



# Dell Fresh Air 2.0:

## Frequently Asked Questions

Achieve improved data center efficiency and powerful enterprise performance you have come to expect from Dell, by deploying Dell Fresh Air hardware. Competitively priced, the select off-the-shelf configurations of Dell enterprise hardware can use clean outside air for cooling; and also operate in a wider range of temperature and humidity conditions to continually withstand air intake of 40°C (104°F) plus added excursion time of 90 hours up to 45°C (113°F) – enabling you to economize and spend less on data center cooling.

### What is Dell Fresh Air hardware?

Most enterprise hardware is designed for a tightly controlled air conditioned environment with a de-facto industry maximum of up to 35°C (95°F). Dell Fresh Air hardware are specific configurations of Dell server, networking, and storage products capable of operating at higher temperature and humidity levels (up to 45°C/113°F and 90% relative humidity (RH)), and they can also be cooled by clean outside air (meeting ISA-71 G1).

### Why did Dell develop Fresh Air hardware?

Dell Fresh Air hardware was the result of more than 7 years of research and development started because Dell was looking for ways to reduce the total cost of ownership of IT for our customers. One of the largest costs of delivering IT is energy and, among energy, one of the largest segments is the cost of cooling. Dell asked what if data centers could reduce or eliminate the cooling costs associated with air conditioning and chillers? The key to accomplishing this goal was designing IT equipment compatible with many world-wide climates. If the temperature and humidity range of the IT equipment is compatible with the outdoor climate then customer data centers will have a wide range of energy saving options open to them including fresh air cooling and other forms of economization.

### Why would you want to use outdoor air for data center cooling?

Using clean outdoor air for economization for all or even part of a year with Dell Fresh Air capable hardware can reduce the number of annual hours data center needs to run an expensive chiller - which can save OpEx and lower your data center PUE. By using 100% outside air for cooling in favorable climates, and making the decision to forgo building a chiller altogether you can save significantly on CapEx.

## What research has been done for Dell Fresh Air?

Dell has invested over 7 years of research into the development of Dell Fresh Air capable hardware - including development of a number of proprietary design components and study of world-wide climate study locations spanning North America, South America, Europe, Asia, Middle East, Africa, and Australia.

## What types of businesses and organizations could benefit from Dell Fresh Air?

From small to medium businesses up to data centers – there are several opportunities for businesses and organizations to economize using Dell Fresh Air hardware.

- **Remote and branch offices** often have a warm wiring closet that doesn't receive a lot of cooling from the common building A/C. Using Dell Fresh Air 2.0 capable hardware, these businesses and organizations can enjoy peace of mind knowing this hardware can withstand continual air intake of 40°C (104°F).
- **Small and medium businesses** often have legacy data centers with unique cooling challenges such as limited air flow and hot spots. Also, some businesses save energy by turning up the building temperature over the weekend. Dell Fresh Air 2.0 capable hardware can handle it with continuous operation up to 40°C (105°F); but if it gets even hotter – don't worry – the extra hour of 45°C (113°F) excursion capability of Dell Fresh Air 2.0 hardware can give you ride-through time to prevent data loss and initiate a graceful shutdown while waiting for the building air conditioning to bring temperatures back down.
- **Data centers and dedicated labs** usually have separate IT equipment areas from staff environments. Using Dell Fresh Air 2.0 hardware, could allow IT equipment areas to have a higher temperature air intake environment. For those wanting to use air or water side economization for cooling a data center or lab to take advantage of free, clean air there Dell Fresh Air capable hardware could be part of a step-wise transition. Whether allowing temperatures to begin increasing on a traditional 'cold aisle' or deploying an outside air economization model, Dell Fresh Air 2.0 hardware can take the heat in these environments performing for 100% of the year at 40°C (104°F) and also allowing an additional 90 hours per year at 45°C (113°F) – and use clean, outside air to do it.

## How can I see an example of Dell Fresh Air hardware capabilities?

Outside of Dell headquarters in Round Rock, Texas where summer temperatures routinely reach 40°C (104°F); Dell built a proof of concept building called the Fresh Air Hot House, which contains a rack of operating Dell Fresh Air capable hardware.

The Fresh Air Hot House has no air conditioning system nor humidity control, and a fan simply draws outside air in through filters at the bottom of the building and exhaust air is pulled out via the building roof vents. The temperature of the air entering the Hot House is that of the outside air, which is the inlet air temperature used by the Dell Fresh Air hardware. The hardware air intake temperature often exceeds 40°C (104°F) in the summer months and the hardware has been operational for nearly 3 years 24/7. The equipment inside the Dell Fresh Air Hot House includes Dell 11<sup>th</sup>, 12<sup>th</sup> and 13<sup>th</sup> generation servers.

## How is a typical data center cooled?

In a typical data center, racks of IT equipment are arranged in long rows, much like bookshelves in a library. Rows of racks are arranged in a back to back configuration so the hot exhaust air collects between one row of racks and the cold supply air is contained by the next row. Alternating hot and cold air is commonly called a hot aisle cold aisle configuration. Environmental controls in the data center maintain the supply air to the cold aisle at a constant temperature year round. The reason traditional data center cooling is less efficient than it could be is the data center takes the hot air from the hot aisle, at a typical temperature of 35°C, and uses air conditioning to cool it back down to 20°C, even in the winter when there is an unlimited supply of cool air outside.

## How is a fresh air data center cooled?

A fresh air or economized data center can be cooled by clean outside air or a combination of clean outside air plus evaporative cooling – depending on climate conditions – and it can be deployed to economize continually throughout the year or within a limited temperature range you determine. Whether you are fully or partially economizing with outside air it can enable reduced A/C use and lower OpEx; and for those locations where full economization is possible, you could forgo buying a chiller and realize substantial CapEx savings. Because Dell Fresh Air hardware is designed for most outdoor climate extremes of temperature and humidity it is an ideal choice for provisioning a fresh air cooled data center.

