



Operation and performance

Paul D O'Sullivan / MeSSO // STL 2015 // Architecture Factory

IEA-EBC Annex 62 Ventilative Cooling

www.venticool.eu



Thermal perception potential of untreated outdoor air for low energy, well insulated, airtight buildings

Improve modelling techniques, guidelines, standards to better account for the contribution to minimising cooling demand

nzero.2020 is a case study

We also are undertaking occupancy evaluation surveys in buildings that utilise ventilative cooling in Cork (and hopefully elsewhere)

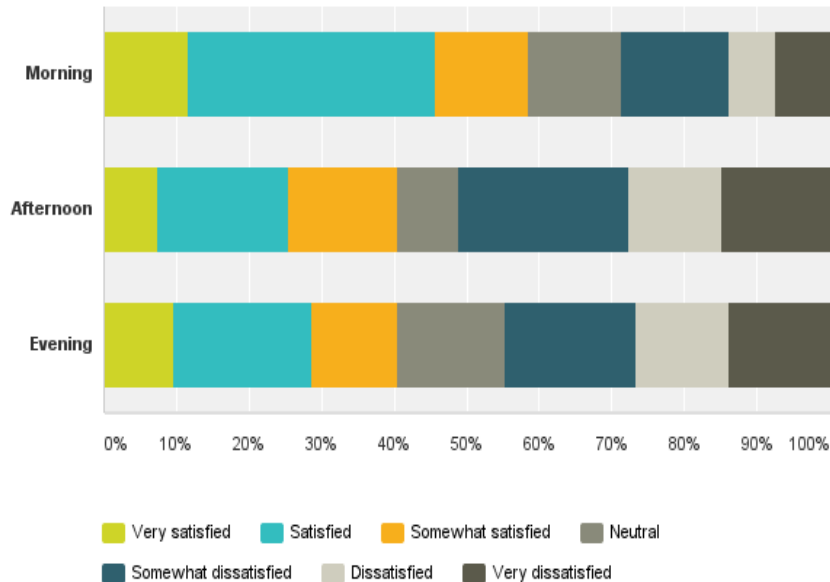


Cork County Hall
– approximately 500 occupants

UCC WGB
– approximately 200 occupants

During the warmer months, how satisfied are you with the temperature in your workspace?

Cork County Hall

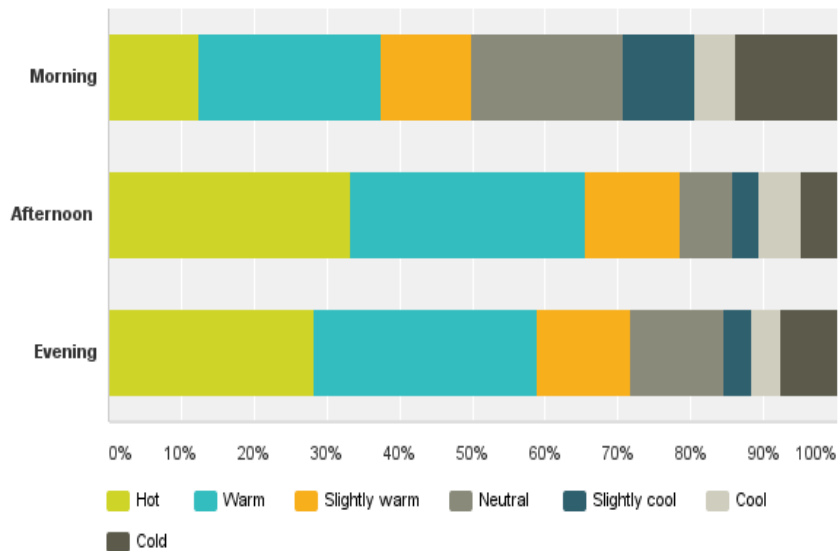


UCC western Gateway

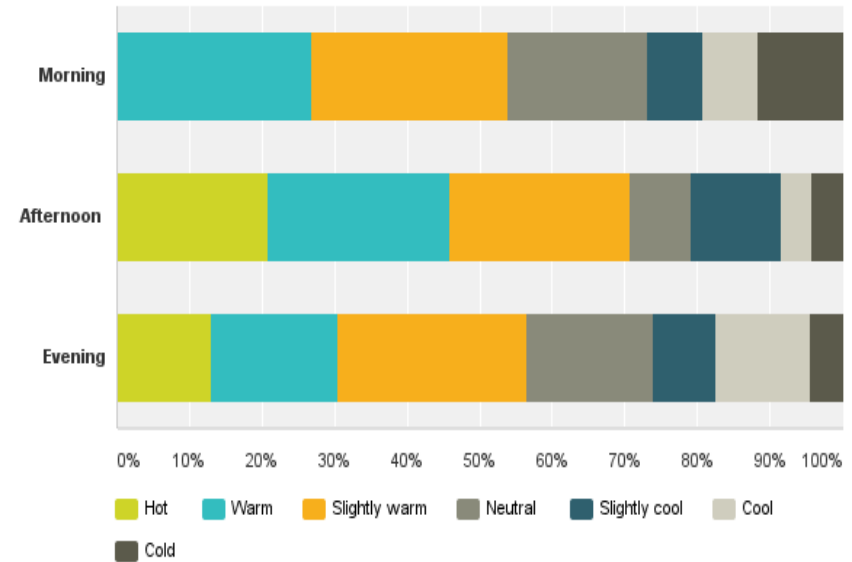


When you are dissatisfied, how would you describe the temperature?

Cork County Hall

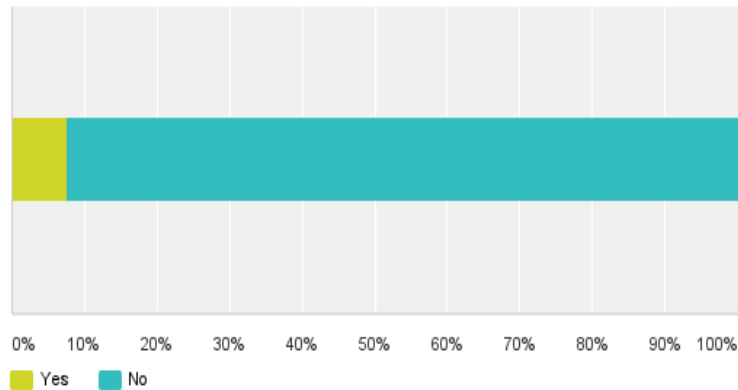


UCC western Gateway

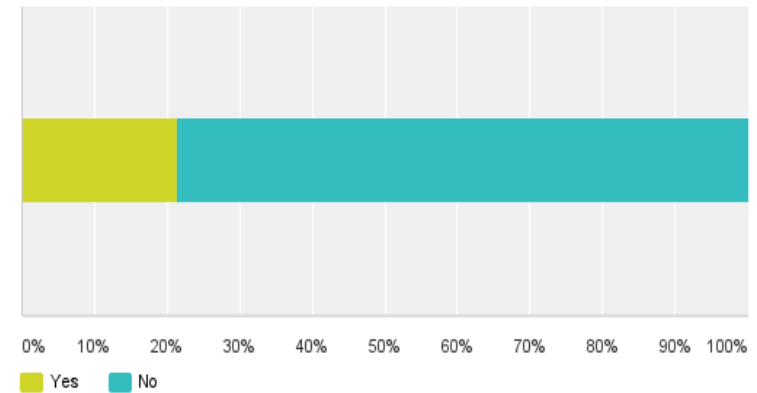


Finally, if you could move to a workspace with air conditioning but no openable windows, would you?

Cork County Hall



UCC western Gateway



nZero.2020 / features & performance

Agenda

1. Features
2. Asset rating & PHPP
3. Energy end use performance 2013
4. PHPP vs. measured data
5. Ventilation strategy
6. Long term indoor air temperatures 2013 & 2015
7. Thermal comfort evaluation
8. What are we learning...



