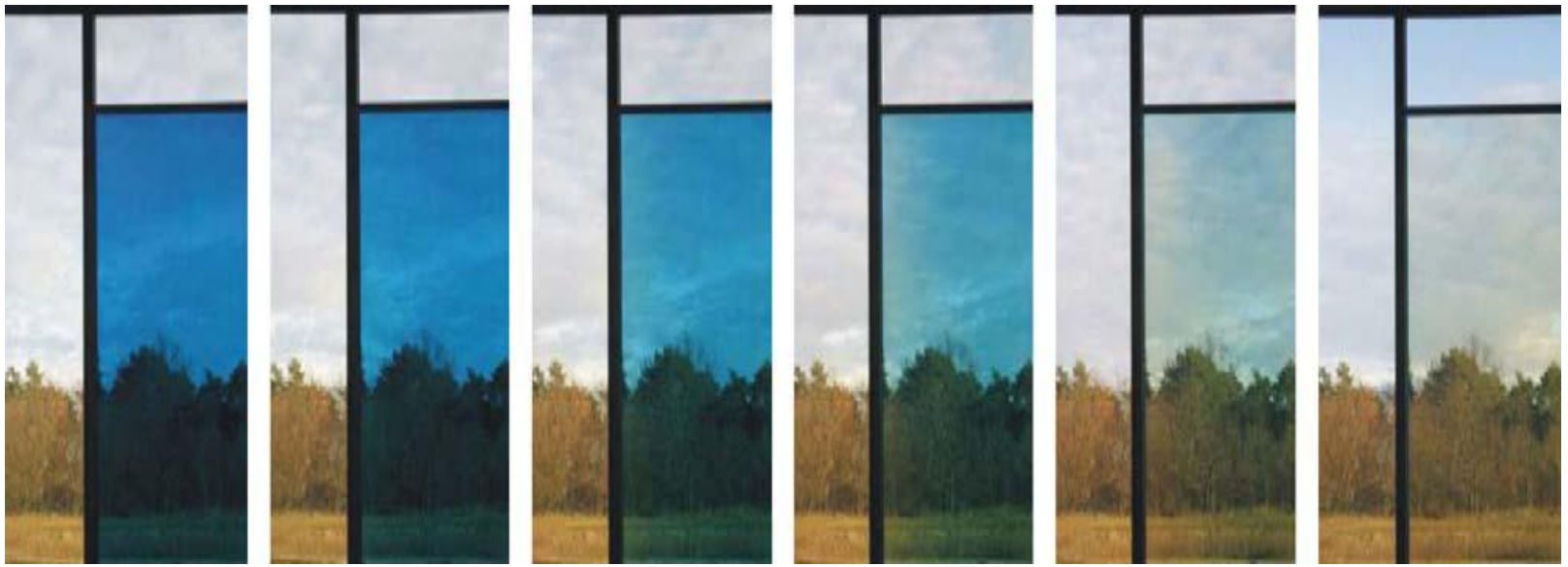
Energy Savings Potential of Electrochromic Windows



ZEB WP1 – Task 1.3 – Activity 1.10

Introduction (1)

