

Chris Croly

Building Design Partnership

BDP.

History

National Gallery, Ireland

1864 Dargan Wing



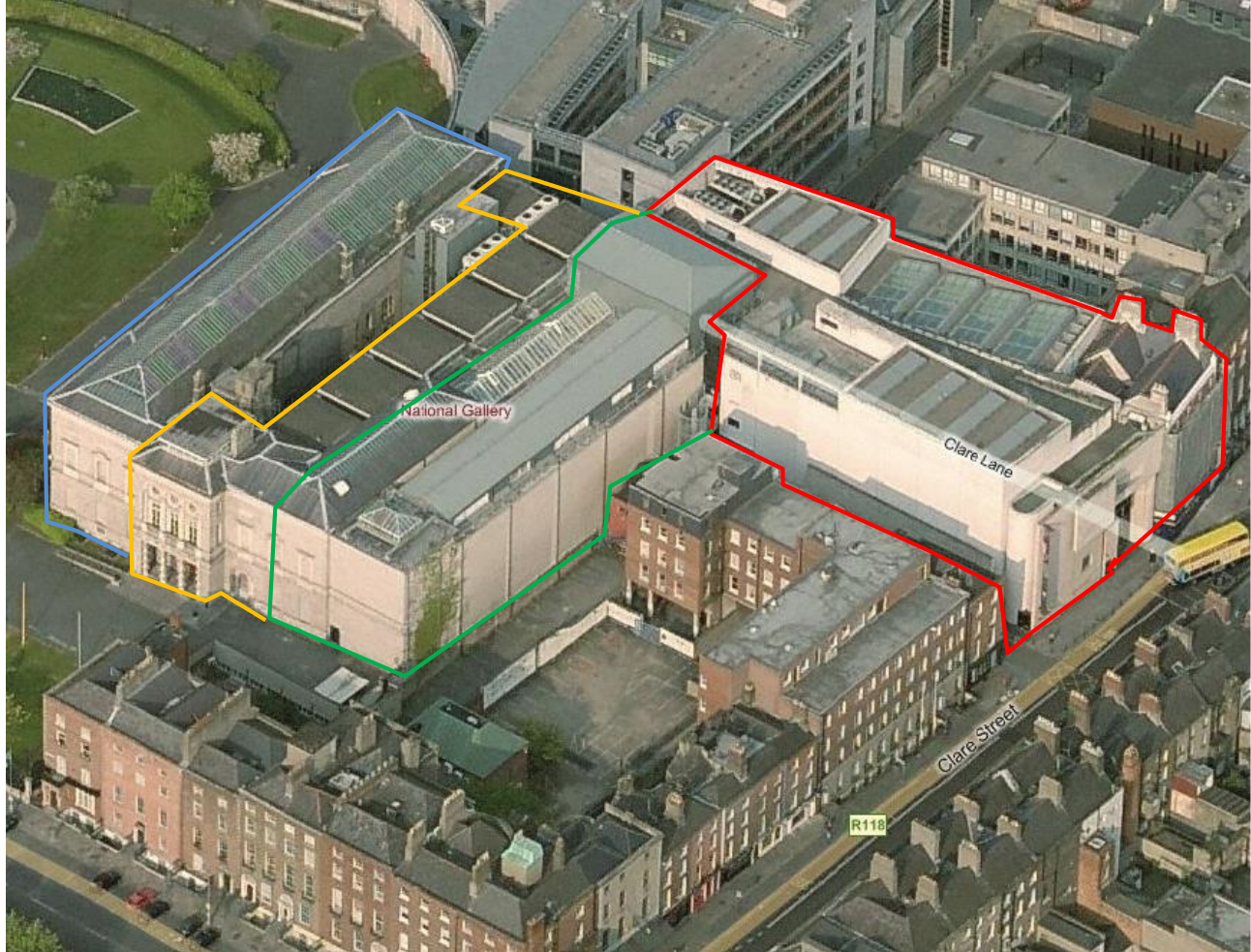
1903 Milltown Wing



1968 Beit Wing (1996 Remodel)

