATURAL GAS – Efficient and Environmentally Friendly

Natural Gas vs. Electric

Energy consumption of a traditional, electric system



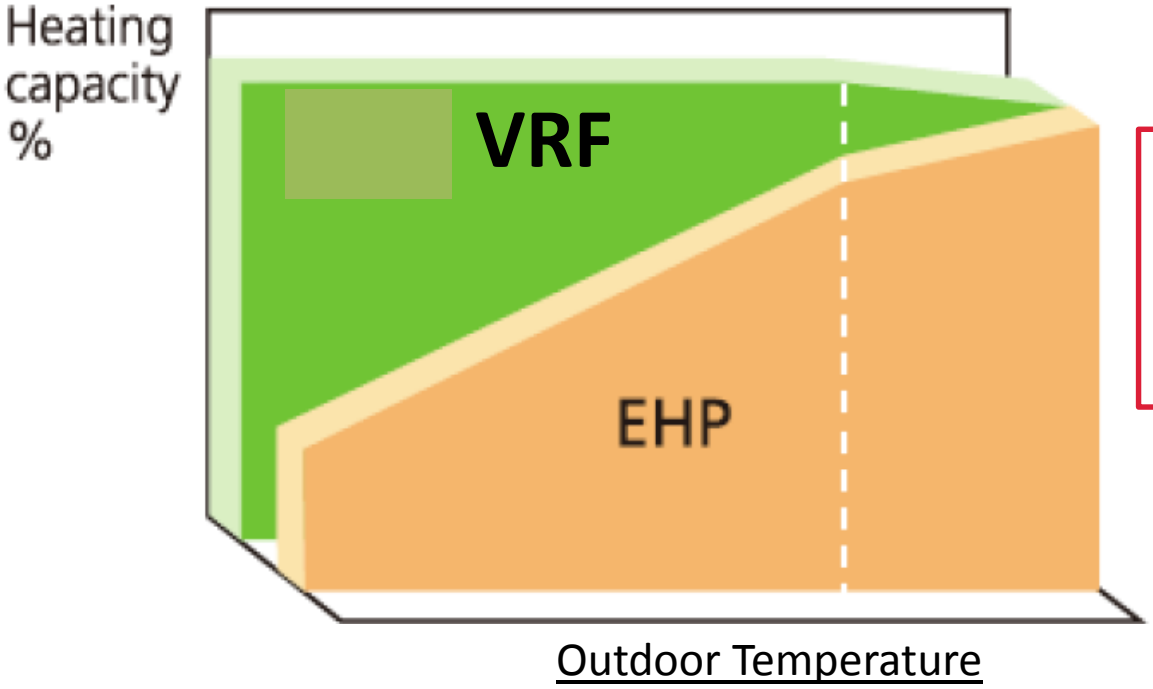
Natural gas displaces the compressor's electric consumption with YANMAR'S system

✓ Natural Gas VRF can reduce electric consumption by as much as 90%.

* Primary energy consumption of a 16 ton Electric Heat Pump

Natural Gas vs. Electric

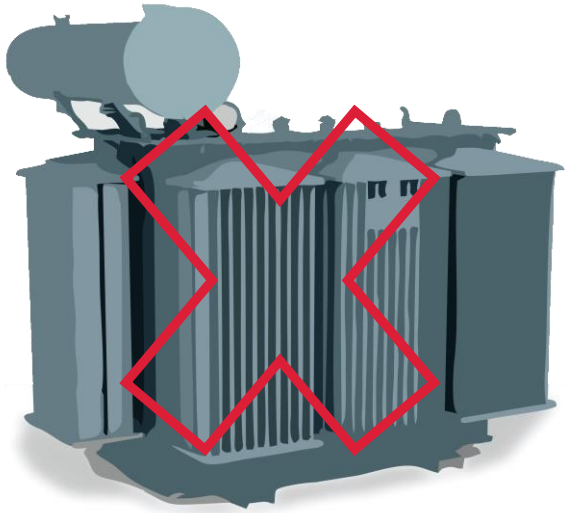
YANMAR's VRF system uses exhaust heat from the gas engine for efficient heating to maintain indoor comfort levels even during low outdoor temperatures.



BENEFIT = More heat available at colder outdoor air temperatures.

Natural Gas vs. Electric

By using natural gas as the primary energy source for heating & cooling, VRF eliminates the need to upgrade the building's electrical services.
(First Cost Savings)



BENEFIT= VRF does not need a large electric transformer facility.

Unless a natural gas line is not already present at the facility, energy infrastructure costs are minimal, and projected VRF design and installation costs are fairly predictable.

YANMAR Models

MODEL	DESCRIPTION	FUEL TYPE		EPA Certified
		NATURAL GAS	PROPANE	
NNCP096JN (New Model)	GHP096 (8rt / 28kW)	●	Not Planned	●
NNCP120JN (New Model)	GHP120 (10rt / 35kW)	●	Not Planned	●
NNCP144JN (New Model)	GHP144 (12rt / 42kW)	●	Not Planned	●
NNCP168JN (New Model)	GHP168 (14rt / 49kW)	●	Not Planned	●
NFCP168JN (New Model)	GHP168 (14rt / 49kW) 3 Pipe System	●	Not Planned	●
ENCP710JJ	GHP710 (20rt / 71kW) *Non-EPA Area*	●	Not Planned	
ENCP850JJ	GHP850 (24rt / 85kW) *Non-EPA Area*	●	Not Planned	

