

Ascough Consulting Engineers



Sean Ascough: Owner / Director

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The Company

- Ascough Consulting Engineers established 2006
- 5 Staff
- Based in Blessington, near Dublin
- www.Ascough.ie

Services

- M+E Design and Project Management
- Energy Solutions
- M+E Trouble Shooting
- Energy Management



Free Cooling Telephone Exchanges



Ascough Consulting Engineers - Awards

Winner SEAI Sustainable Building Excellence Award 2009 - Eircom HQ

- *“positive integration of passive and active intelligently controlled building services”*
- *“The end result is a building that provides high quality working conditions for a substantially lower energy demand”*



Finalist SEAI 2011 for Friends First in two categories

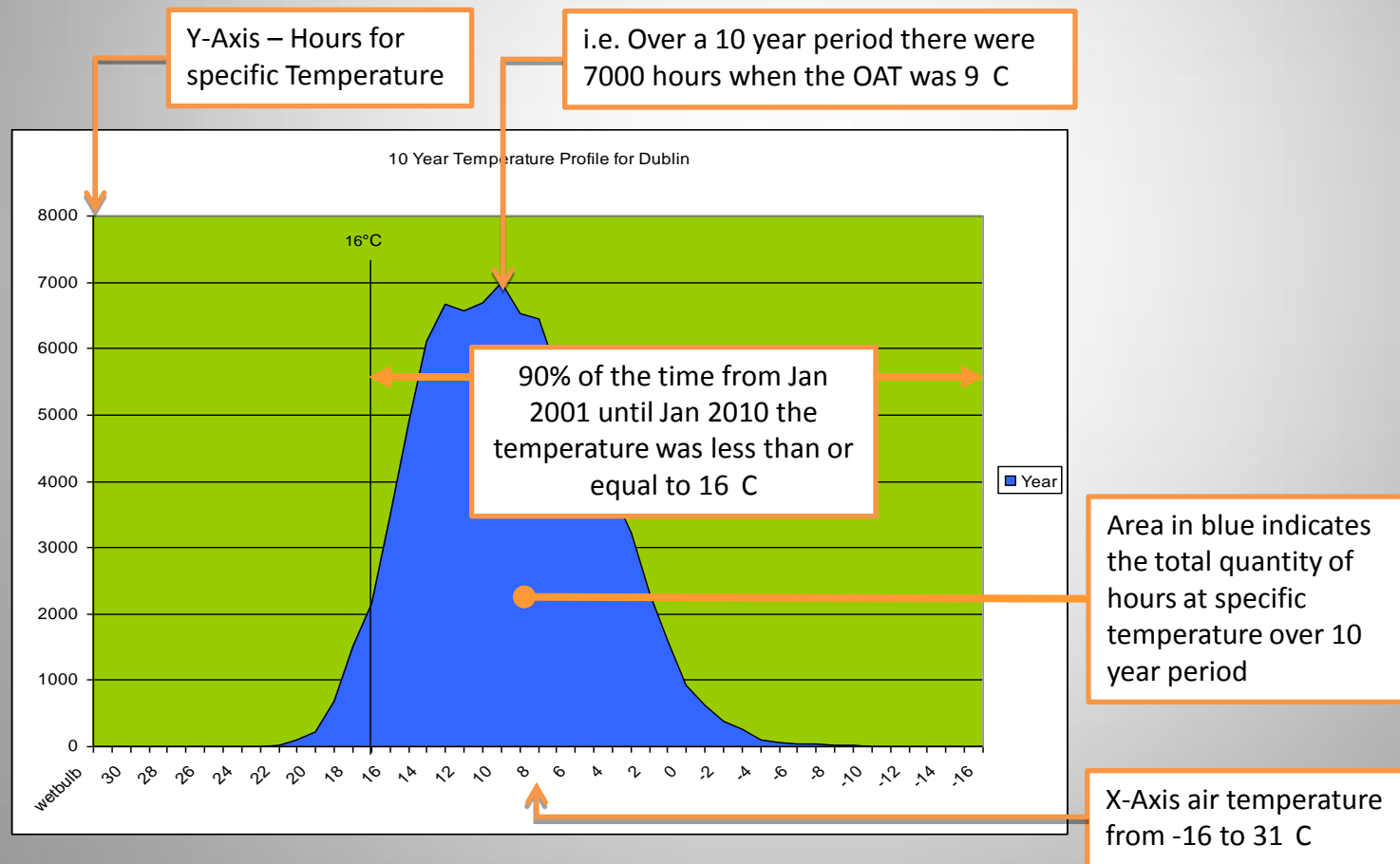
- Finalist – Overall Innovation Award
- Finalist – Small to Medium User Category
- Achieved 40% Electrical and 40% Gas Savings
- Building built 2002



