

Energy-Efficient Buildings

Prof. Qingyan “Yan” Chen
Sponsor: Department of Energy

Objective

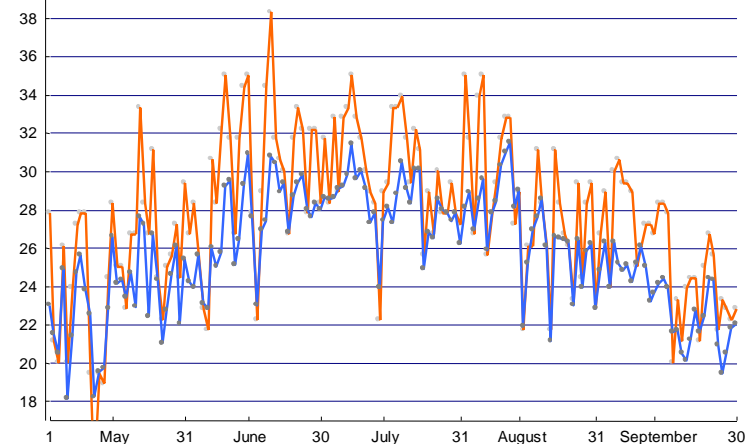
Net zero energy buildings with acceptable indoor environment

Methods

Designing, monitoring, simulating and controlling building systems to achieve the objectives by using various technologies that use little energy and have low environmental impact.

Results

It is possible to reduce net energy use to zero with careful design and operation. Computer tools are great for helping to achieve the goals.



Contaminant Transport in Enclosed Environment

Prof. Qingyan “Yan” Chen

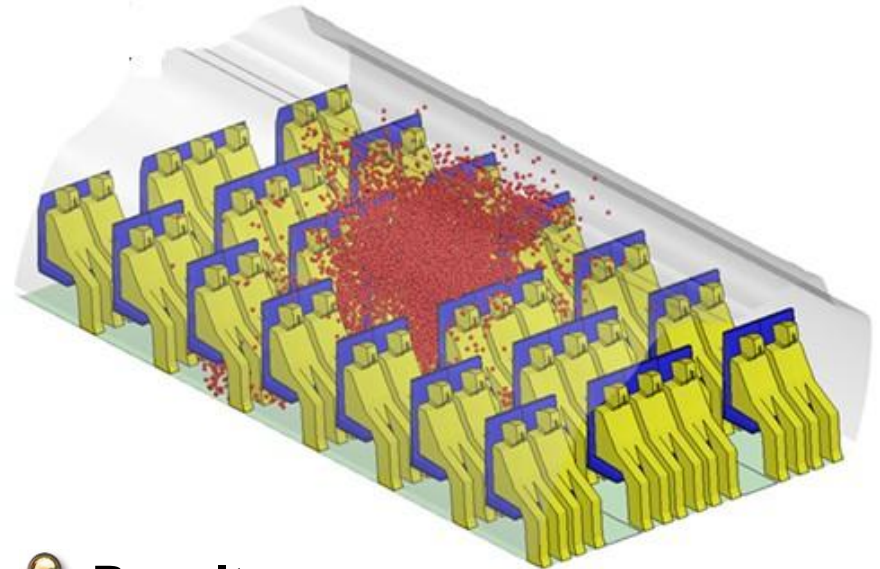
Sponsors: Federal Aviation Administration, Boeing

Objective

To achieve a healthy and comfortable enclosed environments

Methods

By using computational fluid dynamics (CFD), this study can calculate airflow, contaminant and air temperature in enclosed environments.



Results

The results shown above for particle distribution in an aircraft cabin due to someone coughed in the middle of an airliner cabin.



Fast Fluid Dynamics

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Sponsor: Department of Energy

Objective

To calculate real-time airflow distribution in buildings

Methods

The research uses Fast Fluid Dynamics (FFD) that solves Navier-Stokes equations by semi-Lagrangian method.

Results

The computing time by FFD is 50 times faster than that by CFD. If the simulations are performed on a Graphics Processing Unit, the computing time can be further reduced by 30 times.

