hysopt

Navigating the Changing HVAC Industry

A deep dive into the challenges of today’s evolving HVAC market

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Introduction

In today's constantly evolving market, navigating the intricacies of heating and cooling systems can be quite daunting. For years, the HVAC market has remained relatively traditional, experiencing minimal change. However, the industry is now undergoing a rapid transformation, moving away from its traditional roots towards a different landscape, characterised by an almost endless supply of new technologies and innovations. On top of that, requirements and regulations to meet the growing demand for energy efficiency and carbon reduction are getting higher and more stringent.

Consequently, this shift raises many questions and challenges, particularly in terms of design. As HVAC systems become increasingly sophisticated and interconnected with other smart technologies, engineers are faced with the task of integrating these new technologies seamlessly while also meeting the evolving needs of customers and regulatory standards.

Nowadays, the building sector accounts for 40% of the energy consumption and 36% of greenhouse gas emissions[1], with HVAC systems alone responsible for 70% of a building's energy usage. This once again highlights the responsibility installers and engineering companies play in decarbonising the built environment, putting even more pressure on the entire HVAC industry.

In this e-book, we take a closer look at:

- the evolving HVAC market through emerging market drivers
- the rise of new technologies and innovations
- underlying challenges stemming from these trends
- how Hysopt's physics-based Digital Twin software navigates engineers through the constantly evolving HVAC industry

A constantly evolving HVAC market

In today's dynamic landscape, the HVAC industry finds itself at the forefront of rapid change and innovation. Evolving market dynamics coupled with advancements in technology have ushered in a new era, where traditional practices are being reshaped and redefined. However, this transformation did not come without its challenges.

As the industry grapples with a shifting market and embraces emerging technologies, the pressure on margins intensifies. Additionally, the sector is entangled in a "war for talent," adding another layer of complexity to an already intricate ecosystem.

Emerging need for high-efficiency HVAC systems

The HVAC industry is changing rapidly, and traditional practices are being reshaped by evolving market dynamics. Following the European Green Deal, customers are increasingly imposing more demands and requirements, manifesting in various forms, from more proof of performance in tendering to Performance Based Contracting.

As demands for sustainability, efficiency, and accountability in the HVAC market continue to rise, engineering companies find themselves at a crossroads, compelled to adapt or risk falling behind.

The European Green Deal

With the Green Deal, the European Union aims to become the world's first climate-neutral continent, setting a net-zero emissions target by 2050[2]. This calls for urgent action in the building sector, as it accounts for a great deal of Europe's greenhouse gas pollution. That is why, to meet this net-zero goal, carbon emissions from buildings must already be reduced by at least 55% by 2030 under the 'Fit for 55'-policy[3]. New buildings even have to shift from Nearly Zero Energy Buildings (NZEB) to Zero Emission Buildings (ZEB) by then, as outlined in the recently approved EPBD IV[4].

ESG and CSRD

In light of these ambitious targets, the spotlight on sustainability has intensified through the mandatory implementation of Environmental, Social, and Governance (ESG) criteria. Building owners are therefore pressured to ensure that their properties meet strict environmental standards, such as energy efficiency, waste reduction, and carbon footprint mitigation.

The introduction of the Corporate Sustainability Reporting Directive (CSRD), further amplifies the responsibility of companies. Consequently, they are compelled to invest in sustainable infrastructure and implement green building practices.

Increasing customer demands

With the Green Deal and ESG initiatives exerting significant pressure to prioritise sustainability, companies and building owners are compelled to get on board. Customers are seeking targeted results and clear expectations to meet their imposed targets, drawing broader suppliers such as engineering firms and installers into the fold.

These increased customer demands are becoming more overt in a project's contracting. For instance, a 'proof of performance'

is now requested during the tendering process from the HVAC installation that is yet to be delivered. A reputable name and previous experience are often no longer good enough.