Free Cooling Theory

- Free Cooling: Use external air to counteract internal heatgain
- Replace or supplement active cooling i.e. air-conditioning

Dry Bulb Temperature Profile for Dublin – 10 Year Average



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Free Cooling Theory



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Why use free cooling – why not use air-conditioning?

- Example:
- A telecom exchange with a sensible heat-gain of 100kW
- Maximum room temperature 26 C
- Outside temperature 16 C
- Air Volume required to cool space 8.2 m³/s
- Motor Load (@ say 500pa system pressure) 6kW
- Air Conditioning : COP=3: Motor Load 33kW



Free cooling consumes 10 to 50% of the Energy of Air-conditioning for the same load

This is one of the main reasons why Ireland is a popular location for Data Centres, i.e. our temperate climate is a natural resource

Executive Summary

- 3 Pilot Exchanges: Dolphin's Barn, Clondalkin, Mervue
- Originally Cooled with Upflow/ Downflow DX Units (*No humidity control*)
- Fresh Air Free Cooling (*without humidification*)
- Two detailed Scheme Options for Dolphin's Barn
- Hybrid Scheme for Clondalkin
- Centralised Scheme for Mervue
- Average payback 5 years



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Introduction

- Identify scale of opportunity
- High refrigeration based electrical load
- Dolphins Barn detailed costs extrapolated to Clondalkin & Mervue
- Tendering & Cost Control
- Construction
- Handover
- Post-Handover performance



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Building Descriptions

- All Precast concrete clad/ flat slab
- Dolphin's Barn, Clondalkin have windows, Mervue does not
- All were formerly air conditioned
- Some ductwork left
- Central plant space
- Raised Floors
- 24/7 operation/ steady loads



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Design Considerations

- Exchange Internal Congestion
- Security
- Avoidance of Water
- DX Units Setpoint unchanged
- Adiabatic Cooling
- Internal Air Circulation & Hotspots
- Churn by Eircom
- Dust control
- Noise Control



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Design Considerations Continued...

- Planning Permission
- Fire Protection
- Electrical Supplies
- Installation Access
- System Reliability
- BMS Control & Monitoring
- Maintenance
- Verification
- Replication to other exchanges



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Further Considerations

- Tight Programme
- Health & Safety
- Working Live
- Controls Interception of CRACs
- Enabling Works
- Equipment Pre-Order/ Collaboration with Manufacturers
- Procurement route

Programme



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Eircom Free Cooling Works - Dolphin's Barn, Clondalkin & Mervue

No.	ACTIVITY	W/C 22/8	W/C 29/8	W/C 5/9	W/C 12/9	W/C 19/9	W/C 26/9	W/C 3/10	W/C 10/10	W/C 17/10	W/C 24/10	W/C 31/10	W/C 7/11	W/C 14/10	W/C 21/11	W/C 28/11
	Design & Pricing															
1.0	Design	26		10												
2.0	Confirm Key Equipment				15											
3.0	Prepare Design Package			10		19										
4.0	Contractor Pricing					19	29									
5.0	Review Contracts & Appoint						29	3								
	Construction															
6.0	Site Mobilisation							5								
7.0	Builders works							3-7								
8.0	Fire Alarm Interface/ Room Integrity							3-7				31				
9.0	Equipment Review and Ordering							3-7								
10.0	Workshop Fabrication							3		21						
11.0	Install Fans									17	29					
12.0	Install Ductwork									17	29					
13.0	Install Controls									17	29					
14.0	Electrical								3		29					
	Commissioning & Handover															
15.0	Commissioning											4			21	
16.0	Handover														25	
17.0	Final Payment														25	
18.0	Completion and Review															30

