Microsoft

Modern datacenter cooling

Modern datacenters must manage an immense amount of heat. Using traditional methods, a legacy datacenter can require almost as much power to cool and support the IT load as it takes to run the load.

More energy efficient

Microsoft's commitment to sustainability has led to major innovations in energy, water, and carbon efficiency. Through industry-leading cooling technologies combined with the cloud's compute efficiency, thermally effective layout and increased temperature and humidity tolerance substantially reduce the energy required to deliver cloud services.

Dramatically less carbon

Combined with advanced cooling, the cloud's highly efficient compute capabilities and datacenter operations processes allow you to reduce the carbon and energy used to deliver your IT services.

79% to 93%

Improvement in energy efficiency

92% to 98%

Reduction in carbon footprint

Over operating your IT services in a traditional on-premises datacenter[1]

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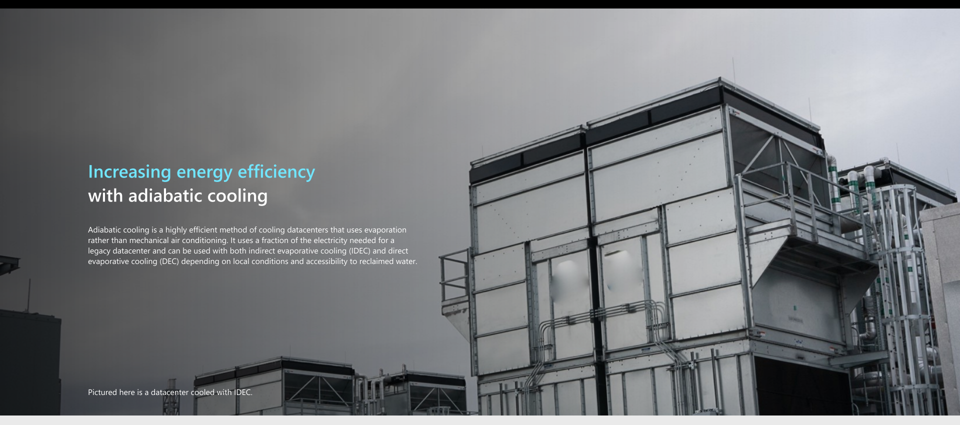
[1] Microsoft-WSP Study Highlights Environmental Benefits of Cloud Computing



Increasing energy efficiency
with adiabatic cooling

Adiabatic cooling is a highly efficient method of cooling datacenters that uses evaporation rather than mechanical air conditioning. It uses a fraction of the electricity needed for a legacy datacenter and can be used with both indirect evaporative cooling (IDEC) and direct evaporative cooling (DEC) depending on local conditions and accessibility to reclaimed water.

Pictured here is a datacenter cooled with IDEC.

Cooling impact on datacenter efficiency

Reducing energy and carbon footprint by using innovative cooling

Legacy datacenter

Built to support older IT equipment with less tolerance to heat or humidity. Typically operates at less than full utilization without engineered air management.

Modern cloud datacenter

Provisioned for maximum utilization with a thermodynamically engineered layout to optimize for ideal cooling.

	Mechanical cooling	High-efficiency mechanical cooling	Adiabatic cooling	
Layout	Open hall, low utilization	High-density layout with containment	High-density layout with containment	
Environment	68°F–75°F and 45%–55% relative humidity	High-tolerance environmental range, 65°F–95°F, non-condensing	High-tolerance environmental range, 65°F–95°F, non-condensing	
Description	High-accuracy air conditioning to maintain precise temperature and humidity control	Variety of high-efficiency mechanical cooling technologies selected for a specific location	Indirect Evaporative Cooling	Direct Evaporative Cooling
Power usage	Very high	Medium	Low	Low
Water usage	High to medium	High to none	Medium	Low
Cost	Very high	High	Low	Low

Adiabatic cooling

Adiabatic technology is used for both indirect and direct evaporative cooling systems.

Indirect evaporative cooling (IDEC)

IDEC uses a "fluid-cooler" that takes advantage of water evaporation to cool air flowing through an external air-to-water heat exchanger (radiator) to remove heat from the datacenter and return chilled cooling fluid to it. IDEC is a closed system that prevents polluted air from being introduced into the datacenter and does not require potable water.

Power usage	Low
Water usage	Medium
Cost	Low

Did you know?

