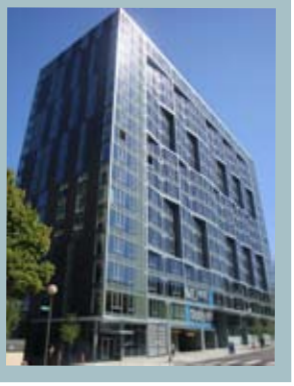
BRADFORD
Consulting Engineers, Inc.

SBA #PO842028, ESB #3803 (tier-2), CAGE #4NVC3

ELECTRICAL ENGINEERING SERVICES

FULL DESIGN SERVICES

-Utility Power Coordination
-15kV, 480V, 208V Power Design
-Code Compliance
-Load Calculations
-Grounding Systems
-Branch Panel Load Balancing
-CAD Drawings
-Lighting Luminaires Schedule
-Site U/G Duct Banks
-Conduit & Cable Schedules
-Metal Clad Cable Layout
-Cable Tray Design
-Division 16 Specifications
-MCC Power & Controls



ENGINEERING STUDIES

-Fault Current Calculations
-Voltage Drop Calculations
-Energy Studies
-Power Quality Studies
-Commissioning
-Arc Flash Hazard Assessment
-Breaker Coordination

CONSTRUCTION SUPPORT SERVICES

-Temporary Construction Power
-Design/Build Engineering
-Permit Drawing Submittals
-PE Review Set Stamp
-As-Build Field Verifications
-Plotting Construction Drawings
-Field Design Coordination
-Installation Details

SUPPLEMENTARY SERVICES

-3-D Modeling
-Architectural/Civil Engineering
-Asset/Inventory Management
-AutoCAD Conversion
-Data/Voice Design
-Design Drawing Verification
-Field Verification
-Facility/Building Management Systems
-Fire Alarm Systems
-Instrument & Controls Design
-Life Safety Systems & Fire Protection
-Microstation Formatted Drawings
-PM/CM Support
-PLC Panel Design
-Security Systems
-Seismic Design
-Staff Augmentation
-Sustaining Engineering:
Engineers, Designers
FAB Planners
Drafters

DESIGN SECTORS SERVED

Commercial:
Offices, Medical, Dental, Retail, Grocery, Theaters, Restaurants

Industrial:
High-tech Fabrication, Material Handling, Manufacturing, Printing, Steel Mills, Wastewater and Water Treatment

Residential:
Low, Medium, and High Rise Multi-Family Housing, Assisted Living

Community:
Schools, Churches, Parks, Hospitals

Government:
Federal, State, County, City

Renewable Energy:
Solar, Wind, Biomass, Digesters

Bradford Consulting Engineers, Inc. is Professionally Registered in:
Arizona, California, Colorado, Connecticut, Georgia, Hawaii, Idaho, Maryland, Montana, New York, Oregon, Tennessee, Utah, Virginia, Washington, and Washington D.C.

16869 SW 65th, PMB #312 - Lake Oswego, Or - 97035 ph: 503.694.2437 fax: 503.694.6041
http://www.bradfordengineers.com

BRADFORD
Consulting Engineers, Inc.

SBA #PO842028, ESB #3803 (tier-2), CAGE #4NVC3

MECHANICAL ENGINEERING SERVICES

FULL DESIGN SERVICES

-CAD Drawings
-P&ID Drawings
-Solvent Tank Install
-Waste Lines (Solvent, General Acid, Copper Bump)
-Small Scrubber Unit Install
-DI Water Pump Stations
-UV Sterilizer Skid Stations
-Reclaim Water Skids/Tanks
-Ultra Pure Water
-Duct Heaters & Swamp Coolers
-Coils and Air Handlers
-Chillers and Cooling Towers
-Boiler Systems
-Kitchen Hoods and Exhaust
-Fans and Blowers
-VAV and VVT Systems
-Piping Systems (Evac, Gas, High Purity, Process, Plumbing, Waste)
-Medical Gases
-Steam and Condensate Systems
-OSA Ventilation to ASHRAE 62.1
-Dust Collection
-Scrubbers & Chemical Hood Exhaust
-Pumps & Heat Exchangers

ENGINEERING STUDIES

-Building Load Analysis w/ TMD
-ACAD BIM
-Energy Efficiency
-Commissioning

CONSTRUCTION SUPPORT SERVICES

-Design/Build Engineering
-Permit Drawing Submittals
-PE Review Set Stamp
-As-Build Field Verifications
-Plotting Construction Drawings
-Field Design Coordination
-Installation Details

SUPPLEMENTARY SERVICES

-3-D Modeling
-Architectural/Civil Engineering
-Asset/Inventory Management
-AutoCAD Conversion
-Data/Voice Design
-Design Drawing Verification
-Field Verification
-Facility/Building Management Systems
-Fire Alarm Systems
-Instrument & Controls Design
-Life Safety Systems & Fire Protection
-Microstation Formatted Drawings
-PM/CM Support
-PLC Panel Design
-Security Systems
-Seismic Design
-Staff Augmentation
-Sustaining Engineering: Engineers, Designers, FAB Planners, Drafters