## How can Dell Fresh Air hardware benefit a partial economization deployment?

Partial economization within a defined temperature range is a very viable and measured approach to implementing economization and realizing energy savings. As a data center operator collects more run time with economization and gains more confidence in the technology, they can widen the economization temperature range gradually to provide even more hours of economization and larger energy savings. The added temperature and humidity range of Dell Fresh Air equipment means your IT equipment won't constrain your economization or the amount of cost savings you can realize.

## What is the difference between Dell Fresh Air 1.0 and 2.0 server specifications?

The Dell Fresh Air 1.0 specification includes specific configurations of select Dell PowerEdge 11<sup>th</sup> and 12<sup>th</sup> generation servers which can perform continuously with inlet air intake up to 35°C (95°F), plus an additional 10% of the year operating excursion of up to 40°C (104°F) and also an additional 1% of the year operating excursion of up to 45°C (113°F); at a 26°C maximum dew point.

The Dell Fresh Air 2.0 specification includes specific configurations of select Dell PowerEdge 13<sup>th</sup> generation servers which can perform continuously with inlet air intake up to 40°C (104°F) plus an additional 1% of the year operating excursion of up to 45°C (113°F); at a 29°C maximum dew point.

## Which geographical locations meet the Dell Fresh Air 2.0 specification?

The Dell Fresh Air 2.0 specification, includes greater temperature and humidity operating tolerances which expands the geographic locales where a Dell Fresh Air deployment could be located to almost anywhere in the world where air quality and climate conditions are favorable including:

- Canada, Japan, Middle East, Northern and Southern Asia, Northern and Southern Europe, South America, and North America
- Partial economization in: Africa, Australia, Indonesia, New Zealand, Papua New Guinea

## What air quality do I need if I am considering using outside air for cooling?

Dell Fresh Air capable hardware requires clean air that meets the ISA-71 specification G1 level. G1 is considered clean air and it is generally found in most of the US, Canada, Western Europe, Australia, Japan, and New Zealand. However, even in regions where the air is generally clean, polluted air can occur locally due to nearby manufacturing facilities such as paper pulp, tire and rubber, refineries, metals smelting, etc. Be sure to check your local air quality before considering use of outside air for cooling.

## How do I test my outside air to find out the quality level?

Prior to deploying outside air cooling, it is highly recommended that you use a corrosion coupon to monitor and test the air in the intended area where outside air cooling is being considered.

## What is PUE?

PUE is Power Usage Effectiveness is a measure of how efficiently a data center uses power for the IT equipment vs. power for other components such as cooling, lighting etc. To calculate PUE take your Total Facility Power and divide it by your IT Equipment Power.

A PUE of typical chiller based data centers has been estimated to be around 1.5 to 2.5 because so much of the total facility power is being used for cooling. By comparison, fresh air chiller-less data centers have reported PUEs as low as 1.05. The significance of a PUE of 1.05 is that nearly all of the facility power is going towards the IT equipment with very little wasted on cooling, lighting, power distribution losses, etc.

## What is ASHRAE and how does it relate to data centers and Dell Fresh Air?

ASHRAE is the American Society of Heating, Refrigerating, and Air-Conditioning Engineers which has a worldwide membership and focuses on building systems, energy efficiency, indoor air quality, refrigeration and sustainability. The ASHRAE TC9.9 committee for "Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment" defines environmental specifications for data centers and IT equipment. Although ASHRAE is a US based organization its membership and its influence on data centers and IT equipment are global. Dell Fresh Air hardware meets and exceeds ASHRAE Classes A1, A2, and A3. Dell Fresh Air equipment meets ASHRAE Class A4 with a restriction of operation at temperatures between 40° and 45°C for 90 hours per year.

## **Does IT equipment fan power increase in an economized or chiller-less facility?**

The fan energy of fans inside the IT equipment does increase with increasing air inlet temperature. However, periods of elevated temperature with higher than normal fan power are limited to a handful of warm daytime hours during the summer. Night temperatures, even during the summer, are usually fairly cool. For the remaining seasons of the year (fall, winter, spring), temperatures are cool and fan power is relatively low. The time averaged fan power over a year with economization is not much higher than in an air-conditioned data center because the number of hours of higher fan power is relatively small. The overall data center wide energy savings from economization is large because air conditioning/chillers can be turned off for a large portion of the year.

## **Is there a performance impact to Dell IT equipment at higher temperatures when using fresh air cooling?**

A modest amount of performance degradation is possible at temperatures above 35°C to limit the maximum power consumption and keep key components, such as the processor, within their recommended temperature ranges. Dell fresh air hardware specifications allow a modest amount of performance degradation in lieu of adding cost to the equipment for items such as more expensive fans and heat sinks.

## **Who is pushing the need for economization in the data centers?**

Many US and world-wide agencies are encouraging and even mandating the use of economization as a way to save energy and reduce the carbon footprint of IT. The European Union has endorsed economization as one of the highest impact energy saving technologies available for data centers. Many other world-wide governments such as Australia and Japan have formal programs to encourage energy saving and the adoption of energy saving technologies such as economization.

## **Why is Dell a strong supporter of economization and expanded operating temperature ranges in the data center?**

Dell Fresh Air hardware was developed to support customer needs to save energy and reduce the total cost of ownership for delivering IT. Equipment with a wider operating temperature and a wider humidity range was needed to support expanded use of energy saving technologies such as economization. Dell realized that the industry was not asking for a ruggedized, more expensive, enterprise hardware platform; but one that could withstand additional hours per year of temperature that exceeded existing hardware specifications.

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