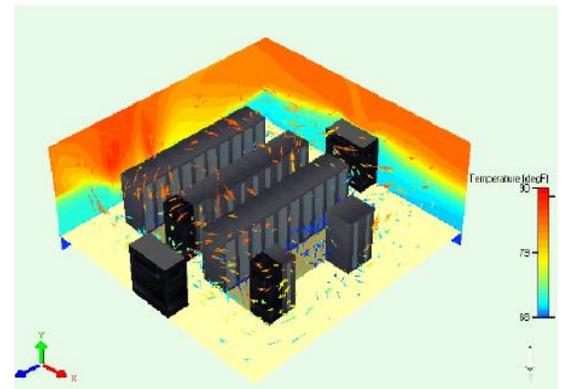


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## 1.0 Executive Summary

Schneider Electric Cooling Analysis uses Computational Fluid Dynamics (CFD) for Data Center to analyze the airflow and temperature patterns of your existing data center. The CFD software creates a 3D model of the physical attributes within the space, as well as the location and performance characteristics of the cooling units, IT equipment, power systems and any other significant equipment within the data center.



The 3D model is used by Schneider Electric service to analyze the temperature and airflow patterns within the data center and to determine the effects of cooling equipment failure.

The Schneider Electric Service Cooling Analysis for Data Center uses the CFD service to provide a complete and detailed thermal review of your data center.

This service involves a site visit by Schneider Electric Service Professional Services Consultants who will collect data pertaining to:

- Physical layout of the space and equipment in the data center.
- Data center power equipment thermal dissipation and rack power density.
- Environmental conditions.
- Cooling capacity and utilization and air distribution effectiveness.

A 3D CFD model of the data center is created based on the information collected onsite.

- This service provides an analysis of a baseline model, an optimized model, and a maximized model, which simulates site recommendations.

## 2.0 Features and Benefits

Features	Benefits
A 3D CFD model of the temperature and airflow conditions in the existing data center.	Provides a baseline 3D visualization of the data center temperature and airflow patterns; identifies excessive temperatures and restricted airflows that can compromise reliability and the availability of equipment.
Predictive impact analysis of new high density loads	Simulates causality situations and "what if" scenarios. Allows the data center operator to model the results of planned modifications or investigate potential failure modes within the data center.
Recommendations to optimize the cooling infrastructure	Identifies methods to maximize the cooling effectiveness of the data center.

## 3.0 Details of Service

The specific activities of this service are listed below. For each item, Schneider Electric service will perform the work described.

Power	
Subsystem	Activity
<b>Data Center Power Distribution Review</b>	Record nameplate data, manufacturer, and displayed load readings of power equipment on the raised floor. Analyze data to determine thermal dissipation.
	Record metered load measurements taken at the critical load distribution panel(s) input and branch circuits to determine rack power utilization and provide an analysis of the data, requires up-to-date panel schedules. Where this may not be accomplished rack power density will be estimated.
	Document excessive load conditions at the critical load distribution panel branch circuit level that may compromise infrastructure reliability

Cooling	
Subsystem	Activity
<b>Data Center Cooling Distribution Review</b>	Visually assess the Computer Room Air Conditioning (CRAC) and Computer Room Air Handler (CRAH) units. Check for general conditions, improper installation practices, damaged equipment and improper use
	Identify the system type (i.e. direct expansion, water based or dry cooler, upflow or downflow) and document equipment manufacturer and model number.
	Record and analyze supply and return temperatures, humidity, set points and operational modes to determine environmental conditions and where demand fighting may occur.
	Identify and record the air distribution topology within the computer room.
	Document the rated capacity (based upon nameplate data and manufacturer nominal ratings) of the CRAC/CRAH unit(s).
	Record and document room temperature and humidity levels to ensure that they are within ranges established by equipment manufacturers and recognized industry standards.
<b>Rack Cooling Documentation and Analysis</b>	Identify airflow obstructions within, above, and below the rack environment.
	Identify racks where air mixing is likely to occur and where blanking panels should be installed.
	Examine rack enclosures for airflow suitability.
	Determine the airflow pattern (i.e. front-to-back, side-to-side etc.) of racked and non-racked equipment.
	Detect and document areas where rack inlet temperatures exceed industry standards and guidelines using infrared thermography.

