

# Halton - Achieving Energy Efficiency in School Design





## Halton Design Tools Drive Energy Efficient Kitchen Ventilation and Comfort

Today, nutritional guidelines for school foodservice programs are more regulated and more stringent. These guidelines are being designed to help schools do their part in fighting childhood obesity by designing high quality, healthy menus for their students. The menus also dictate the kitchen cooking appliances required.

Regardless of menu, all cooking appliances generate heat in two forms: convective and radiant. This heat must be removed from the kitchen, or treated, to maintain a safe, healthy and comfortable environment.

All cooking processes also generate a plume that may include steam, oil and/or proteins that, like heat, must be removed from the kitchen to maintain safety, occupant health and comfort. All cooking appliances do not, however, add equal volumes of convected heat to the cooking plume. Standard appliances produce more convected heat that is wasted, or not used to cook food. Energy efficient appliances, such as those that have earned the government's Energy Star rating, use a higher percentage of the energy input to cook food. Energy Star appliances produce less waste heat. Simply stated, standard appliances require more hood airflow to remove the increased convective heat and energy efficient appliances require less airflow for this purpose.

Radiant heat generated by cooking appliances and/or processes, unlike convective loads, cannot be removed by hood airflow. This heat radiates into the kitchen like sunlight through a window pane. Like the convective example above more energy efficient appliances typically produce lower radiant gains to the space.

Even with the use of Energy Star appliances, commercial kitchens remain one of the most energy intense users of energy thus requiring special attention to the design of kitchen ventilation and comfort systems.

Halton provides that special attention. Halton provides end users and designer's access to Halton's powerful design programs, such as our HELP (Hood Efficiency Layout Program) program, that looks at the energy profile of individual cooking appliances and kitchen air distribution systems. Halton programs use this information to design the most energy efficient kitchen ventilation and comfort systems.

Using actual operating data, from Halton's and Energy Star labs, each cooking appliance's, convective and radiant, operating profile has been catalogued and programmed. Technologies including Computational Fluid Dynamics (CFD) have been used to accurately analyze the performance of kitchen systems and the impact, of even minor changes in design, on overall kitchen performance. It may sound like a complicated solution and in many ways it is. However, Halton's years of experience and practice in this field make the complicated simple for end-users and designers.



**Halton's Total Kitchen HVAC® test facility in Scottsville, KY**



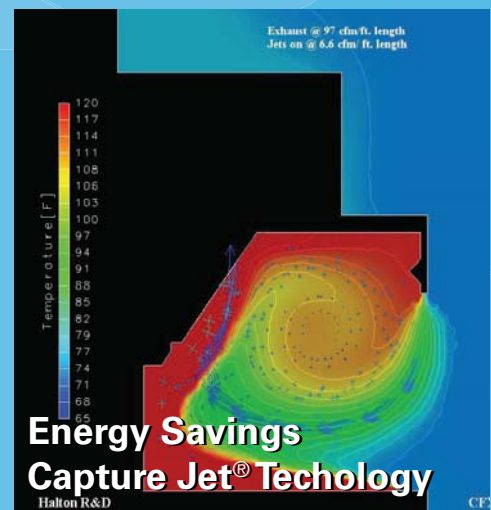
**Capture Jet® backshelf and canopy designs**

## **Total Kitchen HVAC® (TKHVAC™) -**

# Halton's Energy Efficient Solution for Comfort in Commercial Kitchens

The U.S. Department of Energy<sup>(1)</sup> reported commercial kitchens (food preparation) to be the most intense, per square foot, users of energy of all commercial building sectors. According to the food service industry, up to 50% of the energy used may be attributed to kitchen HVAC. Of this 50%, up to 75% may be attributed solely to conditioning outdoor air. In recognition of this energy intensity many kitchen system designs attempt to "get by" with little or no conditioning of outdoor air that is introduced into the kitchen through a separate "Makeup Air" system. These makeup air systems typically do not dehumidify or cool, and in some cases, do not even heat outdoor air before it enters the kitchen. Most makeup air, if heated, is heated to minimum temperatures, which are much lower than comfortable space temperatures. In the attempt to reduce energy these makeup air systems actually increase energy consumption and allow moist outdoor air to drive kitchen humidity up and comfort down.

In 2007, the ASHRAE Journal published "Dedicated Outdoor Air System for Kitchen Ventilation"<sup>(2)</sup>. This article reported the results of a 3-year case study that demonstrated how conventional makeup air drove HVAC energy consumption up, kitchen humidity up and kitchen comfort down. The article also reported how conditioning outdoor air, before it entered the kitchen, lowered energy consumption, lowered space humidity and increased space comfort.



Halton's Total Kitchen HVAC® is today's intelligent outdoor air solution for commercial kitchens. TKHVAC™ eliminates redundant conventional makeup air and HVAC systems. Instead, TKHVAC uses a single, reduced airflow, HVAC system. The single system uses conditioned outdoor air, is used to replace air exhausted through the hood system, to first control kitchen humidity and maintain space comfort. This single system design reduces total kitchen airflow, improves comfort and saves energy

Halton's TKHVAC designs start with Halton's HELP design program to optimize hood performance and reduce hood airflow while achieving proper hood capture and containment based on the designer's cooking appliance selections.