DESIGN SECTORS SERVED

Commercial:
Offices, Medical, Dental, Retail, Grocery, Theaters, Restaurants

Industrial:
High-tech Fabrication, Material Handling, Manufacturing, Printing, Steel Mills, Wastewater and Water Treatment

Residential:
Low, Medium, and High Rise Multi-Family Housing, Assisted Living

Community:
Schools, Churches, Parks, Hospitals

Government:
Federal, State, County, City

Renewable Energy:
Solar, Wind, Biomass, Digesters

Bradford Consulting Engineers, Inc. is Professionally Registered in:
Arizona, California, Colorado, Connecticut, Georgia, Hawaii, Idaho, Maryland, Montana, New York, Oregon, Tennessee, Utah, Virginia, Washington, and Washington D.C.

16869 SW 65th, PMB #312 - Lake Oswego, Or - 97035 ph: 503.694.2437 fax: 503.694.6041
http://www.bradfordengineers.com

BRADFORD
Consulting Engineers, Inc.

16869 SW 65th, PMB #312 - Lake Oswego, Or - 97035
ph: 503.694.2437 fax: 503.694.6041
http://www.bradfordengineers.com

SBA #PO842028, ESB #3803 (tier-2), CAGE #4NVC3

CFD MODELING SERVICES

WHY CFD MODELING

Data Center Owners and Operators

Would you like to…
-Save money on cooling costs?
-Prevent your expensive IT equipment from overheating?
-Delay the need to build another data center?
-Build a new data center with the most optimal design?

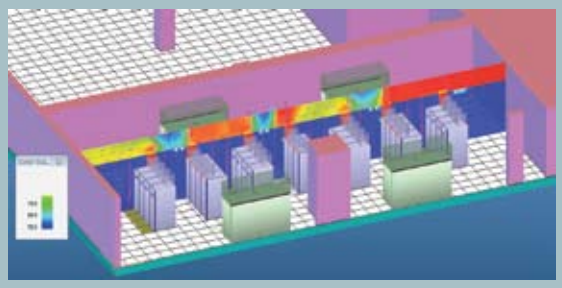
ABOUT CFD MODELING

Computational Fluid Dynamics (CFD) Modeling could be the answer. CFD provides a **detailed 3-D analysis** of how cold air is moving through a data center, identifying potential "hot spots" where equipment is receiving too little airflow. Thermal mapping can also find areas in a data center that are receiving more cold air than needed, wasting cooling and energy.

SAVING MONEY

In a 2007 report to Congress on data center power consumption, the federal Environmental Protection Agency, recommended CFD modeling as a way to "optimize data center airflow configuration." And in a survey of end users last year, the Uptime Institute reported that 47% used CFD to improve site infrastructure energy consumption.

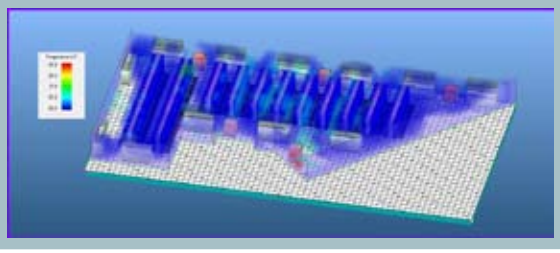
By optimizing the airflow in a room, it may be possible to reduce the number of Computer Room Air Conditioner (CRAC) units in operation. Every CRAC taken out of service can save around $50,000 annually in energy costs. (Calculated with a 30-ton CRAC at $0.10 per kWH.)



DELAY CONSTRUCTION

Building a new data center costs millions of dollars. If it is feasible, it makes far greater sense to retrofit your existing data center space to be able to handle the newer higher density server equipment for a fraction of the cost of a new room. By utilizing CFD modeling, it can be possible to extend the life of an existing data center with a retrofit that has an enormous payback over new construction.

For a data center that supported a hospital operation located just outside of Atlanta, Georgia, Bradford was able to utilize CFD modeling to re-design half of the square footage of the original data center to create a space with double the electrical capacity, which allowed them to upgrade their equipment and utilize the same space for years to come.



PREVENTING OVERHEATING

After paying thousands or even millions of dollars on IT servers, routers, and other equipment, the last thing that any data center owner wants to see is damage to their investment caused by overheating.

In many data centers, the failure of only one CRAC unit could lead to a catastrophic situation leading to significant loss of IT equipment as well as customer downtime. A CFD analysis of the room can pinpoint the areas where there is too little airflow and help in designing the most efficient solution to alleviate the potential issue.

DESIGN OPTIMIZATION

Traditional data center design worked fine when server racks were only loaded up to 2-4 kW, but it simply falls short with today's blade server racks with upwards of 25kW. Without performing an in-depth look at the room airflow, it will not be possible to maximize the efficiency of the data center and support the maximum server load possible.

By using CFD modeling, a data center can be designed to maximize the usage of the available floor space and create a room capable of handling the high density computing solutions that are becoming today's standard.