

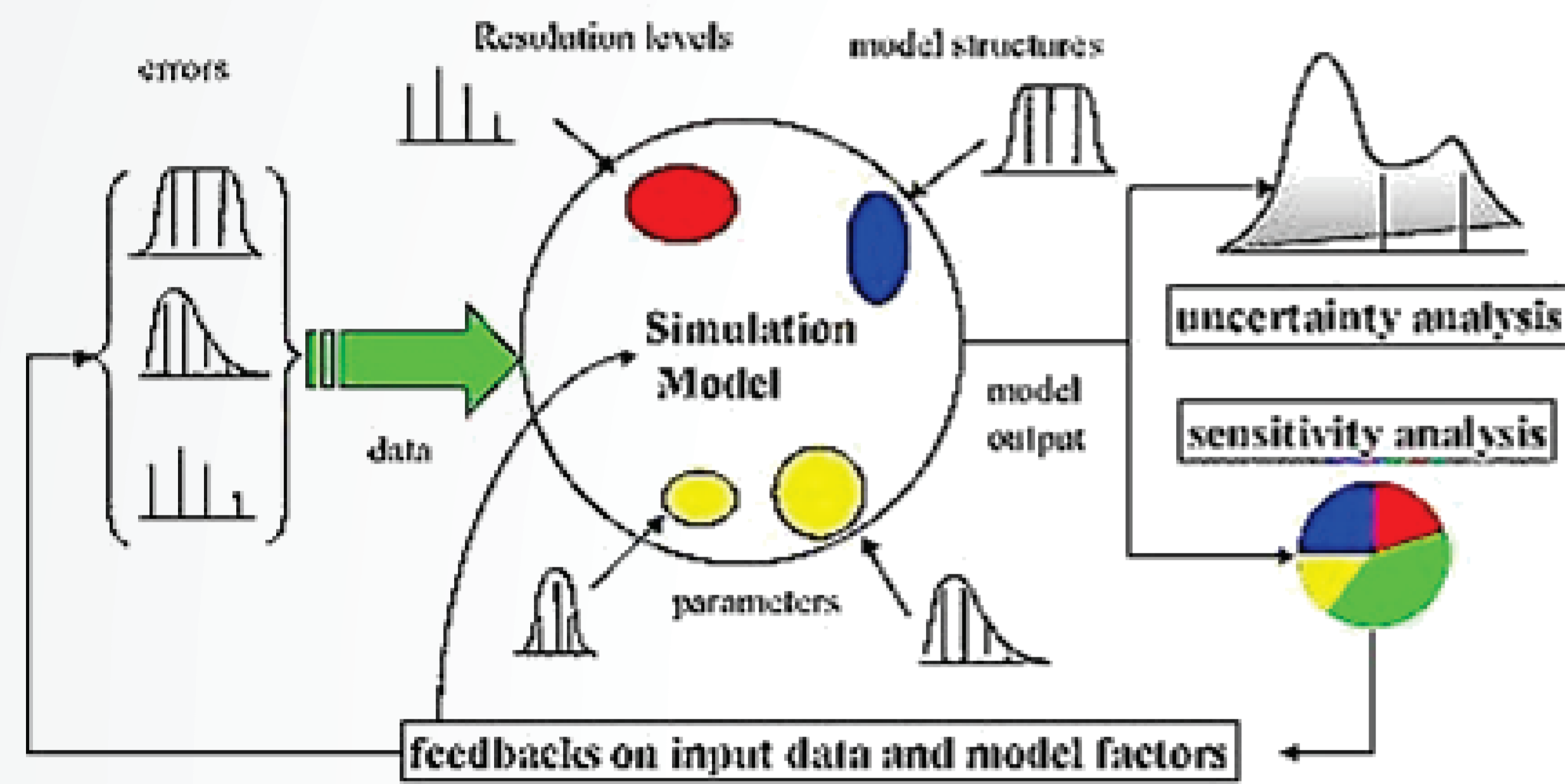
# Probabilistic Assessment of Energy and Moisture



## Introduction

The currently available deterministic methodologies for Hygrothermal Performance of wall assemblies are not sufficient to correctly assess variation on energy consumption and functional performance. Therefore industry needs to adopt designs based on probabilistic analysis to be able to predict failures in early stages of project.

