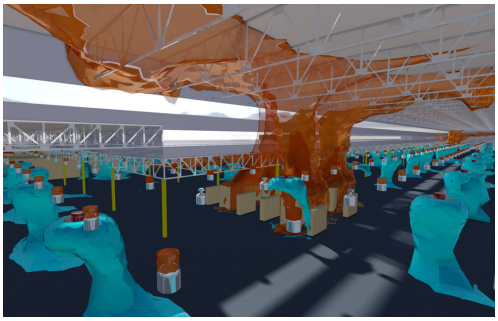
CFD simulation informs safer, more productive factory design



This visualization reveals how heat ejects from equipment and cold air is distributed from the diffusers.

Integrating plant and HVAC layouts with BIM* and Simulation CFD lowers both capital investment and operating costs

Highlights

Analyzes critical temperatures around heat-sensitive machinery
Simulates fan speeds to optimize supply temperatures
Predicts dispersion of weld smoke and other pollutants
Informs decisions on HVAC system sizing, selection, layout

Benefits

Reduce the risk and expense of costly downtime, reduce scrap
Optimize operations without compromise to quality or comfort
Prevent contamination and protect workers
Minimize and justify capital costs of new designs and retrofits

Factory Energy Management is highly complex – and mission-critical

Manufacturing leaders the world over are making bold commitments to reduce their energy use and greenhouse gas emissions. It is not only regulation or branding that's driving this trend. Dialing back energy use and cutting emissions are good for the bottom line because they both lower operating costs and mitigate risk from rising energy prices and future regulatory penalties.

Upgrades to lighting and the installation of higher efficiency equipment are straightforward strategies and a good place to start. But when leading automotive and industrial companies get serious about reducing energy use and their carbon footprint, they focus their attention on factory operations. Seeking to strike the perfect balance between human comfort, sensitive machinery temperature tolerances and fan speeds, for example, is both crucial and complex. And the ability to accurately evaluate the results of factory HVAC upgrades or building retrofit options, and justify their cost prior to any work being done, is critical to capital planning.

Airflow studies to optimize HVAC systems bring on a cascade of benefits

Recent advancements in the capabilities and ease of use of Computational Fluid Dynamics (CFD) have made understanding airflow in the factory a cost-effective way to optimize HVAC system performance. Insight from this method of analysis is used to deduce strategies that reduce energy costs and maximize ROI on factory renovations and HVAC upgrades. Investigations using CFD simulations to optimize HVAC layout have demonstrated up to a 50% savings on electricity at a consumer goods plant and more than $100,000 per year in savings in a one million square foot automotive plant in the U.S. A detailed factory model and CFD simulation provided the critical insight for the facility team to optimize the diffuser and ductwork design and to select, size and lay out the right equipment. Once such a model is built, this tool can be used to evaluate options that guide strategic decisions going forward. For example, a quick study could be conducted to decide if the cost of removing old equipment from the roof could be justified.

CFD-led HVAC system optimization also serves to minimize downtime and scrap by controlling the thermal environment in sensitive areas of the manufacturing process. When areas around CNC[1] machines are kept within ideal temperature ranges, quality issues and production shutdowns are avoided which can save millions. Simulation studies also help guide

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* Building Information Modeling

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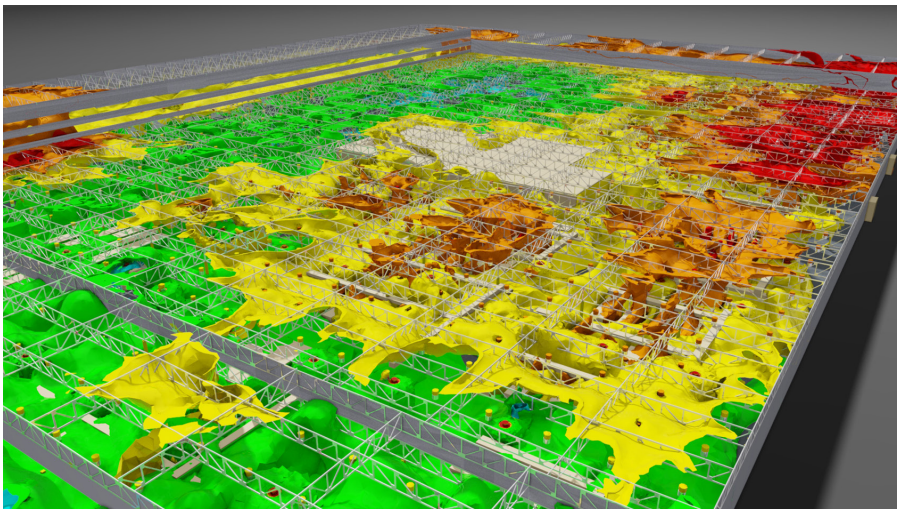
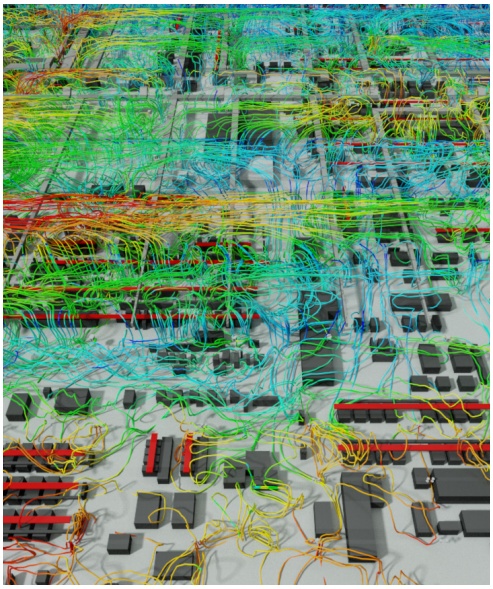
Remediation strategies are evaluated by mapping problem areas on the floor to overhead trusses and ductwork and visualizing thermal dissipation.





Particle tracking highlights potential threats to workers and production from transported weld smoke or other pollutants.

Autodesk Factory Energy Management results[1]	O&M ONLY	WITH RETROFIT
Annual energy savings		
~ Optimize fan speeds and supply temperatures factory-wide	✔	✔
~ Fine-tune energy-intensive assembly processes (e.g., paint)	✔	✔
Downtime and scrap reduction		
~ Control quality, avoid production shutdowns from overheating	✔	✔
~ Protect sensitive machinery such as MQL[2]-CNC	✔	✔
Capital expenditures on retrofits maximized		
~ Optimize HVAC system selection and sizing		✔
~ Pin-point ideal HVAC supply and return locations		✔
~ Refine pollution extraction system design		✔

[1]Automotive factory; [2]Minimum quality lubricant

decisions to improve worker comfort and productivity and prevent cross-contamination of particulates which could be harmful to people or products.

Improve factory efficiency with technology, training and support from Autodesk

For the Factory Energy Management solution presented here, Building Information Modeling tools such as Factory Design Suite and Building Design Suite are used to create 3D digital models of new or existing plants. Then, Simulation CFD is used to conduct studies to identify those modifications to the HVAC systems and building envelope which will save energy, improve the control and efficiency of manufacturing processes, and identify which strategies are most cost-effective.

Teams can work independently or with Autodesk experts who are available to conduct pilot studies for factory projects independently and/or train and mentor facility and design teams to implement the Factory Energy Management solution.

For more information about Autodesk Sustainability Solutions, contact: sustainabilitysolutions@autodesk.com.

[1] Computer Numerical Control

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