<b>Cooling (cont.)</b>	
<b>Subsystem</b>	<b>Activity</b>
<b>Rack Cooling Documentation and Analysis</b>	Analyze rack arrangements for air distribution effectiveness.
	Measure the airflow and temperature of raised-floor air distribution system and overhead grilles, if accessible.
<b>Facility Documentation and Review</b>	Locate significant obstructions under the raised floor and in the drop ceiling that affect airflow. This will be collected onsite or by using customer provided mechanical drawings.
	Determine areas of significant air leakage in the data center.

<b>Data Center Analysis and Report</b>	
<b>Activities</b>	<b>Description</b>
<b>Recommendations for Optimal Air Solution</b>	Provide a comprehensive report indicating conditions that compromise cooling effectiveness and provide recommendations to correct problems.
<b>Drawing of Data Center Floor Plan</b>	Provide a floor plan drawing of the existing data center.
	Provide a drawing of the existing data center depicting measured approximate rack densities and average hot aisle and cold aisle temperatures for comparison to the CFD results.
	Provide a drawing of the existing data center depicting measured raised floor supply tile CFM readings for comparison to the CFD results.
<b>Recommendations for Floor Plan</b>	Provide written recommendations to optimize cooling infrastructure utilization.
	Provide conceptual drawing(s) depicting recommendations for cooling equipment and rack layout.
<b>CFD Model Creation and Analysis</b>	Create a 3D baseline model of the data center based on existing data center attributes that depicts the airflow and temperature patterns of the space.
	Create an optimized CFD model, based on an analysis of the baseline model, that models data center layout improvements.
	Create a CFD model of the maximized data center, based on an analysis of the baseline model and elimination of reasonable constraints, that models data center layout improvements.
	Provide animation, as requested by the customer, of the existing model, the optimized model, and the maximized models.

### 4.0 Deliverables

Schneider Electric service will deliver a comprehensive cooling assessment report to the customer that includes:

- The results of baseline 3D CFD model as well as applicable analysis defined in the terms of the service.
- Specific recommendations addressing customer concerns, along with general recommendations to improve cooling and facility utilization.
- Identification of problem areas based on analysis performed using digital photography, thermal imaging, actual field measurements and the results of the CFD model.
- Tabular data collected from all the activities defined in Section 3.0, Details of Service.
- Three (3) hard copies and a PDF of the final report.
- A follow-up conference call to review the report and answer questions.

### 5.0 Exclusions

The following items are outside the scope of this standard service offering. They can be integrated into a customized Statement of Work (SOW) at your request. Please contact your Schneider Electric service sales representative for more details.

- Specialized testing or commissioning
- Fire detection and fire suppression
- Physical security
- Structural analysis
- Data center circuit tracing

## 6.0 Scope of Responsibility

The items stated here are responsibilities of both Schneider Electric service and the customer.

### 6.1 SCHNEIDER ELECTRIC SERVICE RESPONSIBILITIES

- Assign a Professional Services fulfillment manager to the case.
- Initiate a meeting to:
  - Review the assessment process and deliverables.
  - Establish project stakeholders and key contacts.
  - Review the Assessment Preparation Questionnaire to identify customer specific existing conditions and issues in the data center.
- Schedule assessment and manage complete assessment process through the Schneider Electric Service Professional Services office.
- Perform an assessment of the customer site.
- Provide a written report to the customer of the completed field survey.
- Assist the customer in understanding the report findings via a conference call.

### 6.2 CUSTOMER RESPONSIBILITIES

- Complete and return the Assessment Preparation Questionnaire. This will identify issues or problems in the data center needing specific, detailed analysis and recommendations.
- Provide up to date circuit panel labeling and panel board schedule prior to onsite data.
- If unavailable, Schneider Electric service can provide this as an additional service. Please contact your Schneider Electric service sales representative, or visit [www.apc.com](http://www.apc.com) for details and pricing.
- Provide an electrician to take electrical panel readings on the day the Schneider Electric Service Professional Services consultant performs the assessment.
- Provide building infrastructure architectural, mechanical, and electrical drawings, if available.
- Provide HVAC maintenance records, if available.
- Provide the qualified personnel for physical access to the data center, all infrastructure support areas and electric panels to be surveyed. These areas include, but are not limited to, the cooling systems within the data center and those feeding the data center from outside. Access to data center systems will include:
  - Access to the internal and external cooling system components within the data center.
  - Access to the internal power system components within the data center.
  - Floor panel removal and sub-floor and ceiling plenum access.
- Notify Schneider Electric service of any non-disclosure agreement, security clearance, safety or other certification requirements prior to arrival on site.
- Provide a single point of contact to assist during assessment.