## What is Probabilistic Assessment of Energy and Moisture Performance of Building Components?

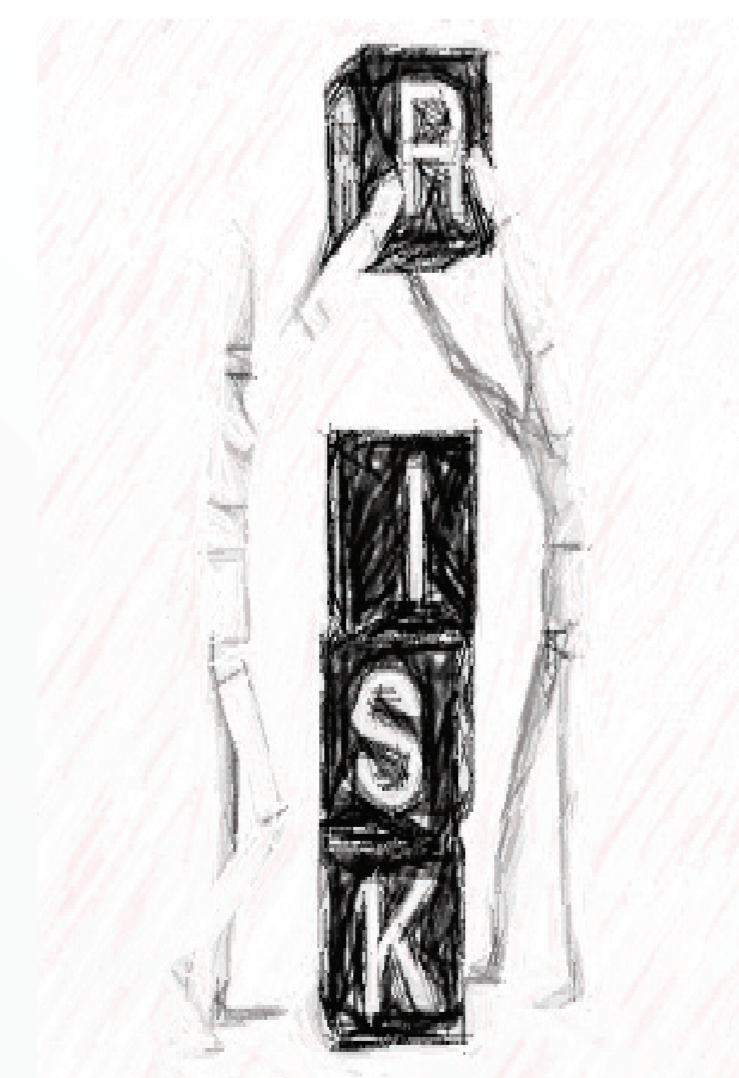
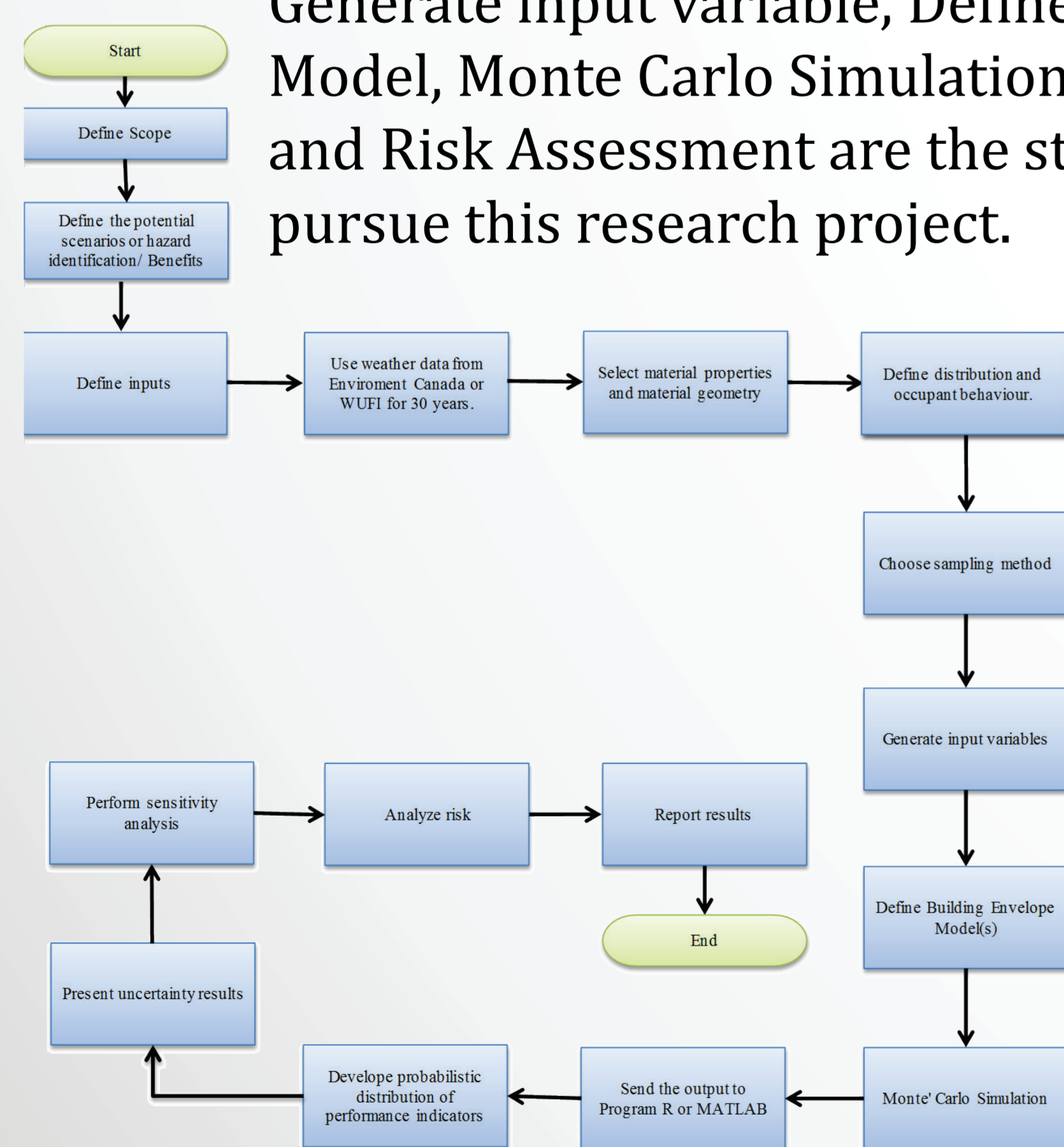


