

# Building Energy Simulation



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# Which one is an energy efficient design?



University of Texas at Austin Dell Medical School Health Learning Building

Delaware Avenue in Buffalo, NY



# Building modeling and energy simulation

## Building Performance simulation:

A computer-based, mathematical model of some aspect of building performance based on fundamental physical principles and engineering models.

## Building Modeling/ simulation

Modeling is the process of describing the physical system (building).

Simulation is determining the time dependent behaviour of the building system.



Concept

Schematic  
Design

Design  
Dev.

Constr.

Cx

Operation

Retrofit

Operation

## CII-Sohrabji Godrej Green Business Centre



**Inaugurated by H.E Dr A P J Abdul Kalam**

**14 July 2004**

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Concept

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Constr.

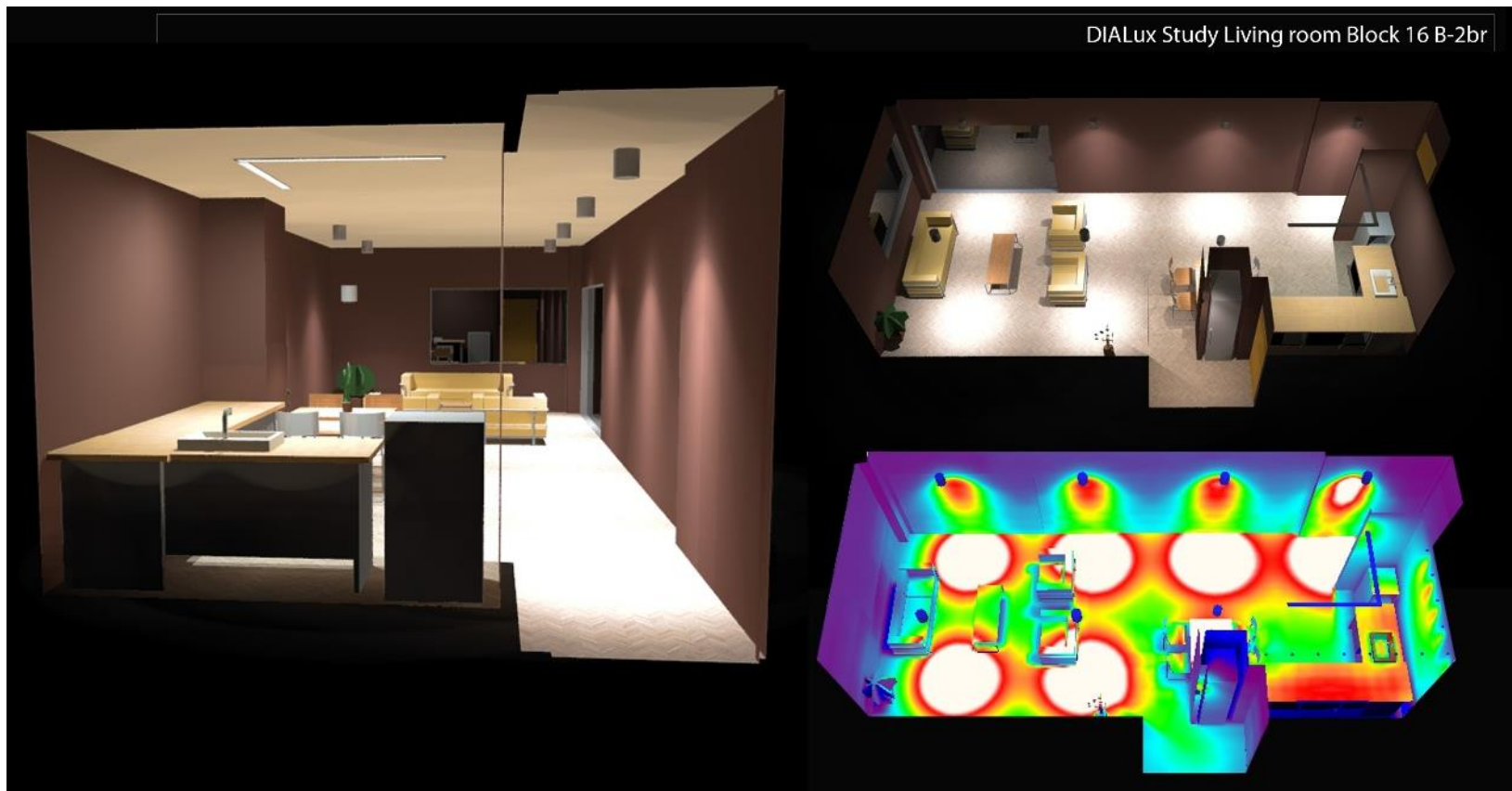
Cx

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## HVAC sizing and lighting





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## Design and calculation of renewables



# But there was a problem...

“In theory, theory and practice are the same,  
In practice they aren’t.”

