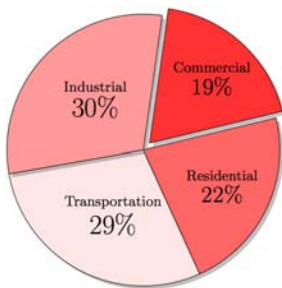


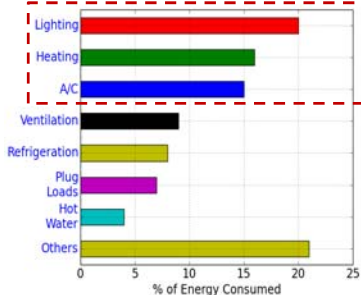
# Simulations of Innovative Solutions For Energy Efficient Building Façades

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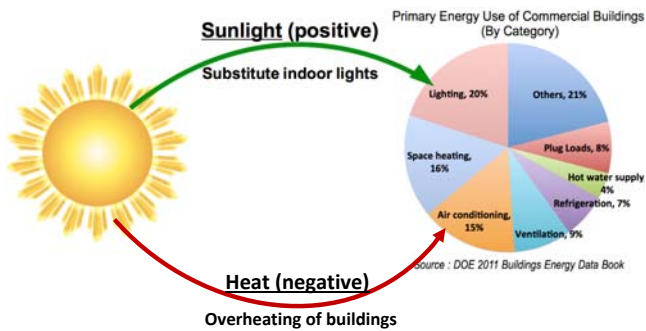
## Background and Motivation



a) Sources of energy use in US



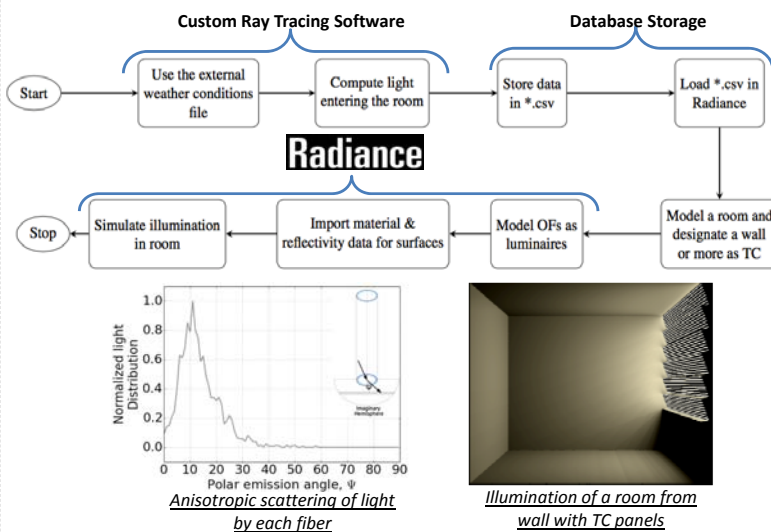
b) Energy consumption in commercial buildings



## Scope and Methodology

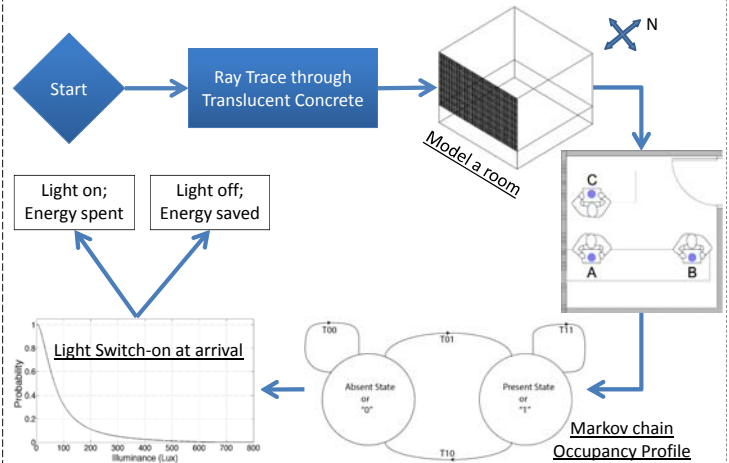
- The scope of the research is developing proper tools for assessing saved energy by using Translucent Concrete (TC) panels as building materials.
- We employ computational platform to capture illumination, heat transfer, stochastic occupancy and light switching patterns to compare the net energy savings incurred during the entire year using TC panels.

## Illumination Calculations

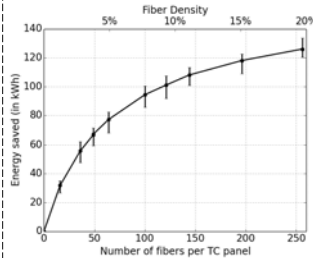


- Optical Fibers (OFs) are modeled as point sources of light.
- OFs are characterized to transmit light anisotropically.

## Algorithm for Lighting Energy Utilized

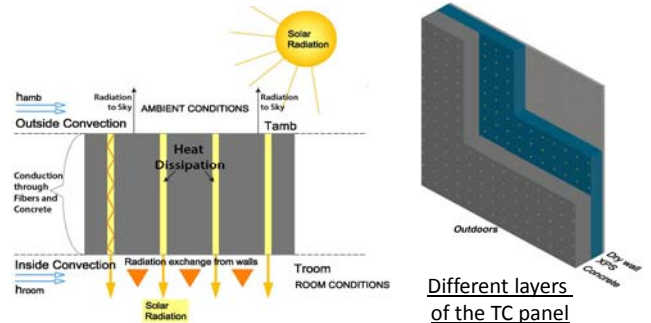


## Lighting Savings from using TC

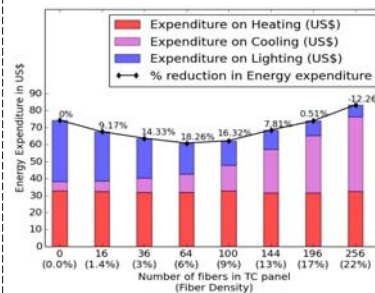


- For OFs volumetric ratio of 5.6%, use of lighting energy is reduced by about 50%.
- The energy saved increases to 65% for an OFs volumetric ratio of 10.6%.

## Heat Transfer Calculations



## Results



- Combining the loads on HVAC with lighting requirements.
- An OFs volumetric ratio of 5.6% performs best in saving about 18% of the cost.
- Small OFs volumetric ratio is more practical for fabricating the TC panels.
- High OFs volumetric ratio leads to monetary loss as solar radiation loads are high.

### Parameters:

Heater efficiency: 95%; Air-conditioner coefficient of performance  $CoP$ : 3.0

Utilities pricing for San Francisco Bay Area:

Electricity: 23.3  $\text{¢/kWh}$ ; Natural gas: 5.4  $\text{¢/kWh}$

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