## Objective

This research objective is to systematically and comprehensively evaluate risks associated with Heat, Air, and Moisture (HAM) transfer through Building Envelope Components by considering uncertainties of input design parameters.

## Methodology

Identifying hazards, Defining input data, Randomly Generate input variable, Define Building Envelope Model, Monte Carlo Simulation, Sensitivity Analysis, and Risk Assessment are the steps that are taken to pursue this research project.



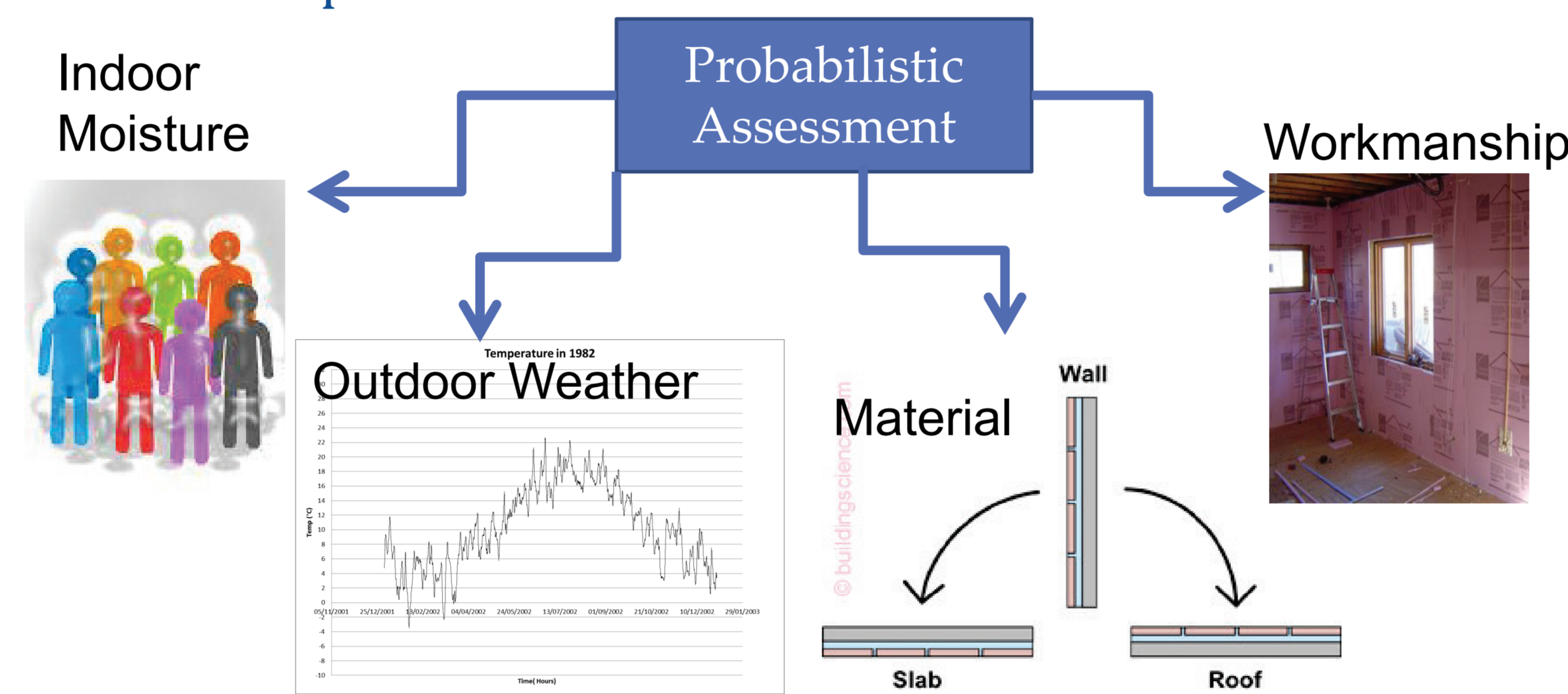
## Performance of Building Envelope Components

