

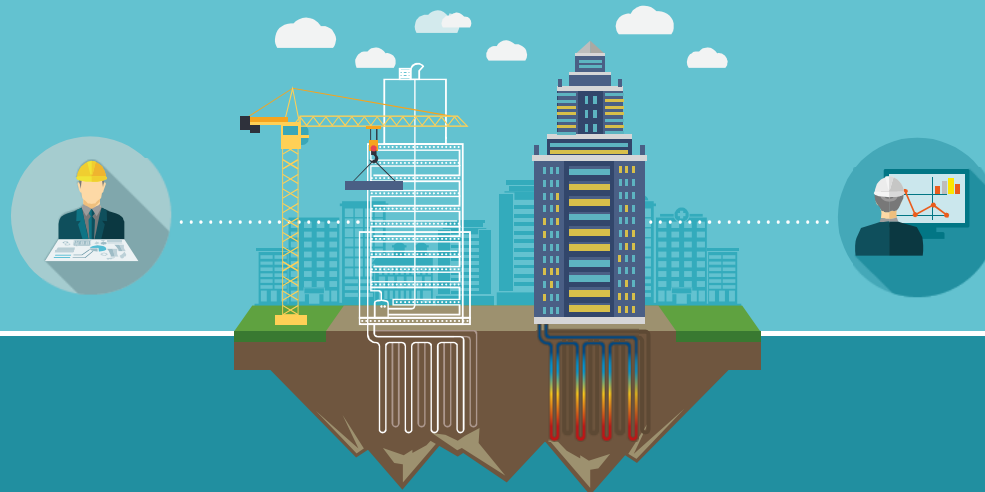


hybrid
GEOTABS

Controlling the power of the ground by integration

ADDRESSING THE CHALLENGES

How we want to boost the market uptake of hybridGEOTABS



CHALLENGES FOR DESIGN

- GEOTABS are often not withheld as a potential solution because of the ***investment cost*** mainly for the GSHX
- there are no guidelines available for sizing such a system to allow for proper tuning between heating and cooling originating from the GEOTABS and that provided by the fast complementary/secondary system. Therefore, a case by case study is needed to size the system, resulting in excessive ***engineering costs***.

CHALLENGES FOR OPERATION

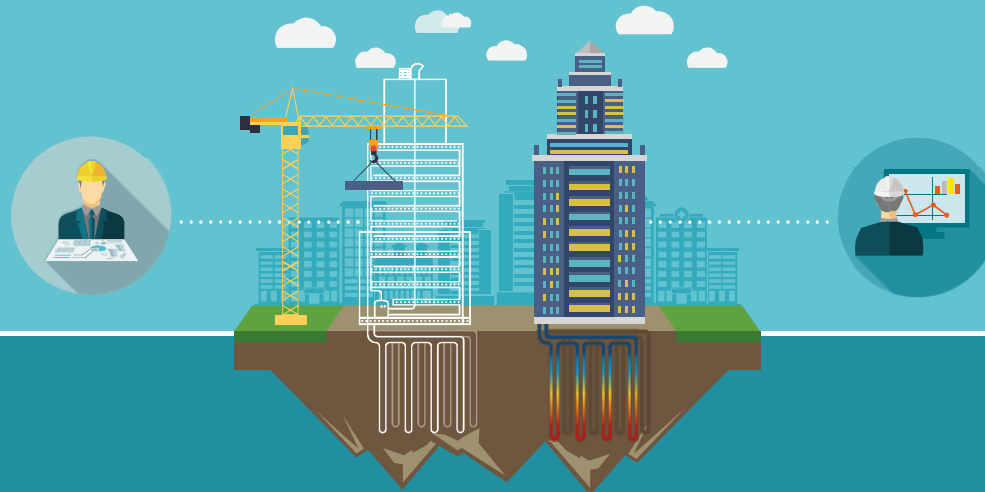
- RBC requires important case by case efforts to tune the control parameter during the commissioning phase, resulting in high ***commissioning costs***
- Current approaches to MPC, however, need extensive measurements on the building as ***training data before the MPC is operational*** (black box or grey box approach) and is therefore only implemented some time after delivery of the building.