Adiabatic cooling reduces our energy costs by **30 percent**[2]

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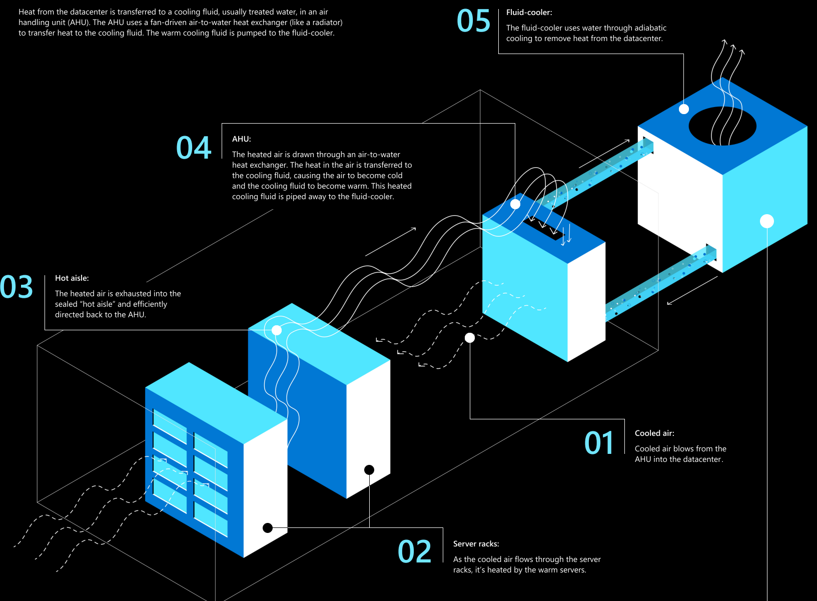
[2] CDP 2017 Climate Change 2017 Information Request

Inside the datacenter:

Heat from the datacenter is transferred to a cooling fluid, usually treated water, in an air handling unit (AHU). The AHU uses a fan-driven air-to-water heat exchanger (like a radiator) to transfer heat to the cooling fluid. The warm cooling fluid is pumped to the fluid-cooler.



01 **Cooled air:** Cooled air blows from the AHU into the datacenter.

02 **Server racks:** As the cooled air flows through the server racks, it's heated by the warm servers.

03 **Hot aisle:** The heated air is exhausted into the sealed "hot aisle" and efficiently directed back to the AHU.

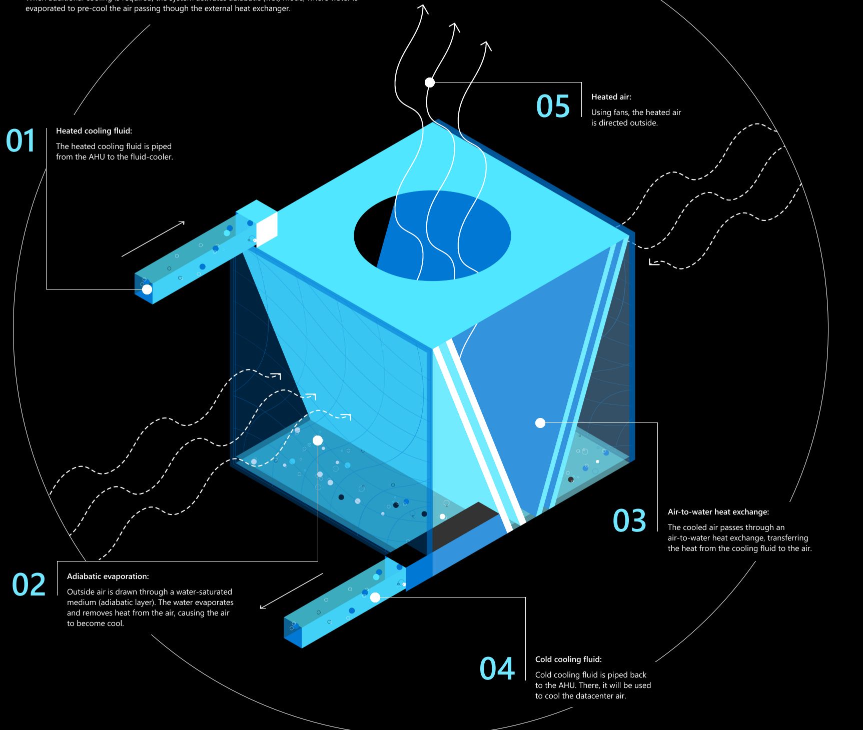
04 **AHU:** The heated air is drawn through an air-to-water heat exchanger. The heat in the air is transferred to the cooling fluid, causing the air to become cold and the cooling fluid to become warm. This heated cooling fluid is piped away to the fluid-cooler.