Iraj Manshadi; M.A.Sc. Candidate

Supervisor: Dr. Fitsum Tariku

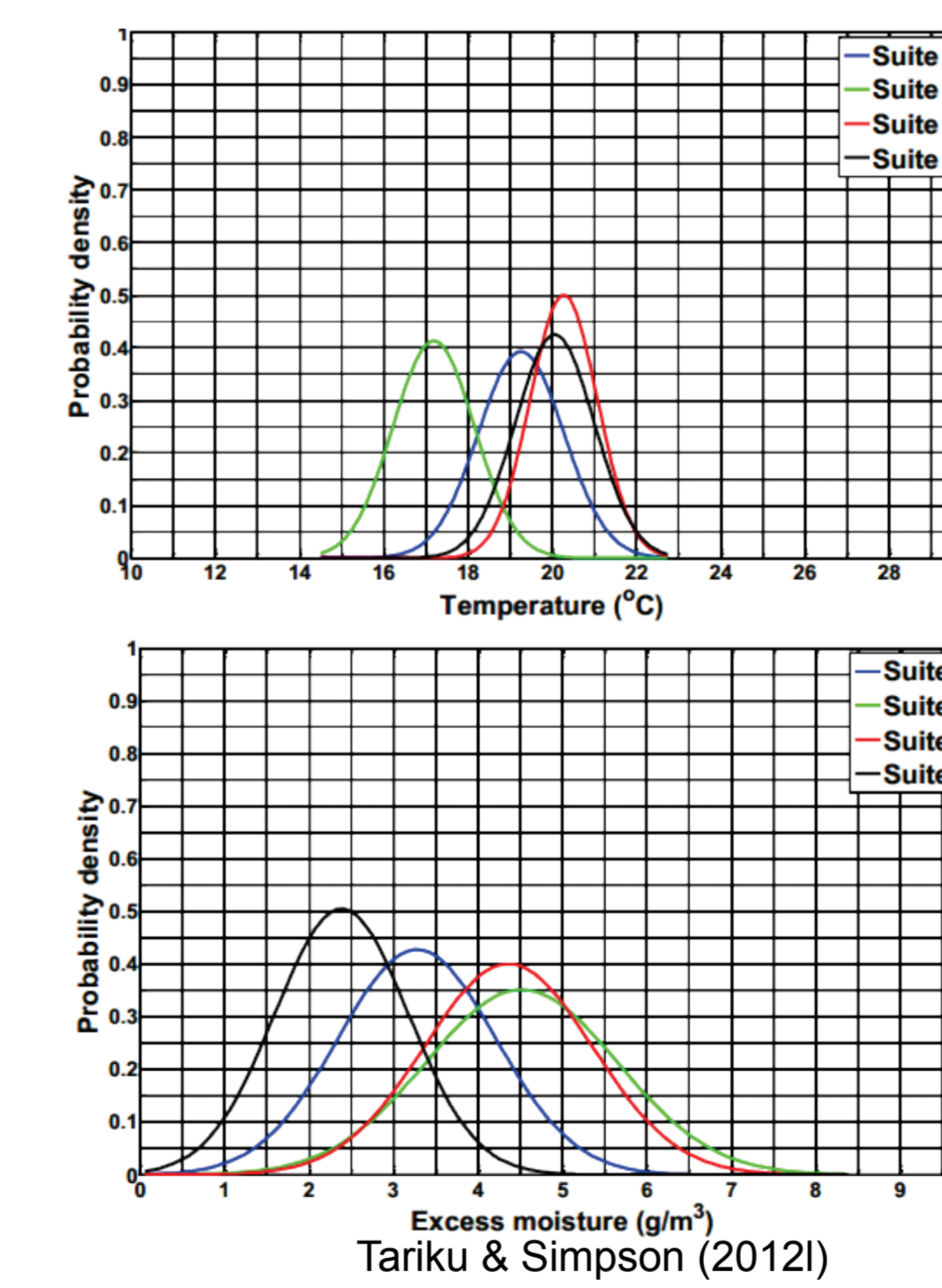
### Main Uncertainty Parameters Considered in Probabilistic Assessment

There are 4 main uncertainty parameters that were considered while pursuing the Probabilistic Assessment. These factors are Indoor Moisture Generation rate (Number of occupants), Outdoor Weather, Building Envelope Components Material, and Workmanship.



