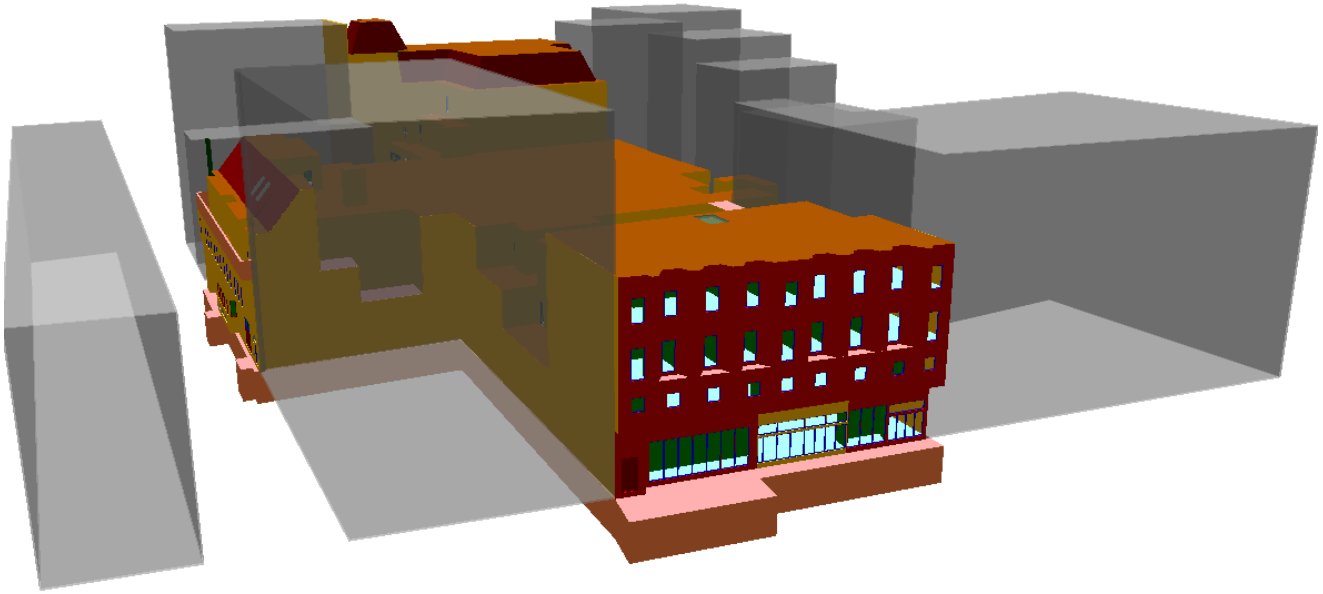
Case Study: Marks & Spencer Oxford Street

Environmental Design Solutions Ltd



M&S Oxford Street

- **The Brief:**

- Calibrate a base model using metered consumption figures – “existing building”

- Apply changes required in the refurbishment brief to predict energy consumption – “proposed building”.

- Information required to create base model:

  - Drawings
  - Constructions
  - Usage patterns
  - Internal gains – lighting, occupants, equipment
  - Plant operation

Considerations…

- Some aspects of operation will affect heating & cooling demands:
  - escalators
  - cooling effect to space from cold aisles
  - plinth heating of refrigeration units
  - small power, e.g. tills
- Some items will not:
  - refrigeration compressor energy consumption, including cold rooms & freezer rooms
  - lifts

State of the art building simulation software...

The table shows how the client wanted the information broken down

Detailed information is required for each field in order to accurately predict consumption for each sub-system.

Energy Sub-System	SITE – Pantheon Marks & Spencer			
	From results of Thermal Modelling for original building (kWh/m²/yr) (C)		From results of Thermal Modelling of the refurbished design (kWh/m2/yr) (D)	
	Electricity	Gas	Electricity	Gas
Heating & hot water	-	-	-	-
Cooling	-	-	-	-
Fans and pumps	-	-	-	-
Humidification	-	-	-	-
Lighting	-	-	-	-
Office empty	-	-	-	-
Catering Gas	-	-	-	-
Catering electricity	-	-	-	-
Other electricity	-	-	-	-
Computer room	-	-	-	-
Total gas	-	-	-	-
Total electricity	-	-	-	-
Total Energy	-		-	

Indication of detail required

- Heating & cooling efficiencies
- Distribution losses
- Pipe index circuit length & pressure drop
- Fan SFPs
- Hot water consumption, generator efficiency & distribution losses
- Lighting installed density
- Daily opening hours with hours of plant operation
- Method of heating, cooling & ventilation
- Ventilation rates