Market Segments

Offices/Retail

Education

Healthcare

Multi-unit Housing

Hotels

Restaurants

ROI Sample

Customer	Adairsville Inn
Street Adress	101 South Main Street
City ,State, Zip	Adairsville

YANMAR

Gas VRF System
Your Facility's Performance Summary
YANMAR Energy Systems

Estimate Date	2016/4/18
Estimator	Mike Cheatham

YES Proforma Rev.0.11

YANMAR System Configuration

System Output	14 RT
Outdoor Units	1
Indoor Units	7
.Cooling Run Hrs	1725
.Heating Run Hrs	818
System Type	Heat Recovery
(Cooling Gas Consumption (HHV	1.50 Thm/hr
(Heating Gas Consumption (HHV	1.31 thm/hr
(Total System Efficiency (HHV	

Utility & Site Data

Current Electric Rate	9.6 ¢/kWh
Summer Demand Charges	$ - /kW
Electric Escalation Rate	5.00%
Gas Rate	$ 0.87 therms
Gas Escalation Rate	1.30%

Tax Data

Sales Tax Rate	8.00%
Fed Bus. Tax Rate	34.00%
State Bus Tax Rate	6.00%

Hitachi Factors

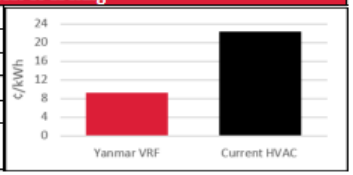
Loan Term	5 Years
Monthly Rate Factor	0.0203
Financed Amount	$41,546
Estimated Loan Payment	$843

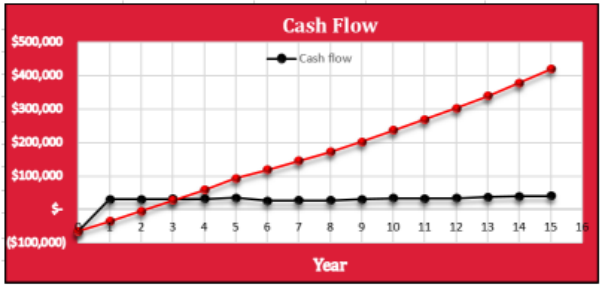
First Year Savings Summary

Current HVAC Costs	$22,447
VRF Energy Costs	($2,306)
Loan Payment	$10,121
Net Savings	**$30,261**

Cost of Cooling

Gas Cost	87.0 ¢/therm
Electric Costs	(9.6)¢/kWh
Yanmar VRF	9.29 ¢/Ton
Current HVAC	22.41 ¢/Ton
Savings	-34.8%





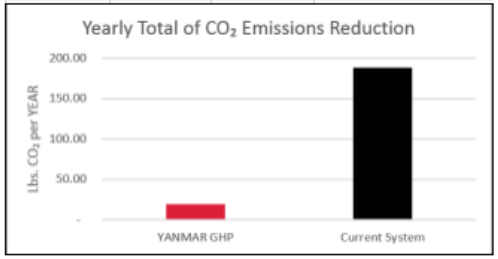
Financial Summary

Cumulative Savings	**$484,600**
Project Term	15 Years
IRR	47%
Simple Payback	2.15

Project Costs

Hardware Price	$49,336	3,524 $/Ton
Installation Price	$12,500	893 $/Ton
Sales Tax	$3,710	
Equip. and Incentives	($24,000.00)	320 $/Ton
Tax Credit	$0	N/A
Net Installed Price	$41,546	2,968 $/Ton
Service Price	$0	0.00 ¢/kWh

Emissions Reductions



VRF Case Study – Adairsville City Hall

"We are proud to be the first commercial building in the United States operating with YANMAR VRF. YANMAR worked alongside our engineering firm to ensure a seamless installation process that was on schedule and on budget."
- Pam Madison, City Manager for Adairsville City Hall.

QUICK FACTS

Application: Office Building
Location: Adairsville, Georgia
Commissioning Date: June 2015
Product Installed: YFZP560J-NB (16 ton, 3-pipe)

KEY RESULTS:

• In the first year of operation, the YANMAR 16-ton VRF demonstration unit provided an average operating costs savings of $1,432 or 80% per month.

• YANMAR's heat recovery (three-pipe) VRF system provides simultaneous heating and cooling in different zones of the building to satisfy each occupant's needs.

YANMAR

VRF Case Study – Trion High School Weight Room

"We decided to go with a natural gas heating and air system in our 50' x 90' weight room. YANMAR was with us from the beginning to end, and provided guidance throughout the process. We are 100% satisfied with YANMAR's product, customer service and commitment to our school system, and we look forward to working with them in the future." –
Dr. Phillip Williams, Superintendent

QUICK FACTS
Application: Fitness Center
Location: Trion, Georgia
Commissioning Date: February 2017
Product Installed: NNCP120J (10 ton)

KEY RESULTS:

- Operating costs savings of $2,500 in the first three months.
- The City awarded and has already commissioned a second project for their recreation center.

VRF Case Study – Stewart Avenue Public School

"We are very proud to be the first YANMAR VRF installation at a school in Canada. We hope this unit will provide a better learning environment for our students, and we are excited to see the results of this environmentally-friendly technology in action." - *Steve Feeney, Supervisor Energy Conservation & Automation, Waterloo Region District School Board*

QUICK FACTS

Application: Education
Location: Cambridge, Ontario
Commissioning Date: August 2016
Product Installed: YNCP560J-NB (16 ton)

KEY RESULTS:

- Operating costs savings of $1,200 during the first three months of operation.
- Reduced electrical consumption for heating and cooling the building by switching to a natural gas-driven YANMAR engine.