Hood selections may be Type I grease hoods or Type II heat/fume hoods. Capture Jet® designs may reduce hood exhaust airflow by 30% or more for type I. Hood efficiency, hood design and appliance type drive hood airflow.



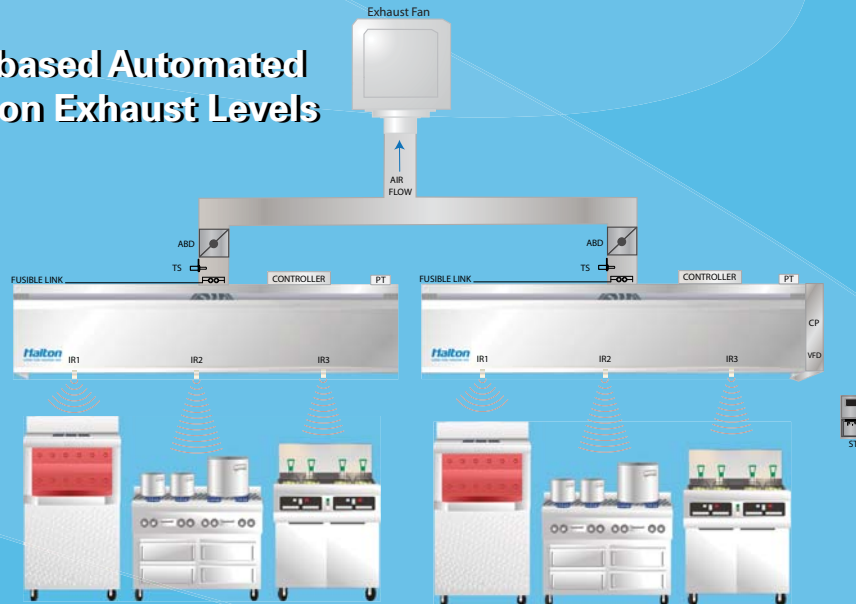
**DOAS at Halton's TKHVAC® test facility**

Kitchen appliances, not located under a hood, such as reach-in refrigerators, mixers and toasters add heat and moisture to the kitchen. TKHVAC™ exhausts these un-hooded gains through the Capture Jet® hood. Outdoor air then replaces the air removed from the hood and conditions the space as it passes through the kitchen to the hood. Moisture in outdoor air is removed before it enters the kitchen. Only when outdoor air or space conditions require is the outdoor air conditioned, and then, only in amounts needed to maintain space comfort.

Location and type of air distribution, like Capture Jet technology, also drives hood exhaust airflow. The PIER study “Optimizing Makeup Air”<sup>(3)</sup> provides a detailed study of how improper air distribution drives hood exhaust airflow up. Halton is a leader in displacement air distribution. This technology eliminates the negative impacts of improper air distribution in kitchens and enhances comfort.

The impact of air distribution in kitchens, the energy benefits of transferring ventilation air from spaces adjacent to the kitchen into the kitchen, and active control of exhaust air based on appliance operation were recognized by ASHRAE in 2009. ASHRAE’s 90.1 “Energy Standards for Buildings Except Low-Rise Residential Buildings” approved changes in 2009 that mandate transfer air participation, demand controls and proper air distribution for many commercial kitchens. Halton’s displacement systems address distribution in kitchens and surrounding spaces like cafeteriums. Halton’s new M.A.R.V.E.L. control system interfaces with the cooking appliances to monitor energy consumption. M.A.R.V.E.L. provides real-time control and modulation of exhaust hood airflow based changing appliance energy profiles. Appliances and M.A.R.V.E.L. speak the same language and can actually communicate appliance ventilation needs before the demand results are seen. M.A.R.V.E.L. saves more energy with simultaneous monitoring and control of TKHVAC airflow and conditioning to maintain space humidity and comfort. All of this can include remote monitoring and remote diagnostics. Halton has the technologies today that you need to meet future energy code mandates.

## M.A.R.V.E.L. - Model-based Automated Regulation of Ventilation Exhaust Levels



Call Halton today at 800.442.5866 and ask for HELP (Halton’s Hood Efficiency Layout Program) designing a Total Kitchen HVAC solution for your commercial kitchen!

- (1) “Commercial Buildings Energy Consumption Survey” DOE EIA (Energy Information Administration 2007)
- (2) “DOAS for Kitchen Ventilation”, Brown, 2007
- (3) Design Guide 2 “Optimizing Makeup Air” Fisher Nickel Inc. AEC CEC PG&E, 2002

**Displacement Diffusers add Comfort and Minimize Turbulence**



**Thermal Displacement provides a draft free comfortable environment**



**M.A.R.V.E.L. maintains indoor air quality and space comfort at minimum energy consumption**



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