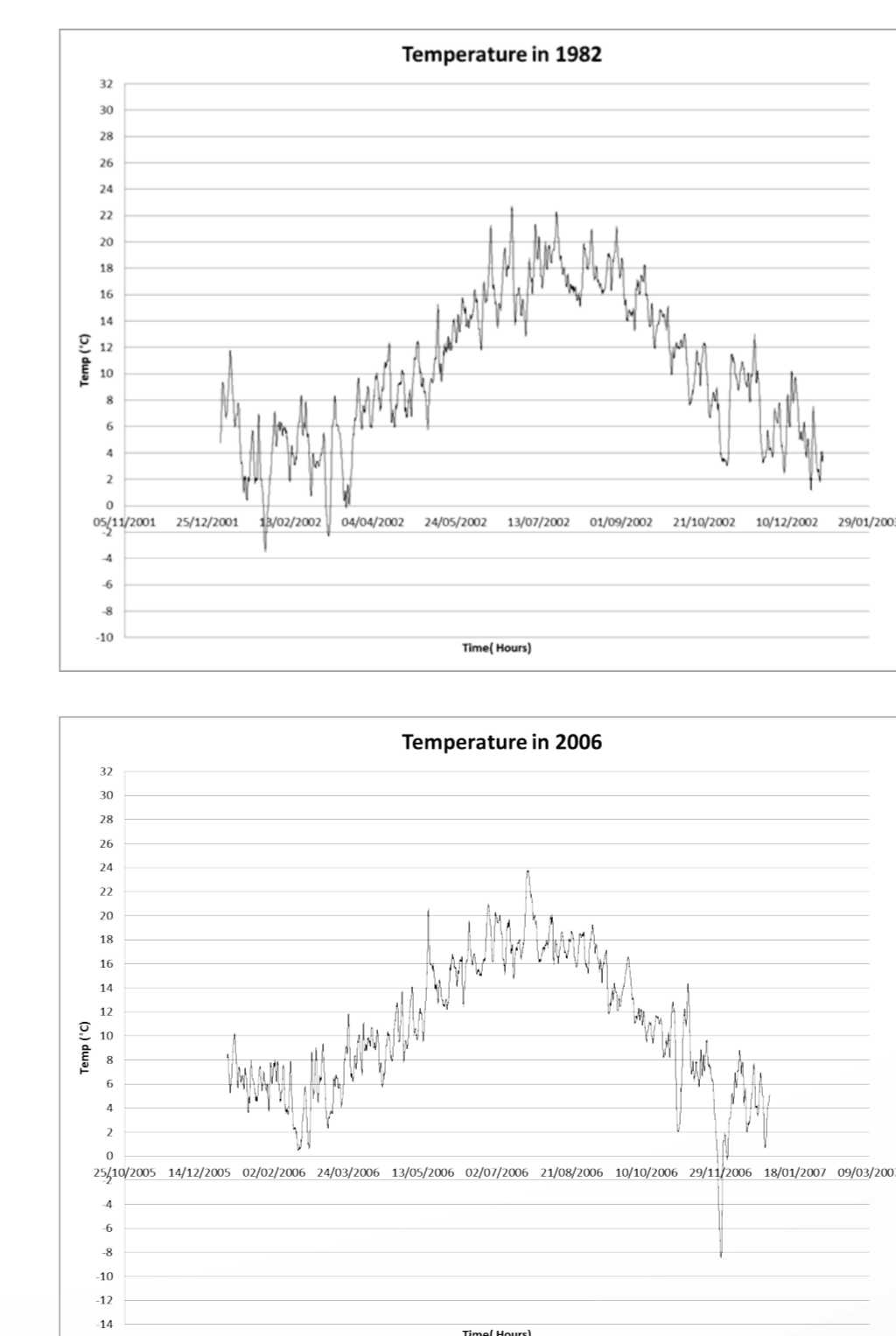
### Indoor Moisture

Indoor moisture is one of the uncertainty parameters which depends on factors such as number of occupants, living condition, cultural habits, and living habits. Probability density vs. excess moisture over the same period of time in two suits in Vancouver shows variation in moisture generation rate.