20kWp PV



20kW ASHP

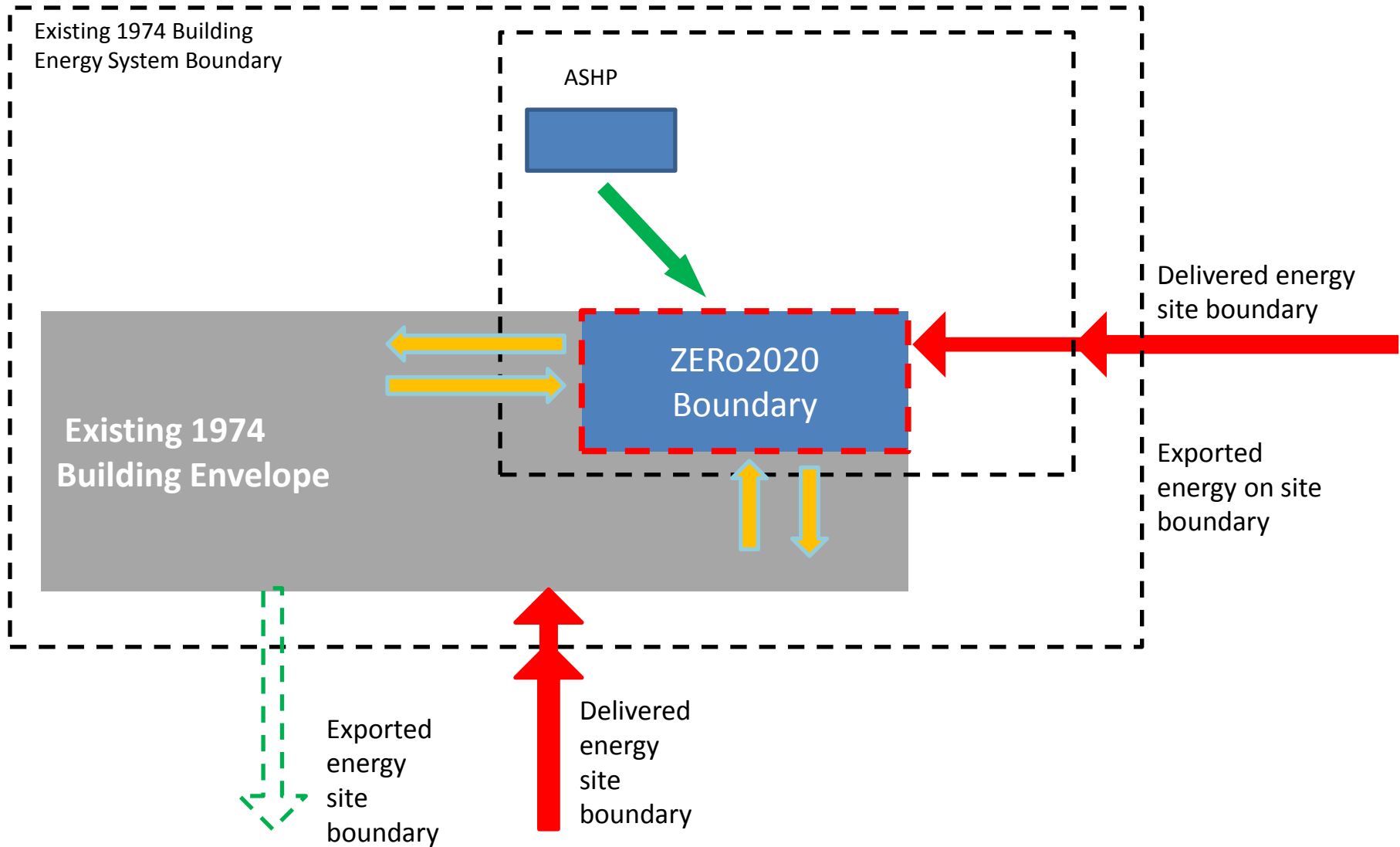


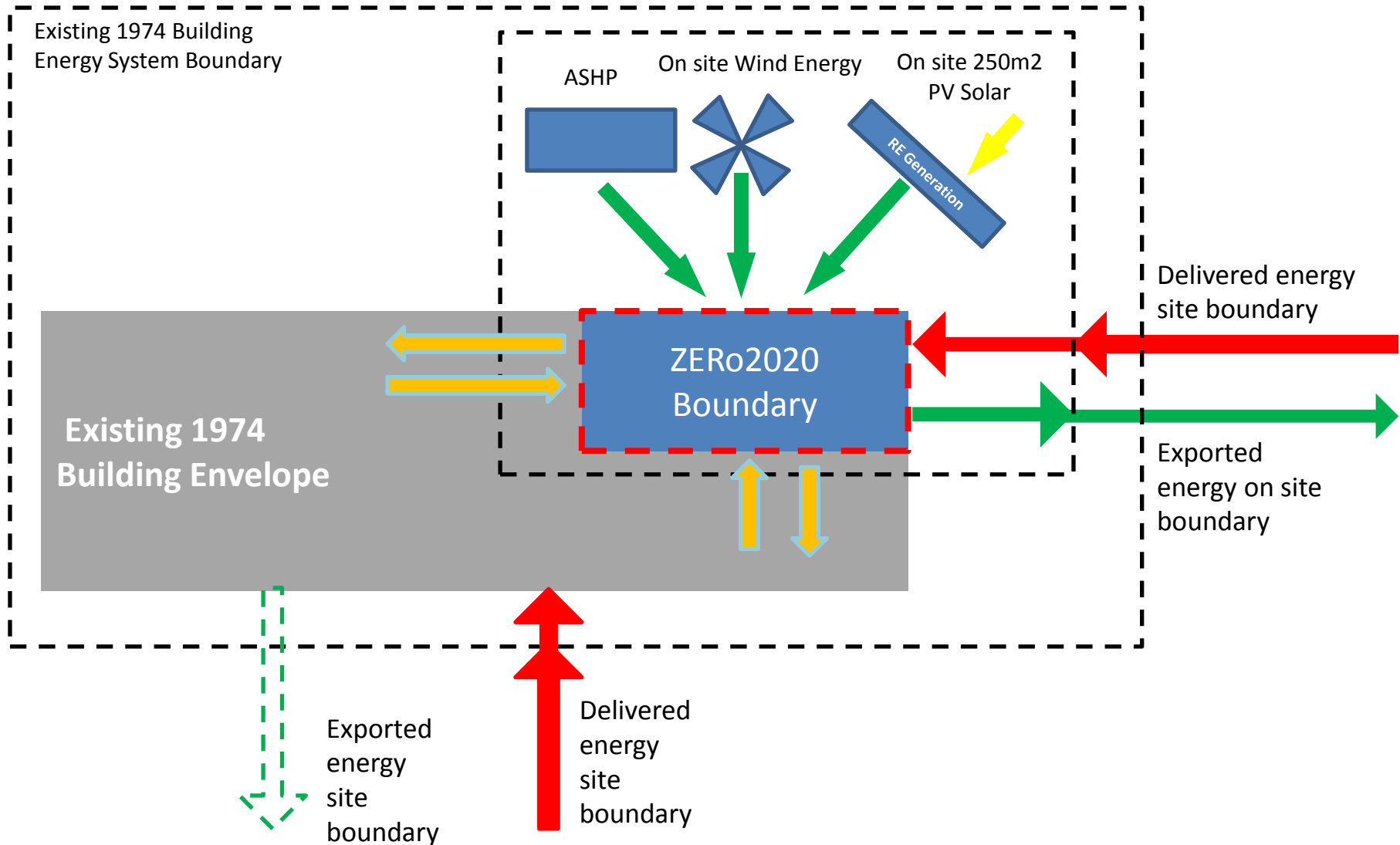
Purpose provided ventilation



Wireless Data logging

Energy Performance

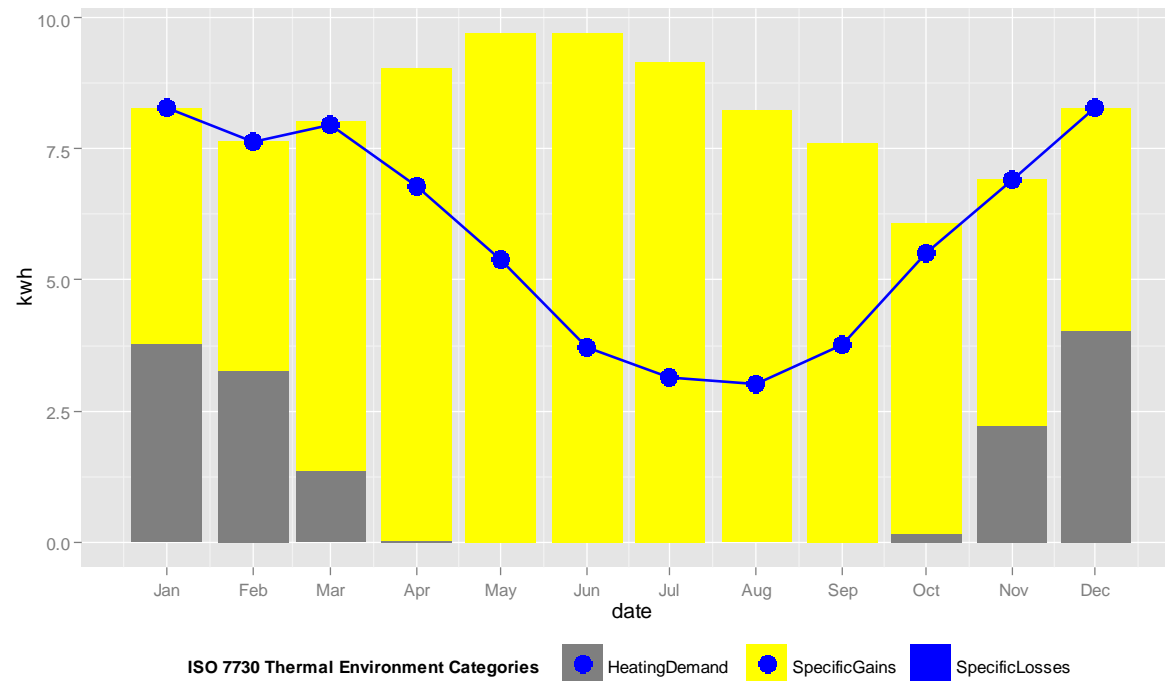




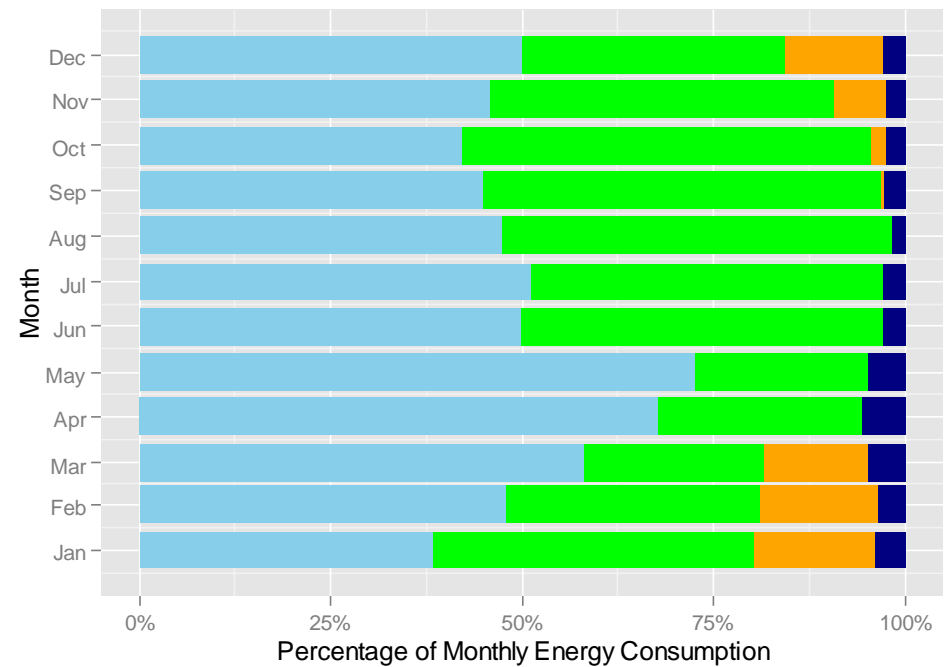
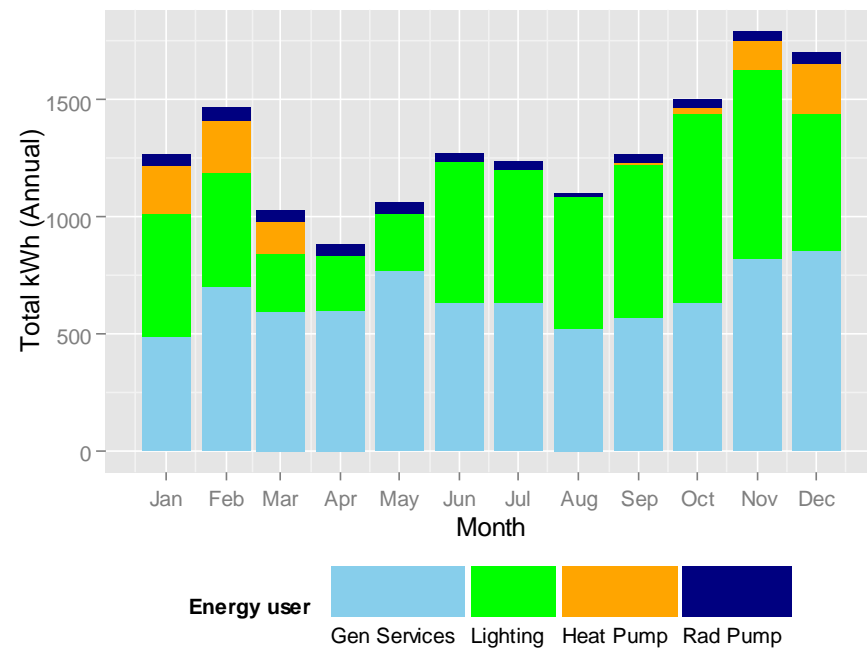
How does the zero2020 retrofit solution compare with the existing building on an equivalence basis?