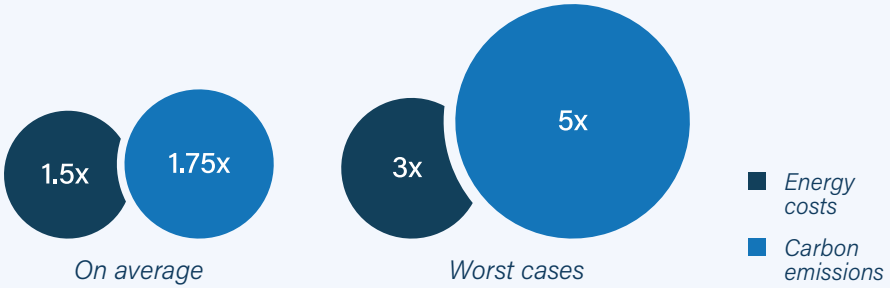
These requirements have even become so demanding, that they can extend beyond initial project stages and persist throughout an Energy Performance Contract (EPC). Companies which partake in these kinds of projects, strive to optimise energy efficiency and deliver tangible results that align with both the financial and environmental objectives of their clients. While this may benefit the end customer more, it does entail a significant bonus-malus system for engineering

companies and installers. This underscores once again the significance of identifying the most suitable energy-saving measures and ensuring their predicted outcomes are achieved, which is very hard to do without the proper tooling.

Rapidly increasing system complexity

On top of the changing market, the complexity of HVAC systems has exploded, bringing forth both new possibilities and challenges. Whereas just a few years ago, buildings were typically heated with (relatively simple) fossil fuel boilers, today we're witnessing a surge in innovative solutions and concepts like hybrid systems, 6- and 4-pipe heat pumps, change-over systems, heat networks, etc. Even when it comes to Building Management Systems (BMS), advancements in sensor technology and the Internet of Things (IoT) appear to offer limitless possibilities.

However, when examining the actual performance of completed installations, they often disappoint. In our other e-book, 'The High Cost of HVAC Under-performance', this issue has been extensively covered, resulting in some interesting outcomes. Out of 550 HVAC installations, 95% of them performed sub-optimally. This caused energy costs to be inflated by 1.5x, and carbon emissions to be 1.75% higher than otherwise necessary[5]. This is not strictly due to any individual components, but rather to the way they are integrated or combined at system level.



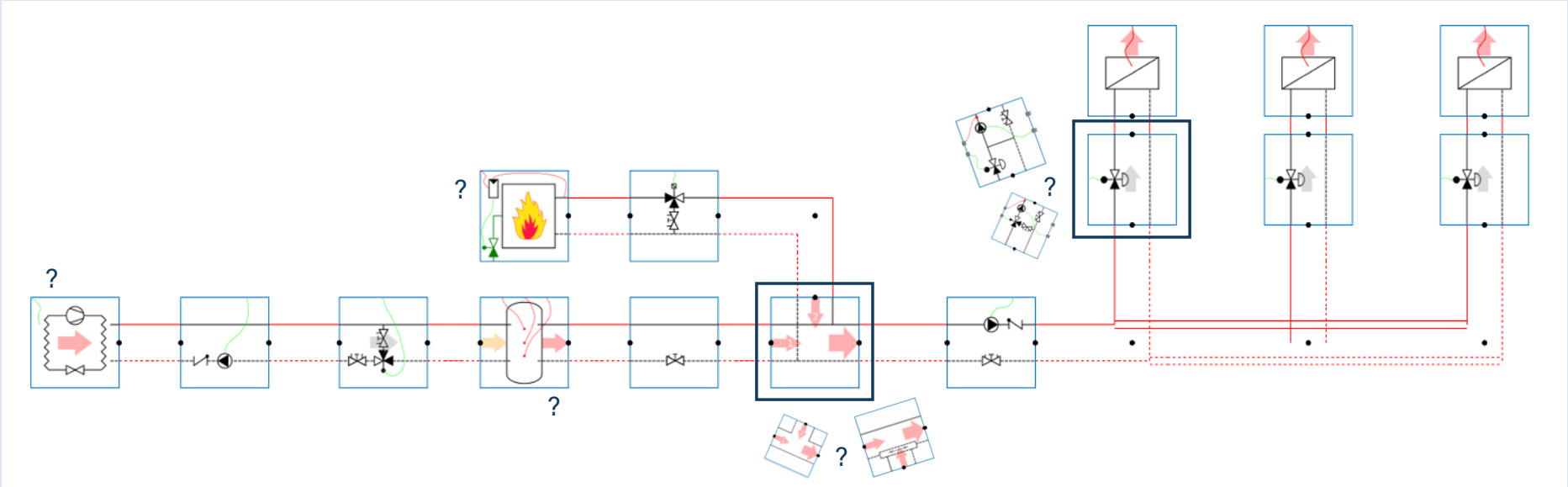
This **"nice components, poorly performing systems"**-phenomenon, which is currently the greatest challenge in the energy transition, stems from the dynamic and complex interactions within a system, leading to substandard performance. This issue, however, is not to be blamed on HVAC engineers, it is the lack of adequate engineering tools to manage these complexities effectively. Bridging this gap demands innovative solutions that address system-level intricacies, ensuring that the potential of these new components translate into an optimal overall performance. The pace of these technological advancements demands a proactive approach to stay ahead of the curve and to meet the increasing demands. Failing to embrace these innovations, puts companies at risk of being banned to the sidelines, unable to harness the full potential of modern HVAC technologies.