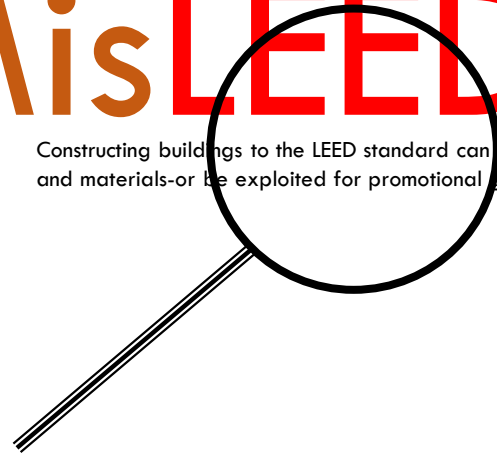
SANTA FE INSTITUTE

“I’ve seen many low-carbon designs, but hardly any  
low-carbon buildings.”

ANDY SHEPPARD, Arup, 2009

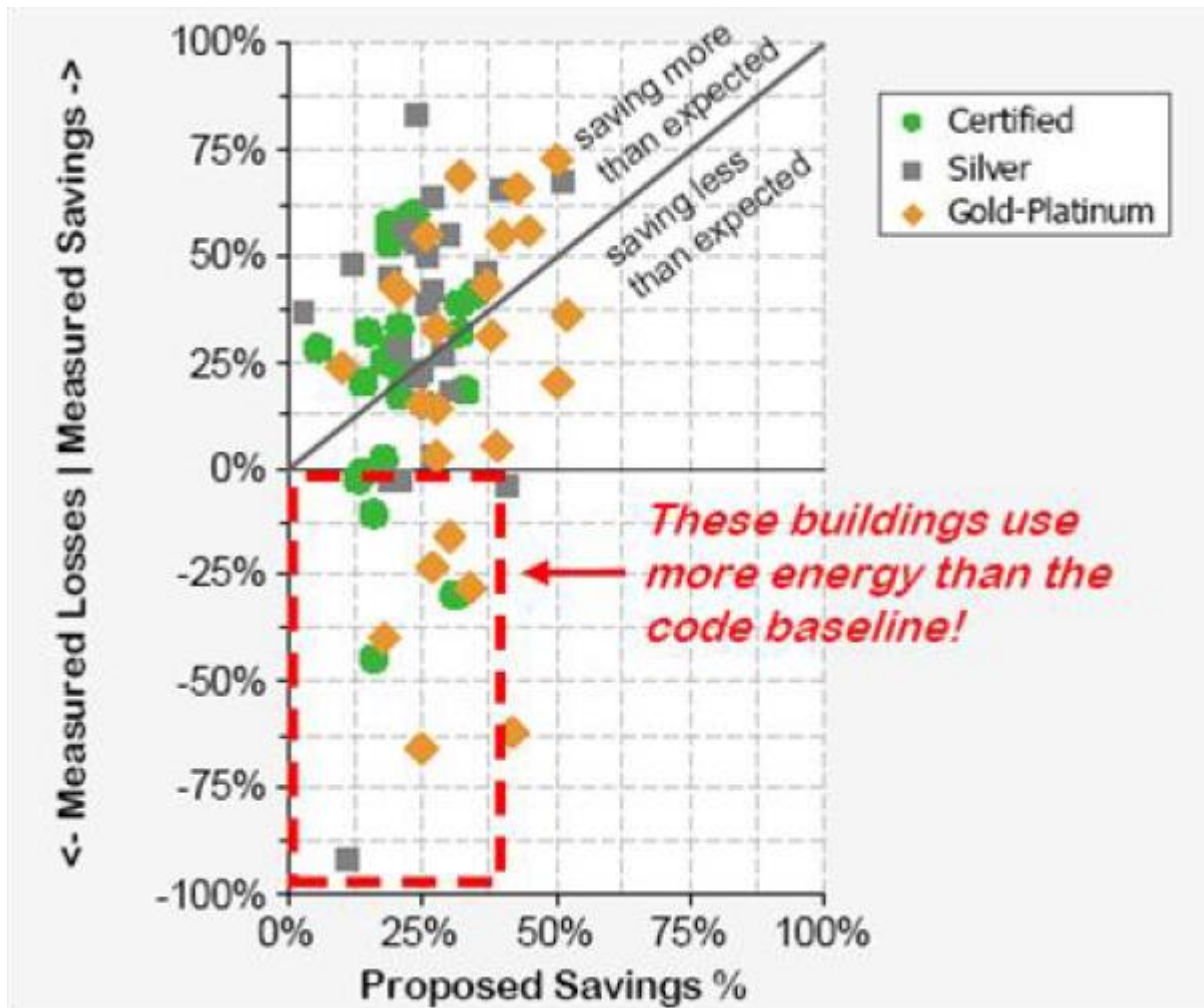
# MisLEEDing?