Building	Heating (kWh/m ² /yr)	Lighting (kWh/m ² /yr)	Auxiliary (kWh/m ² /yr)	Hot Water (kWh/m ² /yr)	Total (kWh/m ² /yr)
1974	386.83	46.43	3.24	16.4	452.57
Zero2020	14.25	45.47	1.91	2.51	64.14
Zero2020 mg					

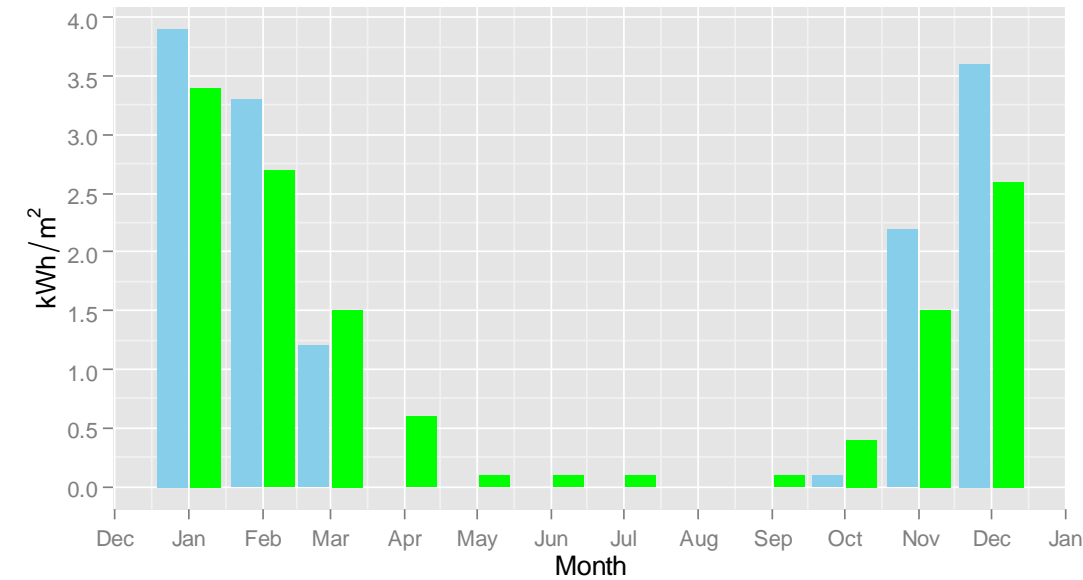
A PHPP model has been developed to investigate how the solar gain component contributes to the reduction in heating demand



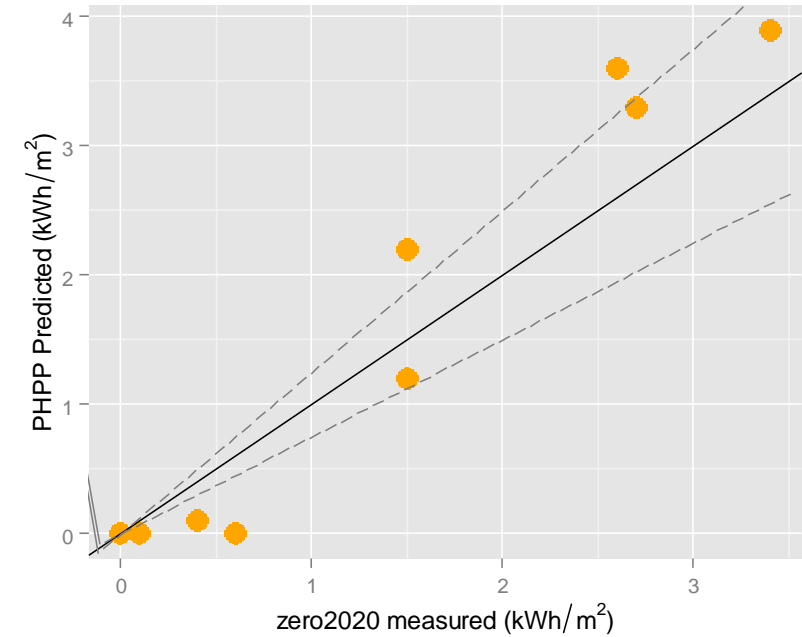
2013 Monthly Totalised Energy Consumption per end use



