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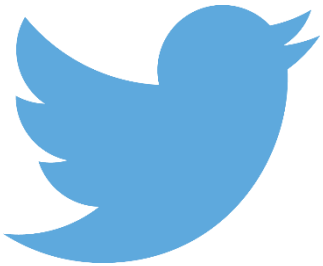

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Building Management Systems & Energy Management Software

By Alan Barber

APSE Associate

& Director of Salvis

SALVIS®

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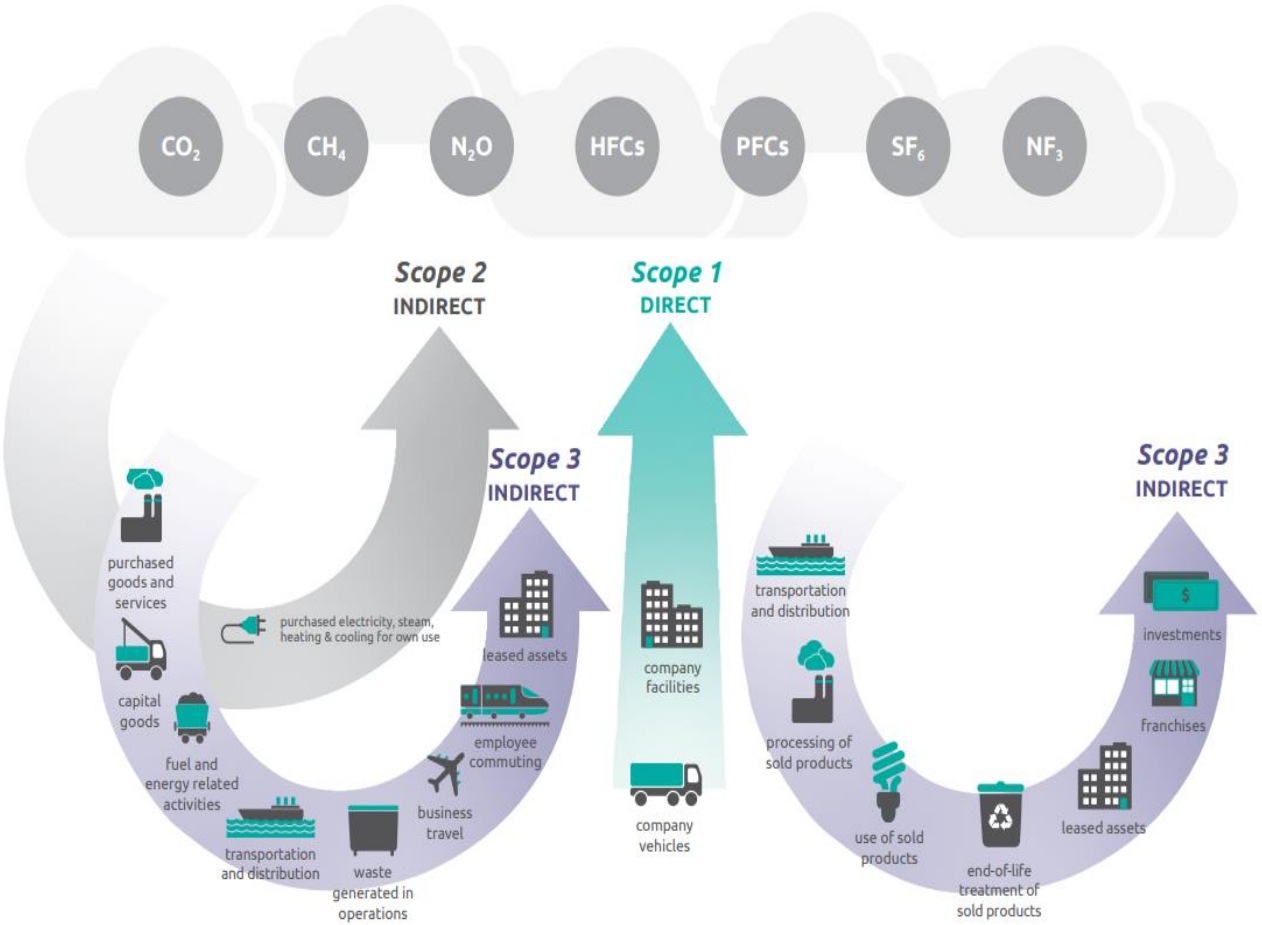
Emissions