Dolphins Barn

Option A – Centralised/ Local Extracts

- Central Supply AHU at high level in loading area
- New/ existing supply ductwork
- Supply via floor gratings
- Builders work
- Minimal impact in equipment rooms
- Local mixing & extract units
- Intelligent controls
- Highest savings



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Dolphins Barn

Option B - Localised

- Individual tailored fresh air supply & extract units
- All air coming via perimeter louvres
- Minimal ductwork
- Challenge to tailor into tight space constraints
- Smaller capacity hence lower savings
- Intelligent controls
- Least builders work



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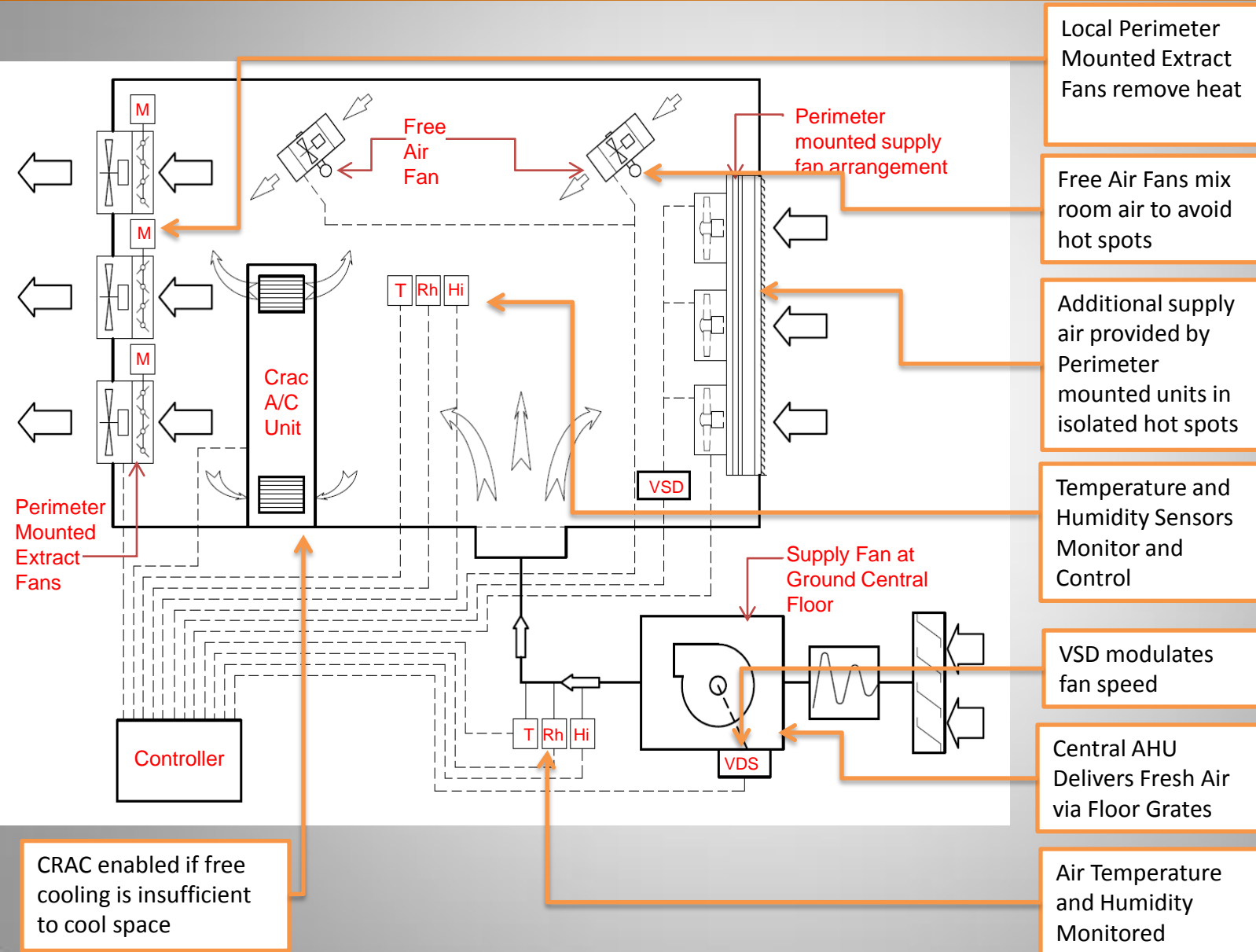
Dolphin's Barn – Free Cooling Diagram