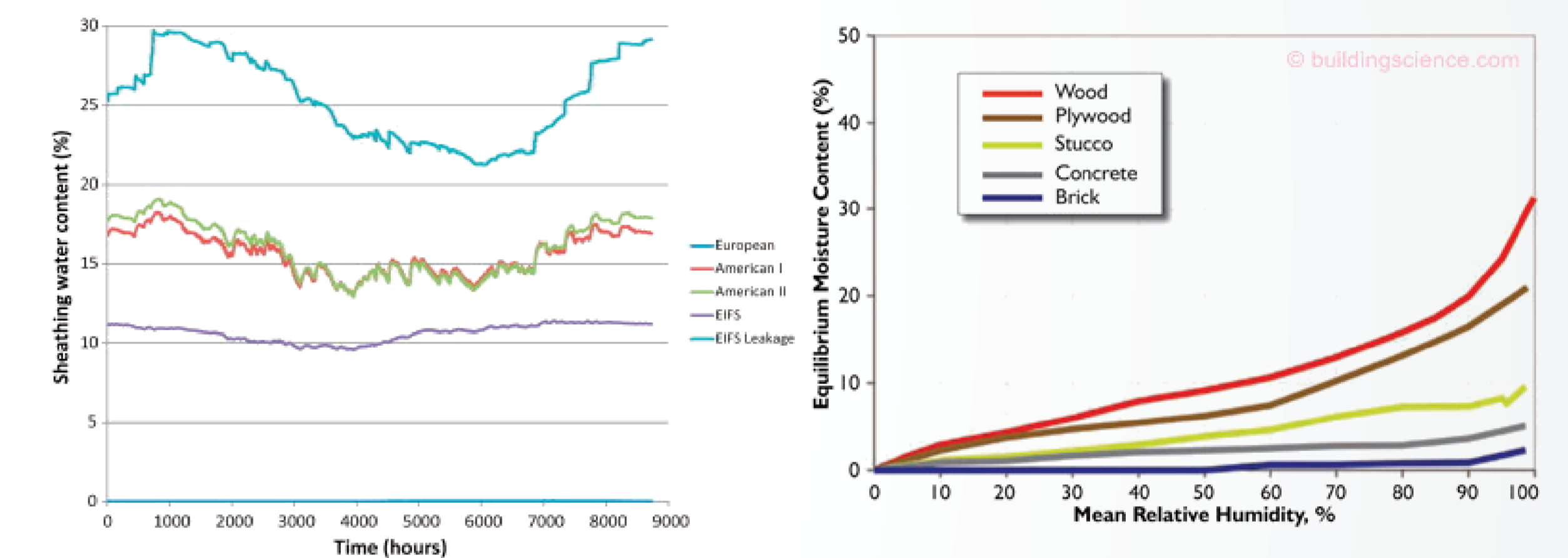
### Outdoor Weather

Outdoor weather is also an uncertainty Parameter. Outdoor weather can change from year to year which would affect durability and risk of failure in building envelope components. Temperature over two independent years are presented in the graphs. 30 years of weather data is considered in this research.