EXISTING MODEL

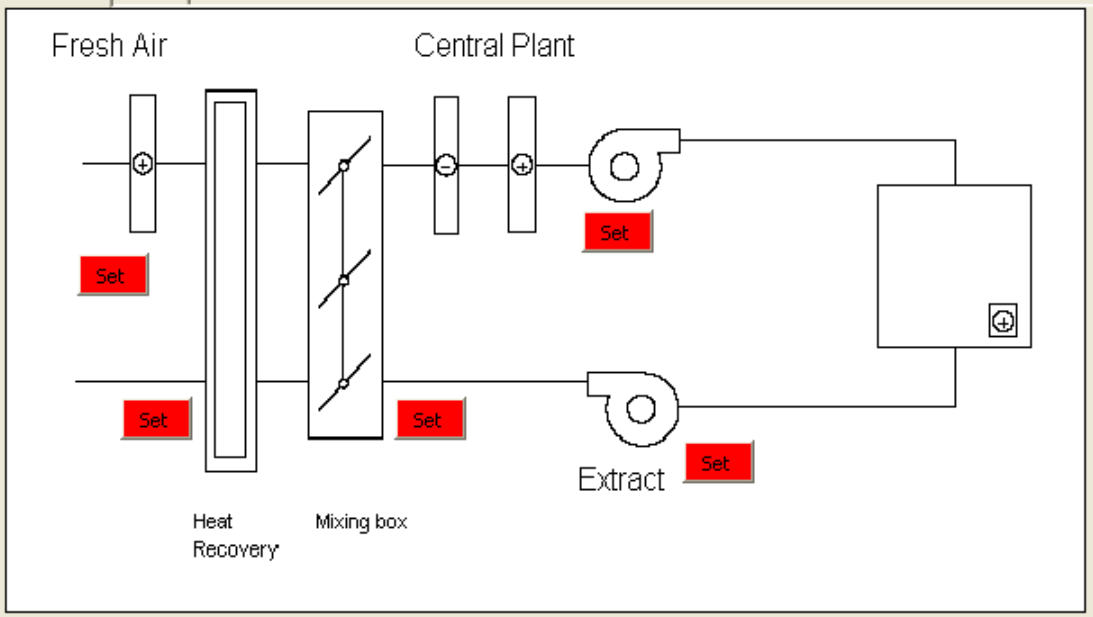
Services Summary

- CAV heating & cooling
- Poor heating & cooling efficiencies – 65%, COP of 2.5
- No heat recovery
- Supply Fan SFP = 3W/l/s, Extract Fan SFP = 1W/l/s
- Lighting 40W/m^2 sales floor, 36W/m^2 back of house
- 1.2l/s/m^2 Fresh Air, 10 l/s/m^2 total supply