> ***"We have the right technology at a component level, the challenge is now to bring these together at a system level."***
>
> Roel Vandenbulcke, Founder/CEO at Hysopt

In-depth: Hybrid of a boiler and a heatpump

In the past, an HVAC system designed with two boilers proved effective, seamlessly meeting heating needs. However, in response to evolving energy demands and environmental concerns, a transition has been made to incorporate heat pumps. Despite this modern addition, the fundamental design remains rooted in traditional methodologies, which limits the efficiency and effectiveness of integrating heat pumps.

However, implementing a heat pump is not just a plug-and-play affair. It involves considering the optimal hydraulic connection (parallel, shunt, series), the power distribution between boiler and heat pump, the thermal storage tank size and its controls, and how to lower the return temperature by intervening in the heat distribution. It is clear that these issues require detailed analysis beyond basic rules of thumb.



Sticking to traditional design concepts for new technologies will result in suboptimal efficiency and performance

HVAC industry under pressure

Margins under pressure

Engineering firms and installation companies make every effort to meet all abovementioned obligations while integrating the latest technologies and trends, but in doing so jeopardise their own margins – which are already as low as 4%[6]. At the same time, they must avoid increasing their prices to the point where they are no longer competitive, as doing so could result in losing contracts to lower-bidding competitors and ultimately threatens their position in the market. Not to mention the ever-increasing labour costs that puts yet another strain on these margins.

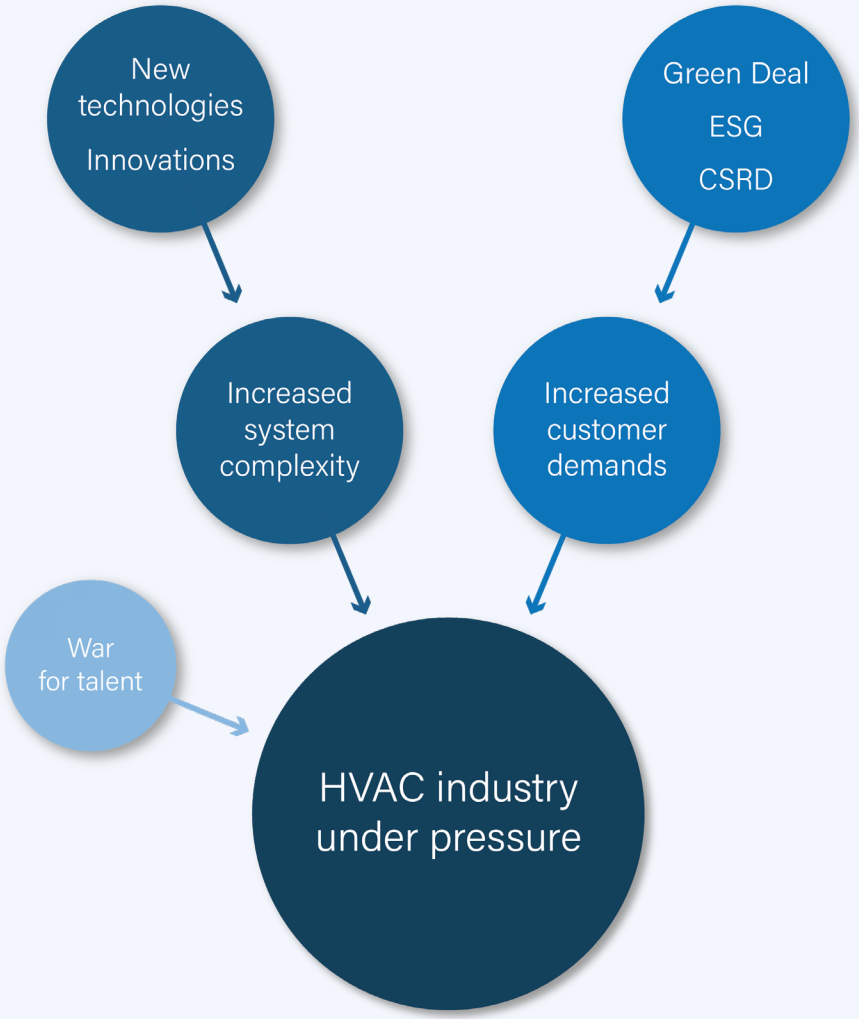
This is also the case when accommodating failure costs.