2013 Monthly Totalised Energy Consumption per end use



Heating Demand Data Source PHPP Model Result Measured Data



Ventilation Rates

Ventilation Configurations

CS.01



RS.01



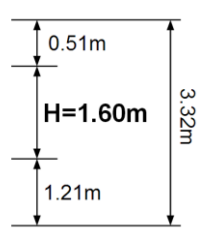
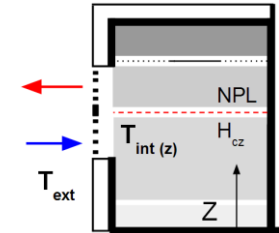
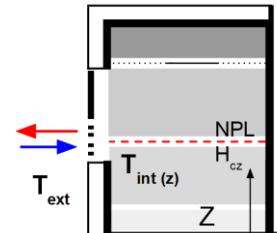
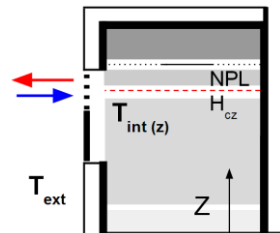
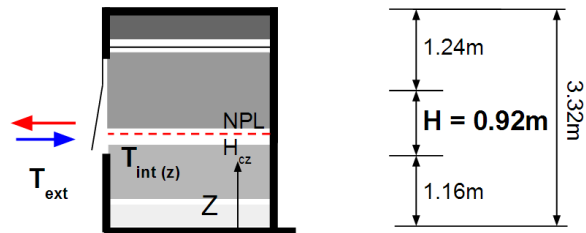
RS.02



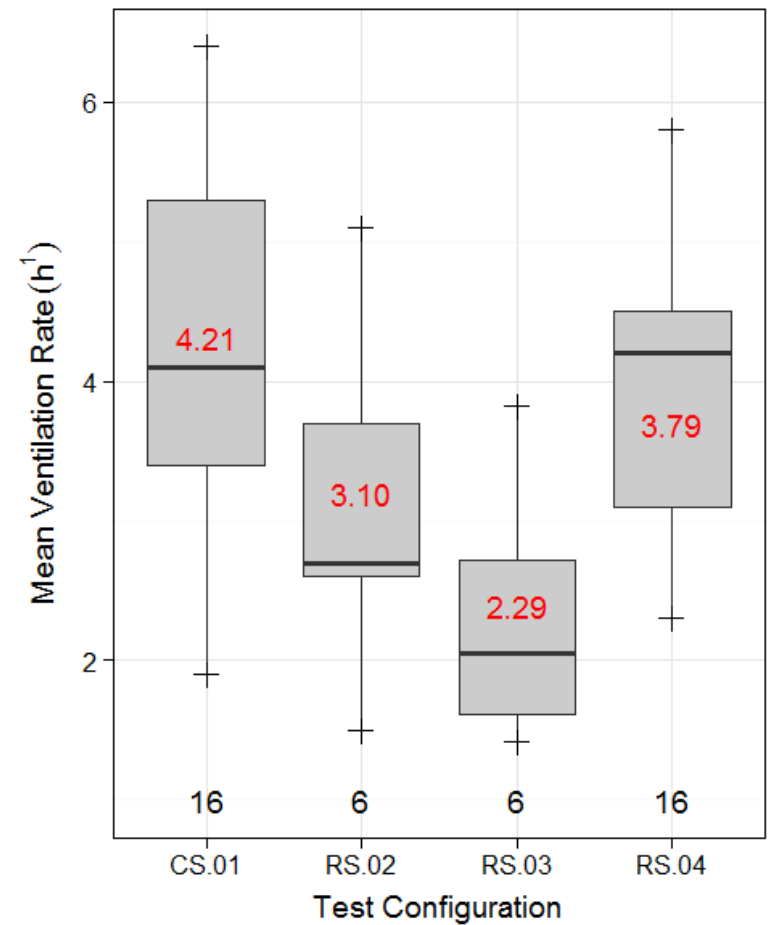
RS.03



RS.04

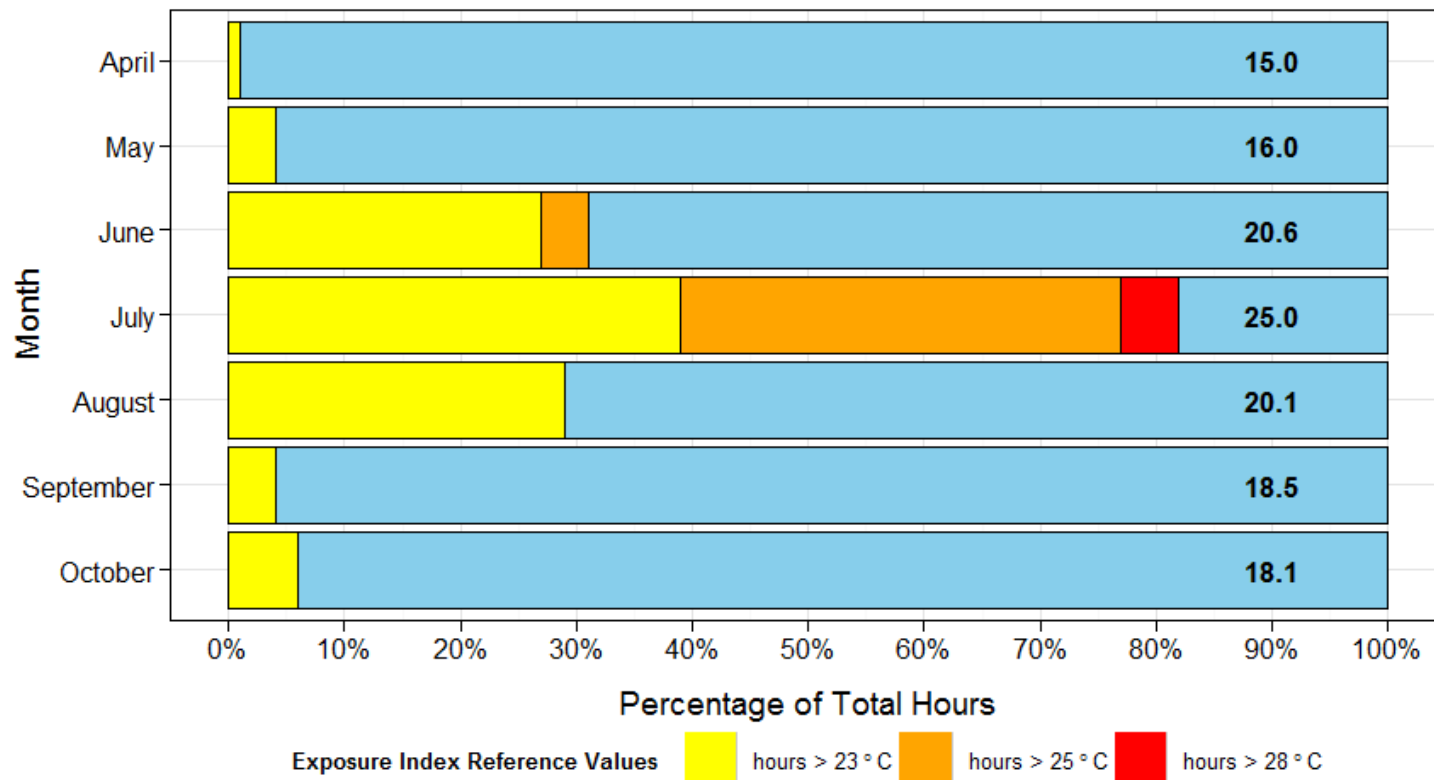


Measured Ventilation Rates (pre and post retrofit)