CO_2
CH_4
N_2O
HFCs
PFCs
SF_6
NF_3
Scope 2
INDIRECT
Scope 1
DIRECT
Scope 3
INDIRECT
Scope 3
INDIRECT
purchased goods and services
capital goods
fuel and energy related activities
transportation and distribution
waste generated in operations
business travel
employee commuting
leased assets
purchased electricity, steam, heating & cooling for own use
company facilities
company vehicles
transportation and distribution
processing of sold products
use of sold products
end-of-life treatment of sold products
leased assets
franchises
investments

Importance of accurate and current data

- Tier 3 – Use metrics of consumption (kWh, volume, miles)
- Tier 2 – Expenditure
- Tier 1 – Estimate

Scope 1 and 2 - Calculating Emissions

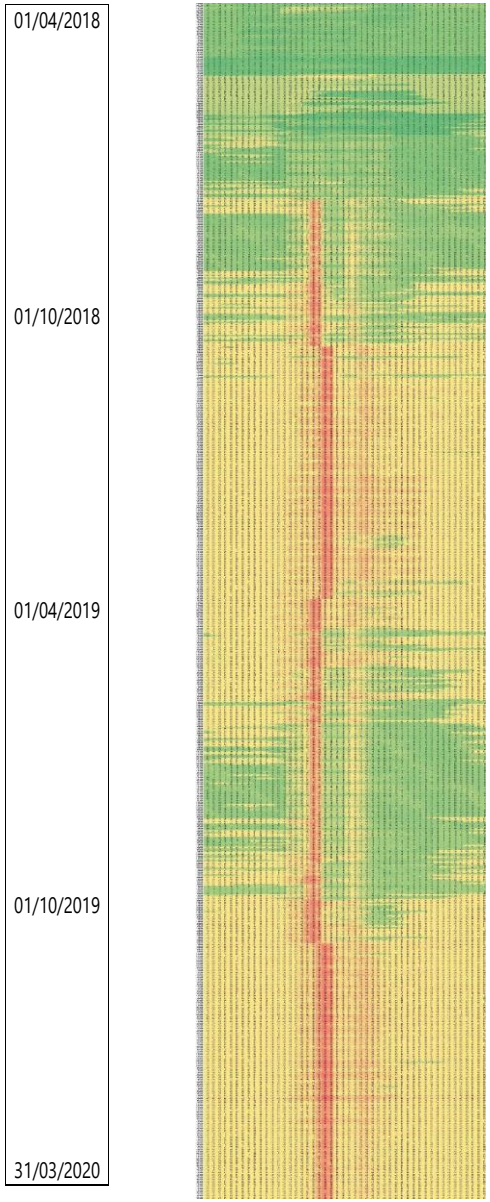
- Identify assets
  - kWh
  - Heat source
  - Energy expenditure
  - Floor area
- Council owned vehicles
  - Type of vehicle
  - Volume of fuel and mileage

Scope 3 - Calculating Emissions

- Water supply and wastewater
- Waste
- Contractors
- Staff travel
- Leased assets
- *The supply chain*

How to Store and Use Data

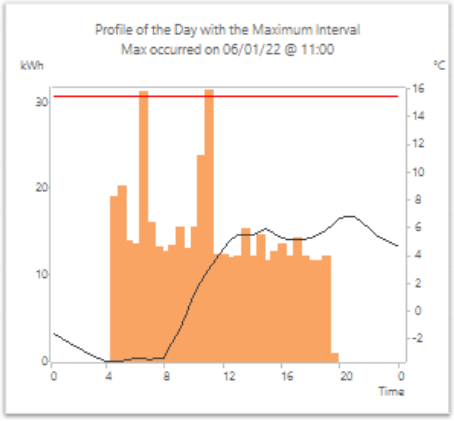
- Energy Management Software Vs. Excel
- Automatic Meter Readers (AMR)
- Building Management Systems (BMS)


01/04/2018
01/10/2018
01/04/2019
01/10/2019
31/03/2020

Automatic Meter Reader - Gas

Consumption	
Total (kWh)	13,048
Average Interval (kWh)	8.8
Maximum Interval (kWh)	31.4
Minimum Interval (kWh)	0.0

Temperature	
Average (°C)	4.0
Maximum (°C)	13.6
Minimum (°C)	-3.6
Heating Degree Days @ HBT of 15.5°C	348.4



Carry Out a Sense Check

- Check data for anomalies
- Check consumption period covers a full year
- Compare consumption against previous years
- Record large changes such as building closures, electrifying the fleet, water leaks, efficiency projects etc.

