bractlet

Provides advanced energy modeling services for increasing savings guarantees while reducing risk on ESPC projects

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Uncertainty & Risk Analysis in Energy Performance Contracting

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Risk & uncertainty analysis in ESPC projects

Risk and uncertainty are both present when predicting savings on energy conservation measures (ECM's)

Risk

Def. Present when future events occur with measurable probability

Ex. Not meeting a savings guarantee

Uncertainty

Def. Present when the likelihood of future events is indefinite or in doubt the

Ex. % chance of not meeting the guarantee

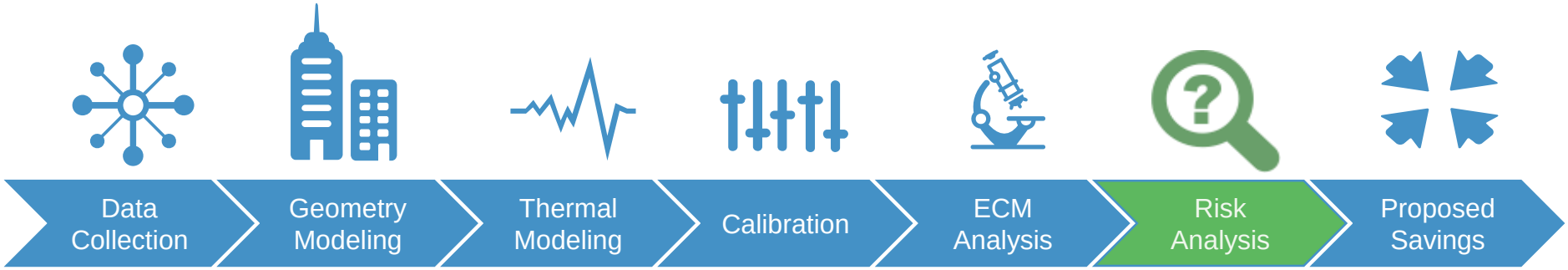
Why is this analysis important on ESPC Projects?

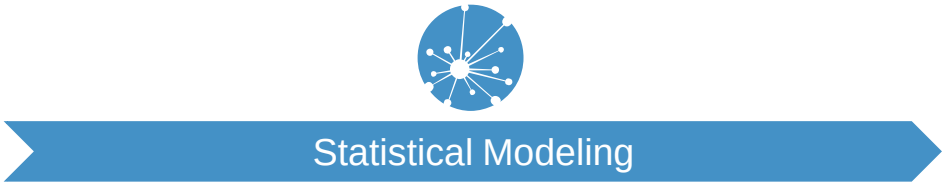
1. **Reduce risk** of savings guarantees not being met by quantifying uncertainty

2. **Reduce safety factors** ESCO's put on savings guarantees that lower profits and margins on projects

3. **Understand the financial impact** more accurately of energy conservation measures (ECM's) selected for the performance contract

Risk analysis in the Bractlet modeling process for an Investment Grade Audit





Uncertainty & risk analysis steps

Data Collection | Geometry Modeling | Thermal Modeling | Calibration | ECM Analysis | Proposed Savings

Uncertainty Analysis Process

1. Key variables defined
2. Uncertainty range definition
3. Monte Carlo simulation
4. Results post-processing

What are the key variables that affect savings estimates

Input variables

Building Geometry
Surface area of the windows on the building

Environmental
Temperature, Solar Radiation, etc.

Operational Characteristics
Characteristics of the equipment in the building (single speed or dual speed cooling tower fan)

Equipment Data
Performance curves, BAS, sub metered power

Key variables are identified

Conduct analysis to identify variables that have the highest impact on energy model results

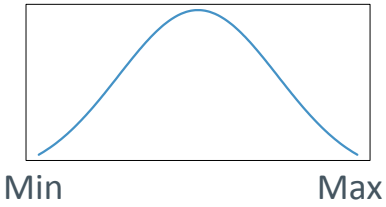
Uncertainty range definition

Key variables minimum and maximum range defined

Equipment Data
Performance, BAS, sub metered electricity

Key Variable: Chiller Performance

Uncertainty profile created on the variable range



Variable's probability is normally distributed

Monte Carlo Simulation

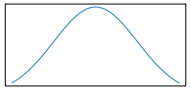
Simulation tool run 1000's of times to create an uncertainty distribution

Key Variables

Chiller Performance

Variable Uncertainty

Vary Inputs according to uncertainty profile

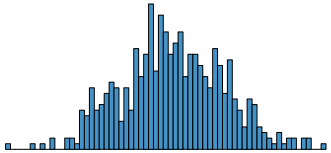


Iterative Simulations

X 1000

Final Uncertainty Distribution

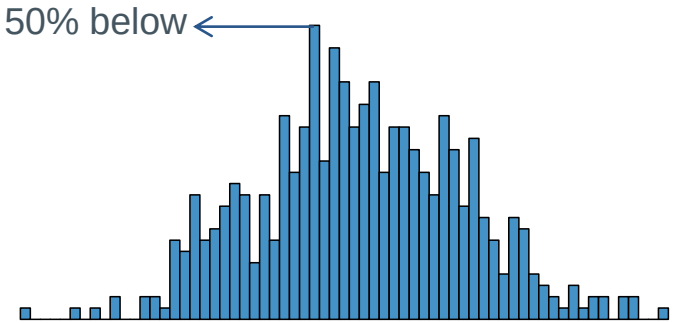
Uncertainty Distribution of Energy Consumption



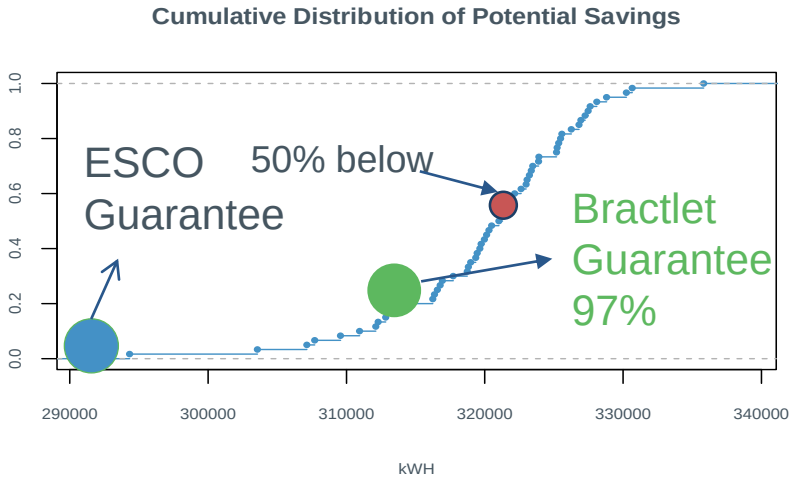
Post processing results

Uncertainty analysis drives understanding of savings risk

Full understanding of the likelihood of future chiller performance



More accurate understanding of the risk of a savings estimate



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Questions

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