Constructing buildings to the LEED standard can conserve energy and materials-or be exploited for promotional gain



Constructing buildings to the LEED standard can conserve energy and materials-or be exploited for promotional gain





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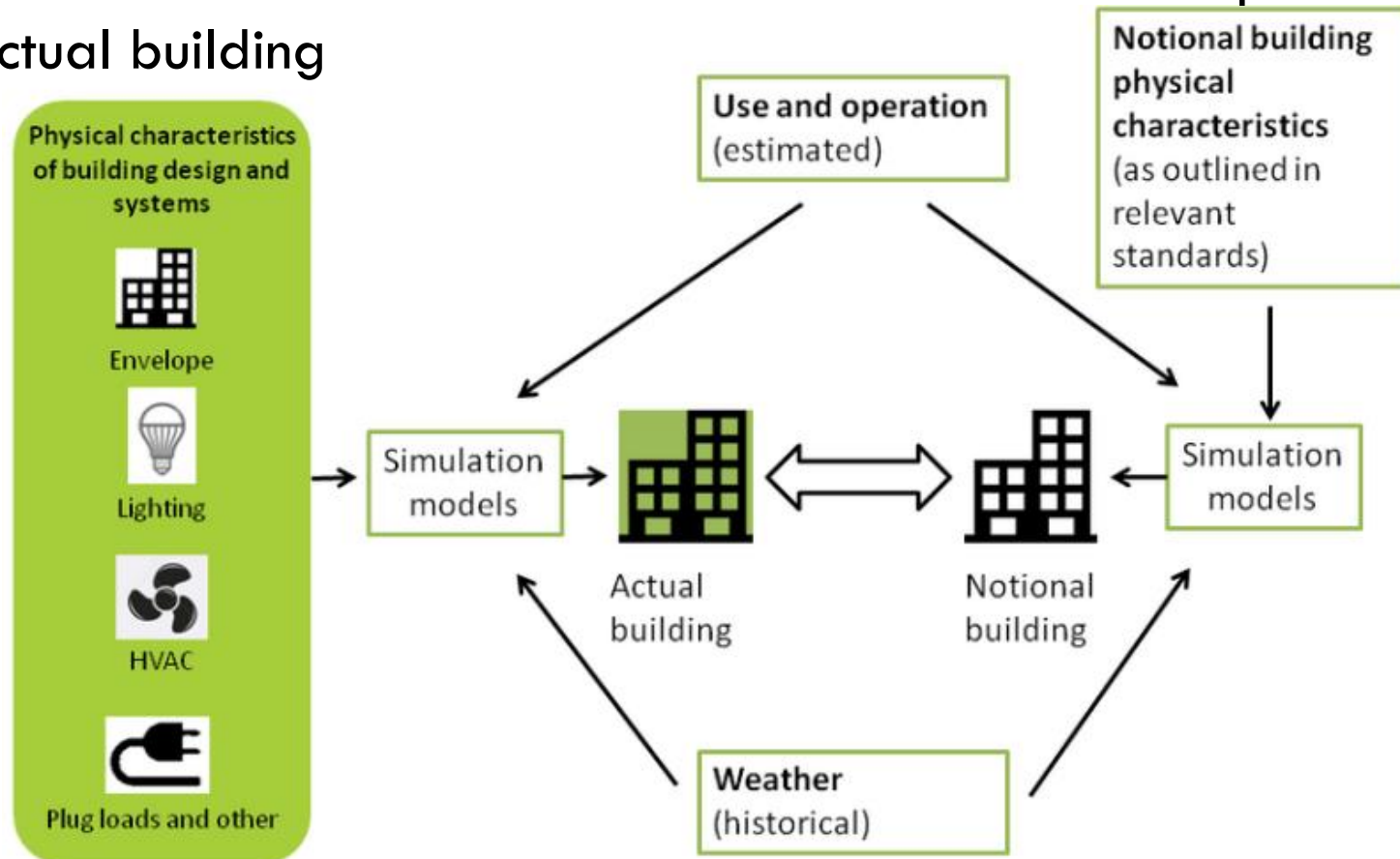
Operation