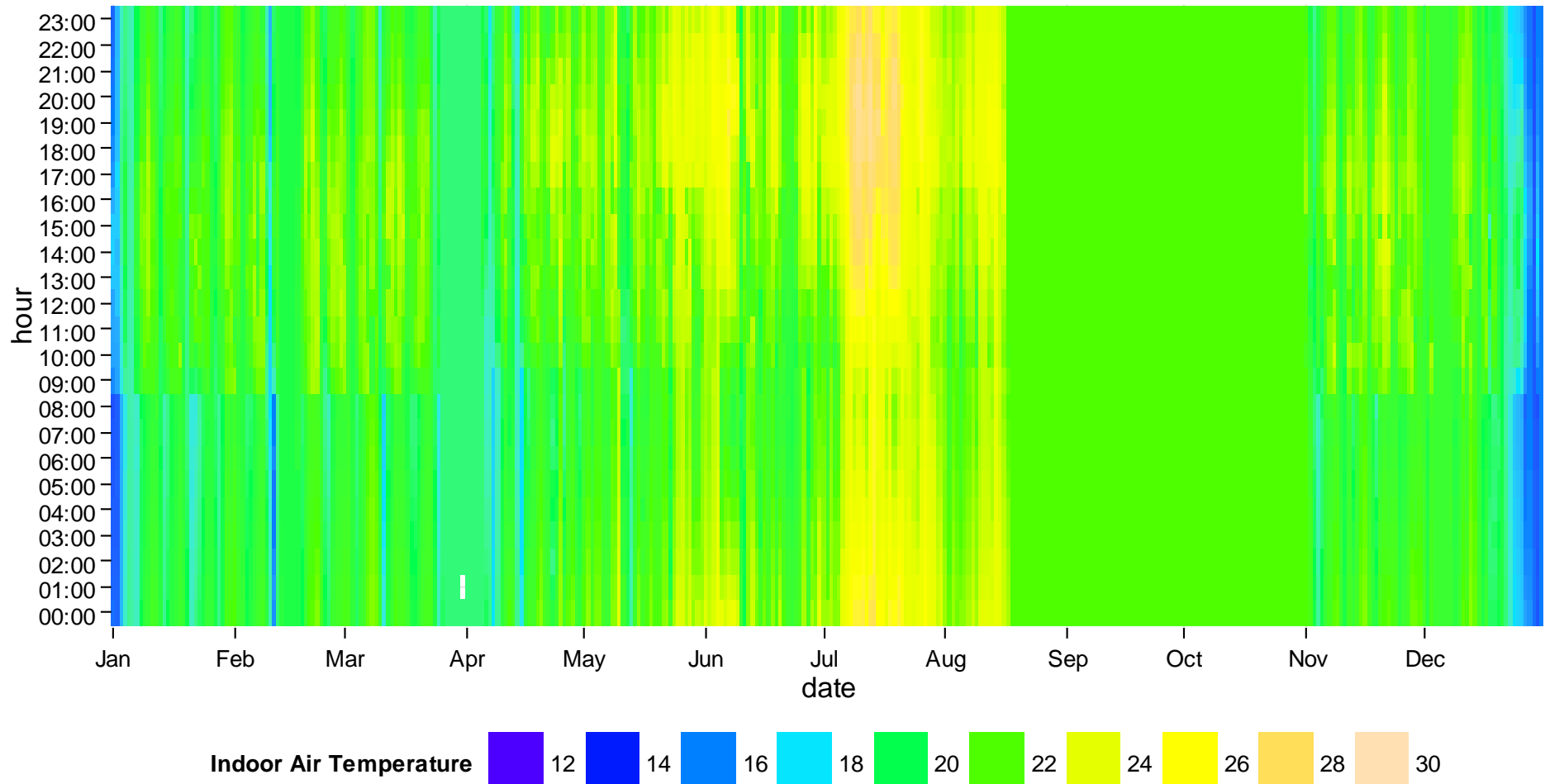


Indoor Air Temperature

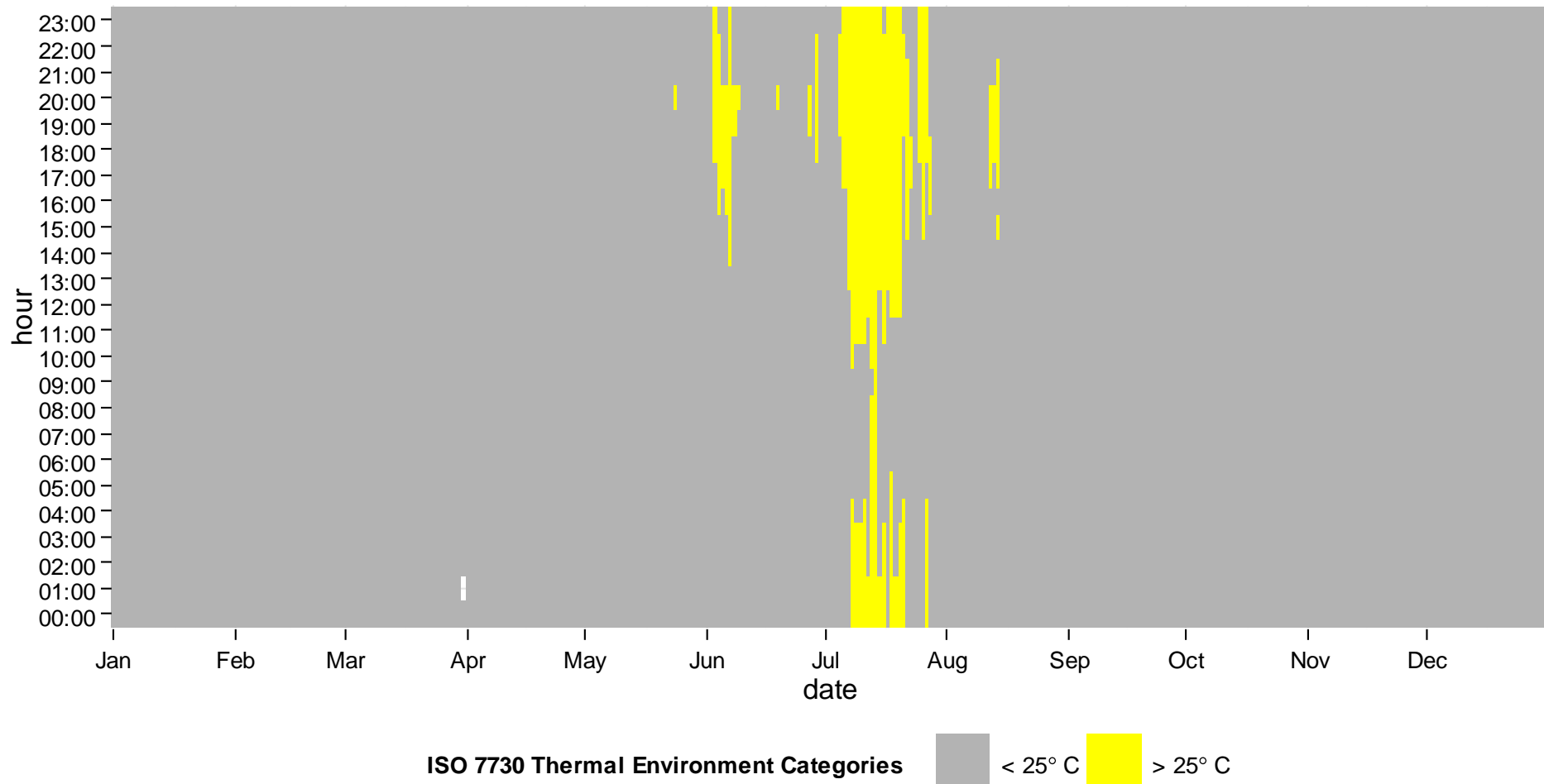
% of Total Monthly Hours for Indoor Air Temperature 2013



