Bloomenergy®

Energy Server® with Heat Capture

Resilient, Predictable, Sustainable.

The Bloom Energy Server is compatible with Combined Heat and Power (CHP) systems. Increasing system efficiency and improving economics.

Bloom Energy is a world leader in fuel cell power generation. With a platform based on Solid Oxide technology, operating at temperatures above 800°C, the Bloom Energy Server can produce clean energy at one of the highest efficiencies in the market today.

The high temperature cathode exhaust from the Energy Server can be channeled, allowing the resulting exhaust heat to be available for further use. Once captured, this high temperature heat can be utilized in various applications and to further increase the overall efficiency of the system.

Compared to combustion technologies and other fuel cell products, the Bloom Energy Server has one of the highest electrical efficiencies in the industry. By adding Heat Capture, the total system efficiency can reach a lifetime average efficiency of >90%.

The Bloom Energy Server with Heat Capture reaches a lifetime average efficiency of:

>90%

What is Bloom Energy's Heat Capture Offering?

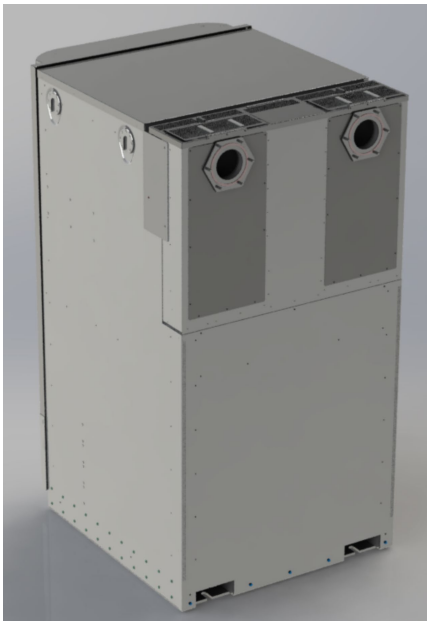
The Bloom Energy Server with Heat Capture offering consists of mechanical exhaust adapters installed on the back of the Energy Server Power Modules (See Figure 1) that harness the cathode exhaust at two connection points for easy integration to heat capture systems.

Mechanical Exhaust Adapters

Figure 1 shows the back of a standard Energy Server Power Module and an Energy Server Power Module that is equipped with Heat Capture. With the Heat Capture option, the exhaust heat exits the equipment at the back of the power module instead of the top and is easily transferred to heat recovery equipment.

Bloom Energy will work with heat recovery process experts to provide guidance for necessary connections, share drawings, and provide best practices for the design of the full CHP system.

Power Module without Heat Capture



Power Module with Heat Capture enabled

Figure 1: Power Module Options

Typical Applications for the Bloom Energy Server with Heat Capture

The Bloom Energy Server produces waste heat at an average temperature of >350 °C. Common applications include using heat for boiler pre-heat, steam pre-heat, space heating, hot water generation, chilled water, biogas digesters, additional electricity generation, chemical processes that require heat, and district water heating. Typical applications would be input to heat exchangers or absorption chillers. Figure 2 below shows a typical application of a Bloom Energy Server working with an absorption chiller and Table 1 shows the expected lifetime average output. These projections are calculated based on actual monitoring of existing Bloom Energy systems that are installed around the world.