05 **Fluid-cooler:** The fluid-cooler uses water through adiabatic cooling to remove heat from the datacenter.

Outside the datacenter:

The fluid-cooler uses a fan to pull air though a water-soaked medium, using evaporation to cool the air, which is then passed through an external water-to-fan–driven water-to-air heat exchanger that transfers the heat to the outside air, cooling the fluid for return to the datacenter.

When additional cooling is required, the system activates adiabatic (wet) mode, where water is evaporated to pre-cool the air passing though the external heat exchanger.



01 **Heated cooling fluid:** The heated cooling fluid is piped from the AHU to the fluid-cooler.

02 **Adiabatic evaporation:** Outside air is drawn through a water-saturated medium (adiabatic layer). The water evaporates and removes heat from the air, causing the air to become cool.

03 **Air-to-water heat exchange:** The cooled air passes through an air-to-water heat exchange, transferring the heat from the cooling fluid to the air.

04 **Cold cooling fluid:** Cold cooling fluid is piped back to the AHU. There, it will be used to cool the datacenter air.

05 **Heated air:** Using fans, the heated air is directed outside.

Direct evaporative cooling (DEC)

DEC uses the direct evaporation of water to produce significant cooling and humidification with low energy consumption. A water-saturated medium is used to allow a large volume of air to contact evaporating water. This is widely regarded as the simplest, most cost-effective method of cooling and humidifying air. This technology is deployed by operators that have access to potable water, are willing to let the air in the datacenter fluctuate with the outdoor air, and are willing to take the risk of bringing in air from the outside.

Power usage	Low
Water usage	Low
Cost	Low

Did you know?

Adiabatic cooling uses less electricity and up to **90 percent** less water than other water-based cooling systems[3]

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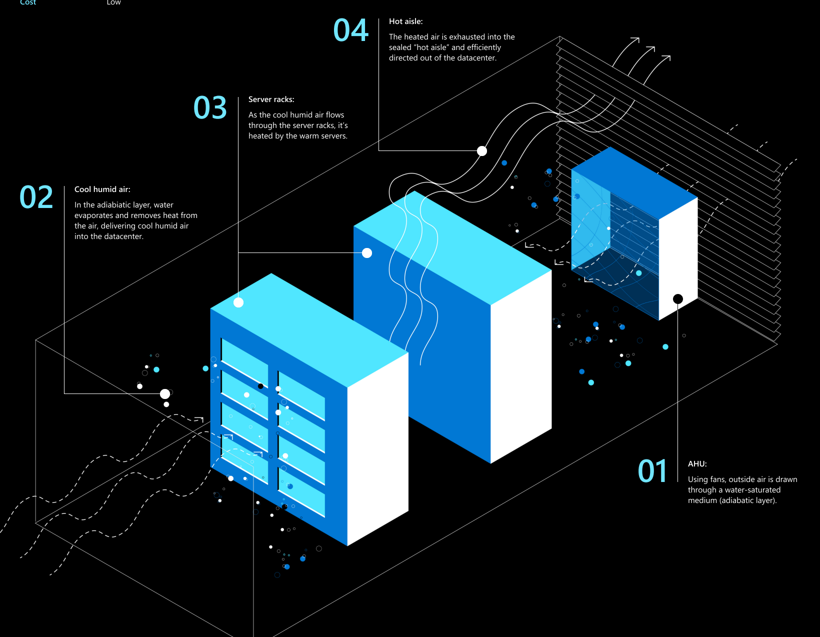
[3] Microsoft will replenish more water than it consumes by 2030



01 **AHU:** Using fans, outside air is drawn through a water-saturated medium (adiabatic layer).

02 **Cool humid air:** In the adiabatic layer, water evaporates and removes heat from the air, delivering cool humid air into the datacenter.

03 **Server racks:** As the cool humid air flows through the server racks, it's heated by the warm servers.

04 **Hot aisle:** The heated air is exhausted into the sealed "hot aisle" and efficiently directed out of the datacenter.

Move forward sustainably

Microsoft believes technology can help people everywhere build a more sustainable future. Explore sustainability tools, resources, and products.

Start your sustainability journey

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