



BIM-BEM INTEROPERABILITY THROUGH AUTODESK REVIT SYSTEMS ANALYSIS FOR ENERGY MODELING

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On today's

AGENDA

00 Introduction

01 Objectives

02 Methodology

03 Case Study

04 Results & Discussion

05 Conclusion & Future work



00 Introduction



Why BIM & BEM ?

- **BIM:** digital model unifying design and performance data
- **BEM:** energy simulation tool (demand, consumption, HVAC loads)
- **Efficient simulations** and **collaboration** between engineers

Research Gap

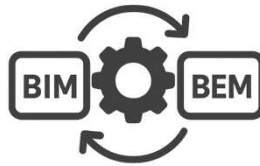
- Current BIM–BEM interoperability = data loss & manual refinement
- Open question: *Can Revit Systems Analysis deliver reliable BEM inside BIM?*



01 Objectives



Develop an **EnergyPlus baseline model** of an office building in Padova to validate results



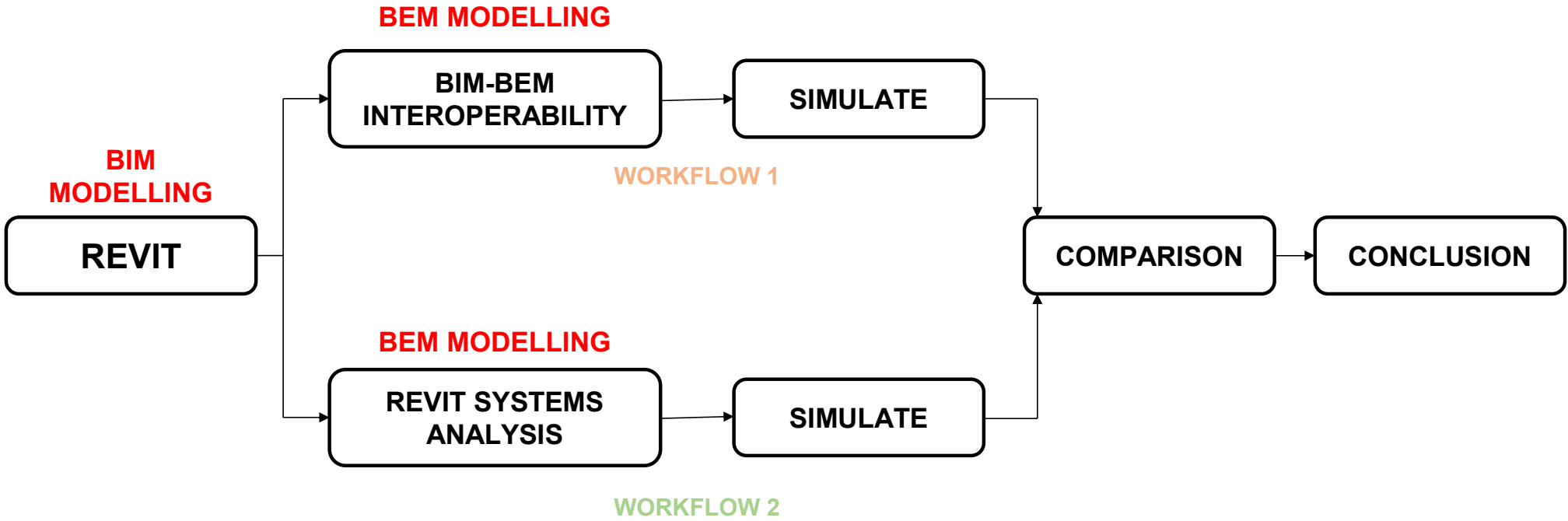
Define a **BIM-driven BEM methodology** that performs energy simulations entirely within Revit



Evaluate the advantages and limitations of using **Revit** as both a **BIM and BEM tool**