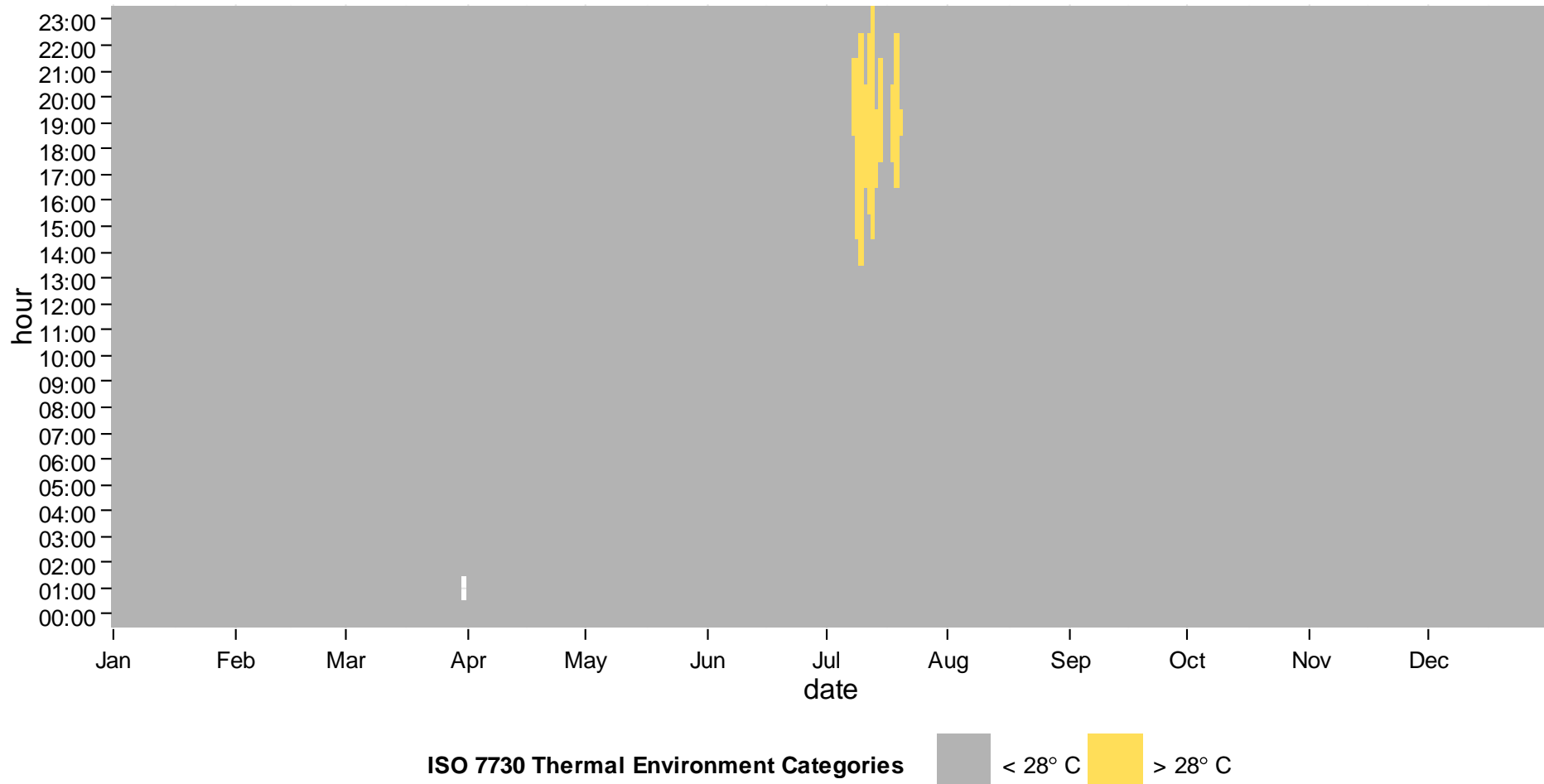
Heat map Open Plan office 2013



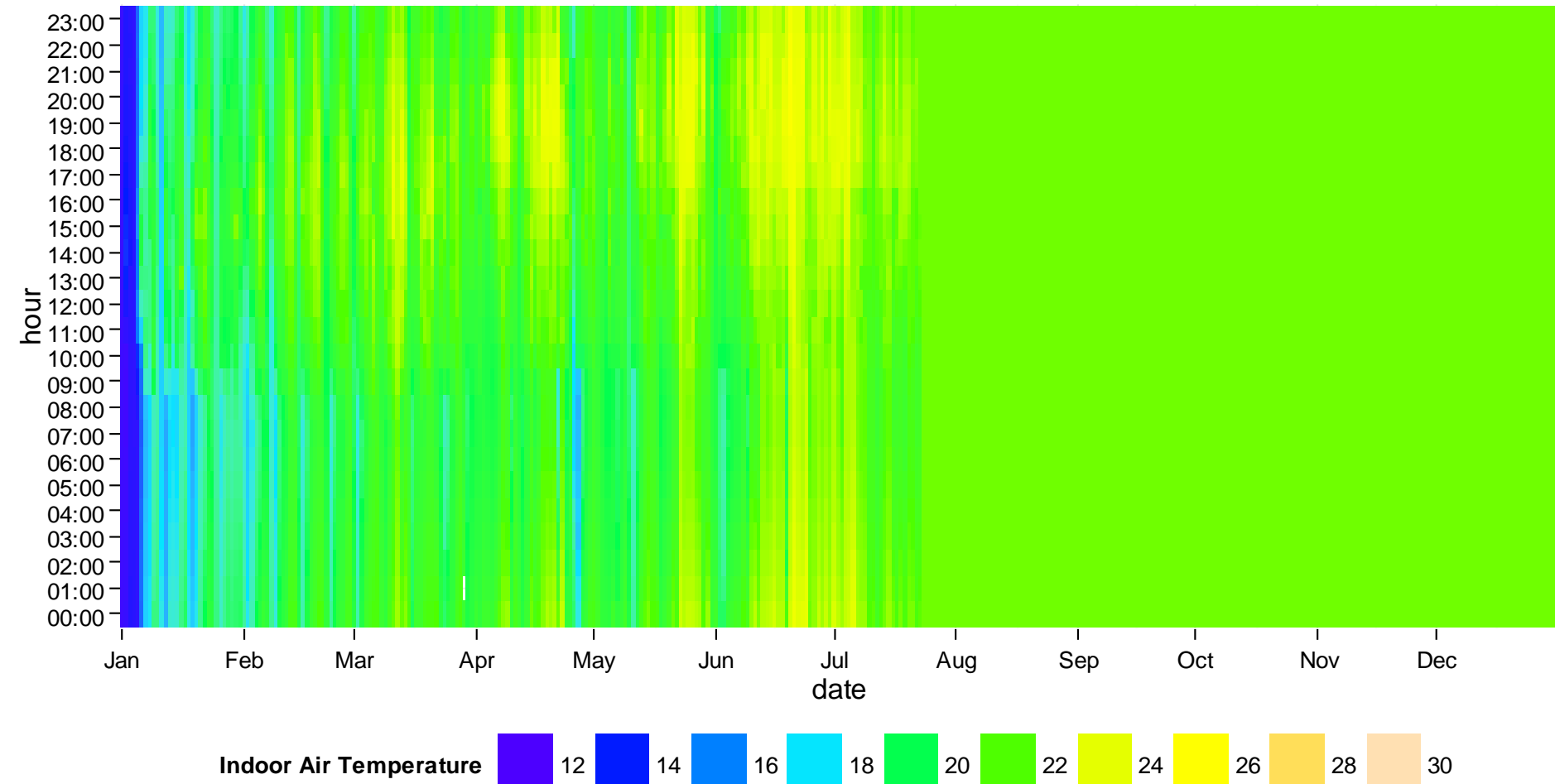
Heat map > 25°C Open Plan office 2013



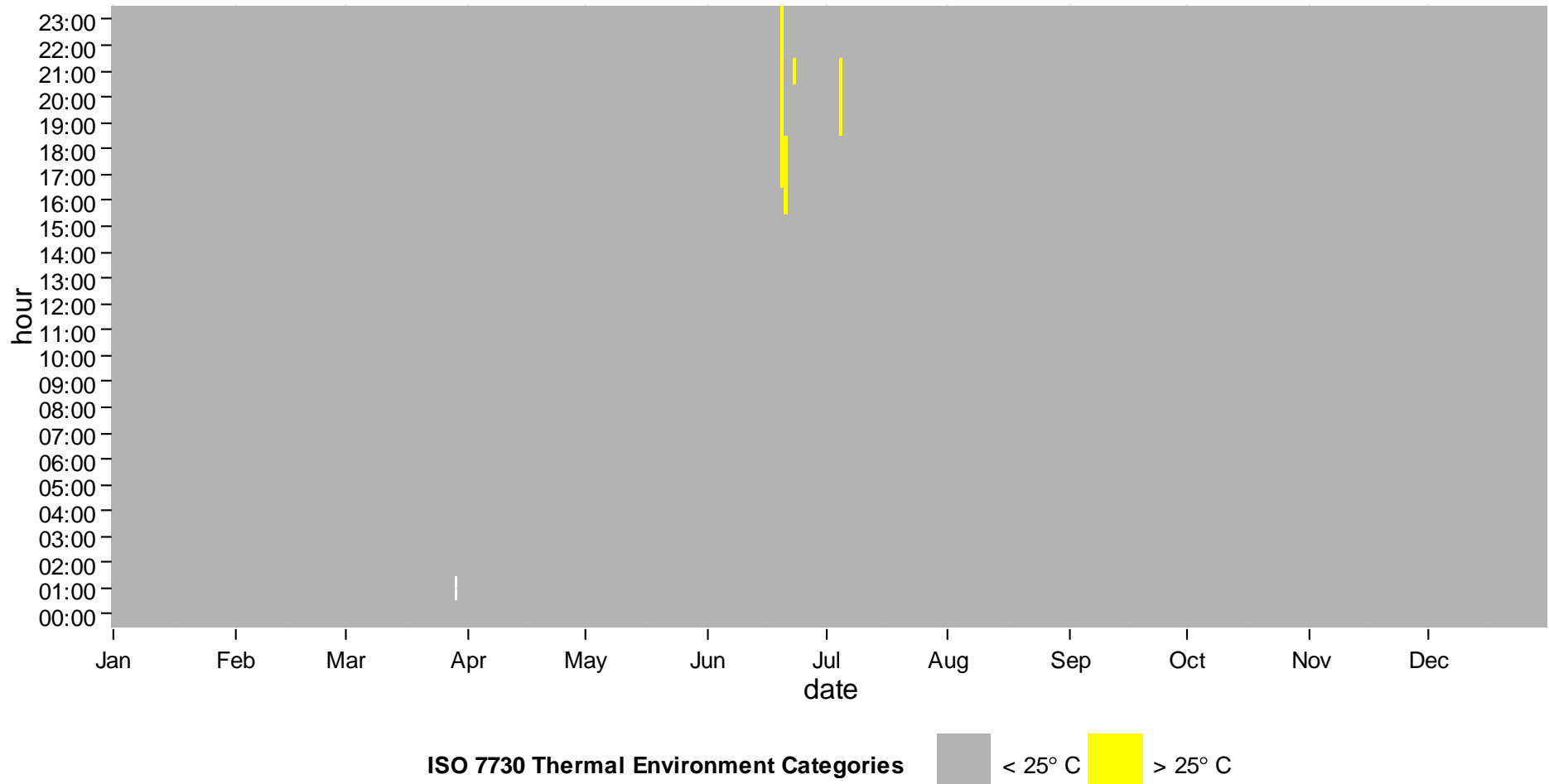
Heat map > 28°C Open Plan office 2013



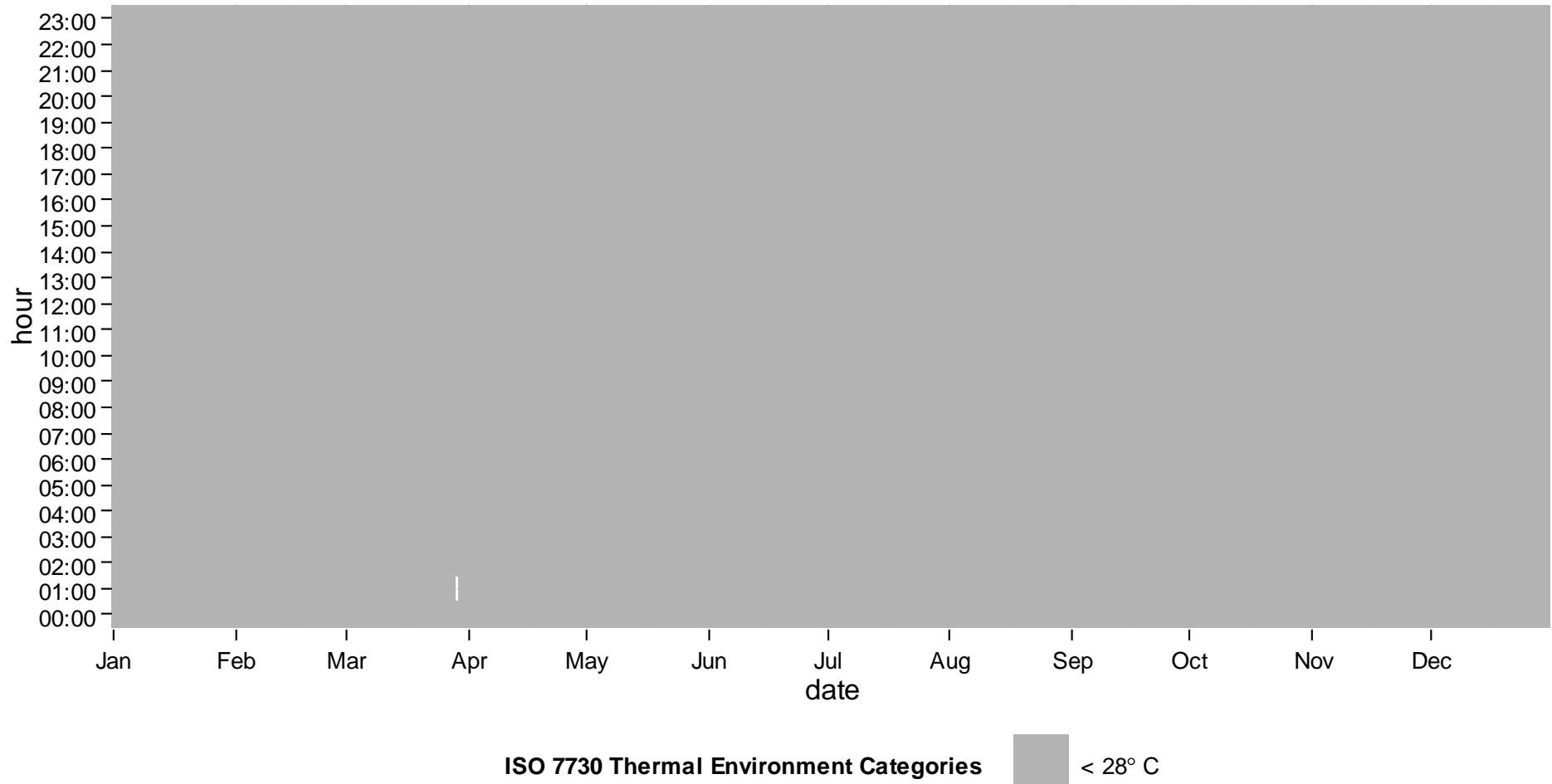
Heat map Open Plan office 2015