## 7.0 Project Work Details

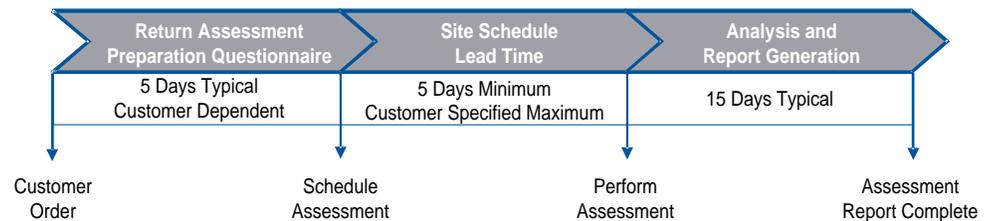
The following details of the project specify the schedule, location and successful completion criteria.

### 7.1 SCHEDULE

1. All onsite services performed by Schneider Electric service are executed during the normal business hours of Monday through Friday from 8:00AM to 5:00PM, local time. Exceptions are national or provincial holidays. Services performed outside of normal working hours may incur additional charges.
2. The service will be scheduled as quickly as possible at the convenience of the customer. Delays in fulfilling the service caused by labor disputes of third parties, customer contracted services, or other unforeseen conditions may affect the schedule. Schneider Electric service will not be responsible for delays related to circumstances outside of its control.

### 7.2 ASSESSMENT PROCESS TIMELINE AND FLOW

3. Customer Purchase Order received by Schneider Electric service.
4. Assessment Preparation Questionnaire completed and returned to Schneider Electric Service.
5. Site assessment scheduled with customer through Schneider Electric Service Professional Services office.
6. Meet with IT, facility management and Schneider Electric service sales representative to coordinate site visit.
7. Site assessment performed at customer location.
8. Customer site assessment report completed.



The actual and specific dates are not contracted due to the variability in each unique site assessment and analysis.

### 7.3 LOCATION

The location of this project will be onsite. It will be discussed and approved by Schneider Electric Service and the customer.

### 7.4 COMPLETION CRITERIA

Schneider Electric service is expected to have finished its written duties when any of the following occurs:

1. Schneider Electric Service completes all the items described in Section 4.0, Deliverables of this SOW, with exception of the follow up call, which may be omitted at the customer's discretion, or at Schneider Electric's service discretion if the customer fails to request the call within a reasonable time frame.
2. This project and SOW are terminated for other reasons, within the Schneider Electric service Customer Agreement.

## 8.0 Pricing

Part Number: QWPACFD-MISC

Pricing for the Data Center Cooling Analysis using Computational Fluid Dynamics varies depending on data center size, equipment, power capacity, cooling capacity, available as-built documentation and location of the data center. To receive a price quote for your application visit [www.apc.com](http://www.apc.com) or contact your Schneider Electric service sales representative.

## 9.0 Terms and Conditions

Schneider Electric Standard Terms and Conditions apply.

The information provided in this Scope of Work cannot be used or duplicated, in full or in part.

Other uses for this document are prohibited without written consent by Schneider Electric.

All documentation, photographs, imaging or other information provided by the customer, or gathered at the customer site, will be for internal use only and used solely for the purpose of report generation, analysis and recommendations.

All services' conditions included in this document apply (i) only between Schneider Electric and that organization that bought the Services Solutions; and (ii) only to those products and services ordered by the Customer at the time that the Schneider Electric Services information is current. Schneider Electric may change the Schneider Electric Services Information at any time. The Customer will be notified of any change in the Schneider Electric Services Information in the manner stated in the then current product ordering and/or services solutions related agreement between Schneider Electric and the Customer, but any such change shall not apply to products or service ordered by the Customer prior to the date of such change. Schneider Electric will have no obligations to provide Services Solutions with respect to equipment and assets that are outside the Service Area. "Schneider Electric Service Area" means a location that is within (i) one hundred (100) miles or one hundred and sixty (160) kilometers radius of a Schneider Electric service location; and (ii) the country in which the Installation site is located, unless otherwise defined in the governing agreement with Schneider Electric, in which case the definition in the governing agreement prevails.

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