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Clondalkin

Localised/ Hybrid

- Individual tailored fresh air supply and extract units
- Partial reuse of existing ductwork to cater for ground floor
- Tailor into tight space constraints
- Smallest potential savings of smaller load capacity hence lower savings
- Least builders work
- Intelligent controls



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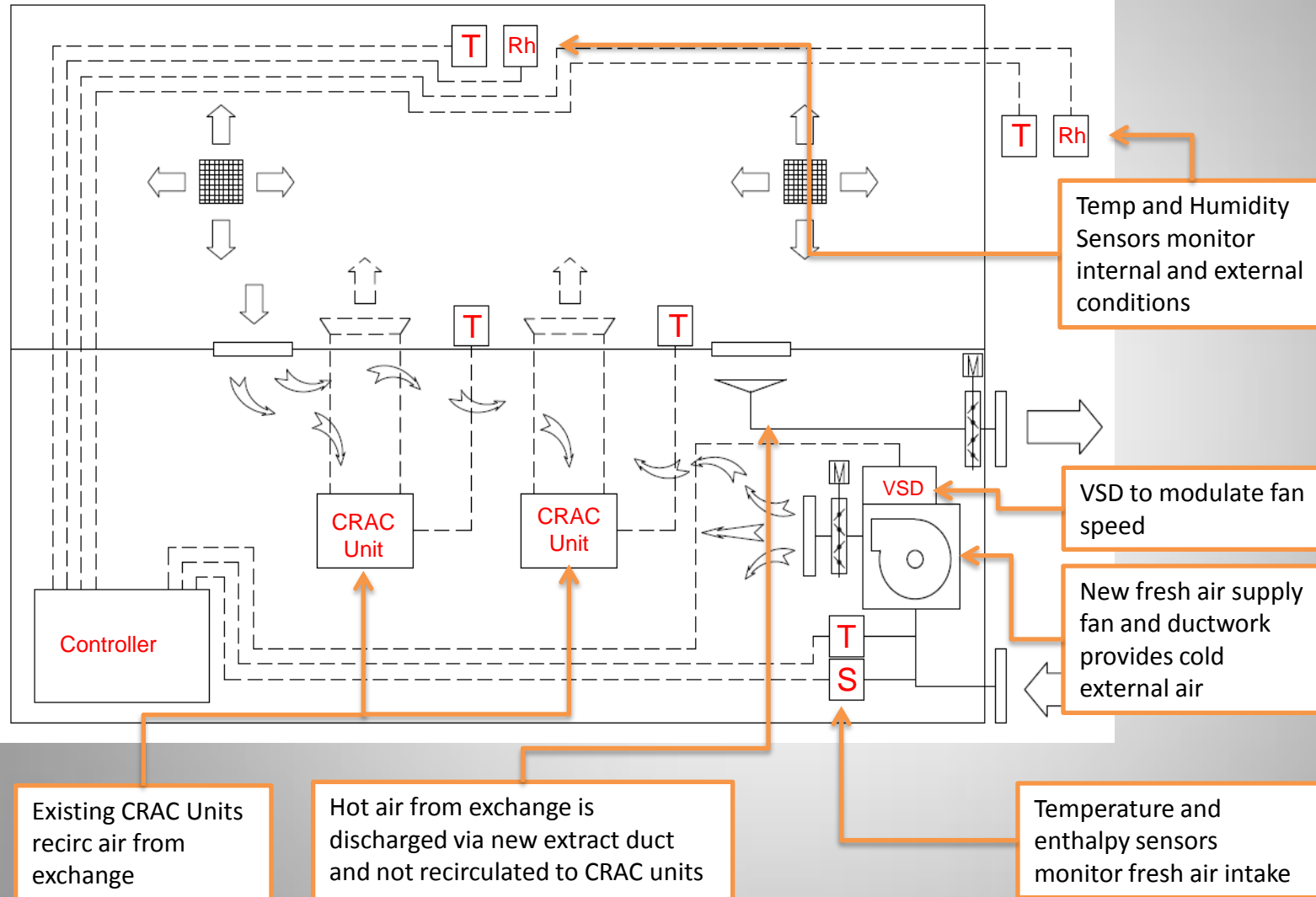
Clondalkin – Free Cooling Diagram



