THE NOVEL DESIGN CONCEPT FOR COMMERCIAL KITCHEN

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ABSTRACT

The complex design, build, maintain and retrofit process has been mapped in order to provide a logical structure and flow for the kitchen design system. The developed prototype kitchen design tool demonstrates the capabilities and requirements of a truly integrated and efficient design process. The design of the professional kitchen environment follows the methodology of the industrial design process. The kitchen layout design and time dependent internal loads are specified through the understanding of a specific restaurant and its food service process. Also the target levels for the IAQ and ventilation system performance are to be defined at an early stage of the design. The local ventilation can be accomplished with modern kitchen hoods equipped with the most sophisticated features including capture air technology for maximum hood efficiency and local supply air with individual control for worker comfort. Finally the kitchen air conditioning design can be performed taking into account the capture efficiency of individual hoods and loads from other internal and external sources. The total design approach allows designer to consider both IAQ and energy efficiency factors of chosen room air distribution system.

INTRODUCTION

Kitchen design requires the expertise of many different specialists to produce designs that meet the requirements of productive and cost-effective working environments. The decisions of various designers strongly affect each other. Owners and end-users are important players in design process as well as cooking and ventilation equipment manufacturers. Due to the wide diversity of their expertise, a common understanding is needed to accelerate the process. An integrated design environment supports the entire design process e.g. visualization. The total objective is to produce design data in a form that designers can utilize in different applications [1]. The tool for that is photo realistic visualization. An example of visualization is shown in Figure 1.

DESIGN METHODOLOGY

The design of the professional kitchen environment follows the methodology of the industrial design process [2] The kitchen layout design and time dependent internal loads are specified through the understanding of a specific restaurant and its food

service process, see Figure 2. Also the target levels for the IAQ and ventilation system performance are to be defined at an early stage of the design.

The local ventilation can be accomplished with modern kitchen hoods equipped with the most sophisticated features including capture air technology for maximum hood efficiency and local supply air with individual control for worker comfort.

Finally the Kitchen Air Conditioning Design can be performed taking into account the capture efficiency of individual hoods and loads from other internal and external sources. The total design approach allows designer to consider both IAQ and energy efficiency factors of chosen room air distribution system.

Kitchen layout design

In the beginning of the kitchen design process the designer defines kitchen type and process type as an input. The layout design tool utilises the default data library and gives preliminary information regarding the type of menu, number of meals to produce in a day divided to different serving periods and size of portions. All default data library values are alterable if needed. In that way it is possible to specify preliminary values to get more detailed information. In Figure 3 is shown an example of the tool where the menu serves as source of information for the various food items to be prepared.

The space dimensioning includes room estimates for all functional areas, such as receiving, storage, preparation, cooking, and dishwashing, that is required to produce the menu items. The space required for each functional area of the facility is dependent upon many factors. The factors involved include the number of meals to be prepared, the functions and tasks to be performed, the equipment requirements and the suitable space for traffic and movement.

Kitchen hood design

First the indoor air quality is selected by the designer together with the owner and the end–user. It means evaluation of indoor climate including target value adjustment for temperature, humidity and air movement. After that the ventilation strategy of the kitchen space is pre-selected which is one of the key input value for kitchen canopies and hoods selection.

Based on kitchen equipment information (such as heat gain (sensible/latent), maximum electrical power and surface temperatures e.g.) the canopies are chosen.

The capture jet technology increases the efficiency of the hoods. The capture jet has the effect of forming a protective barrier that prevents heat, smoke, grease and other contaminants from spilling into the kitchen thereby reducing air-conditioning load and making for a more comfortable and safe environment for employees working in the kitchen. The principle of the capture jet is shown in Figure 4.

In a series of independent tests conducted by Architectural Energy Corporation (AEC) in USA, the capture jet hood performed favorably against traditional style back shelf hoods. In fact, the exhaust-only hood required 100% greater exhaust air to capture than the capture jet hood during idle conditions and 36% greater exhaust air during cooking conditions [3].

Kitchen Air Conditioning design

Kitchen Air Conditioning system loads consists of the loads not captured with the individual hoods, and loads from other internal and external sources. The total system load is affected by the selection of the room air distribution method as the capture efficiency of the hoods is influenced by the selection.

The design of the kitchen environment is based on the pre-selected target levels for temperature, humidity and air movement. The total design approach allows designer to evaluate both IAQ and energy efficiency of designed room air conditioning system towards set target levels.

One possible concept is use low velocity ventilation (displacement). These units are installed on the floor or alternatively installed on the wall. The total ventilation concept for kitchens is shown in Figure 5.

CONCLUSION

Currently used design tools for commercial kitchens are complicated to exchange data between different applications and key players. No integrated kitchen design environment is available although kitchen design requires the expertise of many different specialists and the decisions of various designers strongly affect each other. The complex design, build, maintain and retrofit process has been mapped in order to provide a logical structure and flow for the kitchen design system. The developed prototype kitchen design tool demonstrates the capabilities and requirements of a truly integrated and efficient design process.