Commissioning to check if the building is built as planned and if it is performing as expected



Concept   Schematic Design   Design Dev.   Constr.   Cx   Operation   Retrofit   Operation

Calibrated simulation to make the simulated model comparable to the actual building



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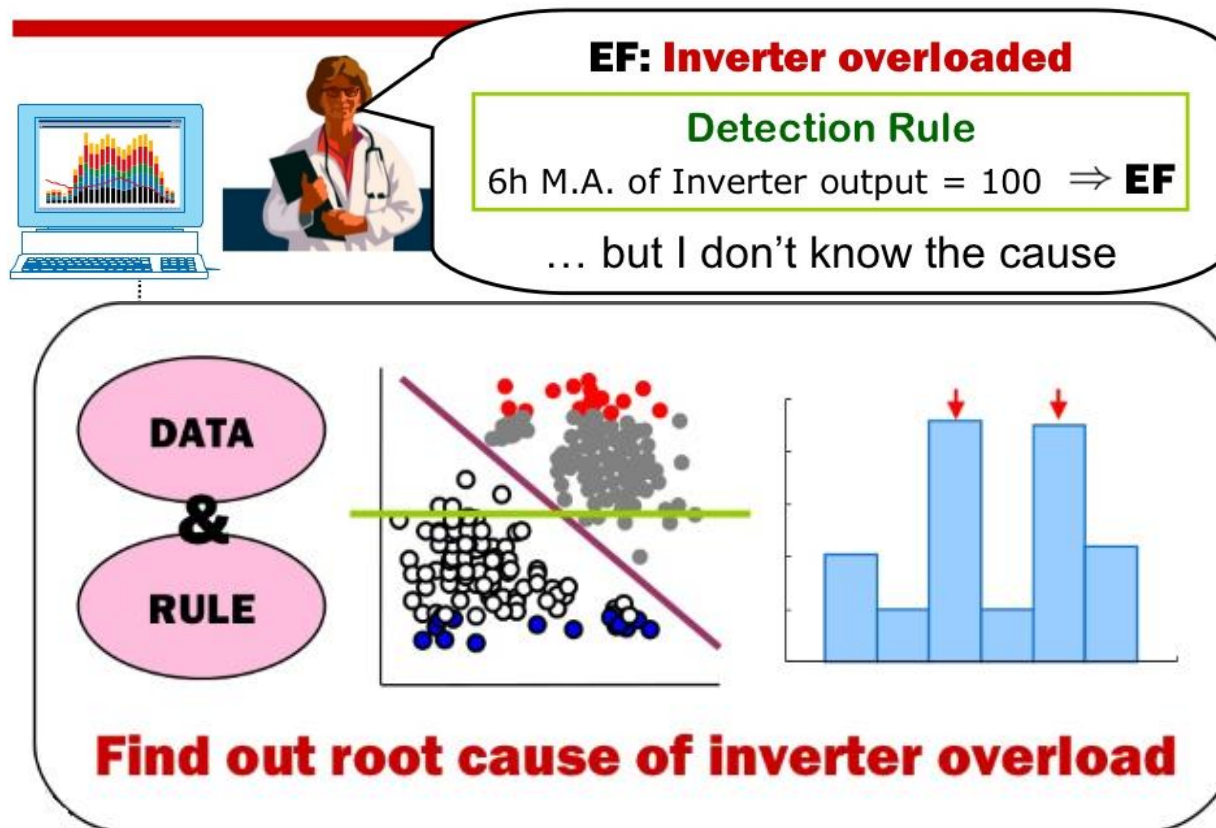
Operation

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## Fault Detection and Diagnosis