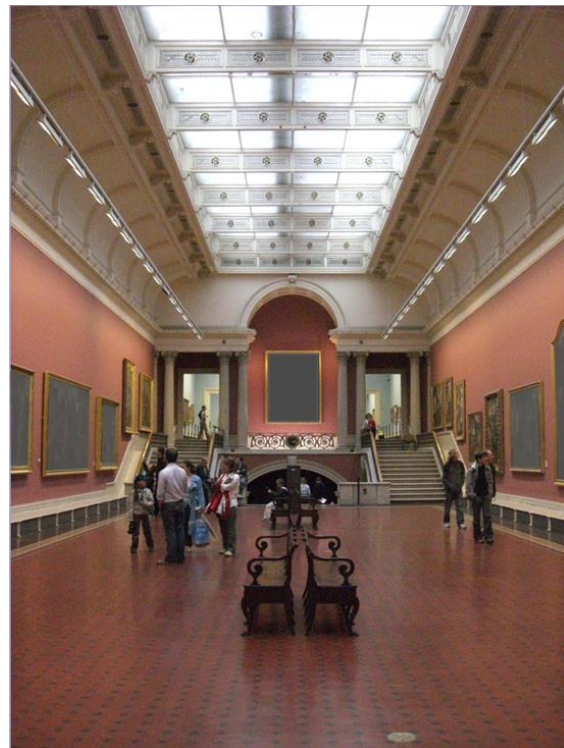
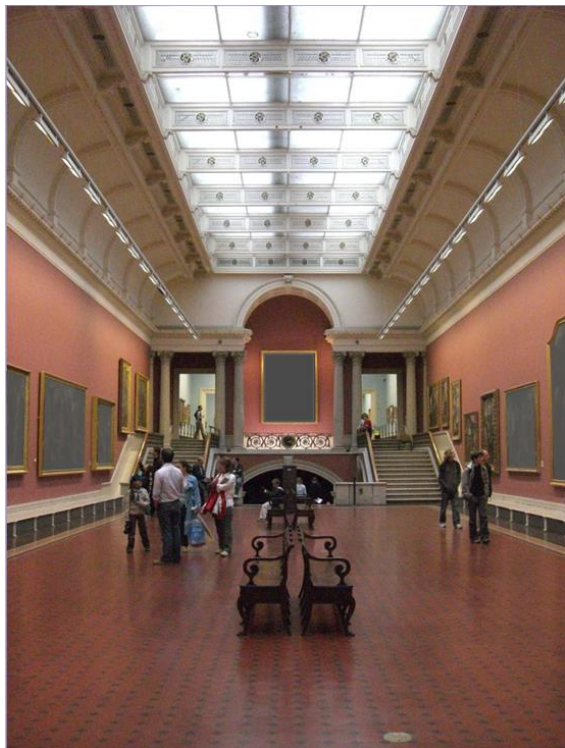


2002 Millennium Wing



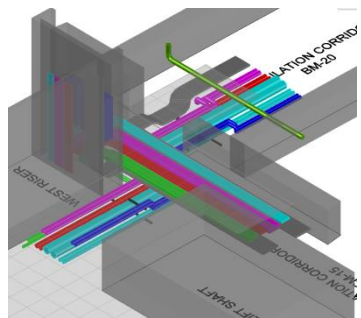
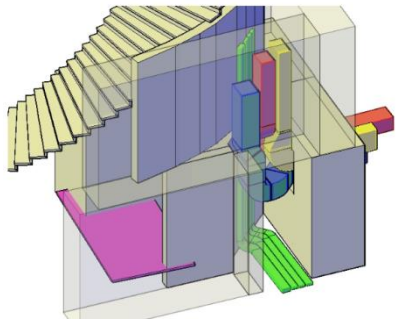
Refurbishment