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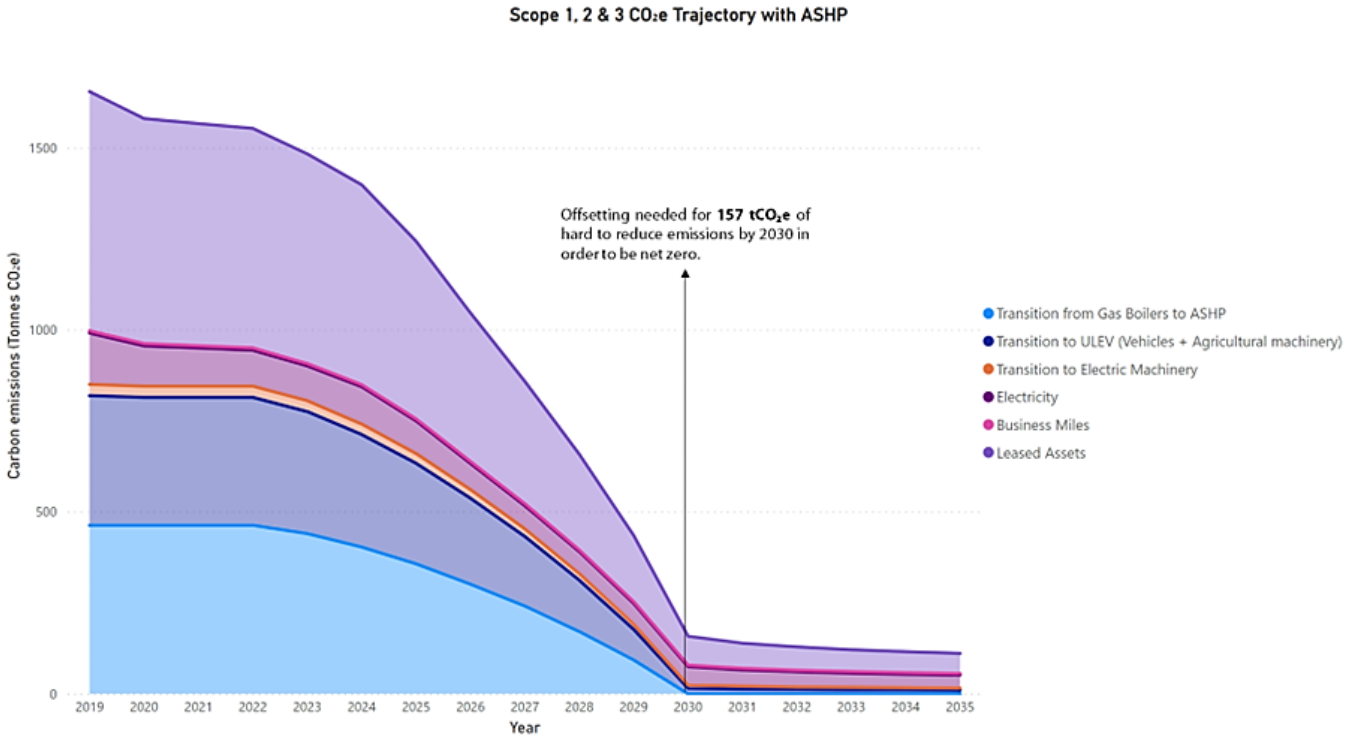
	Tonnes CO_2e								
Emissions	Reporting Year								Baseline Year
	Apr 2020 - Mar 2021	**Apr 2019 – Mar 2020**	**Apr 2018 – Mar 2019**	**Apr 2017 – Mar 2018**	**Apr 2016 – Mar 2017**	**Apr 2015 – Mar 2016**	**Apr 2014 – Mar 2015**	**Apr 2013 – Mar 2014**	**Apr 2008 – Mar 2009**
Scope 1 - Direct Emissions	**3312.9**	**5161.6**	**4963.0**	**4385.7**	**4468.8**	**4673.1**	**4707.3**	**5022**	**5829**
Natural Gas	2,393.1	3606.7	3378.2	2780.9	2811.2	*3051.7*	*3052.8*	*3340.3*	*4161.1*
Transport Fuels (operational)	919.8	1554.9	1565.2	1584.5	1631.1	*1499.1*	*1535.3*	*1549.9*	*1595.3*
Biomass (CO_2 outside of scope)	Decommissioned	Decommissioned	Decommissioned	2.2	5.0	2.3	1.7	4.5	0
Other Fuels	Decommissioned	Decommissioned	19.5	18.1	21.5	120	117.5	127.3	72.6
Refrigerant	Not Available	Not Available	Not Available	Not Available	Not Available	*Not Available*	*0*	*0*	*Not Available*
Scope 2 – Electricity Emissions	**2115.9**	**2645.7**	**2660**	**4182.3**	**5548.05**	**6671.6**	**6763.4**	**6771.5**	**8354.9**
Total Scope 1 & 2 Emissions	**5,429**	**7,807**	**7,623**	**8,568**	**10,017**	**11,345**	**11,471**	**11,793**	**14,184**
Scope 3 – Indirect Emissions	**644**	**806**	**859**	**991**	**1,080**	**1345.9**	**1489.4**	**1556.9**	**1510.6**
Gas – transmission emissions (WTT)	311	469	443	421	382	*414.3*	*409.8*	*448.4*	*363.4*
Fuel Oil – transmission emissions	*Decommissioned*	*Decommissioned*	5.0	4.1	3.9	*313.5*	*364.8*	*369.9*	*319.6*
Electricity – transmission	182	225	240	391	502	*500.9*	*591.4*	*592.1*	*601.6*
Biomass – transmission	*Decommissioned*	*Decommissioned*	*Decommissioned*	1.4	3.1	*1.4*	*2.3*	*6.1*	*Not Installed*
Water Supply	17	14	31	30	27	*57*	*60.6*	*58.1*	*115*
Water Treatment	33	26	60	58	53				
Business Travel by car	25	49	55	61	64	*45*	*47*	*67*	*111*
Business Travel by Train	Not Available	1.31	2.12	2.22	1.60	*2.1*	*1.9*	*1.8*	*Not Available*
Business Travel by Underground	Not Available	0.17	0.33	0.32	0.34	*0.3*	*0.3*	*0.2*	*Not Available*
