



# Designing with Confidence

How the IES APACHE Engine Delivers Trusted Building Performance Insights within Enscape Impact

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# Introduction

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Building performance modeling plays a critical role in enabling the design, retrofit and operation of energy-efficient, low-carbon and resilient buildings. By simulating how a building will perform in response to different design parameters, usage profiles and even future climate scenarios, these tools crucially enable project teams to predict the impact of their design choices early on, avoiding potential issues, higher costs and poor environmental outcomes further down the line.

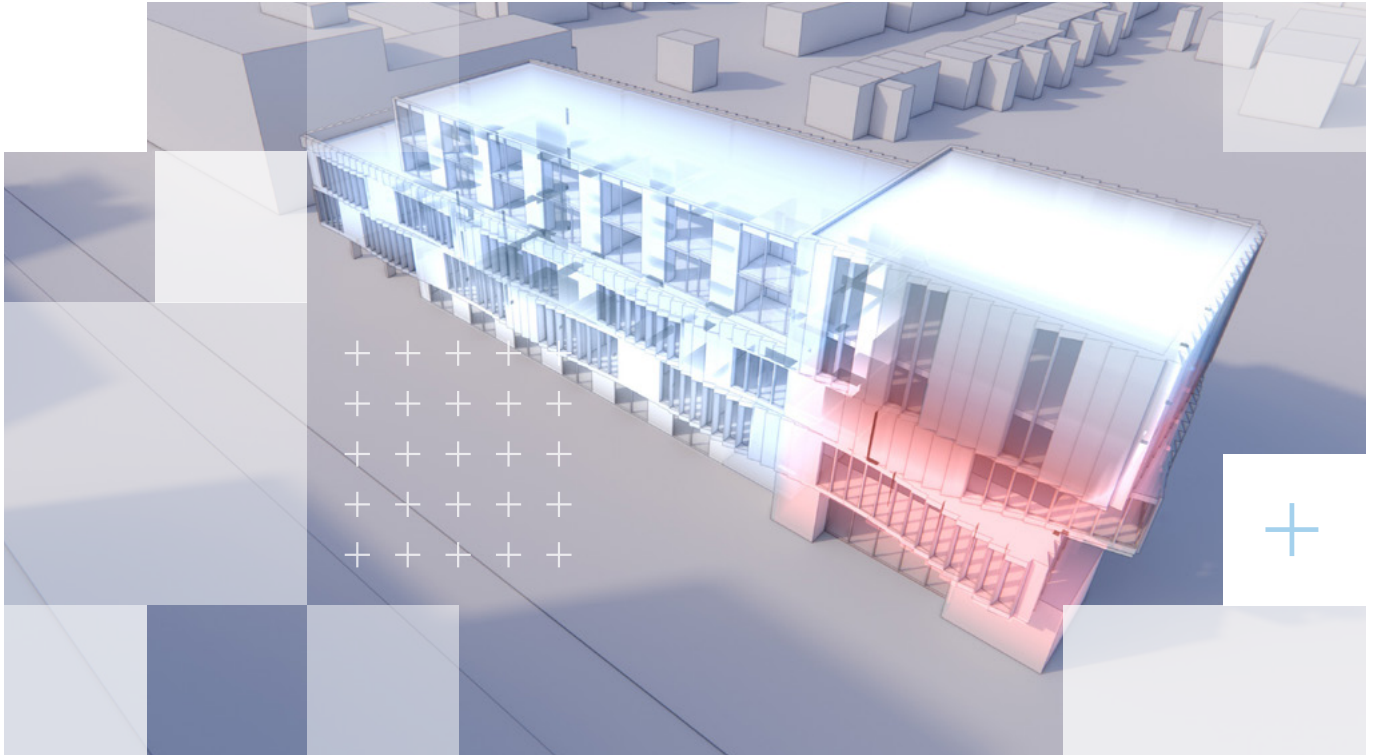


While traditionally, uptake of building performance modeling during the early design stages has been limited, the growing complexity of contemporary building design and a heightened emphasis on sustainability and net-zero is increasingly making performance modeling an essential component of architectural workflows. As architects strive to optimize energy efficiency, occupant comfort, and environmental impact, tools that simulate thermal behavior, lighting, and energy efficiency are not simply a nice-to-have but an essential component of successful project delivery. By enabling data-driven decisions, performance modeling is helping teams anticipate challenges, reduce costly revisions, and meet today's increasingly stringent regulatory and voluntary rating standards more efficiently. This shift reflects a broader trend towards evidence-based design, where a broad scope of performance metrics is as critical as aesthetics and functionality.