Fabric

And conservation challenges



Energy Usage

24 hr / 365 Conditioning

Air Movement

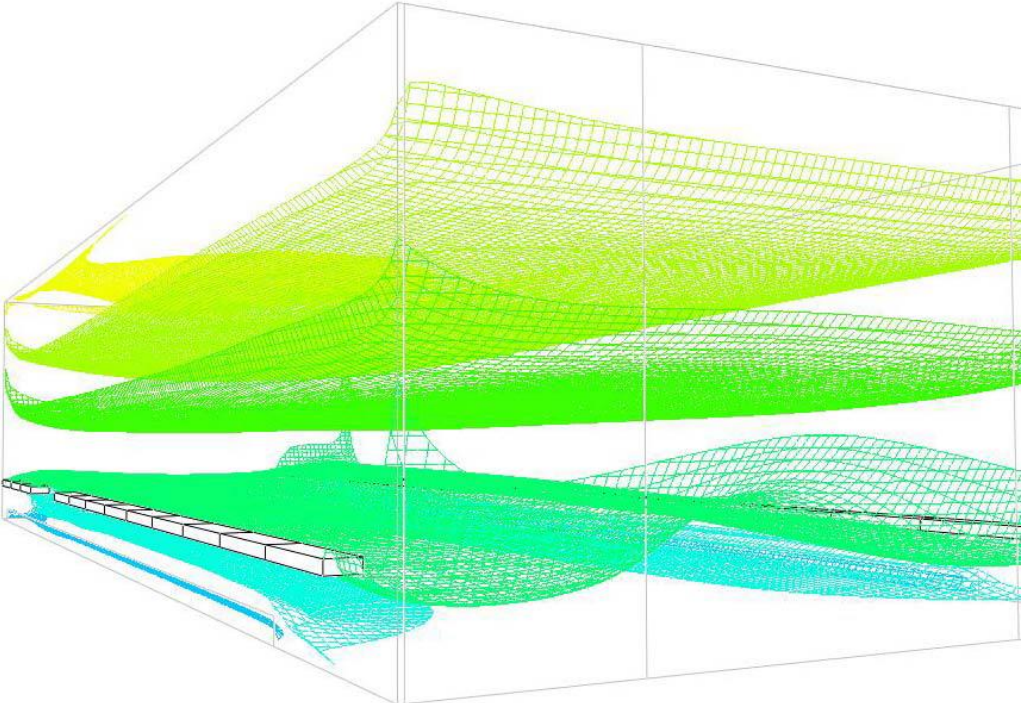
Heating

Cooling

De-Humidification

Lighting

Security



Lighting

LED lighting with controls significantly reduces cooling loads

Art lit only when occupied

Set back security mode

Colour adjustable for each space

Cumulative lumen hours recorded



Air Movement

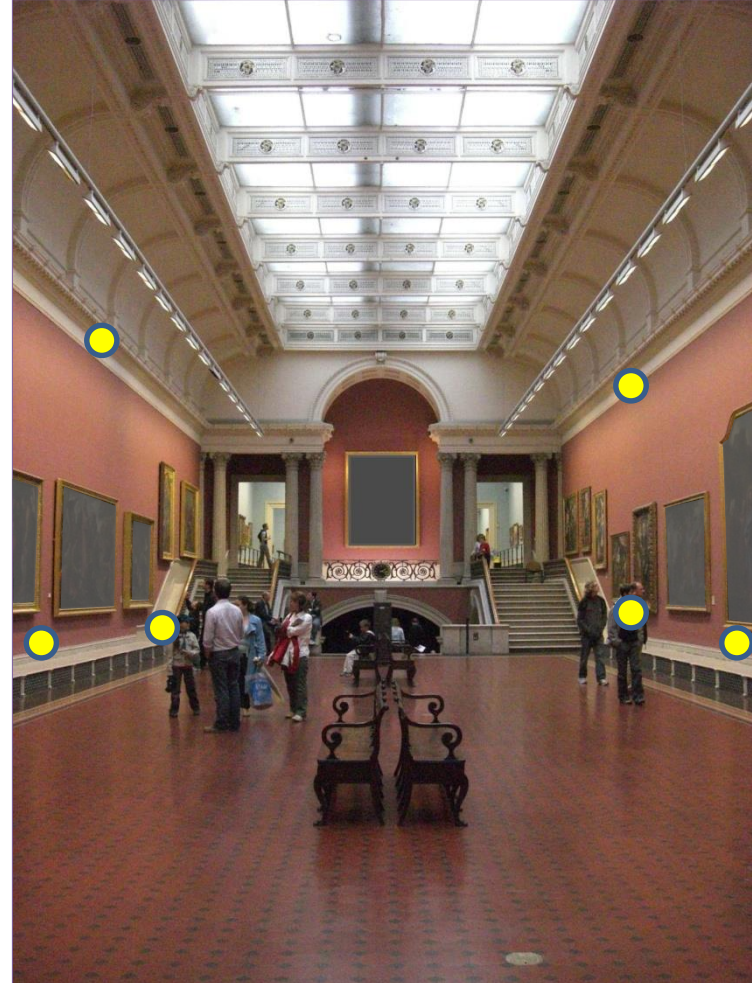
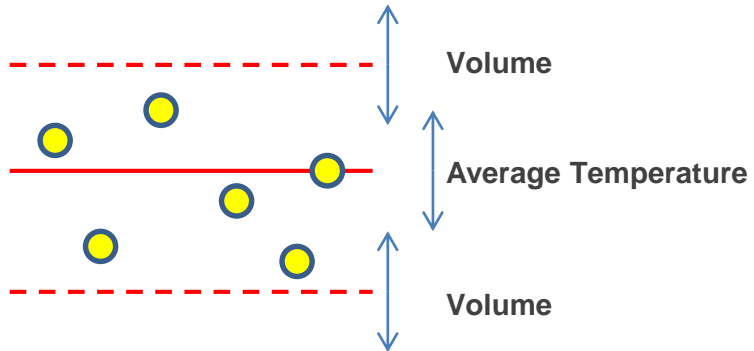
20 °C +/- 2°C RH 50%+/- 5%