REFERENCES

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2. K. Hagström, K. Pöntinen, J. Railio and E. Tähti, "Design Methodology of Industrial Air Technology". INVENT –report, TAKE, Helsinki April 1998.
3. D. Schrock, Rick Bagwell and Andrey Livchak, "Quantifying Capture & Containment for Kitchen Exhaust Hoods". Proceedings of Ventilation 2000, Helsinki June 4-7, 2000

Figure 1. An example of the visualized kitchen workplace.

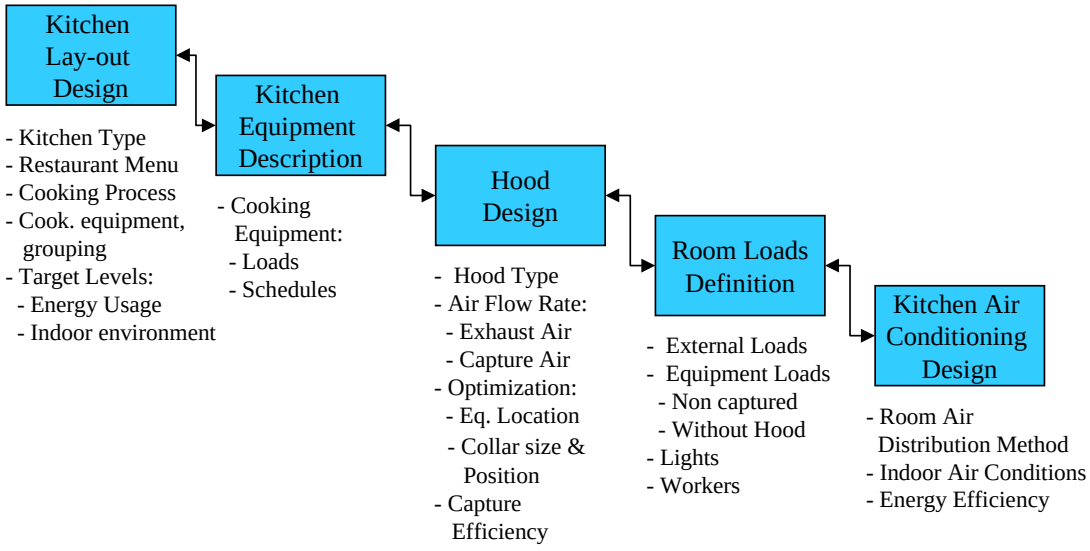

Figure 2. Professional kitchen design process

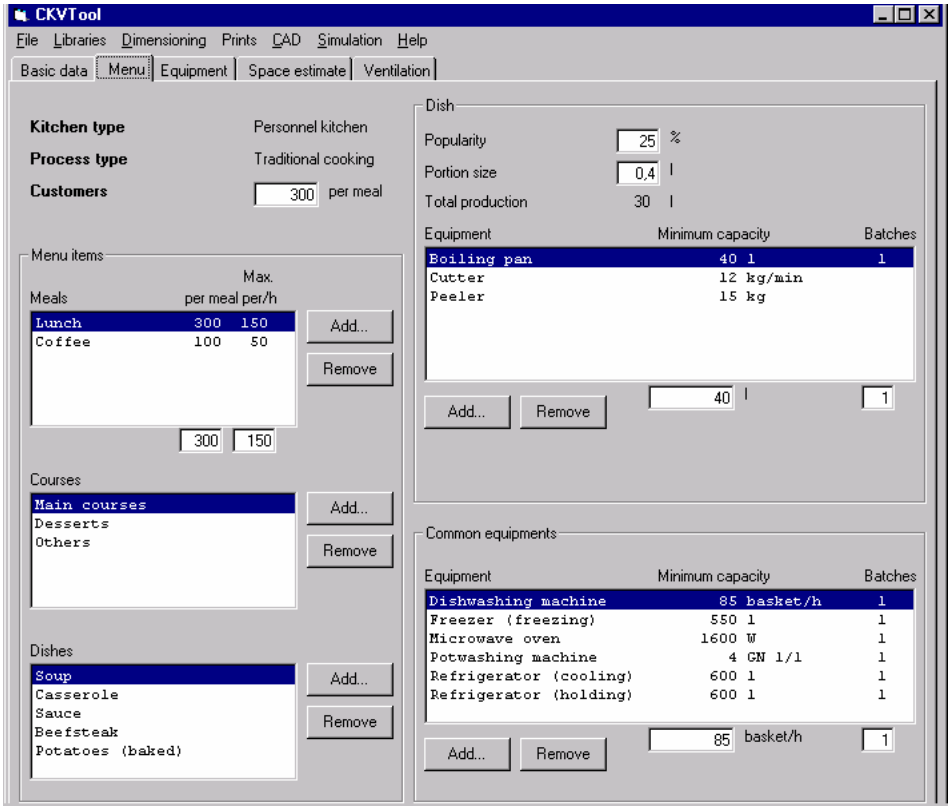

Figure 3. Menu selection in the kitchen layout design tool.

