BUILDING PHYSICS, CONSTRUCTION AND SERVICES RESEARCH GROUP
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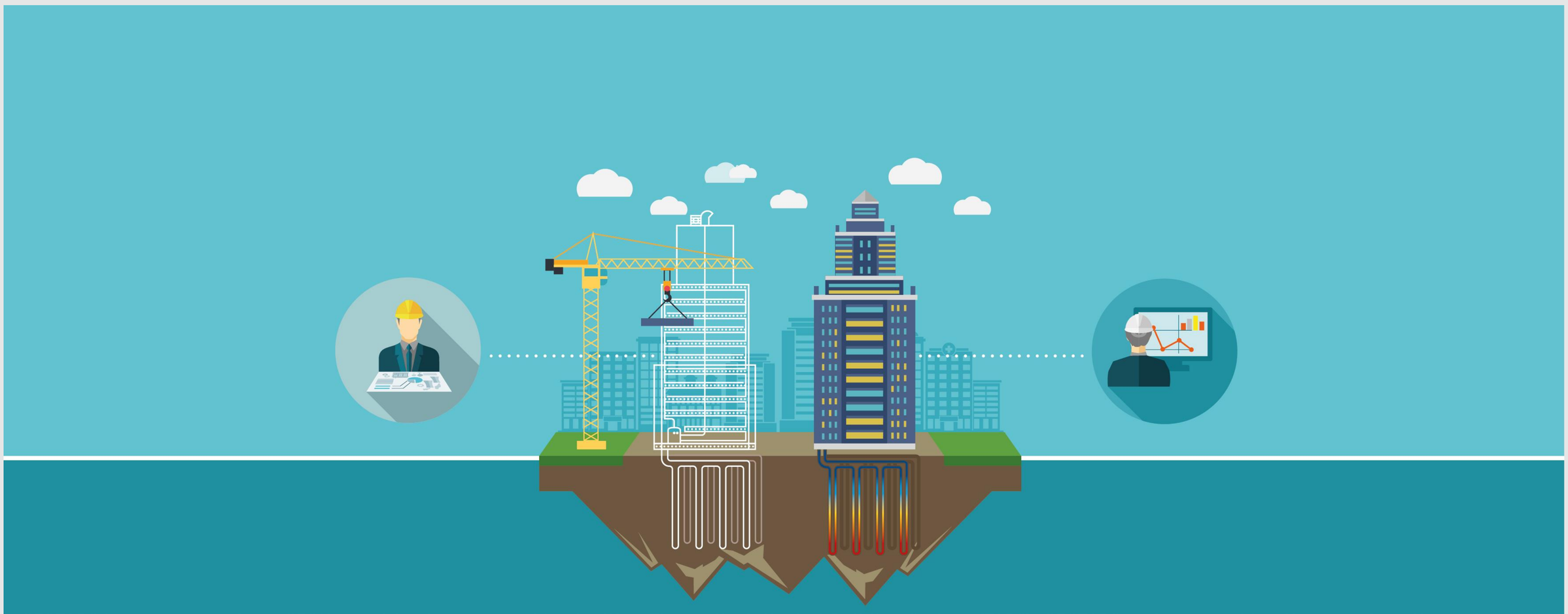
HYBRID GEOTABS WITH MPC
DESIGN, OPTIMISATION AND VALIDATION



GEOTABS is an acronym for a GEOthermal heat pump combined with a Thermally Activated Building System (TABS). GEOTABS systems combine the use of geothermal energy, which is an almost limitless and ubiquitous energy source, with radiant heating and cooling systems, that can provide very comfortable conditioning of the indoor space.
GEOTABS^{hybrid} refers to the integration of GEOTABS with secondary heating and cooling systems and other renewables, offering huge potential to meet heating and cooling needs in office buildings, care homes, schools and multi-family buildings throughout Europe in a sustainable way. By use of Model Predictive Control (MPC), a new control-integrated building design procedure and a readily applicable commercial system solution in **GEOTABS^{hybrid}**, the overall efficiency of heating and cooling will be significantly improved in comparison to current best practice GEOTABS systems and its competitiveness will be strengthened.

GEOTABS^{hybrid} is an active European research project with the aim to optimise the predesign and operation of GEOTABS^{hybrid} systems.