Waste from Council operations	*74.35*	*20.87*	*20.88*	*20.94*	*41.40*	*8.5*	*8.5*	*recycling &waste 13.3*	*Not Available*
Recycling from Council operations	*1.43*	*1.13*	*1.13*	*1.15*	*1.11*	*2.9*	*2.8*	*As above*	*Not Available*
Total Gross Emissions	**6,073**	**8,613**	**8,482**	**9,559**	**11,096**	**12,691**	**12,960**	**13,350**	**15,694**
Carbon offset									
Hydro generated and exported	*15.9*	*12.0*	*47.7*	*59.7*	*74.6*	95.7	55.8	86.7	118.5
Total Net Emissions	**6,057**	**8,601**	**8,435**	**9,499**	**11,022**	**12,595**	**12,904**	**13,264**	**15,576**
Further Information									
Out of Scope									
Biomass (outside of scope)	*Decommissioned*	*Decommissioned*	*Decommissioned*	*60.1*	*134.6*	*62.9*	*51*	*133.9*	*Not Installed*
Renewable/CHP CO_2 avoided									
Generated electricity & consumed (CHP)	1.6	625	754	CHP not operational	CHP not operational	0	101	531	486
Biomass CO_2 offset						27.4	21.7	56.9	0
Solar PV generated and consumed on site	*15.1*	15.4	17.6	14.1	23.6	*35*	*37*	*40*	*Not Installed*
Degree Days at 15.5 ^{o}C	1875	1856	1757	1950	1974	1792.7	1885.7	1941.9	2016.8
(an indicator of heat demand)									
Summary of energy usage									
Total electricity kWh	9,075,558	10,350,984	9,396,811	11,885,691	13,464,504				
Total gas kWh	13,014,903	19,617,366	18,374,817	15,099,950	15,278,504				
Conversion Factors used above									
Electricity kWh to $kgCO_2e$	0.23314	0.2556	0.28307	0.35156	0.41205	0.49636	0.49426	0.49426	0.543
Gas kWh to kgCO2e	0.18387	0.18385	0.18396	0.18416	0.184	0.18407	0.184973	0.184973	0.206
Diesel litres to kgCO2e						2.661163	2.6024	2.6024	2.63
Gas transmission factor kgCO2e (WTT)	0.02391	0.02391	0.02413	0.02785	0.02499	0.02499	0.02483	0.02483	0.1799
Electricity transmission factor kgCO2e	0.02005	0.0217	0.02557	0.03287	0.03727	0.03727	0.04322	0.04322	0.0390982
Fuels – transmission factor kgCO2e (litres)	N/A	N/A	0.60122	0.60061	0.58484				
General Refuse to landfill to kgCO2e	458.2	99.8	99.8	100.1	199.0				
General Refuse to combustion to kgCO2e	21.3	21.4	21.4	21.8	21.0				
Biomass woodchip to kgCO2e	N/A	N/A	N/A	6.1	13.5				