Research shows that extra costs to anticipate any possible failure costs run as high as 8% or more[7]. These costs are in fact unnecessary and have a significant impact on a project's margin. More than half of these costs can be attributed to errors in the engineering design and the failure to predict and effectively achieve optimal system performance. This is, however, not always an engineer's fault. As mentioned before, they just might not have the right tools for these complex installations and corresponding calculations.

Ongoing war for talent

On top of all that, the HVAC industry is a dynamic and fast-paced environment where things change every so often, including its engineers. In 2023, the average tenure of an employee was 4.1 years[8], with a staggering 1-2 years for HVAC engineers specifically[9]. This constant turnover of employees results in a steady drain of crucial expertise, as a wealth of knowledge and know-how departs with each and every colleague.

Not only does the loss of knowledge take its toll, also the need to upskill the workforce due to the evolving skill requirements. It is hard to keep up with all these changes, especially with the lack of feedback on recently designed system's performance. Even when feedback is received, it often surfaces only years later when the system is underperforming.



> ***"We're seeing, for example, that products are constantly being developed further and becoming more technical, and we also need to take the ever-changing legislation into account, which is making HVAC installations increasingly complex."***
>
> Wim Jonkers, Director Project Department at Van Marcke

Amid a constantly shifting market landscape and escalating complexity, current practices and technologies fall short in addressing the dynamic demands of the industry. There is a pressing need for a tool to navigate these challenges, because it is simply becoming too complex to stick to old industry standards. Thus, adopting new technologies in the HVAC engineering process is an absolute necessity for staying ahead of the curve.

This is where Hysopt comes into play.

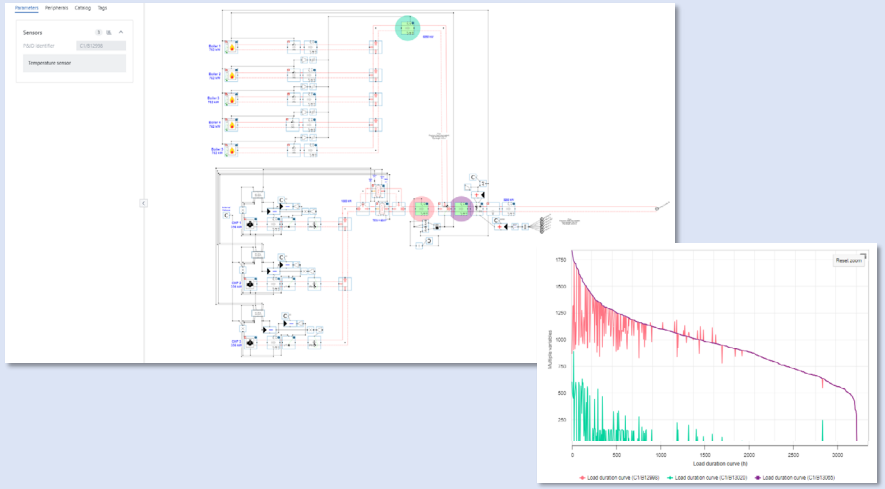
Hysopt's physics-based HVAC engineering software

The Hysopt software enables engineering companies and installation firms to tackle the increasing system complexity, while also meeting the ever-growing client expectations, and on top of that, increase their profit margins.