### Energy Fault Diagnosis Problem



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Retrofit

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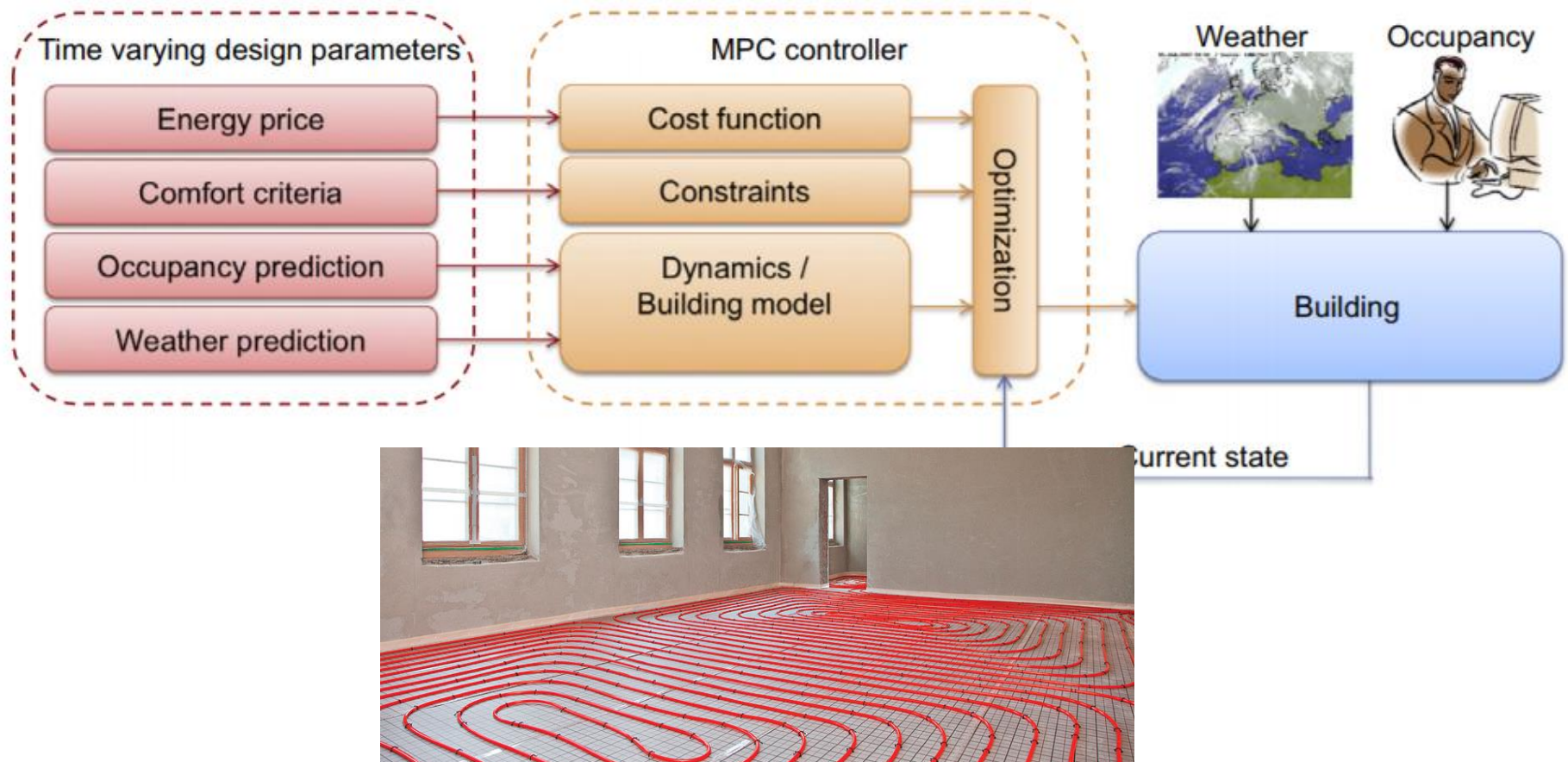
Calibrated simulation to evaluate the retrofit options