Heat map > 25°C Open Plan office 2015



Heat map > 28°C Open Plan office 2015



Summary Open Plan office 2013 & 2015

2013

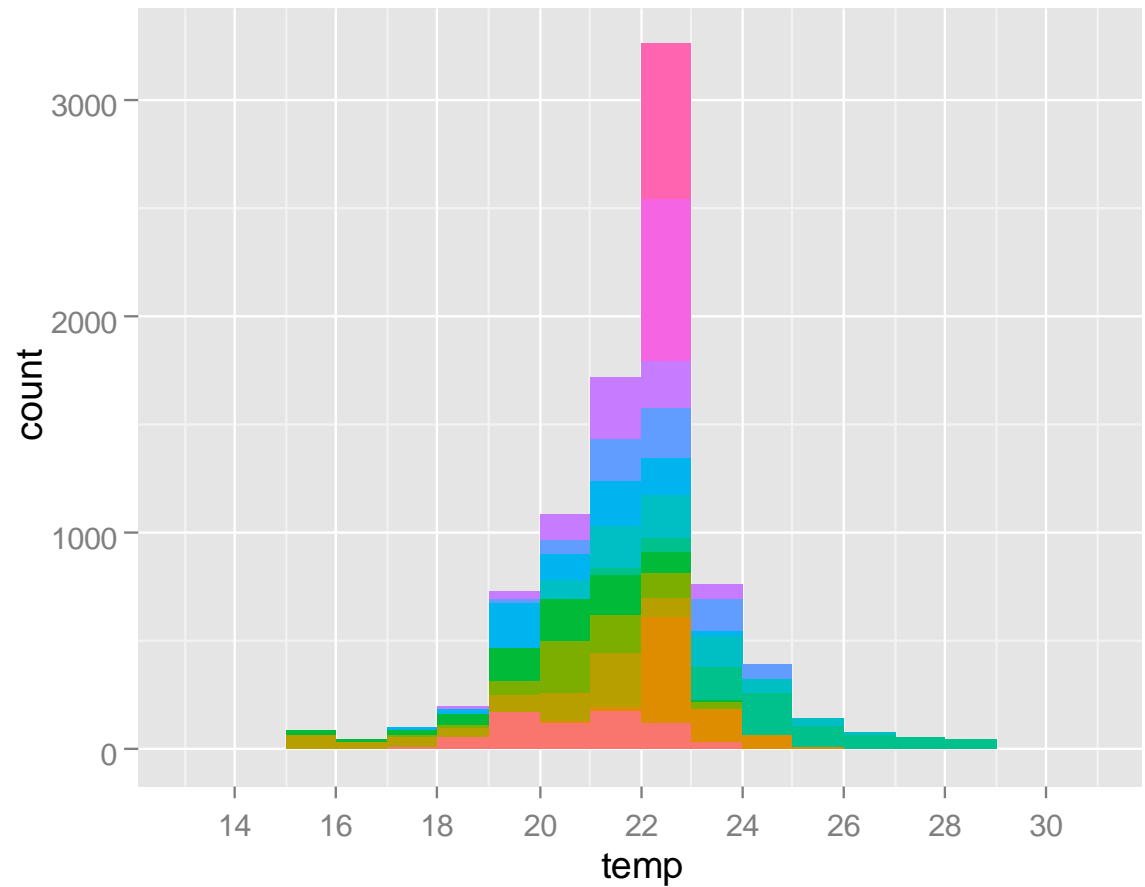
No. hrs > 25 = 3.9%

No. hrs > 28 = 0.6%

2015

No. hrs > 25 = 0.15%

No. hrs > 28 = 0%



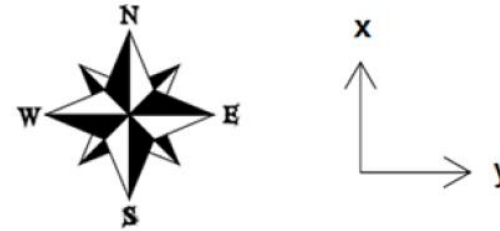
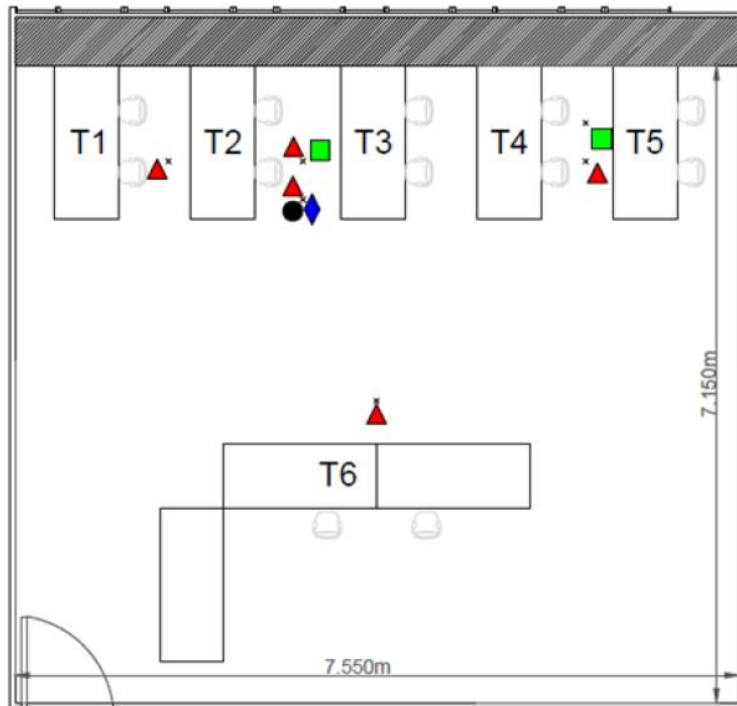
Month