Yet until recently, few tools have successfully combined the robust analytical capabilities that building performance engineers rely on with the intuitive, visual workflows architects prefer. In this paper, we take a deep dive into the simulation engine that powers Enscape Impact to prove that it is possible to have the best of both worlds – powerful, architect-friendly visualizations, without compromising on quality performance insights.

**Performance modeling  
is an essential component  
of architectural workflows.**

# What is Enscape Impact?



Enscape Impact is a tool developed through a joint venture between Chaos and IES. It bridges the gap between energy modeling and design visualization, enabling architects to integrate powerful energy analysis into their creative workflow.

Enscape Impact transforms how architects evaluate the sustainability of their designs from the outset. It integrates IES's trusted energy modeling capabilities with Enscape's real-time rendering engine, enhancing visualizations with energy efficiency data, simulated energy use, carbon emissions, and thermal comfort indicators to guide early design decisions.

Incorporating building performance analysis earlier in the design process can enable architects to make more informed decisions when they matter most, enhancing overall project sustainability and efficiency.

#### Key benefits include:

- Better communication during early design stages
- Fast energy analysis to support early issue detection & data-driven decisions
- Simplified workflows and a quick learning curve
- Improved collaboration between architectural and engineering teams
- Increased productivity supported by faster feedback loops



*“Enscape Impact is a sustainability partner in the design process, delivering early-stage performance insights without interrupting creative flow.”*

Dilyana Neykova, Product Owner, Chaos

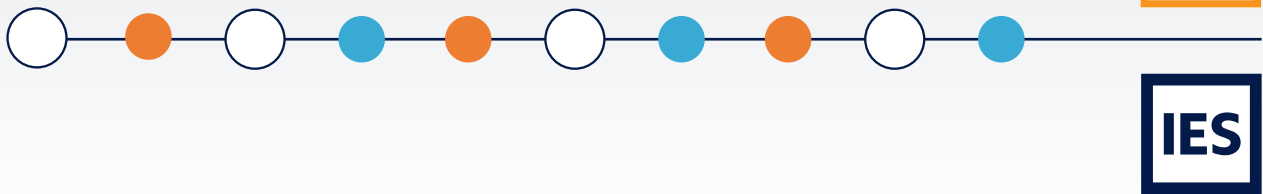


# Why did Chaos partner with IES to create this solution?

Buildings account for almost 40% of global carbon emissions, and while it is often early design decisions that have the greatest influence on building performance, there is a lack of easy-to-use tools for architects that provide actionable building performance insights during the early design stage.