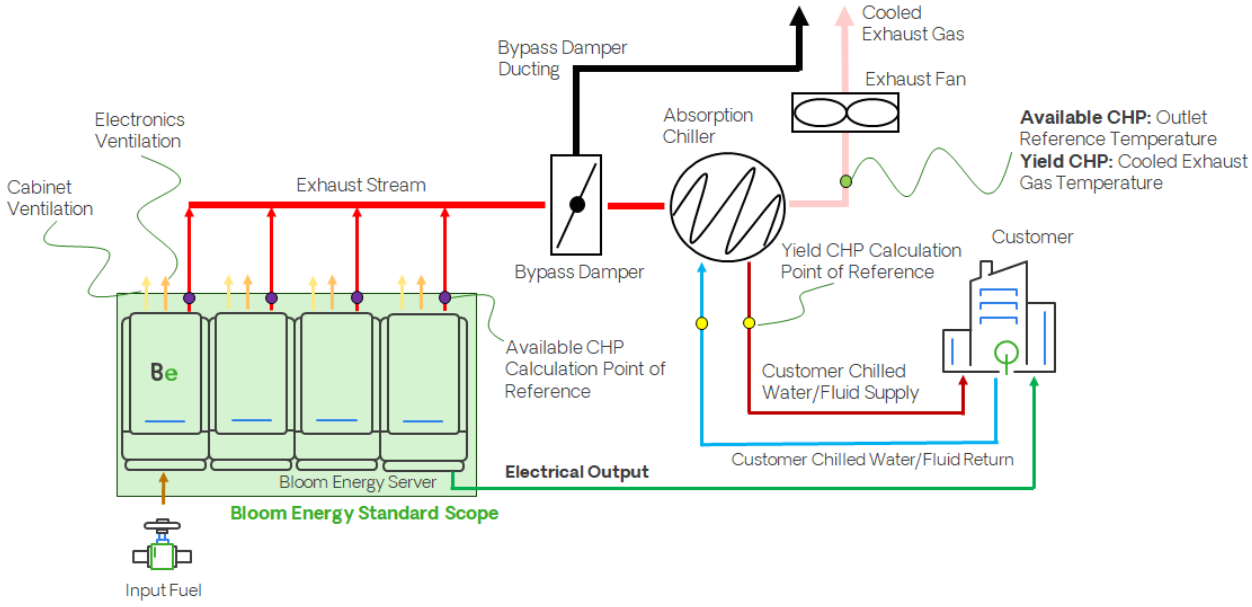


Figure 2: Bloom Energy Server Delivering High Temperature Heat to a CHP System

Parameters	Units	LT Avg. - Low Pressure Drop App.[1]	LT Avg. - High Pressure Drop App.[2]
Electrical Efficiency	(%)	54	54
Thermal Efficiency	(%)	31	36
Total Bloom CHP Efficiency	(%)	85	90
Available Heat Output	(kW)	186	216
Available Heat Output	(MMBTU/h)	0.63	0.74

Table 1: Expected Output of a Typical 325 kW Bloom Energy System Used in a Customer CHP System

1. Assumes a 70°C reference outlet temperature for available CHP. Applies to low pressure drop applications such as hot water heat exchangers. 2. Assumes a 30°C reference outlet temperature for available CHP. Does not include latent heat of vaporization from moisture in flue gas. Applies to high drop pressure applications such as absorption chillers, steam generators, condensing economizers, and saturated economizers with the use of an induced draft fan.
3. Assumes 0°C temperature loss of flue gas. 4. Values calculated at 95% Total Maximum Output (TMO). 5. Values are for reference only. System performance depends on site and system specifics. All values are based on modeling data that have a +/-5% accuracy compared to actual field data.

Table 2 provides a deeper look into modeling of a typical 325 kW Energy Server and projected operational performance at the beginning of life and over the lifetime of the system.

	Units	Start	Lifetime Average
Minimum Allowed Static Pressure at Fuel Cell Outlet	mbar	-5.0	
Maximum Allowed Static Pressure at Fuel Cell Outlet	mbar	7.5	
Induced Draft Fan Operating Setpoint at Fuel Cell Outlet (If Present)	mbar	-0.5	
Maximum Allowed Pressure Drop across Heat Recovery Unit(s)	mbar	60	
Exhaust Air (Thermal Recovery Condition) - Mass	kg/h	1,650	>2,270
Exhaust Air (Thermal Recovery Condition) - Volume	m3/h	2,251	>3,100
Exhaust Air (Thermal Recovery Condition) - Temperature	°C	334	>350
Peak Exhaust Mass Flowrate	kg/h	2,725	
Peak Exhaust Volume Flowrate	m3/h	3,896	
Peak Exhaust Temperature	°C	379	

Table 2: CHP System Operation Parameters and Performance

1. Values for reference only, system performance depends on site and system specifics. All values displayed in the table are estimations based on modeling data that have +/- 5% accuracy compared to actual field data. 2. Pressure range only applies if an integrated controls solution is present. Peak exhaust temperature and flowrate predicted to occur approximately 2 years after commissioning of the Energy Server.

Benefits of the Bloom Energy Server with Heat Capture

By harnessing heat and repurposing it, the overall efficiency of the system increases, and more energy is delivered per unit of fuel. With the Bloom Energy Server with Heat Capture, the system can reach a lifetime average efficiency of >90%. This efficiency advantage equates to considerable savings compared to less efficient systems, especially if fuel prices increase. Depending on the application, the efficiency advantage also reduces scope 1 and/or 2 emissions.

Available Configurations

Figure 3: 1.8 MW Power Tower with Heat Capture Installation (3x600 kW)

The Bloom Energy Server with Heat Capture is scalable with building blocks starting at 220 kW to multiple MW systems, custom designed to fit any customer need.

The Energy Server with Heat Capture can be installed at ground level or can be installed as a Power Tower with Heat Capture (see Figure 3).

For more information on Bloom Energy's products, please visit our website at: bloomenergy.com

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