Thermal Comfort

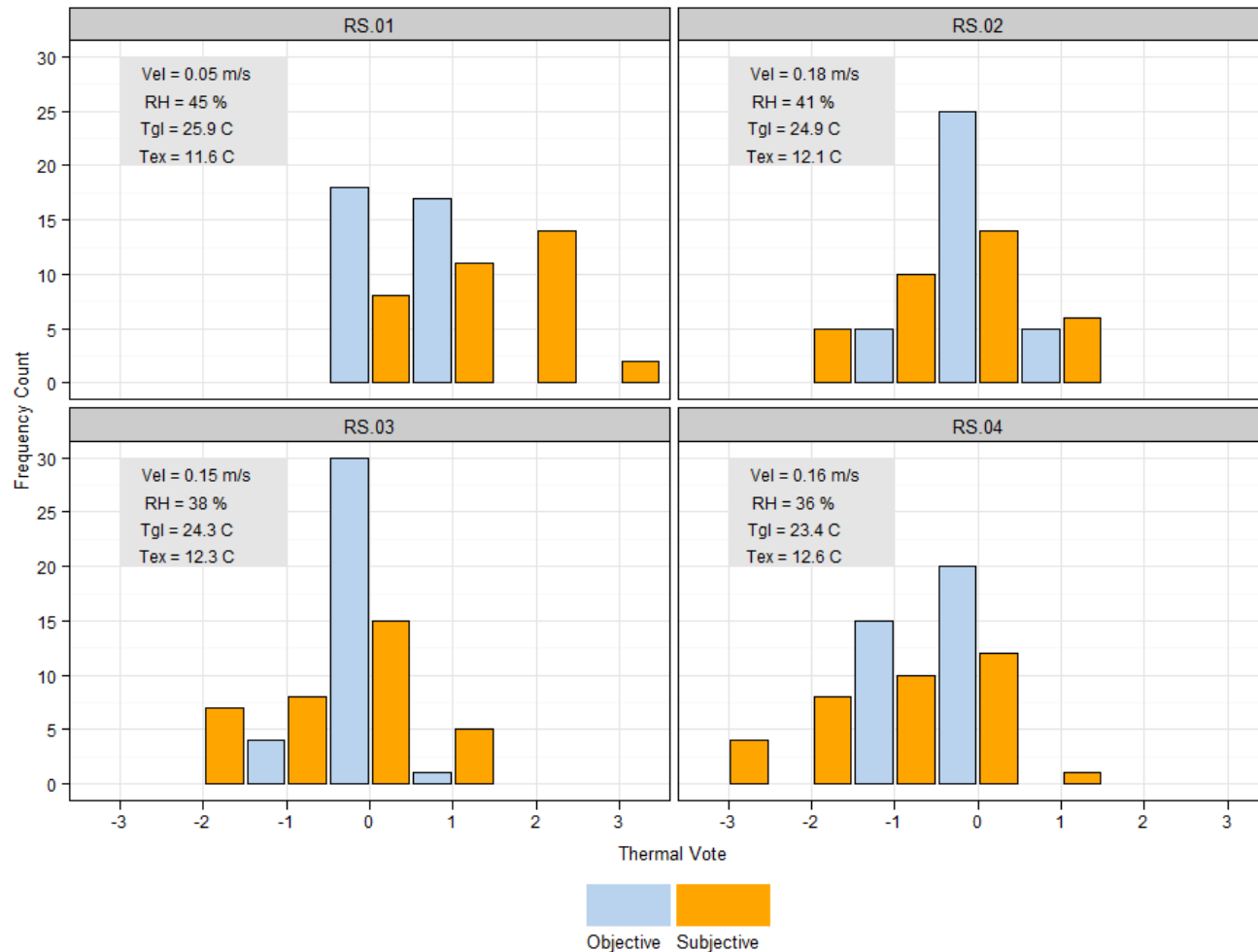


Ventilative cooling performance in a simulated overheating scenario

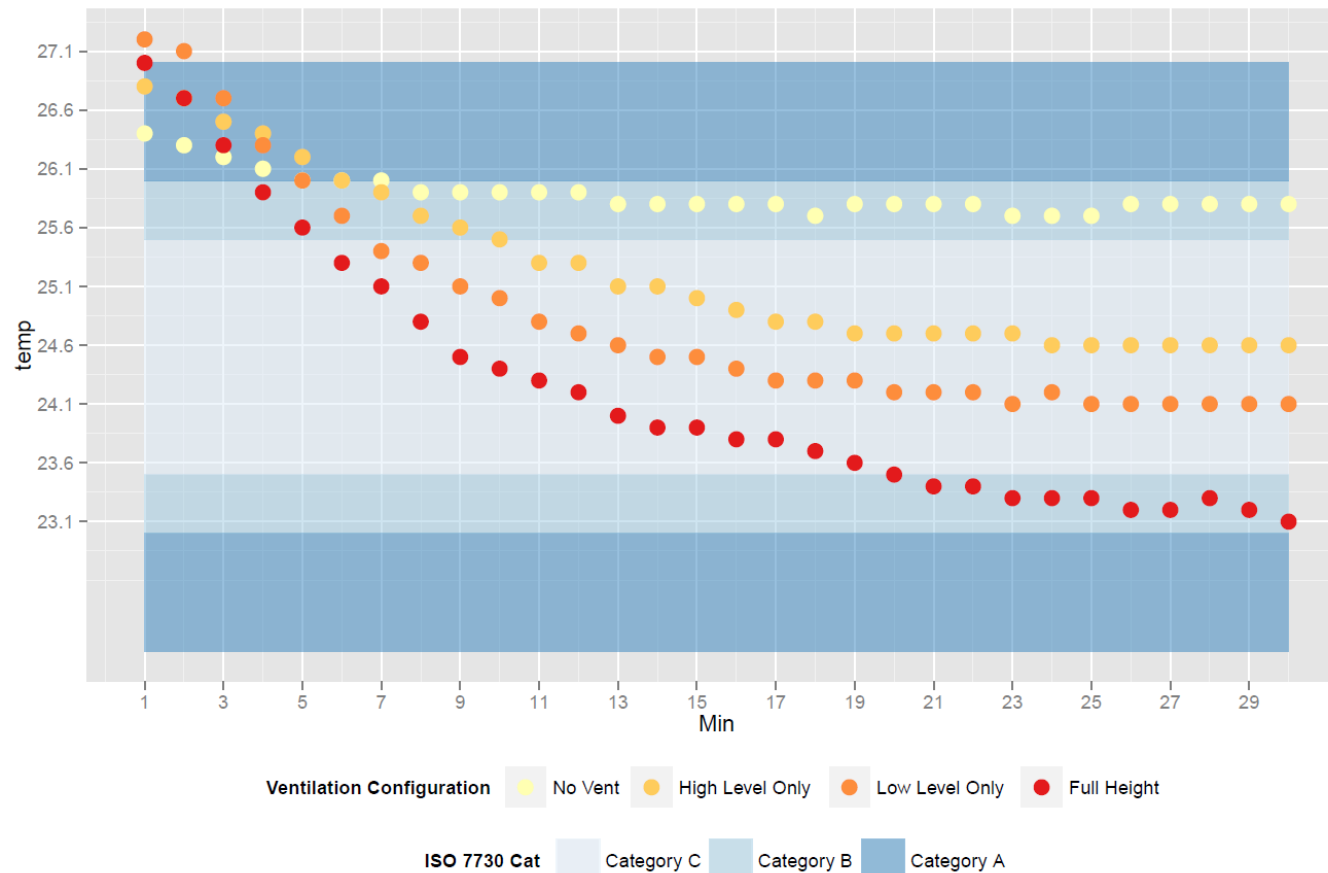


	2 Bi-directionnal anemometers (on x and y axis)
	3 air temperature sensors (0.1m ; 0.6m ; 1.1m)
	Black globe thermometer
	Relative humidity sensor

Recorded PMV from subjective survey data along with a comparison to the Fanger PMV model



Measured indoor air temperature profiles during thermal comfort tests for each ventilation configuration



What are we learning?

- People like natural ventilation / openable windows
- PHPP gives realistic predictions for heating energy consumption even with non residential environments
- So did SBEM for annualised values
- Up to 4 ACH possible with NV slot louver systems
- Low energy can mean comfortable but adaptive approach important (free running buildings)
- Overheating still likely even with night cooling
- It is difficult to obtain consistent, accurate measurements over extend periods of time