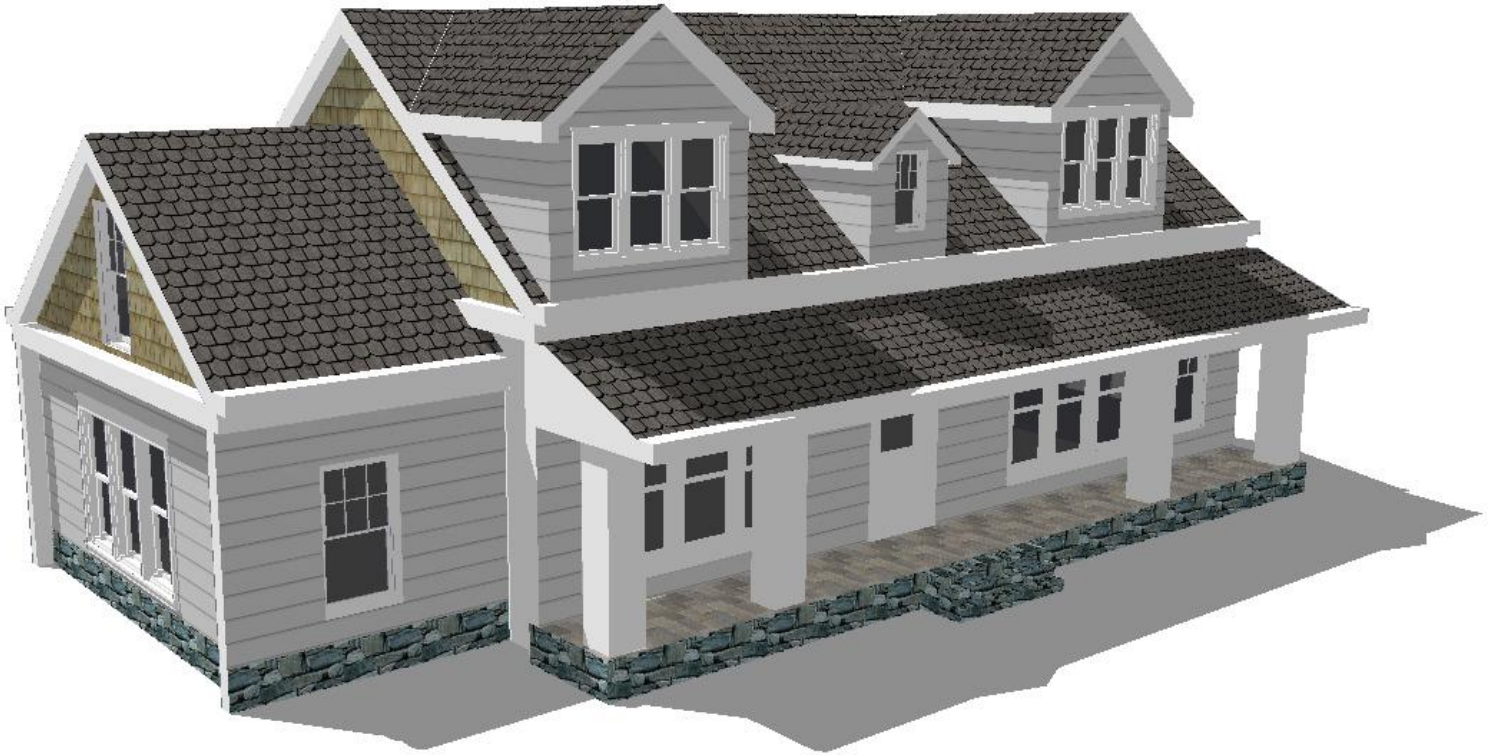
Why ECW?

- Bye bye excess solar heat gain during the summer
- Allows solar energy to enter during the winter
- Allows access/contact to the outside world