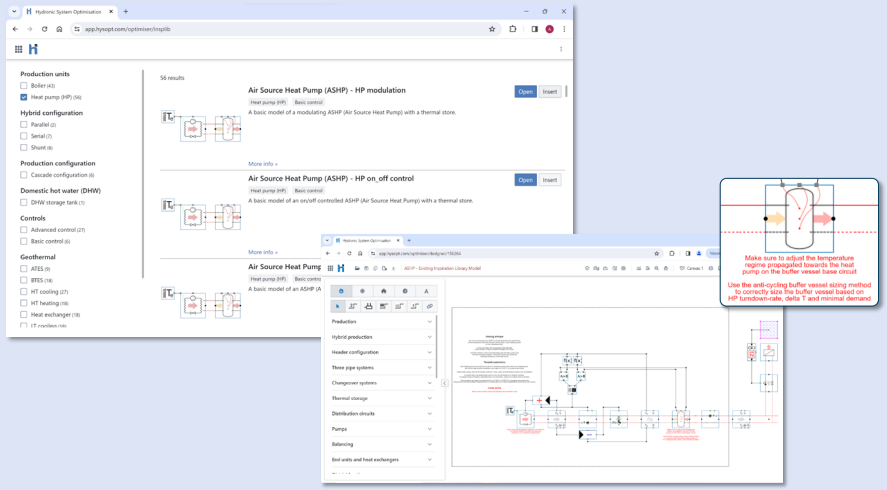
Hysopt's core technology can be best described as physics-based Digital Twin software, meaning that HVAC systems can be fully calculated and simulated in a virtual environment before being built or renovated in real life. In order to do so, our software provides a mathematical model of the entire system, with all applicable physical laws incorporated, such as thermal, hydraulic, controls, and dynamics. At the same time it makes no compromises on complexity, allowing for the most intricate calculations to be performed easily through powerful cloud servers.

> ***"Thanks to Hysopt, we're now witnessing consistently high-quality designs emerging from the design team, revolutionising our approach enhancing our reputation."***
>
> Laura Bishop, Director at HI Group

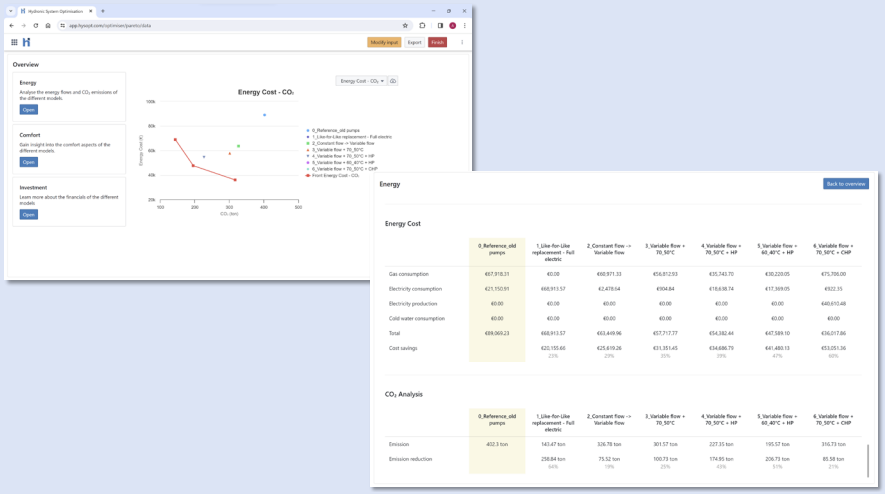
The latter is crucial because when people encounter complex systems or calculations, they tend to simplify these complexities to make them more manageable. This often involves using outdated rules of thumb or treating the system as a purely thermal 'problem', overlooking hydraulic and control aspects, resulting in poorly performing systems. Hysopt addresses this issue by considering all relevant and necessary aspects, seamlessly pulling the complexity and its automated calculations into the background. This ensures that all factors are accounted for without burdening the user, providing a comprehensive solution while maintaining a user-friendly experience.