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SOLUTIONS



MAIN SOLUTIONS

- Developing a ***design method*** to size Secondary System, GSHX and HP based on a large set of precalculated simulations
- Developing a ***white-box*** MPC



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SNEAK PEAK INTO THE PROCES

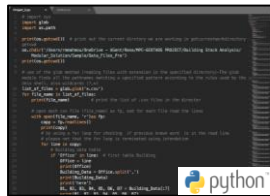
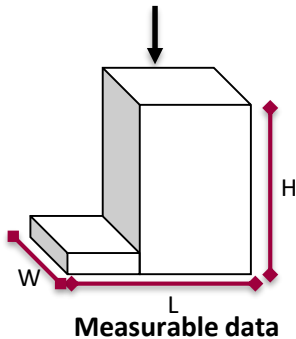




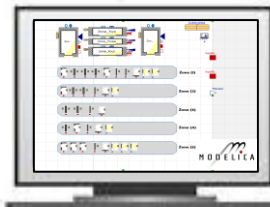
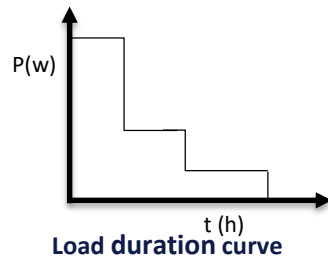
Sizing the SS, GSHX and the Heat Pump based on **Simulations** of building stock

ID	Geometrical box year	Parallelepiped m	Volume m ³	Heat loss area m ²	Temp coeff K/m ³	No. of floors	Area of building m ²	Volume of building m ³	Mean height m	Building type	Heat loss coefficient W/m ² K
0176	2006	624633	1035	18961.0	1.62	1	962.70	1035	1.061	1.62	78.61
0108	2006	624633	16790	87711.6	0.97	1	8497.13	16790	8.771	1.67	119.26
0170	2006	624633	1130	13869.0	2.18	1	626.71	1130	1.130	2.18	168.64
0173	2006	624633	1259.12	17969.6	2.12	1	1439.69	1259	1.259	2.12	166.36
0162	2006	624633	1407.28	21218.0	1.29	1	1771.15	1407	1.407	1.29	117.11
0166	2006	624633	1164	14551.6	1.76	1	1001.05	1164	1.164	1.76	161.15
0165	2006	624633	1120	14217	1.61	1	1047.70	1120	1.120	1.61	161.15
0168	2006	624633	1102.13	17761.0	2.18	1	1128.64	1102	1.102	2.18	174.02
0169	2006	624633	1198.12	17411.0	1.91	1	1701.06	1198	1.198	1.91	168.64