Concept Schematic Design Design Dev. Constr. Cx Operation Retrofit Operation

## Model predictive controls



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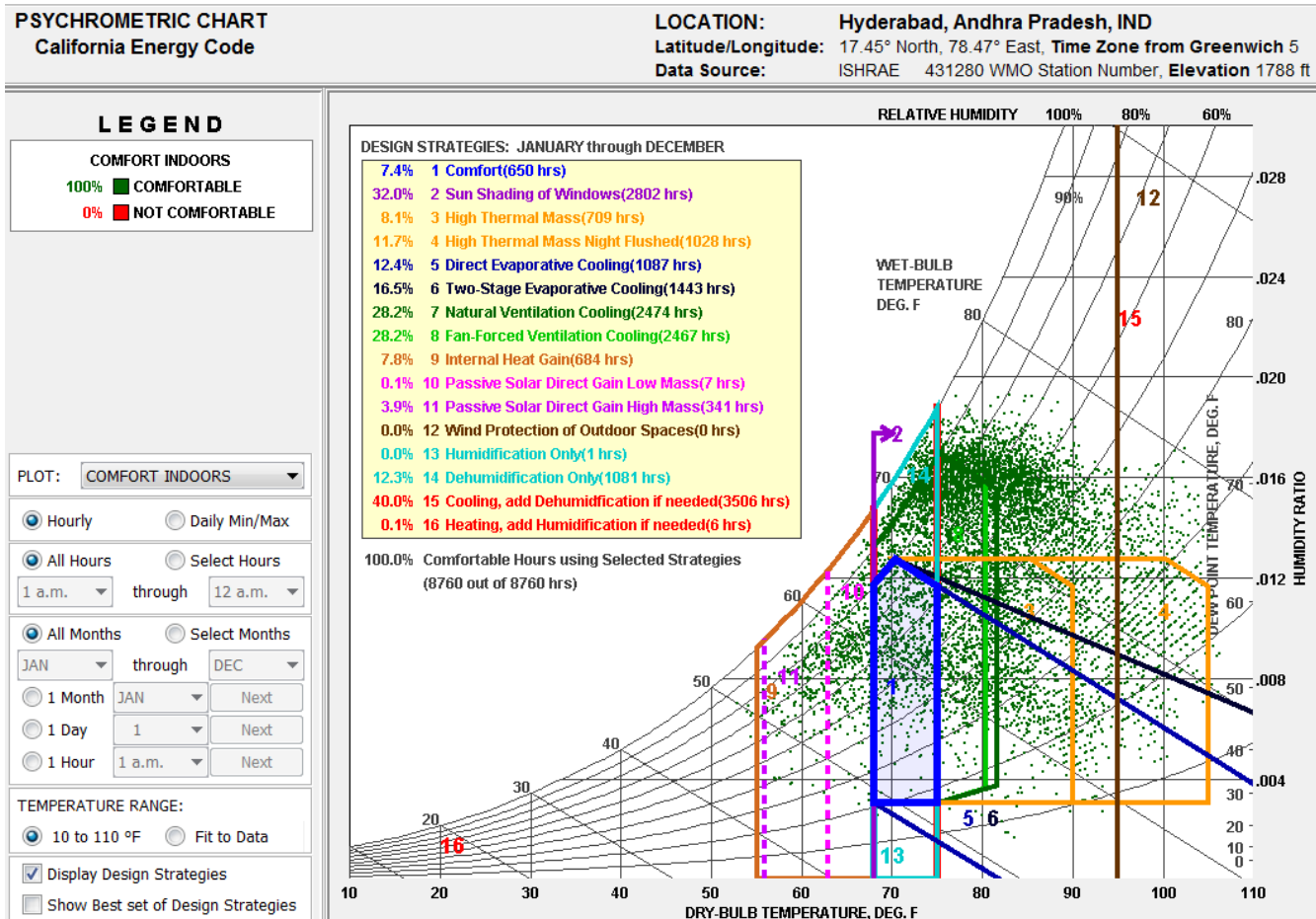
Cx

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## Early design tools for Architects to aid early design