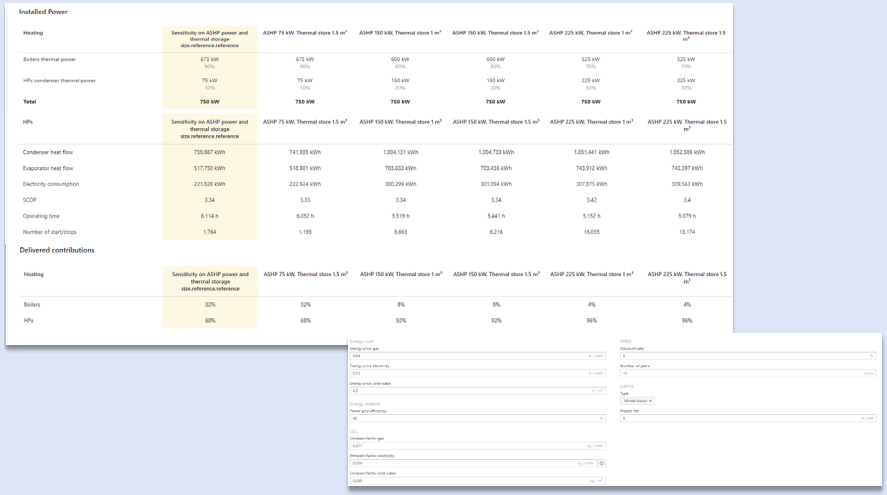
Match real-life system behaviour with Dynamic System Simulation



Gain inspiration and customise templates in the Proven Concepts Library



Compare different system alternatives in a Pareto Analysis



Visualise changes on the overall performance through Sensitivity Analysis

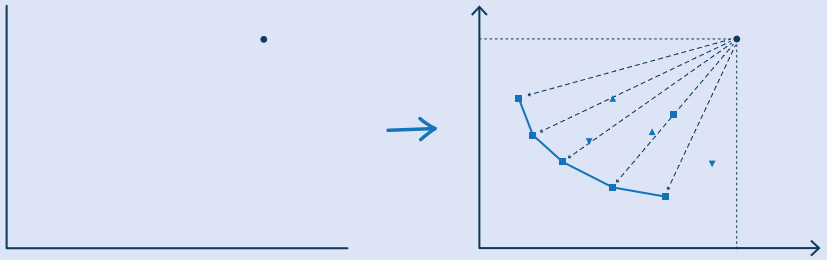
Meet increasing client expectations

The Hysopt software provides scientifically based solutions and transparency regarding what clients can expect from their HVAC installation. It offers multiple design options in one Pareto chart, quantified by different KPIs such as carbon emissions, energy consumption, CAPEX and OPEX. Foster a client's active involvement in the decision-making process by utilising optioneering, and get one step ahead of competitors by guaranteeing optimal performance.

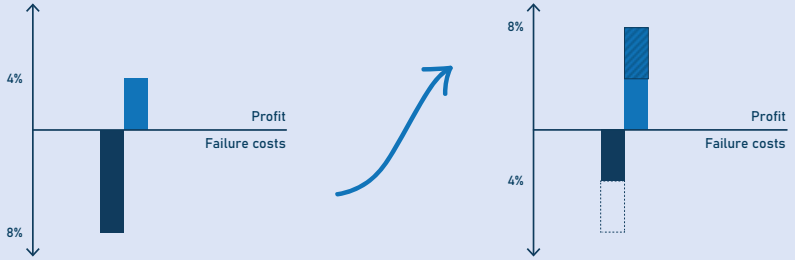
Reduce failure costs

By eliminating any mistakes in the design process, the Hysopt software anticipates on and avoids unnecessary costs which might otherwise have been overlooked. Through features such as the System Check and automated (re)calculations, a correct design is guaranteed from the very beginning, de-risking your projects through accurate system predictions and ensuring less operational issues and a higher profit margin.

> ***"We can now offer tailored solutions with quantified benefits and costs, enabling them to reduce energy consumption carbon emissions. Hysopt's precise modelling capabilities ensure that projected savings translate into tangible real-world results."***
>
> Alex Rummens, Senior Energy Engineer at Low Carbon Alliance



In current practice, there is no tangible proof of performance, with only one design based purely on experience and rules of thumb. With Hysopt, you can offer multiple substantiated options based on all applicable physical laws.