Large spaces with multiple sensors

Temperature varies with height

Traditionally fixed high air change rates

20% reduction in volume flow = 40% Fan energy reduction



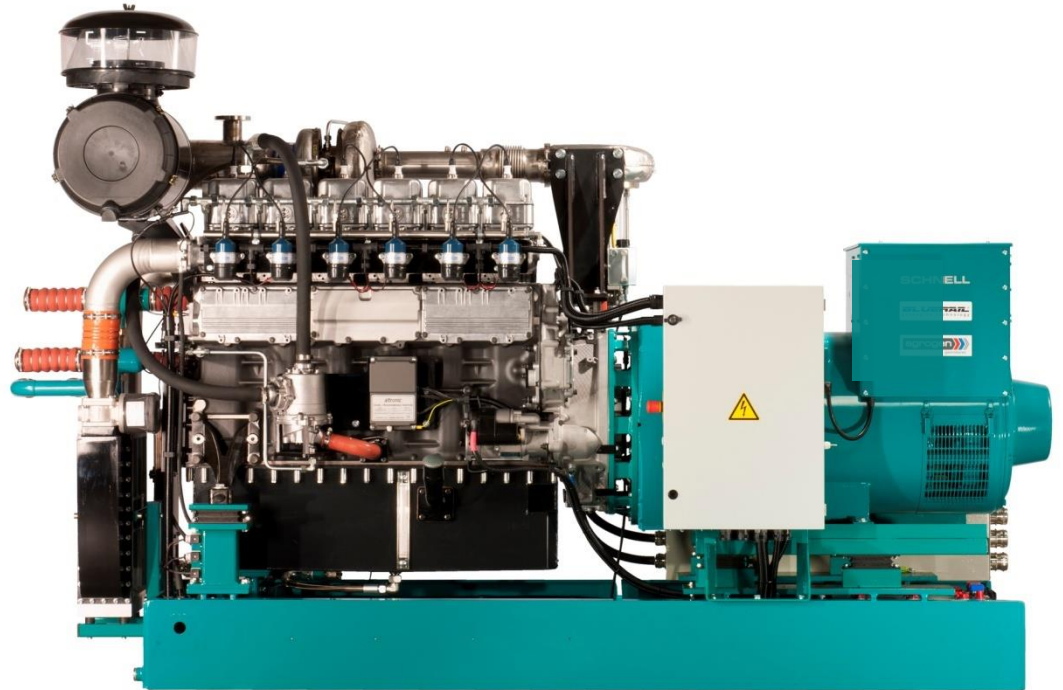
Systems - CHP

Net Cost Saving: € 85,000 yr (ex vat)