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Fully Centralised

- Re-use of existing supply & extract ductwork & plant space
- 1No new full recirc units with filtration
- Ability to switch off CRAC fans
- No need for free air fans
- Intelligent controls
- Least builders work of all
- Potential for short payback depending on duct route/ sizes



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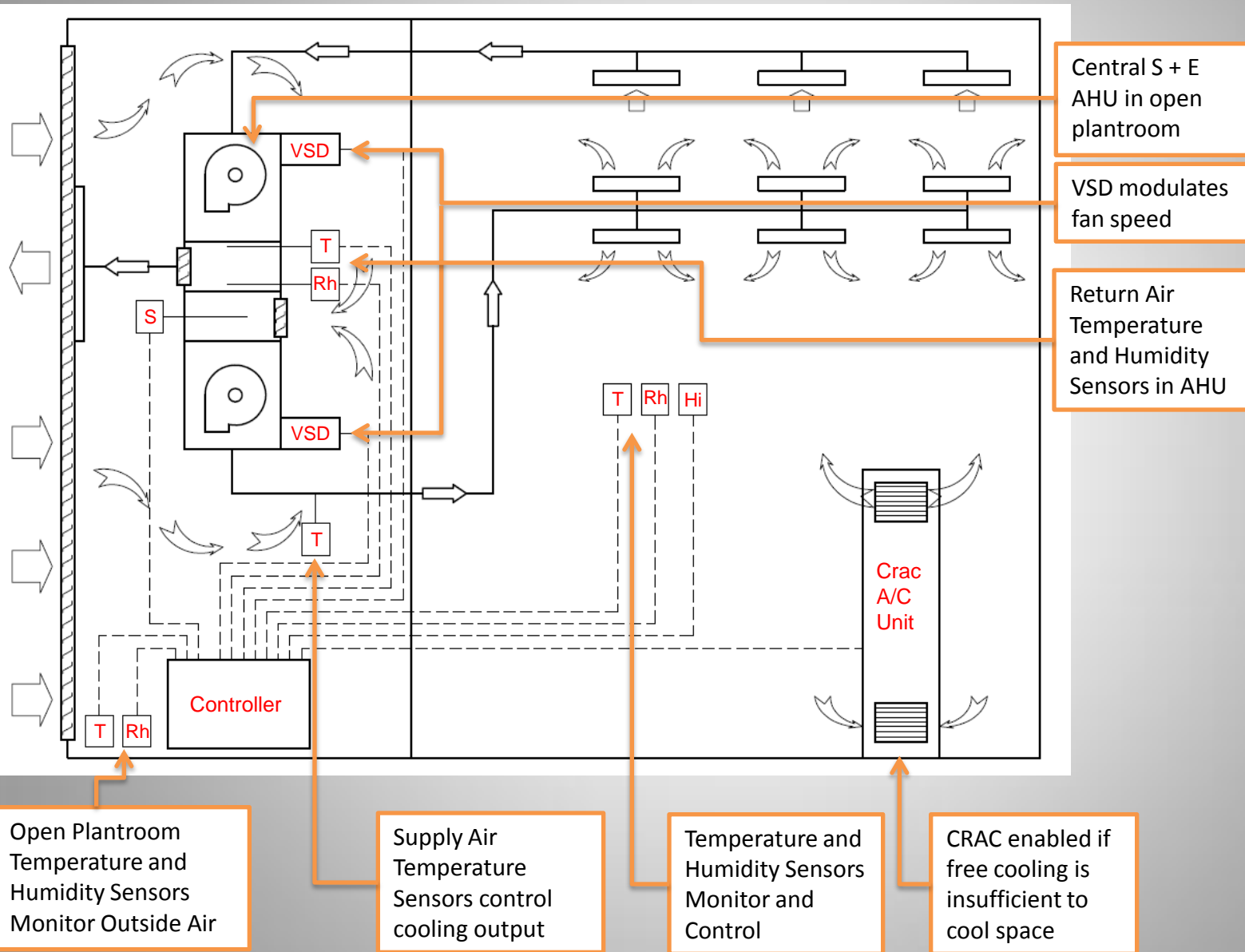
Mervue – Free Cooling Diagram