Net Zero Trajectory



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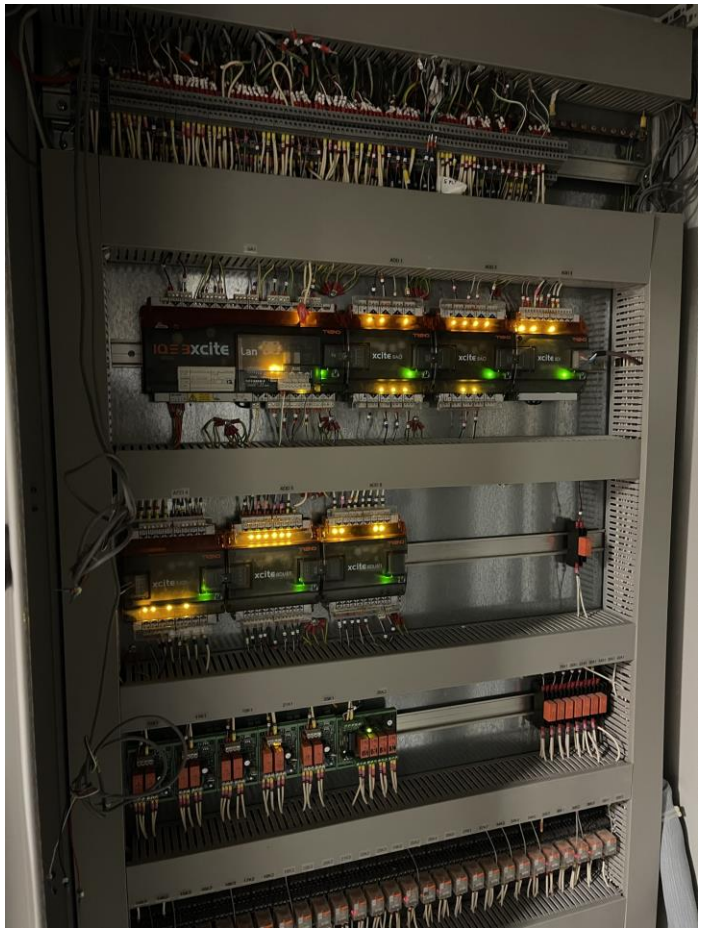