Failure costs are running twice as high as a project's profit margin nowadays, causing significant losses. Hysopt allows you to reduce failure costs drastically, leading to increased profit margins.

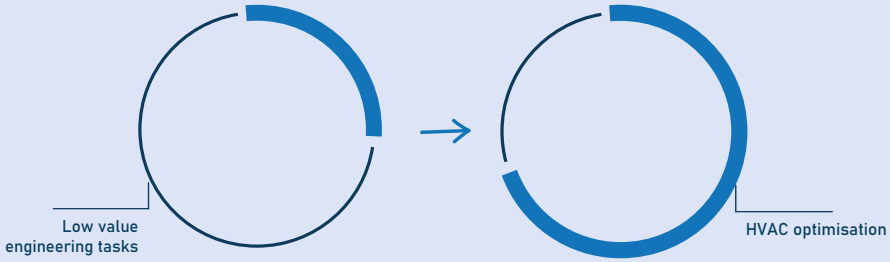
Save engineering time

Hysopt's advanced automation not only significantly reduces the number of engineering hours, but also streamlines the entire HVAC design process. With projects and installations frequently changing, the ability to perform (re)calculations in one click saves a great deal of time. Ensure that designs remain accurate and responsive to changes, facilitating smoother project management and execution.

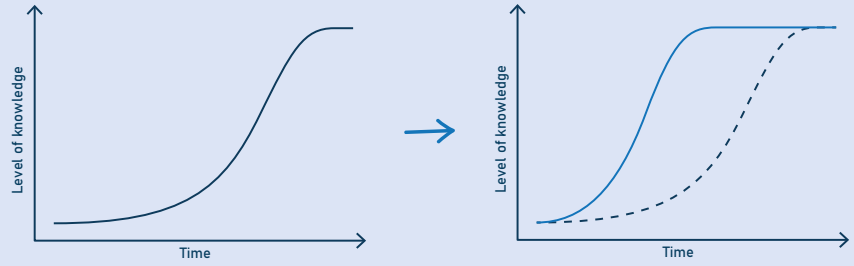
Fortify your knowledge base

Design principles and concepts can be captured and documented in Hysopt's Concepts Library, allowing companies to preserve knowledge and standardise proven concepts. No knowledge will be lost with a shift of colleagues, and standardisation within the company will be promoted. On top of that, due to the instant results and immediate feedback, engineers accelerate their learning curve and can take pride in delivering optimally functioning HVAC systems.

> ***"With the Hysopt software, we have saved 50% on commissioning time because the presets and setpoints are automatically calculated in advance in Hysopt. In the past this was a long trial and error process to commission an installation."***
>
> Maik Van Tilburg, CEO at Van Tilburg Energie Design



A majority of the time right now is spent on low value tasks, such as manual rework and cumbersome communication. The Hysopt software offers solutions like one-click recalculations in one shared digital engineering platform.



In current practices, there is a long learning curve based on trial and error, with little to no feedback on executed designs. With Hysopt, engineers experience an dxpedited learning curve due to instant feedback loop.

Conclusion

By approaching HVAC engineering on a system level instead of looking at individual components, we empower HVAC Engineers to design and optimise HVAC systems for maximum efficiency and performance. Our cutting-edge software not only enhances system functionality – driving sustainability and cost savings – but also streamlines your overall engineering process and deals with all the complexities involved in a user-friendly but accurate way.

> ***Experience the difference of system-level thinking with Hysopt, and revolutionise your approach to HVAC engineering to achieve unparalleled results.***