Carbon savings : 12% Of Energy Usage
158.6 Tonne/yr

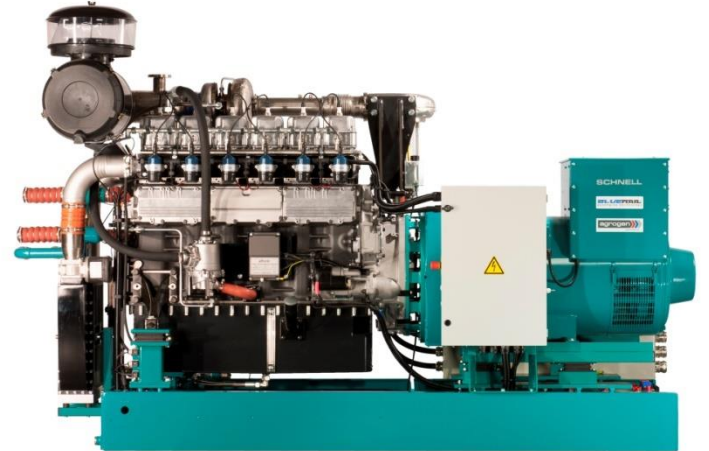
Payback period : 2 yrs

No heat dumping



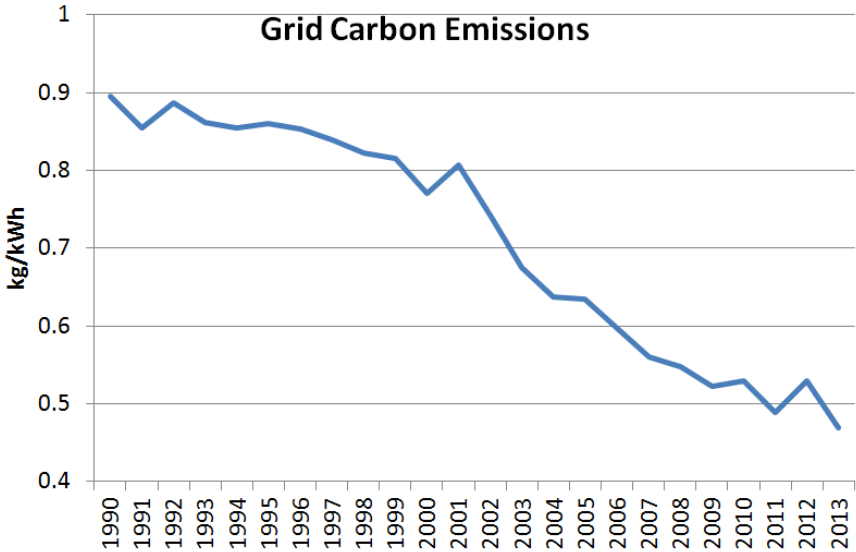
Things to know about CHP

- 1) It must be large to generate significant cost savings
- 2) Maintenance costs are high
- 3) Reliability is far from perfect
- 4) Dumping Heat saves money but not the environment
- 5) Carbon savings reduce as grid performance increases