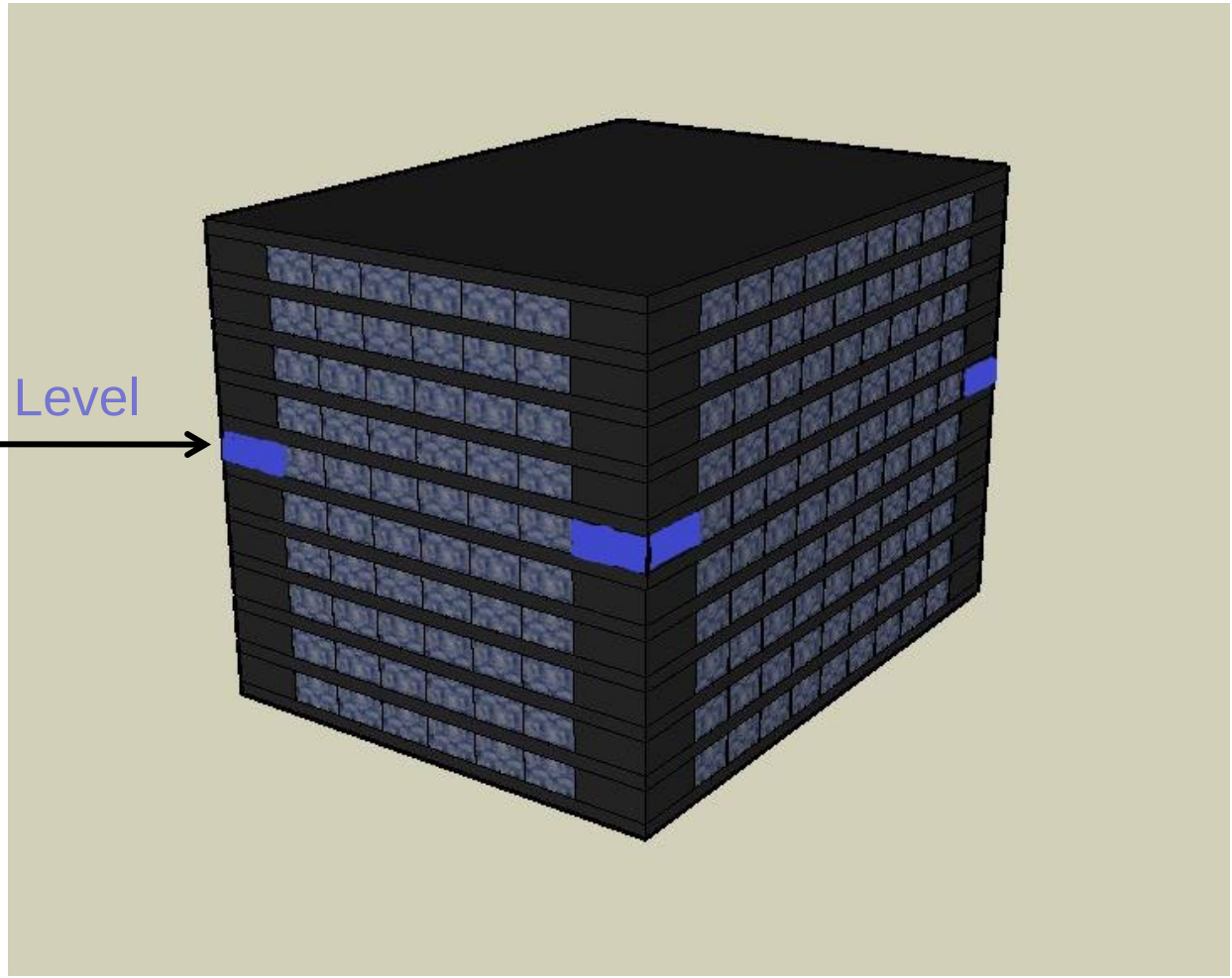
Introduction (2)

- Question to be answered
  - What is the energy savings potential with technology currently available on the market today?