## Design + Visualization + Building Performance

Architects, 3D Artists, Engineers, Building Performance Specialists

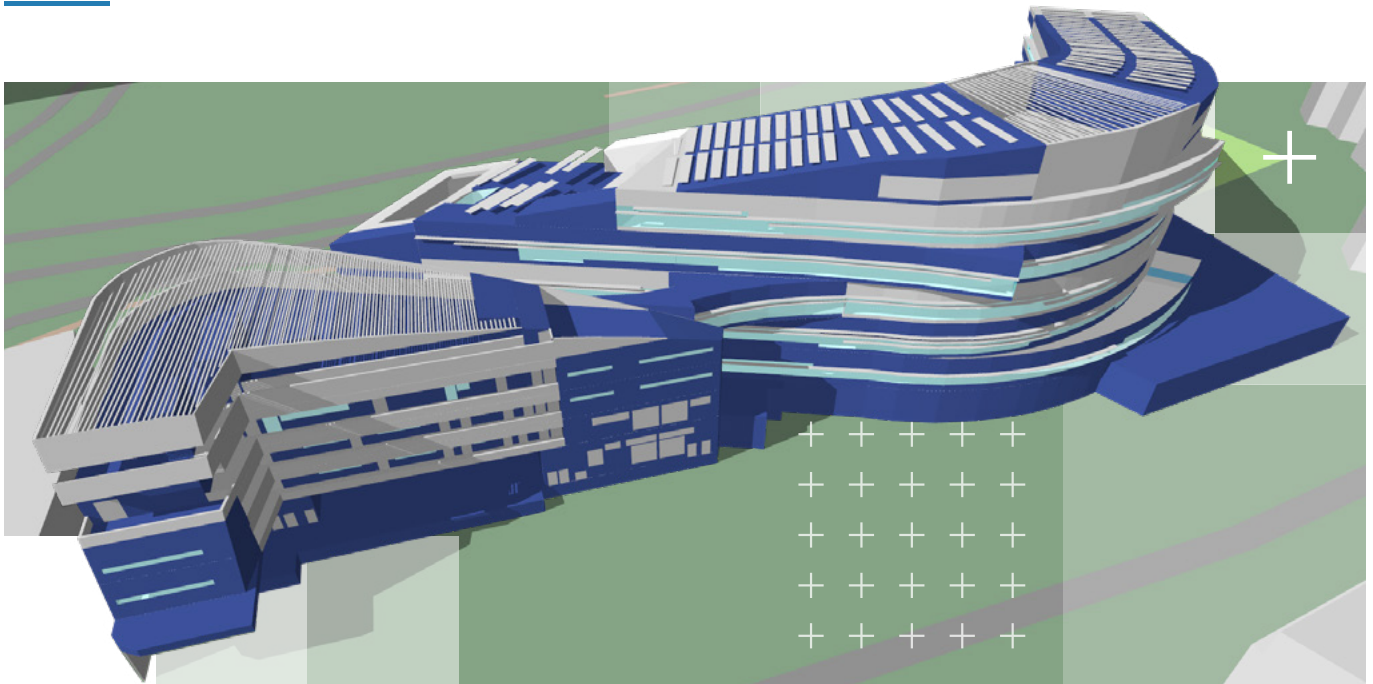


Recognising this gap in the market, Chaos and IES joined forces with a shared vision: to democratize access to building performance insights and empower architects to make informed, sustainable design decisions earlier, before it's too late or too expensive to adjust.

IES have been pioneers of building performance analysis technology for over 30 years. Their APACHE building performance simulation engine, which sits at the centre of all of IES's current solutions – including their renowned Virtual Environment (IESVE) building performance analysis software – was selected for integration with Enscape to enable data-driven design decisions within an intuitive visual context. It is estimated that the engine has helped to improve the performance of more than 1.5 million buildings globally to date.

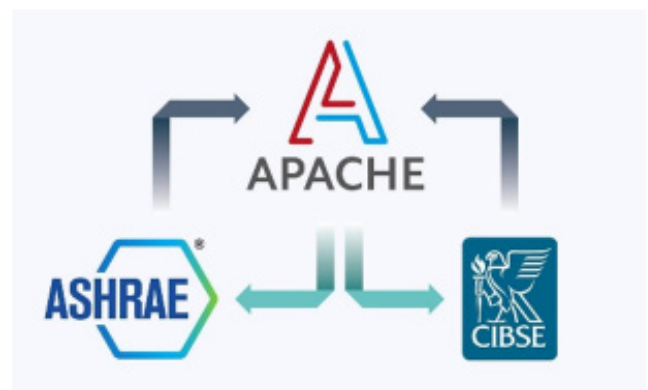
As world leader in design and visualization technology, Chaos develops technology for architecture, engineering, construction and other creative industries, and their Enscape tool is geared specifically towards architects who need intuitive, real-time visualization in a single CAD environment. By combining IES's powerful performance analytics capabilities with Chaos Enscape's visual representations, designers can better understand how factors like energy use, and in the future daylighting and thermal comfort, impact a space throughout the design process. The integration streamlines workflows, reduces the need for early-stage external analysis tools, and fosters a more iterative, performance-driven approach to architectural design.

# The IES APACHE Engine: 30 Years of Simulation Excellence



With origins reaching back over 30 years, the technology originally dubbed “APplication for Air-Conditioning and Heating Engineers” has evolved into a user-interface, rules processor and is widely regarded as the best whole-building energy simulation engine in the world. It carries out a dynamic thermal simulation with a time-stepped output, a crucial component of any advanced simulation.

Fully compliant with international standards, the IES APACHE engine helps designers worldwide effectively decarbonise their buildings. APACHE utilizes a virtual representation of the building and physics-based models of heat transfer processes, alongside historical or future predicted weather data. The simulation considers the accurate effect of sun-time, solar shading and the associated solar gain entering building spaces. Space conditioning systems definitions also provide a complete understanding of energy usage predictions for both the building and its equipment.