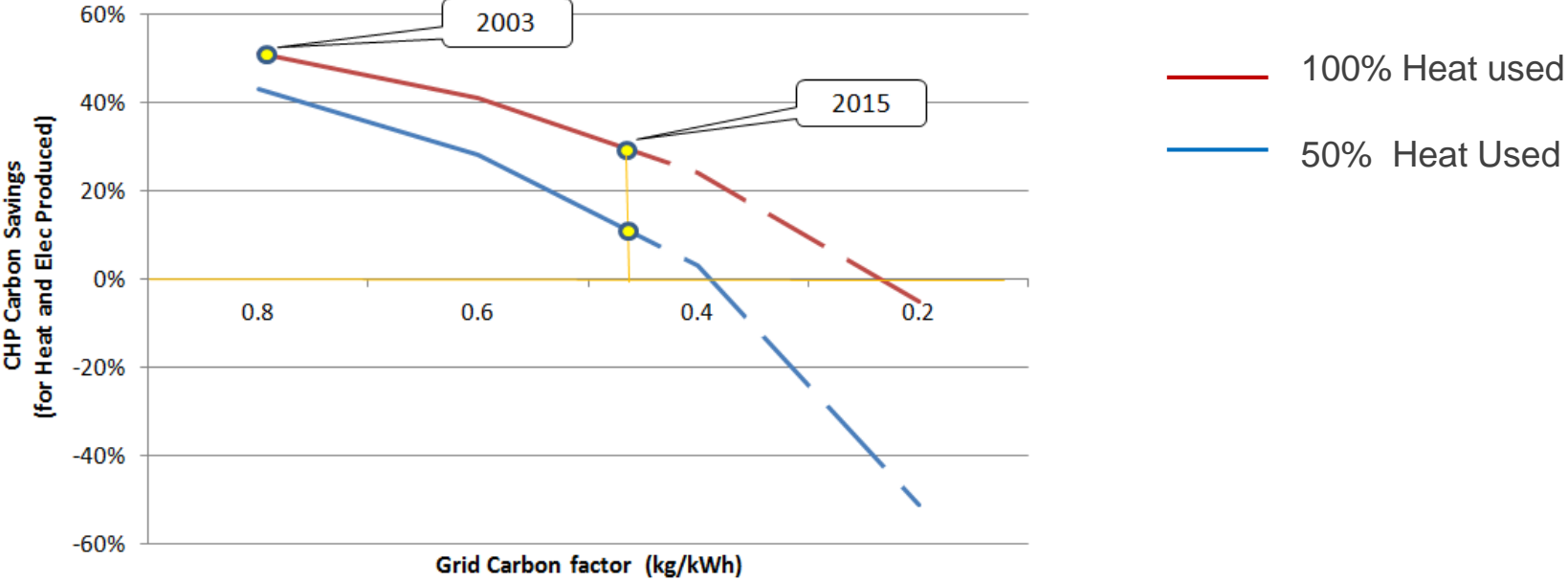


Grid Carbon Emissions

40% Renewable on grid by 2020



CHP Carbon Savings Relative to Grid Efficiency

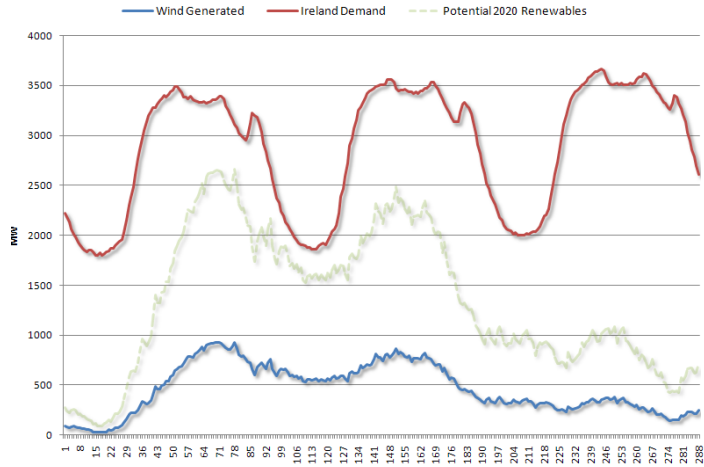


% Savings are relative to the energy produced by the CHP – not total building energy usage

Systems – ICE Bank

Performance on its own:

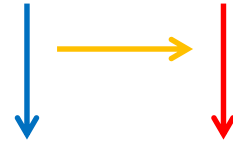
Cost Saving: € 8,497 yr (ex vat) (ignoring MIC and chiller savings)
Carbon savings : Very small ?
4.7 Tonne/yr
Payback period : 3.5 yrs



Systems - Heat Pump (Alone)