Typical services schematic

EXISTING MODEL

Description | Details



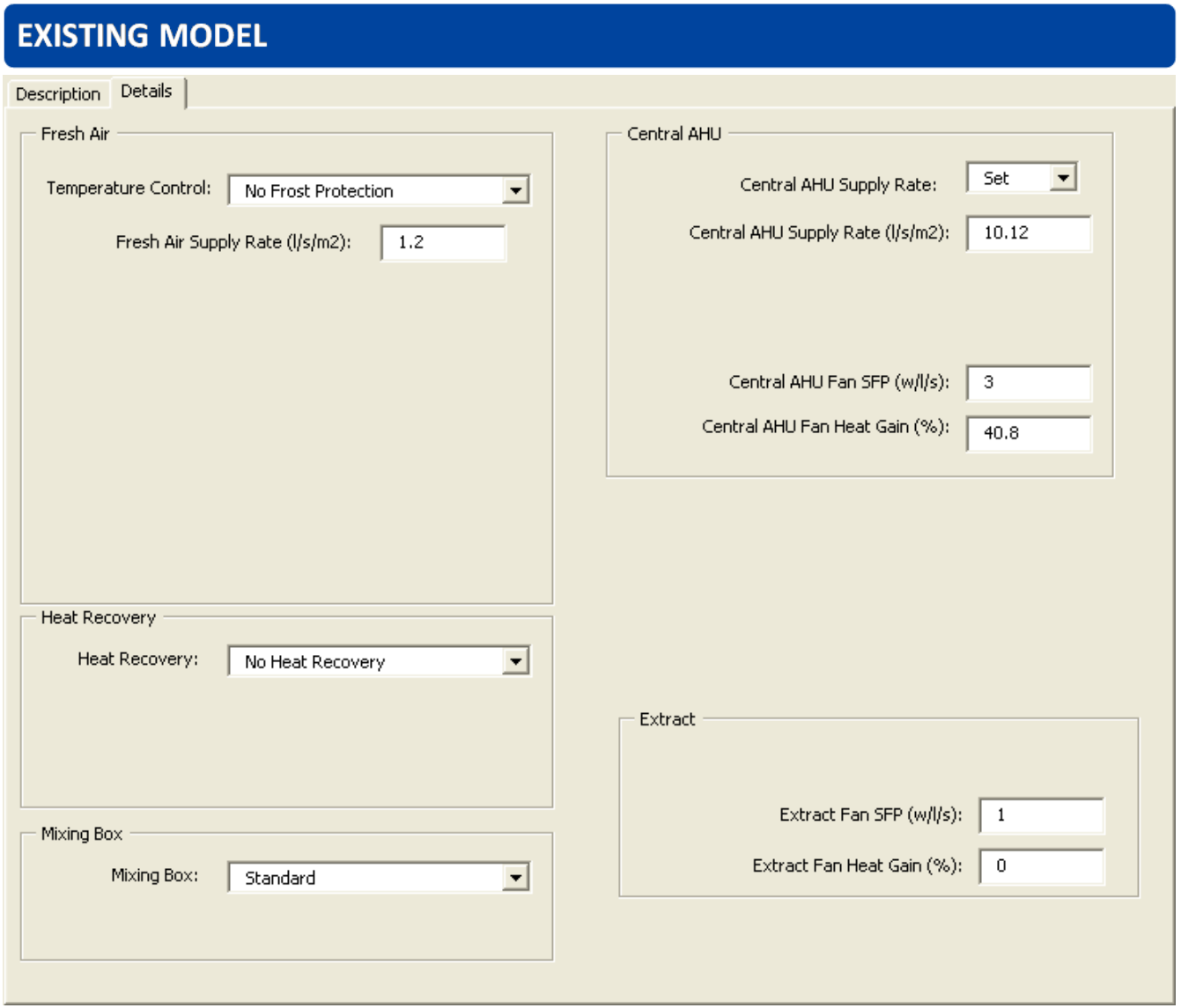
This is a HVAC system where the air enters the zone at a constant volume. The supply air is conditioned in an attempt to meet the heating and cooling demand requirements. If multiple zones are used in the sub-project then the CAV system will meet the demand of the zone that requires the most cooling and then re-heat the other zones.

There is an option to size the flow rate based on the central AHU setpoints and the peak of the zone heating load and zone cooling load.

There is an option to heat the fresh air before it enters the mixing box for the purposes of frost protection. This is done by checking the fresh air heating box and setting the heating setpoint.

If this type of system is used in the design, the notional building will use a fancoil system with fresh air being conditioned so that it is room neutral.

Typical services schematic



The refurbishment of the building had already commenced by the time we were approached, so availability of data was limited

With the data we had we attempted to match metered fuel types *and* total energy consumption

EXISTING MODEL

Energy Sub-System	SITE - Pantheon			
	Thermal Modelling on existing building (kWh/m²/yr)		Metered Results (kWh/m²/yr)	
	Electricity	Gas	Electricity	Gas
Heating & hot water	-	112.65	-	-
Cooling	84.8	-	-	-
Fans and pumps	123.97	-	-	-
Humidification	-	-	-	-
Lighting	126.38	-	-	-
Office empty	-	-	-	-
Catering Gas	-	-	-	-
Catering electricity	20.7	-	-	-
Other electricity	66.56	-	-	-
Computer room	-	-	-	-
Total gas	-	**112.65**	-	**184.75**
Total electricity	**422.42**	-	**339.74**	-
Total Energy	**535.06**		**524.49**	

With the base model complete, the next step was to include the changes put forward by our client

PROPOSED MODEL

Areas of investigation

- Lighting
- Replacing heating & cooling plant
- Installation of local VRF
- Changes to occupancy levels
- Improved fan efficiencies
- Addition of new staff & customer cafes
- Addition of a new bakery & hot food sales area
- Extra refrigerated aisles