# Making Reliable Analysis Accessible: The Integration between Enscape Impact and IES APACHE

While APACHE’s credentials are proven, how do they actually translate into the results you see in Enscape Impact? Here we explore how the tool communicates with the APACHE engine, making it possible to combine building geometry and location with thermal performance data and fabric information, all while simplifying the process for wider audience.





## Required inputs for Enscape Impact

The analytics within Enscape Impact are based on simple and readily available information. A default building configuration is set based on the following: Location and the associated Climate Zone, Building Age, and Building Type.

The model inputs from Enscape Impact are assessed in detail and converted to a raw geometry file, supplemented with the geolocation information, building type and age. All of this data is passed onto APACHE using IES's Model Translation Engine (MTE) – a software library for creating simulation data models, which uses data creation, enrichment and modification Application Programming Interfaces (APIs) to provide the means to manipulate analytical models. MTE supplements the received data from Enscape Impact with datasets of typical thermal properties and systems information suitable for the location, age, and selected building type. This includes climate zone information and the associated weather file for the building's location, fabric performance data, and standard operational schedules. As well as internal space conditions, typical internal loads, heating, ventilation and air conditioning, and hot water system types.

## Basis of the model processing

The IES APACHE engine delivers dynamic thermal simulations that consider the energy efficiency and sustainability of a building from an energy and carbon usage viewpoint. It provides a complete virtual representation of the real building and uses physics-based heat transfer calculations.

Simulations are driven by recorded or future predicted weather data and comprise a complete understanding of energy and carbon usage predictions for both the building and its standard equipment.

Furthermore, the delivered insights and benchmarking of the designed building against its peers allows for an early-stage assessment of a design's viability, quickly informing further design iterations, without incurring unnecessary costs.



## Integrated Benchmarks

The Model Translation Engine utilizes regional building benchmarks, to assure relevance of the design within the regional market. For the USA, benchmarks for each climate zone and building type have been generated from public domain CBECS & RECS databases as provided by the U.S. Energy Information Administration (EIA). The United Kingdom & Ireland benchmarks for each climate zone and building type have been generated from public domain Display Energy Certificate data, as provided by the UK Government.

IES have derived data from these public datasets, which in turn help to identify how close the design is to the dataset median, if it is better or worse than the median peer building, or if close to an extreme, it prompts the designer to investigate further and ask why.

The rest of the world follows the USA benchmarks until more regional datasets become available.