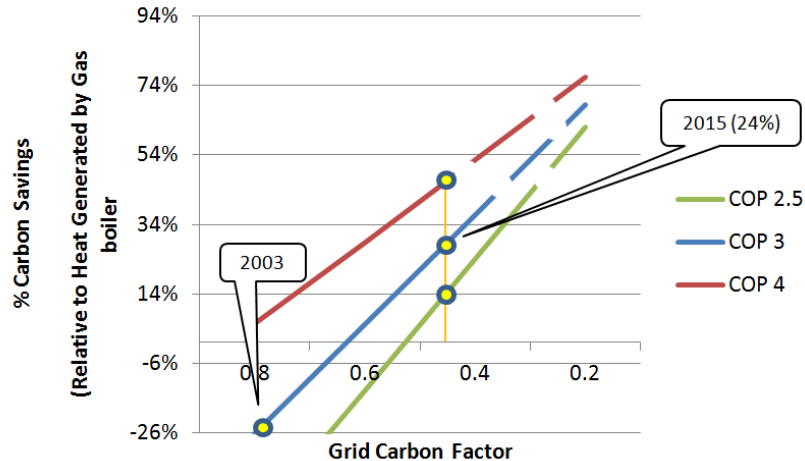
Cost Saving: € 5,200 yr (ex vat)
Carbon savings : 56 Tonne/yr
Payback period : 3.5 yrs

Larger future savings when Beit is added
Phase over to heat pump as carbon impact of grid reduces
Ice bank compliments heat recovery



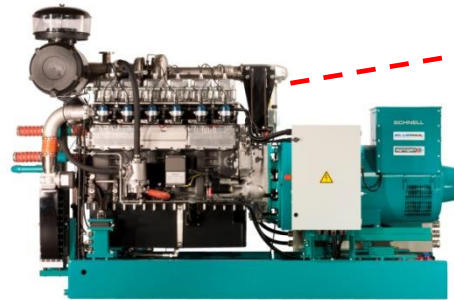
Things to know about heat pumps

- 1) Economics improve significantly with simultaneous loads (COP of 7)
- 2) Environmental benefits improve as the grid efficiency improves (but not cost savings)
- 3) Heat / Cooling Potential Storage improves performance

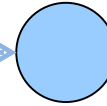


Systems Combined

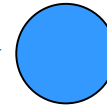
Simulated as Part of Masters Thesis



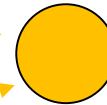
CHP and Ice also serve the Millennium wing



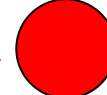
High temp cooling



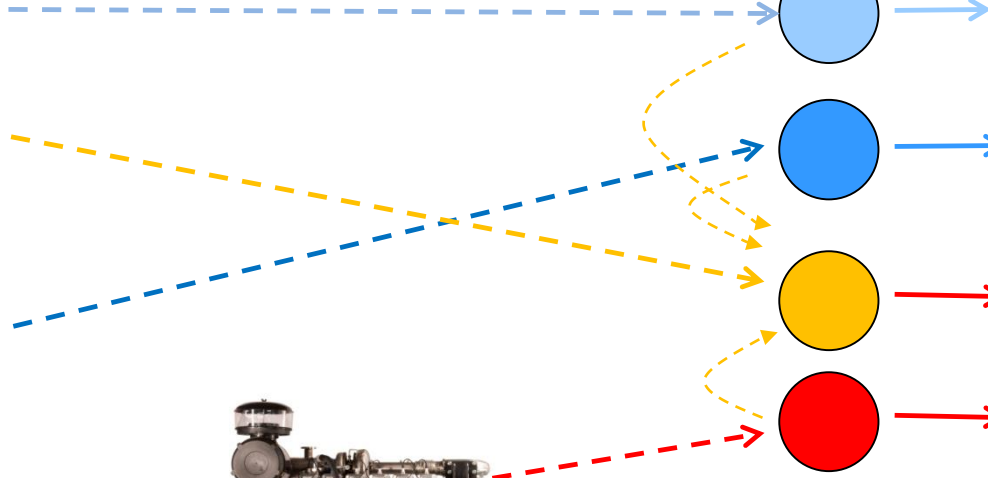
Low temp cooling



Low temp Heating



High temp Heating



Systems Combined

Cost Saving: €106,000 yr (ex vat)
Carbon savings : 227 Tonne/yr
14.7% Of Building Load

Payback period : 3.5 yrs

Savings Increase as the Gallery develops
Systems are future proofed to reduce carbon savings