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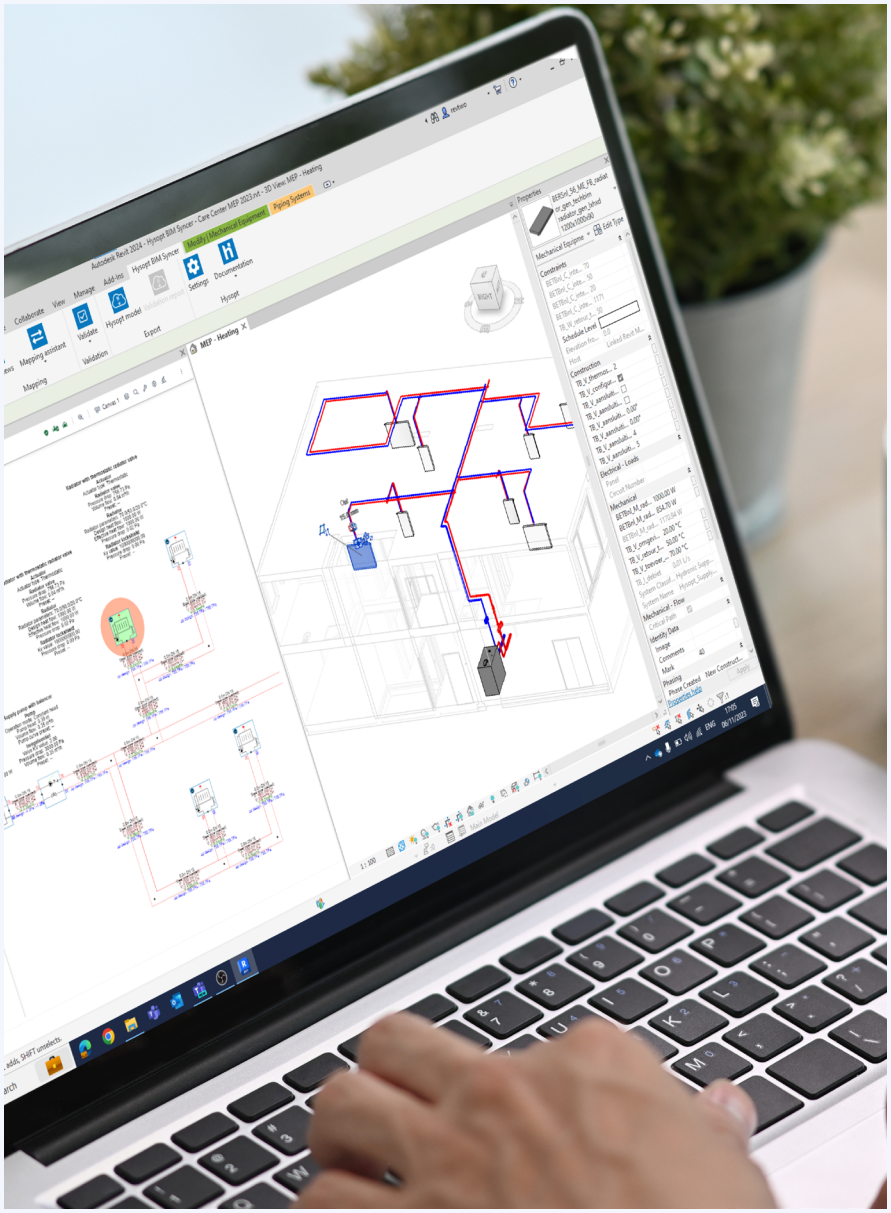

About Hysopt

"**Hydronic System Optimisation**", better known as Hysopt, was founded in 2013 as a spin-off from the University of Antwerp. It is the result of a junction of separate, complex disciplines such as HVAC Engineering, Physics and Mathematics.

As buildings account for 40% of energy consumption and no less than 36% of CO2 emissions, **heating and cooling them more efficiently is our answer to global warming**. However, there is still a deep-rooted misconception that investing in sustainability is extremely expensive. But the experience of optimising the HVAC performance in over 550 buildings has taught us otherwise. It is now our mission to deal with system under-performance to reducing energy costs and minimise environmental impact.

With the Hysopt software, we now offer a SaaS solution to engineering offices, installation companies, and independant HVAC Engineers to support them in their mission towards sustainability and optimal HVAC performance.

Hysopt was proud to receive the prestigious CIBSE Building Performance Award for Innovation – the **only industry awards that focus on actual, measured performance outcomes**, and not just design intent.

The Hysopt software also received an ISSO validation for its underlying calculations, praising us as a "**powerful tool for HVAC optimisation**".

validated by ISSO

Discover more about Hysopt's unique Digital Twin software

Request a demo

Watch our latest webinar

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