PROPOSED MODEL

Summary of changes

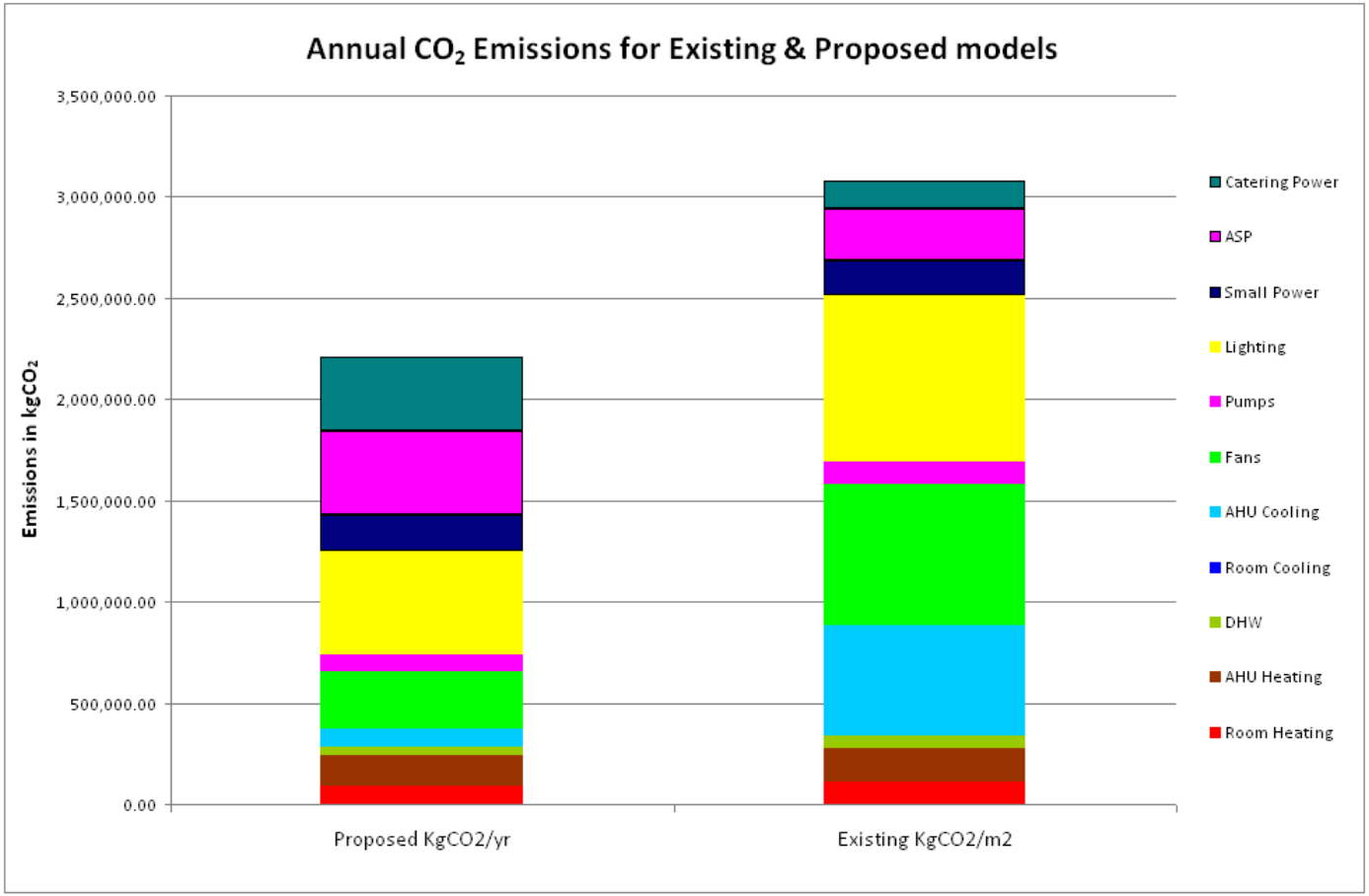
- CAV heating & cooling with local VRF
- Heating efficiency from 65% to 80%
- Chiller COP from 2.5 to 2.8
- 60% improvement in Fan SFPs
- Sales lighting from 40W/m^2 to 30W/m^2
- Back of house lighting from 36W/m^2 to 8W/m^2
- Ventilation rates unchanged

State of the art building simulation software...