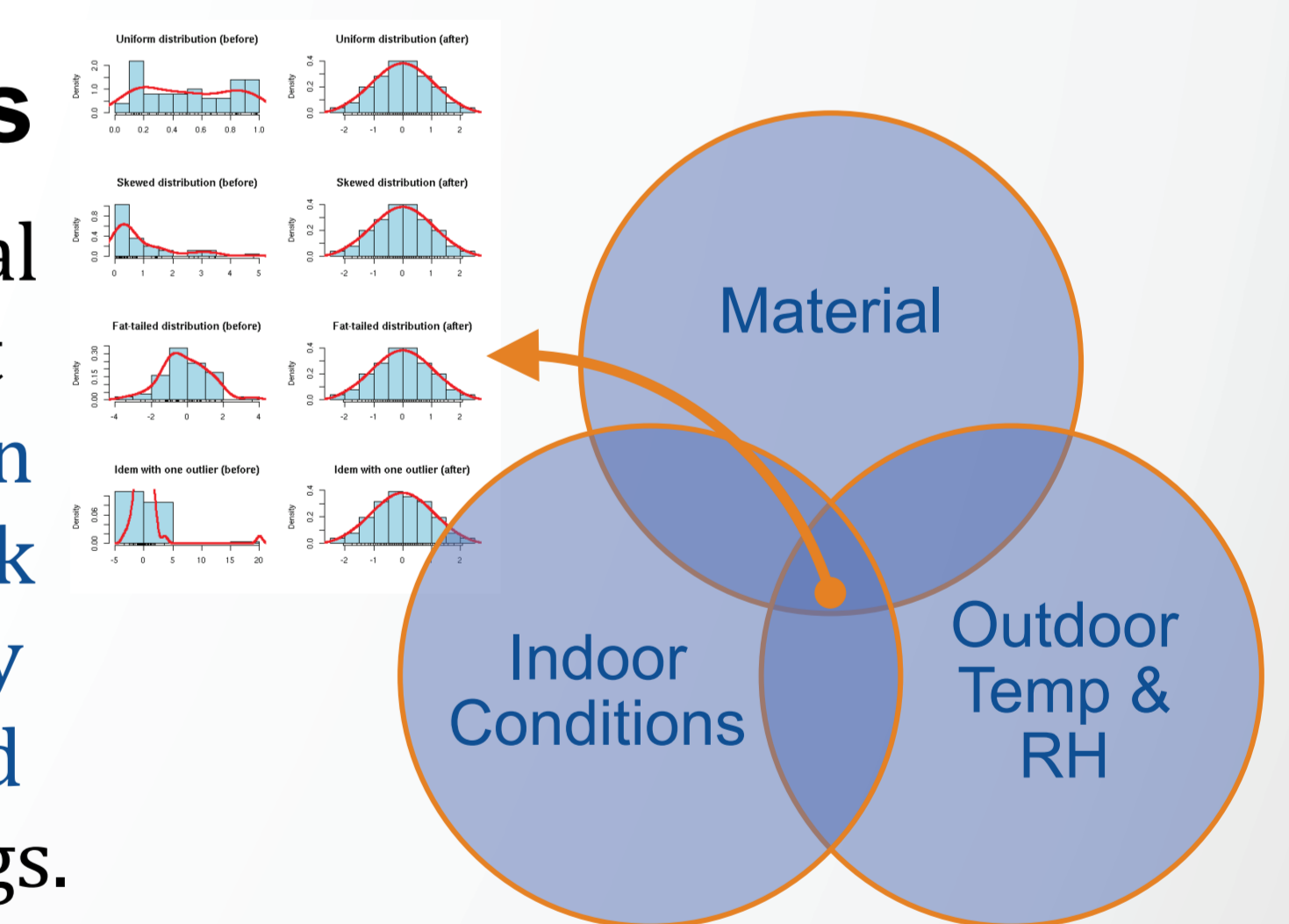
### Material and Workmanship

Material uncertainty is mainly due to variation in material properties. The same material may have different properties. Also, workmanship uncertainties can be caused by faulty or wrong installation. For instance, rain penetration in wall assembly which is caused by improper detailing.



### Expected Findings

Its expected that the final results provide different probabilistic distribution curves and priorities risk factors that affect energy efficiency, durability, and risk of failure in buildings.



### Contributions from this research

In every design, risk exists. If multiple buildings are being built, stochastic performance of building components can be predicted by taking into account uncertainty of different parameters. The approach developed in this research work will help to design durable and energy efficient building envelope components through probabilistic analysis. It can also lead to a better failure risk assessment and failure prediction in buildings.