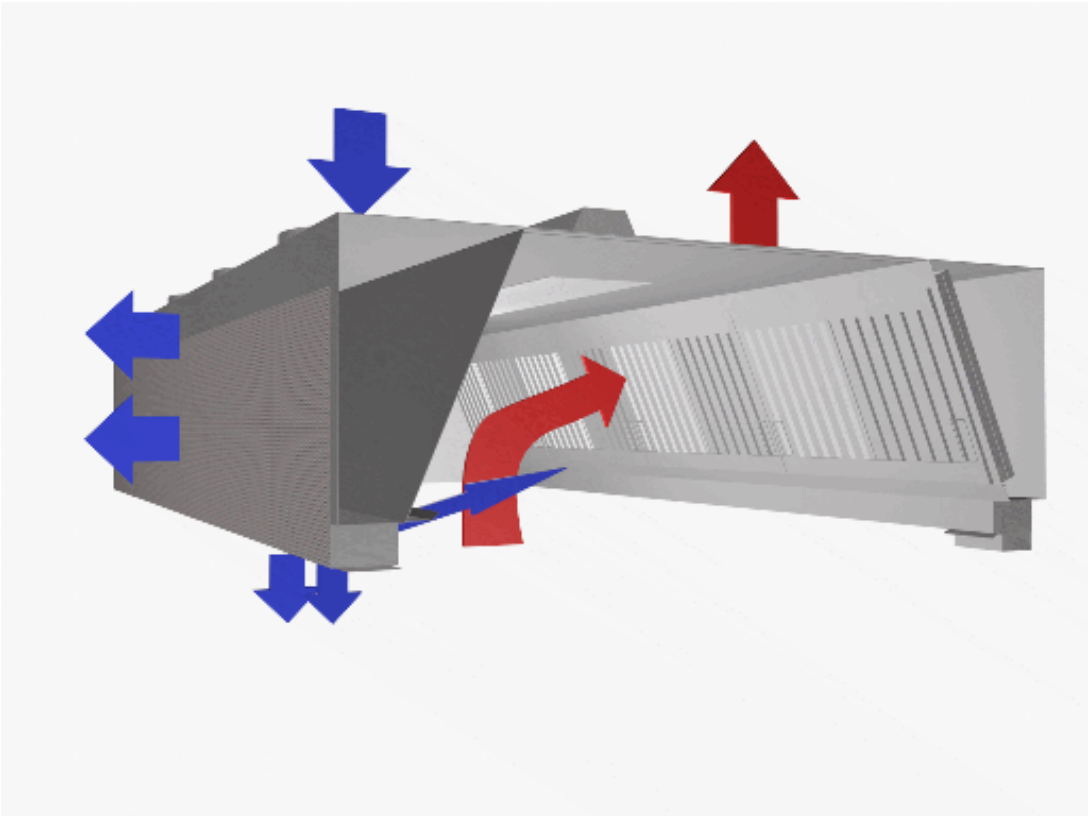

Figure 4. The capture jet canopy where the supply airflow is also integrated.

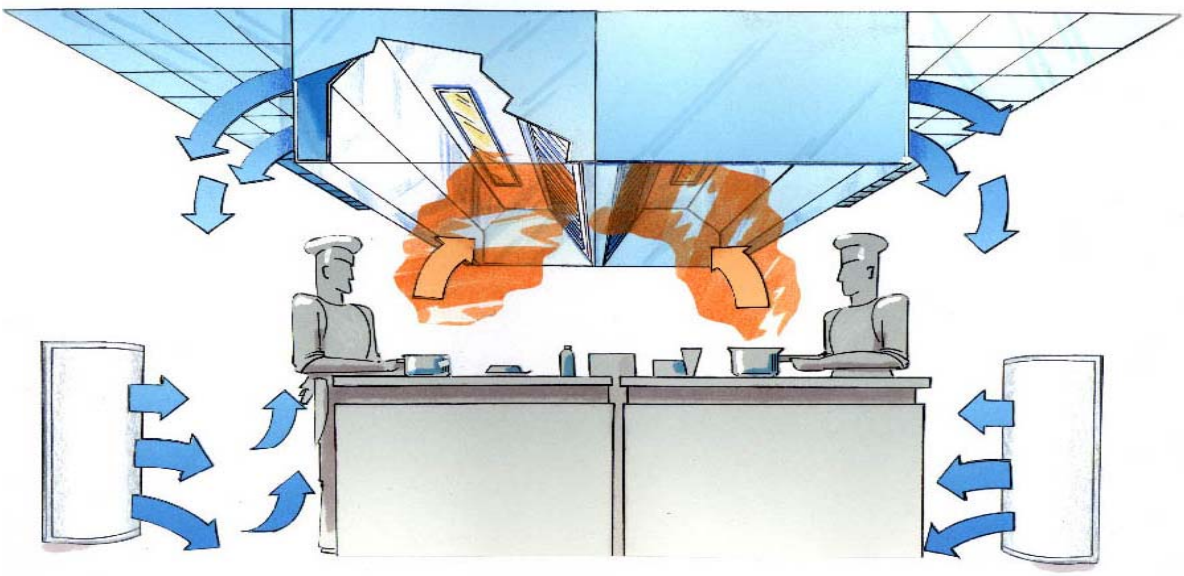

Figure 5. The total solution for ventilation of commercial kitchens.