With the changes made we could analyse for consumption

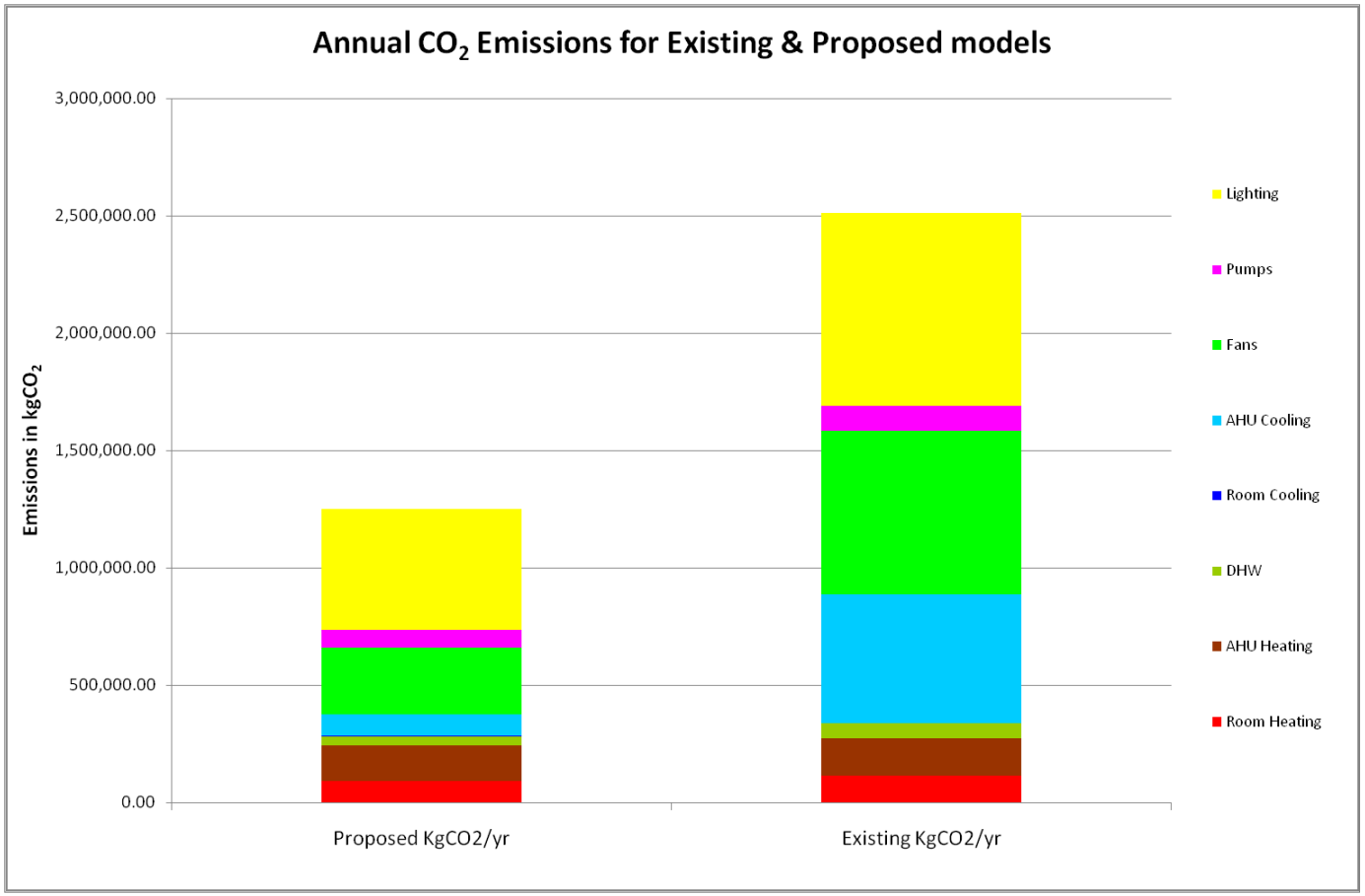
When comparing results it is clear to see the areas of change

We can view results for the whole building energy consumption or CO_2 results



State of the art building simulation software...

Just looking at the consumption & CO_2 for environmental treatment elements, we can see that total energy consumption has dropped by 46% and CO_2 has dropped by 50%



CONCLUSIONS

Summary of improvements

Energy consumption reduced by 21%

CO_2 emissions reduced by 22%

All this despite the inclusion of:

- A new Café
- A new Staff Kitchen
- A new Bakery
- Local VRF units
- Increased footfall

CONCLUSIONS

Summary of improvements

Environmental treatment total consumption reduced by 46%

Environmental treatment total CO_2 reduced by 50%

CONCLUSIONS

Benefits to end-client:

- Expected energy consumption broken down by fuel type & end use
- Indication of expected cuts in running costs
- Marketing potential

Environmental Design Solutions Ltd