02 Methodology





02.1 WORKFLOW 1: Energy simulation via IFC workflow with CYPETHERM EPlus





02.2 WORKFLOW 2: Automated energy simulation using Revit Systems Analysis



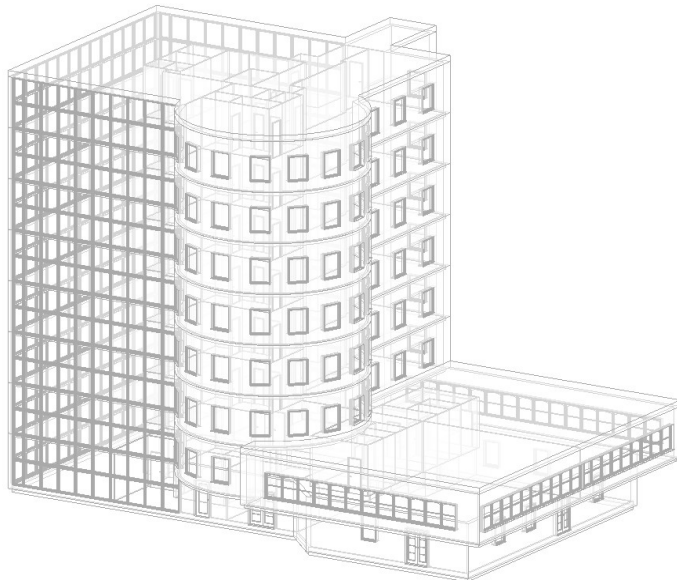


02.3 COMPARISON

	Revit workflow	CYPETHERM EPlus
IDF File Size	4.7 MB	1.3 MB
Export Method	Indirect via gbXML	Direct native IDF export
HVAC System Objects	Minimal	Detailed
HVAC Availability Control	Not exposed in interface Setpoint temperatures configurable	Full control
Internal Load Scheduling	Good interface with possibility to add different schedules for different days	Good interface
Schedule Coverage in IDF	Schedules disconnected from HVAC	Explicitly defined
Exclusive Object Focus	Costing Reporting Auxiliary Loads	HVAC networks Setpoint Managers Convection Logic
Workflow Integration	Strong BIM integration direct from architectural model	Standalone engineering tool requires geometry import
Simulation Trigger	One-click simulation from within Revit	Manual control, but higher transparency



03 Case Study



Case study building
model

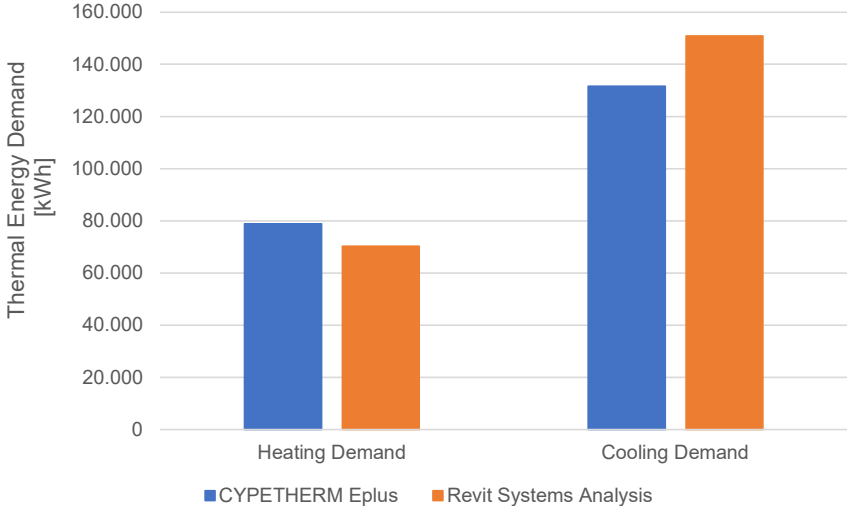
- **Location:** Padova, Italy
- **Climatic Data:** Venice, Italy
- **Building Area:** 3367 m²
- **Building Type:** Eight-story office building
- **Glazing Area:** 500 m²
- **Adjoining Walls:** None

U-value of the external walls	0.46	W/m^2K
U-value of the windows	1.2	W/m^2K
g-value of the windows	0.43	–
Air change rate	0.6	h^{-1}
Heating set point	21	$^{\circ}C$
Cooling set point	25	$^{\circ}C$

Thermal properties of the building envelope and boundary conditions



04 Results & Discussion



Annual Thermal Load Comparison Revit vs. CYPETHERM EPLUS



Heating Demand
-10.8 %



Cooling Demand
+14.6 %



04 Results & Discussion

Weather Data Variations

No possibility to import a custom weather file in Revit, leading to mismatched climatic inputs.

Setpoint Scheduling

No heating/cooling setpoint scheduling in Revit → results in unrealistic cooling during winter.

Unconditioned Space Treatment

Revit excludes unconditioned spaces from load calculations (no HVAC, lighting, or gains), while CYPETHERM accounts for their indirect effects (e.g., adjacent heat transfer).

Model Complexity

Revit-generated IDF $\approx 3\times$ larger → indicates more detailed geometry and system definitions, influencing results.



05 Conclusion & Future Work



CONCLUSION

Key Advantage: Fast & reliable energy analysis **directly inside Revit**

Suitable for **early design decisions** and efficient scenario testing

Results show **close alignment** with CYPETHERM EPLUS

Revit workflow provides reliable results for annual demand analysis



FUTURE WORK

Enhance HVAC system modeling and scheduling inside Revit to improve control strategies & seasonal setpoint definition

Validate across different building types & climates, to ensure generalizability of results

Move towards digital twin workflows, by linking simulations with real-time building data for continuous performance monitoring



***Thank you for your
attention !***

Any questions?