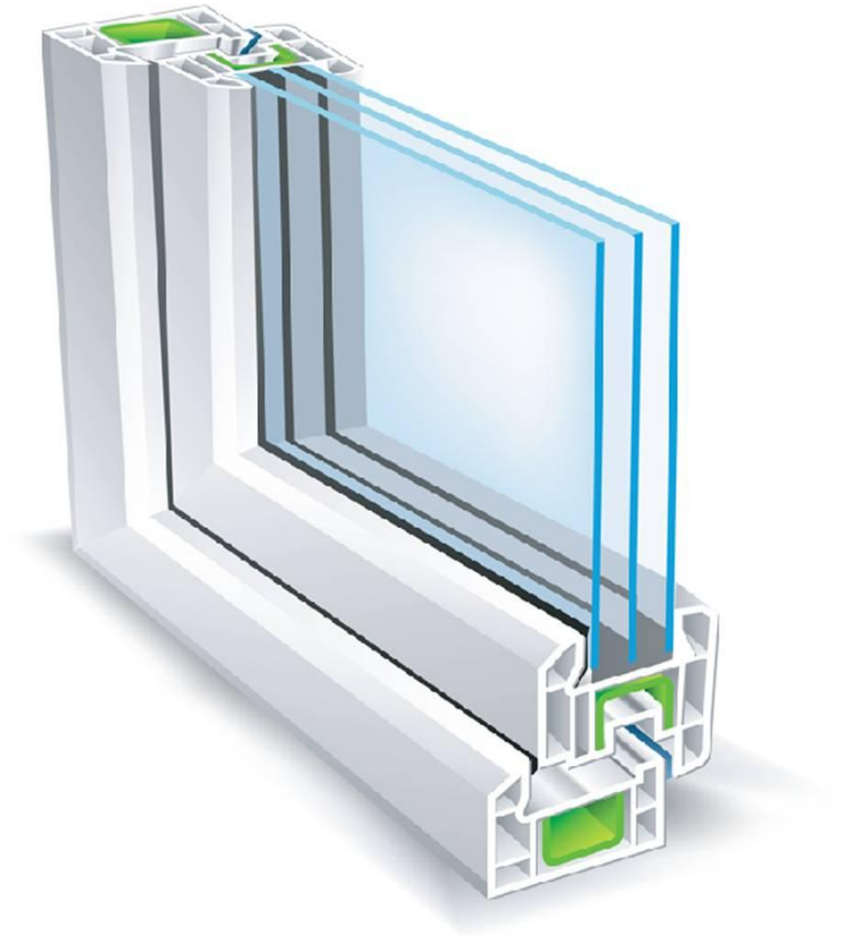
A Building



Generic Office Building



Triple Glass Windows



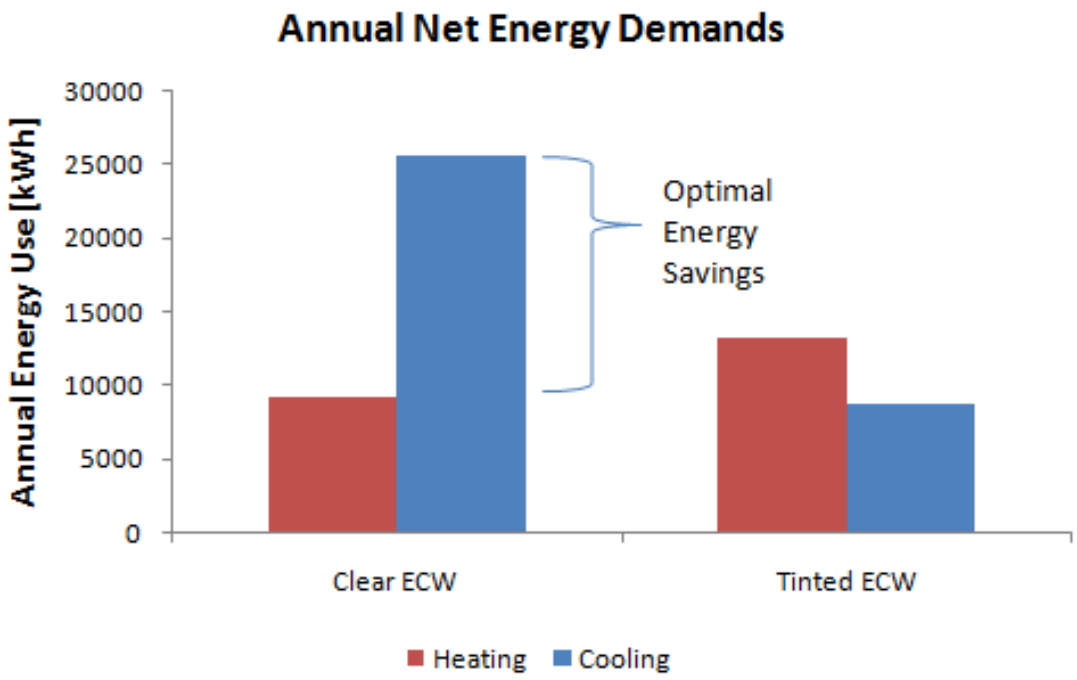
IGDB – LBNL Window 5

Database ID #	Database Name	Thickness [mm]	Tsol	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tir	E1	E2
413	Clear Float Glass	4	0.813	0.074	0.075	0.890	0.083	0.084	0.000	0.840	0.840
8900	SageGlass® tinted state	4	0.018	0.103	0.103	0.039	0.059	0.024	0.000	0.840	0.148
8901	SageGlass® untinted state	4	0.498	0.180	0.131	0.696	0.167	0.081	0.000	0.840	0.148

Windows Imported into TRNSYS

	U-value [W/m^{2}K]	Solar Factor	Tvis
ECW Triple Pane - clear state	1.154	0.446	0.562
ECW Triple Pane - tinted state	1.154	0.099	0.031

Optimal Performance



Control Strategies

The electrochromic window is activated through switches that are governed by temperature, time, incident solar radiation, or a combination thereof.