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Projected vs. Actual Comparison



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Exchange	Projected Yearly Savings kWh	Actual Yearly Savings kWh	Projected Payback in Years	Actual Payback in Years
Dolphins Barn	373,200	359,077	4.82	4.15
Clondalkin	251,650	142,856	3.97	6.54
Mervue	400,000	223,377	3.2	4.25
TOTAL	1,024,850	725,310	4	4.65 (2.9 after grant)

Carbon Saving – Emissions Table



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Emission Factors

	t CO ₂ /TJ	g CO ₂ /kWh
Liquid Fuels		
Motor Spirit (Gasoline)	70	251.9
Jet Kerosene	71.4	257
Other Kerosene	71.4	257
Gas/Diesel Oil	73.3	263.9
Residual Oil	76	273.6
LPG	63.7	229.3
Naphta	73.3	264
Petroleum Coke	98.9	334.5
Solid Fuels and Derivatives		
Coal	94.6	340.6
Milled Peat	116.7	420
Sod Peat	104	374.4
Peat Briquettes	98.9	355.9
Gas		
Natural Gas	56.9	204.7
Electricity (2011)	135.7	488.6

Carbon Emissions Table
published by the SEAI

Electricity generated in Ireland
produces 0.488 kg of CO₂ for
each kWh used.

**Eircom's Annual
Reduction in
Carbon Footprint
from energy
upgrades**

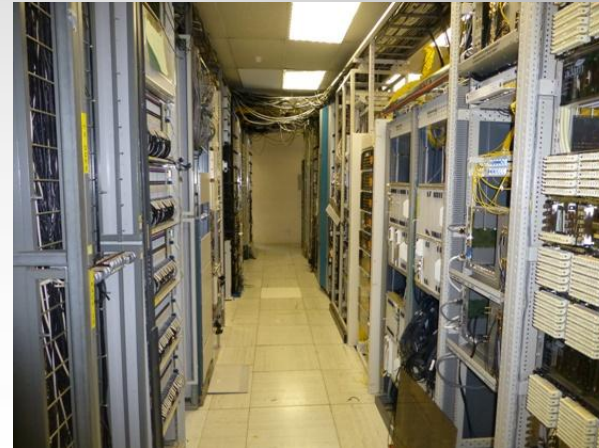
354.4

Tonnes

Site Photos



Free Air Fan



Typical Exchange



Downflow CRAC Units



Typical BMS MCC



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Site Photos



Unitary supply & exhaust



CRAC Room



CRAC Fresh Air
Conversion via
bespoke fresh air input
unit



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Thank You



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