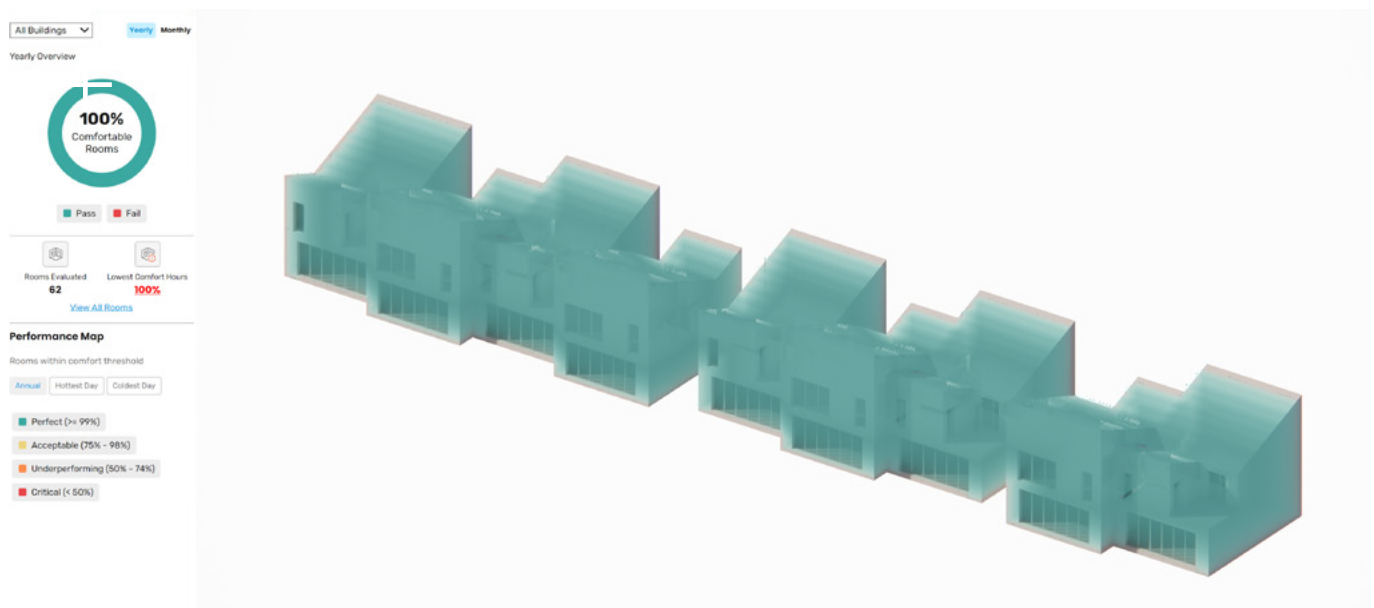
## Validated Outputs

To assure the best performance and results accuracy, IES and Chaos implemented a validation process of the building energy performance metrics of Enscape Impact against the IES Virtual Environment (VE) – IES's flagship software for delivering detailed building simulation analysis. The validation testing was undertaken across a range of building types, climate zones, glazing ratios, and ASHRAE standards. Through a joint approach, IES & Chaos were able to cover significant model variations through this exercise. Representative scenarios were selected including variations of building types, glazing extent and positioning, floor area and floor height, climate zones, ASHRAE standards, and complexity of building geometry.

We are continuously collaborating on testing to support ongoing improvements to the tool. Comparison testing results can be viewed [here](#).

# Latest Enhancements

To ensure Enscape Impact continues to meet evolving user needs, Chaos and IES have been working to further enhance the tool’s functionality, performance, and usability. These latest updates introduce new simulation capabilities and deeper integration with the APACHE engine’s simulation capabilities.



Recent enhancements in the latest Enscape Impact 4.13 release include **Thermal Comfort Analysis**, enabling users to assess how comfortable designs feel for occupants in the early concept stage. With this latest update, Enscape Impact enables architects to visualize and assess the comfort levels (predicted mean vote, or PMV) and leverage thermal comfort data to create spaces that balance occupant well-being with energy efficiency, right from the start of the design process.

Additional enhancements include updates to streamline the modeling workflow, allowing for an assignment of **space types**. This will provide more detail and insight into the analysis, by creating a distinct model of the designed building.

**Exportable performance reports** is another new feature, making it easy to share findings with clients or team members, compare design options, and keep a clear record of sustainability decisions without manually copying data.

While not yet released, future enhancements to the tool will include **daylighting analysis** capabilities that will empower designers to make informed decisions about glazing, shading, and façade design. Well-lit spaces contribute to the creation of sustainable, energy-efficient environments while improving spatial comfort and aesthetics.

Additionally, feedback from existing and new adopters will continue to inform the prioritisation of features, ensuring the development path remains closely aligned with real-world design practices. Through these enhancements, the tool aims to remain a reliable and forward-looking solution within the architectural technology landscape.

# Conclusion

The APACHE simulation engine brings technical depth and credibility to Enscape Impact by offering validated, industry-standard methods for modeling building performance.

Its robust algorithms and proven track record ensure reliable results, enabling users to make informed design decisions with confidence. By integrating a trusted simulation backbone, the Enscape Impact tool gains both analytical precision and professional legitimacy, making it suitable for both expert and broader user groups.

**Explore Enscape Impact:**  
[www.chaos.com/enscape/impact](http://www.chaos.com/enscape/impact)

# About Us



## Chaos

Chaos develops 3D visualization technology for architecture, engineering, construction, product design, manufacturing, and media and entertainment. They create intuitive and powerful workflows for architects, artists, and designers in any industry. Their research and development is leading the way towards a truly comprehensive end-to-end visualization ecosystem to meet the evolving needs of customers. Headquartered in Karlsruhe, Germany, Chaos is now one of the largest global 3D visualization companies, with more than 700 employees and offices worldwide.

[www.chaos.com](http://www.chaos.com)



## IES

IES is a global climate tech company delivering innovative technology solutions and consultancy services to decarbonize the built environment. Over the last 30 years, they have built a solid reputation as the leading global innovator in integrated performance-based building analysis and they are now home to the largest building physics analytics team in the world.

Supporting energy-efficient, healthy and cost-effective built-environments, IES' digital twin technology provides those involved in the design, retrofit and operation of buildings the information needed to make smarter, more sustainable decisions with confidence.

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