

Managing the successful design process of hvac systems

[Profession](#)



Introduction

A good HVAC system design plays a critical role in creating an optimal building environment. The design process of a HVAC system is a complex process involving client's needs, building regulation compliance, energy efficiency, environmental impact and sustainability. A lot of different professionals with distinct disciplines, such as clients, architects, structural and service engineers are involved in a building construction project. The design process involves constant communication and clarification between the different team members. By working together at key points in the design process, participants can often identify highly attractive solutions to design needs that would otherwise not be found (1). The effectiveness of the design process in the building industry has a great influence on the success of subsequent processes in the construction of projects and also on the quality of the environment (2). Several studies have also pointed out that a large percentage of defects in building arise through decisions or actions taken in the design stages (3). It is also said that poor design has a very strong impact on the level of efficiency during the production stage (4). In recent years, the increasing complexity of modern buildings in a very competitive market-place has significantly increased the pressure for improving the performance of the design process in terms of time and quality. Despite its importance, relatively little research has been done on the management of the design process, in contrast to the research time and effort which has been devoted to production and project management (5). This essay will concentrate on various issues related to the management of successful

design process of HVAC system and put forward arguments to reflect the above.

History of HVAC System

HVAC is an acronym that stands for Heating, Ventilation and Air Conditioning. HVAC is based on the principle of thermodynamics and heat transfer. The functions of heating, ventilation and air conditioning are interrelated. HVAC systems provide thermal comfort and acceptable indoor air quality. Like many great innovations, earliest heating and plumbing systems originated with the Romans. A hypocaust(6) was an ancient Roman system of central heating / under floor heating; they were used for heating public baths and private houses. English historian Edward Gibbon mentions “stupendous aqueducts,” when describing the building of public baths in The History of the Decline and Fall of the Roman Empire(7). The Romans built an aqueduct that carried water for many miles in order to provide a crowded urban population with relatively safe, potable water. In modern buildings the design, installation and control systems for these functions are integrated in to HVAC systems.

Design Process and Management

Throughout the history of mankind, people have always designed things; it is human nature. It may take years to design a new system but it could be made in a matter of hours. When one is trying to design something, drawing is widely used as a most understandable form of communication. Designers sit down and brainstorm a lot of ideas, discard most of them until a suitable

one is found for investigation at a more detailed level enabling the best to be chosen (8).

In the past the HVAC system was given less priority in term of design on the basis of sub-optimal consideration, such as preferences for certain types of systems, or equipment budget or space constraints imposed by architects (9). Design and construction were carried out by two different parties.

Designers used to design the system and walk away. The contractors carried out the HVAC installation and commissioned the systems. Poorly designed HVAC systems pose health hazard and discomfort to the building occupants. The emergence of “ sick building syndrome” led to the realization that the HVAC system itself acts as a breeding and concentration site for pathogens and allergens (9). The duct net work of a central air handling system poses fire hazard as these are ideal path for fire, smoke and explosive gases. They are also prime target for terrorists to release chemical and biological agent into a building.

Nowadays, traditional professional practices are replaced by multi-disciplinary practices. A fresher approach is needed to the planning and coordination for multi disciplinary buildings and their system designs to facilitate integration and communication across the disciplines (10). It has been pointed out that poor communication, a lack of documentation, missing input information, a lack of co-ordination between disciplines and erratic decision making is the main problem in design management (3). Designers try to achieve satisfactory or appropriate solutions. The design tends to take place through a series of stages during which design components are

continually trialled, tested, evaluated and refined. Therefore, most design processes involve much feedback from the different individuals employed to design the system. It can be seen that defects in a finished building also shows the failure to communicate the known technological factors that have been accepted for many years during the design process. The problems caused seem to be due more to the deficiencies in managing communication during the design process, rather than technology failure (3).

HVAC systems for the modern buildings must become fully optimized. Comfort, health and safety function required for each area in the facility must be executed perfectly. Performance of a good HVAC system makes economic sense. Optimized HVAC systems reduce the capital cost and equipment space. They provide the best comfort and health which increases productivity (9). Life-cycle cost is greatly reduced because optimized systems operate with the least possible energy.

In recent years, the HVAC industry has been under immense pressure to reduce the energy consumed by HVAC plants and increase energy efficiency to conserve fossil fuels and reduce carbon emissions. HVAC systems in typical commercial buildings are responsible for more than 40 percent of the total energy output (11). Low and zero carbon technologies can be integrated into the HVAC systems to achieve sustainability. Properly designed HVAC systems run at peak efficiency maximising energy used without compromising thermal comfort or indoor air quality. It requires an integrated design approach. It has been pointed out that by adopting this type of design, high performance with multiple benefits can be achieved at a

total cost lower than all the components used in the project (1). The design process needs to be well planned and controlled, in order to minimise the effects of complexity and uncertainty (12). As the involvement of interdependent professionals' disciplines with concurrent design processes is now the norm, well managed design processes with effective communication is the key to minimising errors that could lead to defective buildings or systems in the future (3). A successful HVAC design process involves interactive efforts, Co-ordination and project programming

Conclusion

HVAC systems play an important role in keeping a building comfortable. The design of HVAC systems involves working with a team of professionals demonstrating various disciplines. Design errors should be prevented or identified during the design process. These design errors are costly in time, rework, money and lost reputations. Effective design of sustainable HVAC system is needed to make buildings survivable in a current climate of very high energy costs. Managing the HVAC design process successfully saves considerable time and money as well as delivering projects on time and within budget.

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