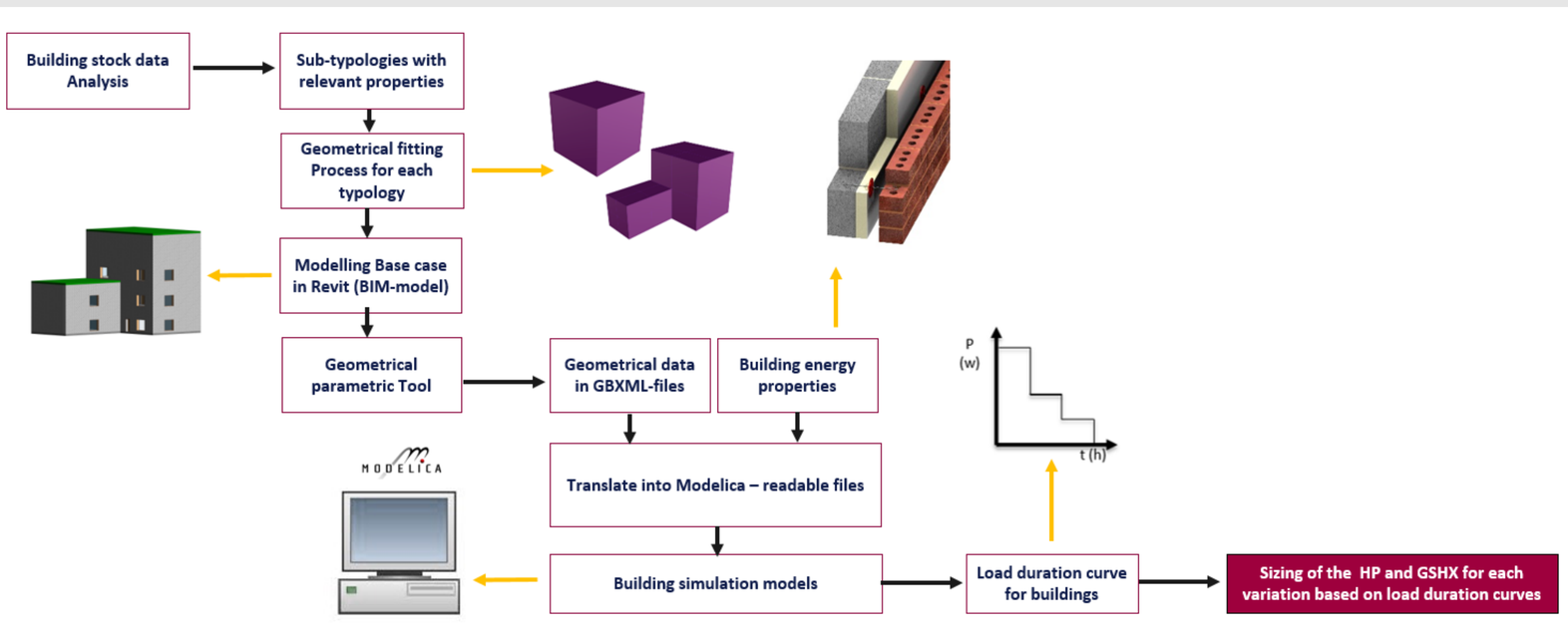
- Improving the efficiency of heating and cooling by 25% compared to the best practice GEOTABS
- Develop a design strategy for GEOTABS^{hybrid} systems, consisting of easy-to-use guidelines, design tools and methods for choosing appropriate HVAC components, allowing the design phase to be short and easy, comparable to the design phase of traditional technologies
- Develop a Smart Grid-ready automated control system based on MPC, that is robust, adaptive and obtained through a (semi) automated toolchain, and provide it as an open source solution
- Establish a trade body or association to promote the hybrid GEOTABS concept and best practices for increasing take up of the system
- Validate the technology and approach on a virtual validation test-bed and on demonstration buildings, consisting of the four building typologies in focus (offices, schools, elderly care homes and multi-family buildings) and for different European climates

The **GEOTABS^{hybrid}** project team comprises a wealth of experience including SMEs, large industry and research institutes throughout Europe.

Towards a GEOTABS^{hybrid} design strategy

The main challenge with designing GEOTABS^{hybrid} buildings is combining the different components into an efficient and reliable package for that specific building. Current standards, however, do not provide the information necessary to size these separate components of a hybrid GEOTABS system. To size the components appropriately, HVAC engineers need to take recourse to detailed dynamic building energy simulations. These tools require expert knowledge, they are very labour intensive and need lots of input information. During feasibility studies and the predesign stage, this information is typically not available and the resources of design teams are limited.

The alternative developed in this project is to use research grade simulation software to derive generalised sizing rules for TABS and other components (e.g. heat exchanger, heat pump…) for a specific building typology, thus eliminating the need for dynamic simulations on a case-by-case basis. Using stochastic dynamic simulations, in which building energy properties and building geometries are varied, a large amount of sizing options can be tested. Building stock data is used to fit a variety of building geometries to BIM-models. The geometrical data files obtained, and building energy parameters are entered into BES-models, that are used to obtain heating and cooling load duration curves for a variety of buildings. These are the basis for sizing the GEOTABS^{hybrid} components.



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hybrid GEOTABS

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