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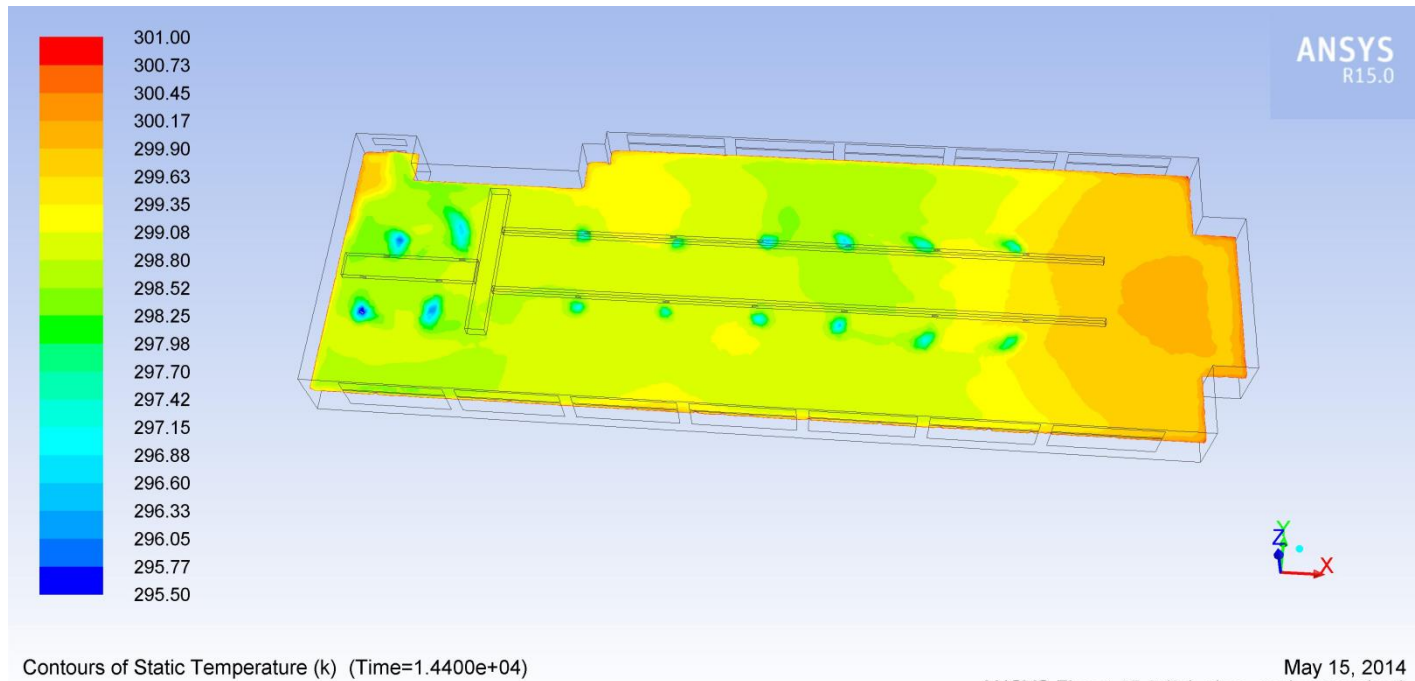
Cx

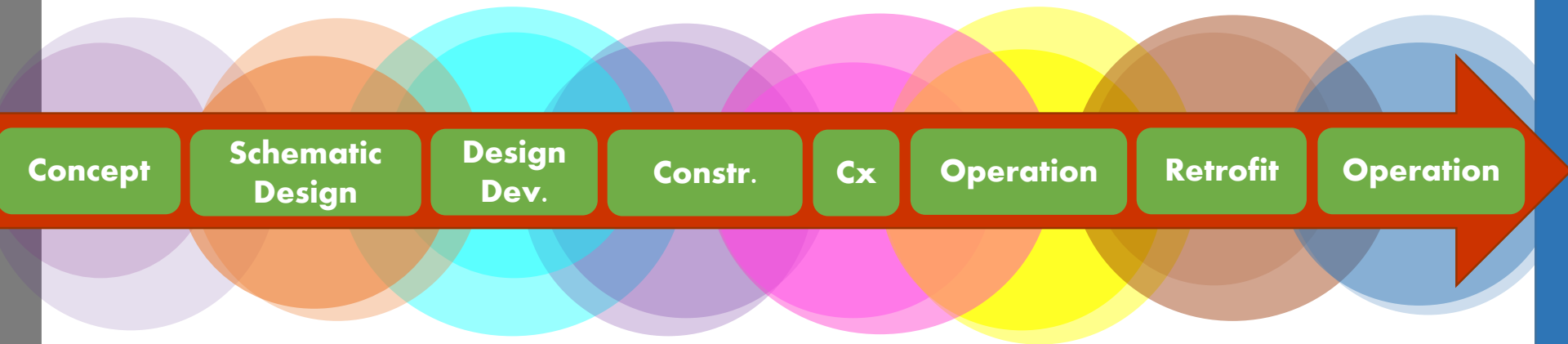
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## Computational Fluid Dynamics





**Questions?**

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