A Static Window – Clear ECW all year round

B Static Window – Tinted ECW all year round

C Switch governed by the incident solar radiation on the south facade

D Switch governed by a time schedule

E Switch governed by the outdoor ambient temperature

F Switch governed by the outdoor ambient temperature during a set time frame and only on workdays

G Switch governed by the operative temperature within the south thermal zone

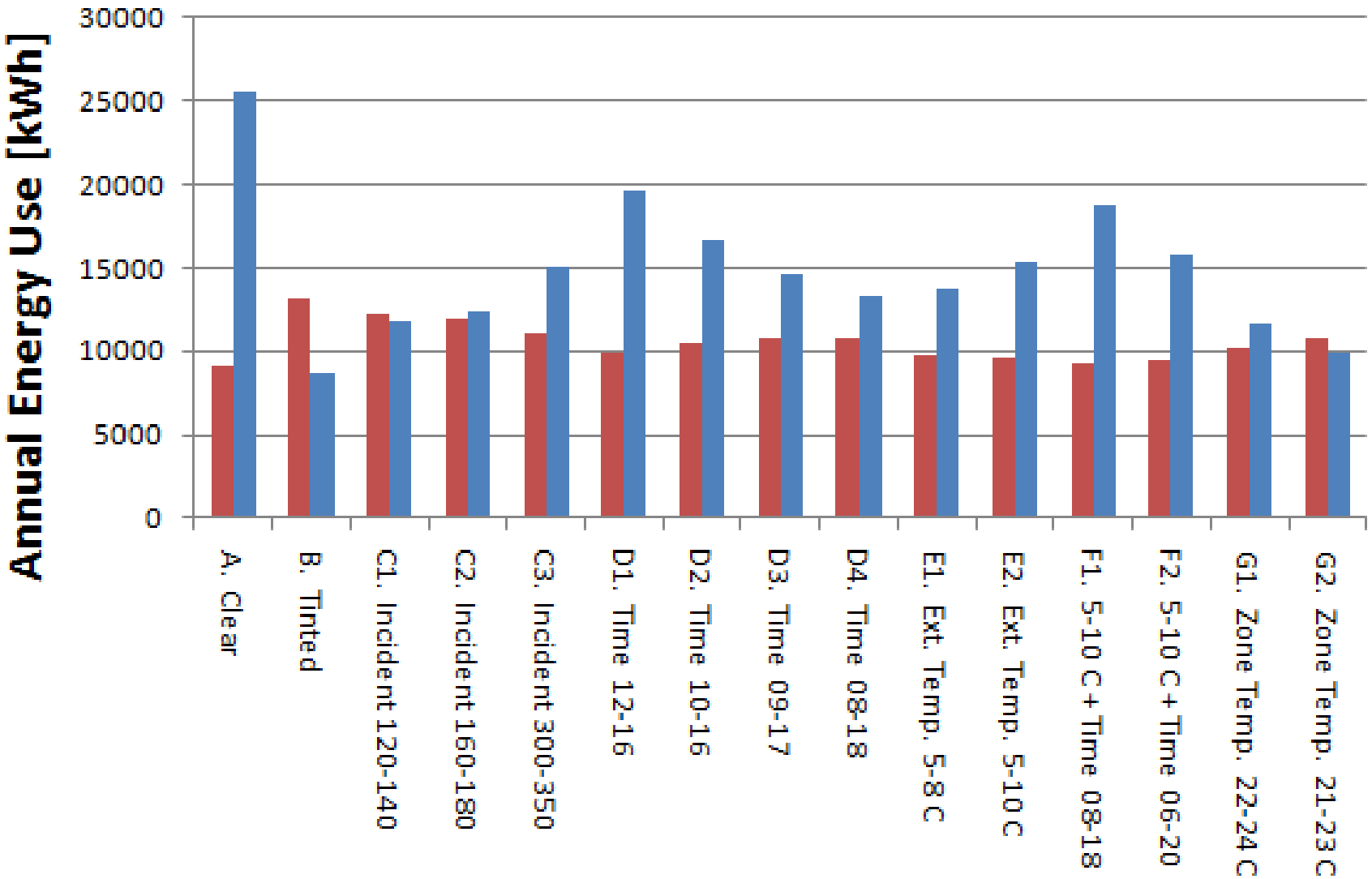
Net Energy contra Delivered Energy

When comparing the performance of two different control strategies, both the heating and cooling demands need to be taken into account. If the focus of the comparison is put onto the performance of the building, it would be adequate to sum up the heating and cooling demands. If the focus of comparison is put onto what the consumer must purchase, then the energy demands need to be converted into delivered energy.