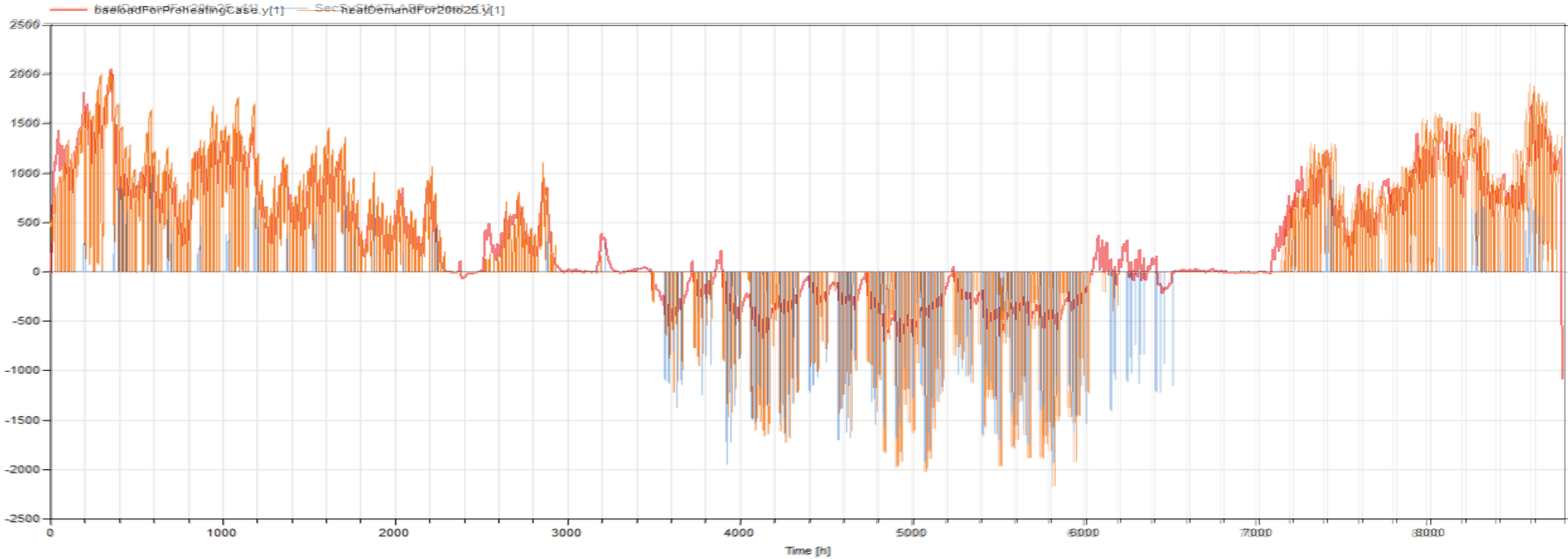
**Building General
DATA**



Interface



Simulations





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INPUT

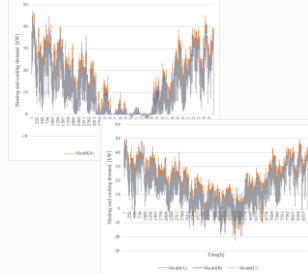
Surface area
Heat loss surface area
Volume
Window ratio



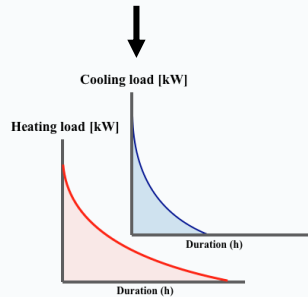
Building stock
database

+

OUTPUT



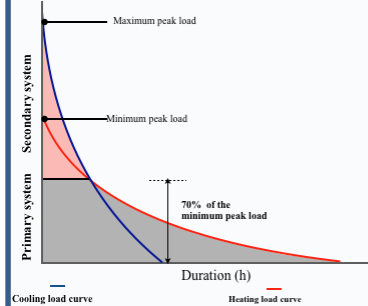
Automated dynamic
heating and cooling
demand curves



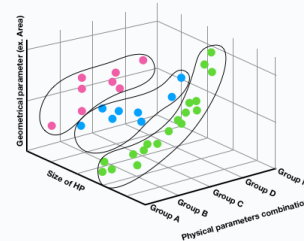
Heating and cooling
load duration curves

SIZING

Heating and Cooling load [kW]



Sizing of HP, GSHX and
secondary systems

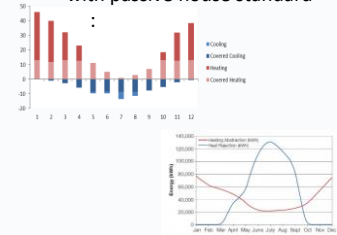


Cluster analysis based on
sizing and parameter
combination

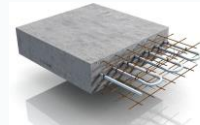
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DESIGN METHOD

Example:
School of 5000 m² in Germany
with passive house standard



PRODUCT PACKAGES



Example:
Cluster 1 → 60 kW
Cluster 2 → 90 kW
Cluster 3 → 150 kW



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MPC?