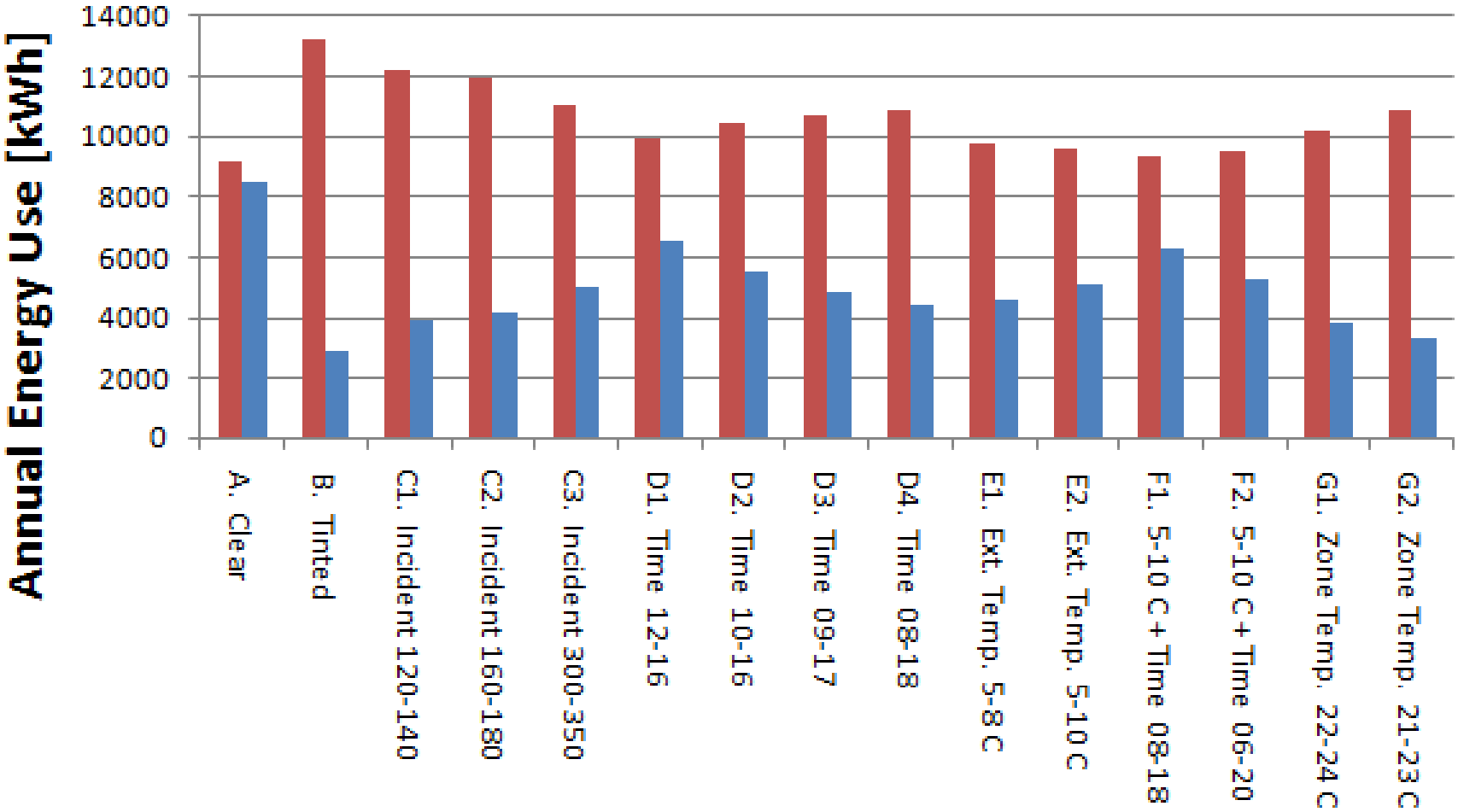
1) District Heating & District Cooling

2) Direct Electricity & Heat Pump (COP 3)

Annual heating and cooling demands for all strategies with district heating/cooling



Annual heating and cooling demands for all strategies with a heat pump for cooling



Conclusion

- With ECW's that are currently available on the market, simulations indicate a potential energy savings ranging between 4.3 to 11.7 kWh/m^2 floor space for the control strategies simulated in an office building with TEK10 minimum components and situated in Trondheim, Norway.
- If a heat pump is used to supply heating and cooling, the savings potential will be divided by the COP factor of the heat pump.

Questions???