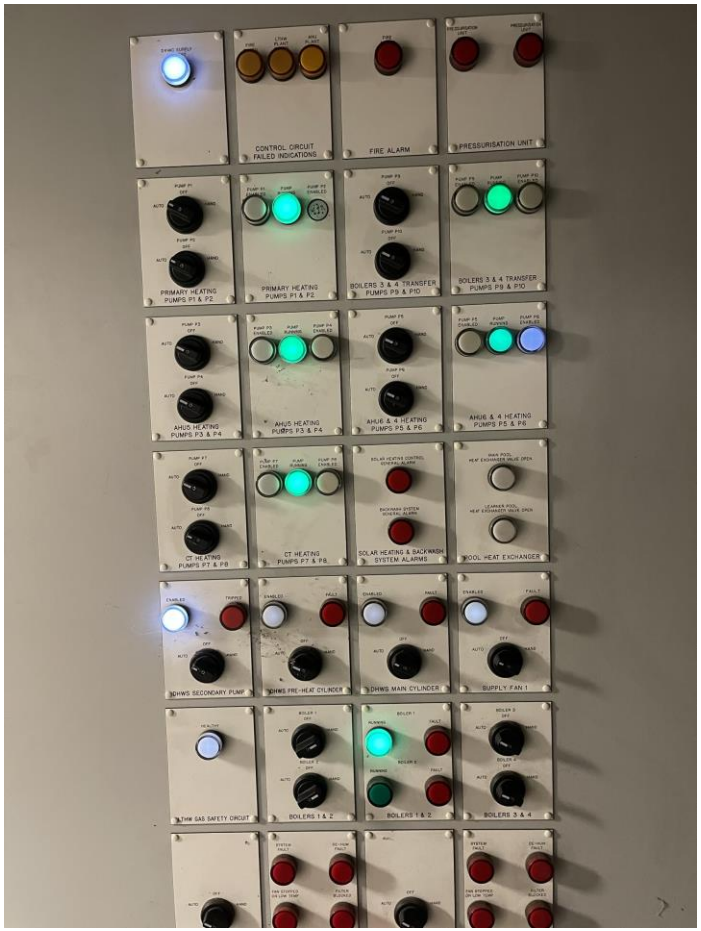
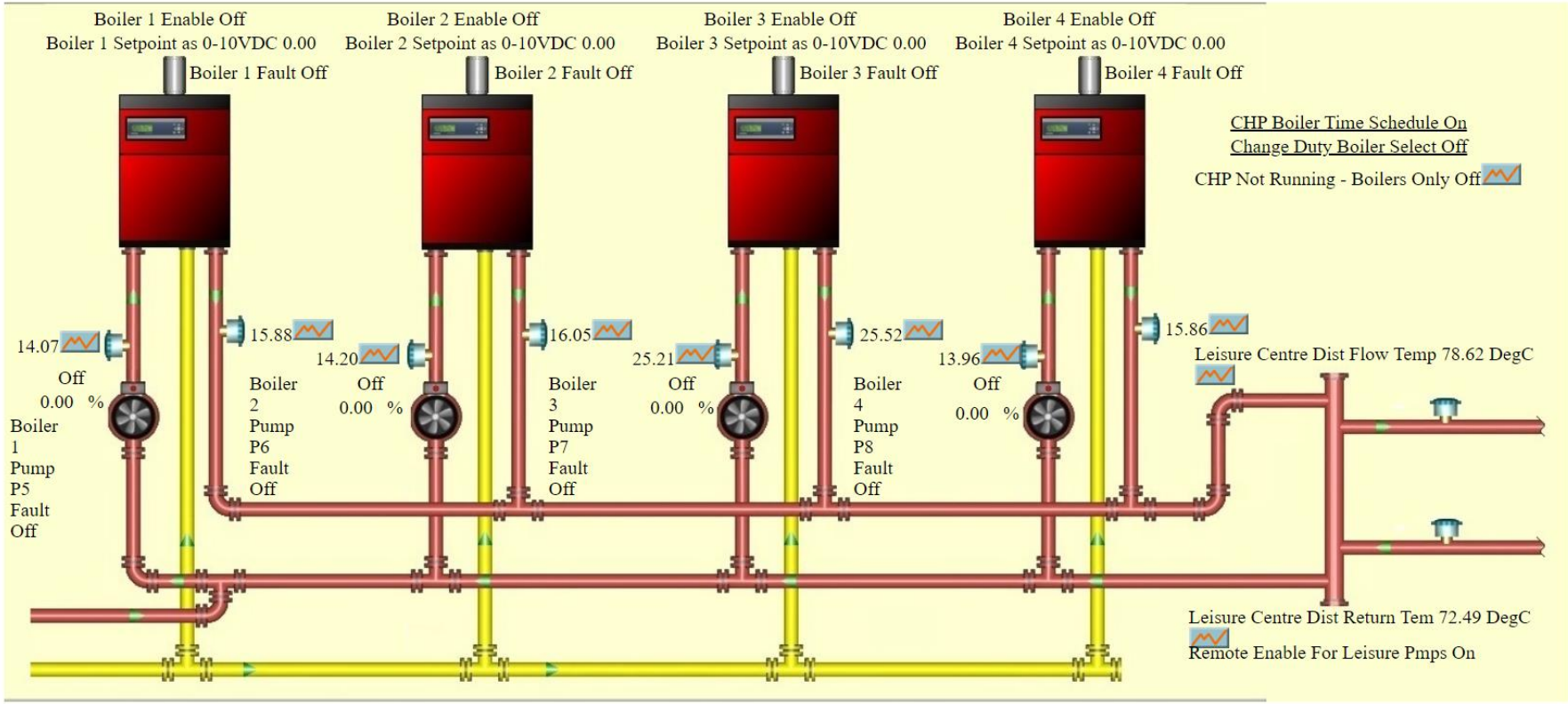
Building Management Systems






Boiler 1 Enable Off
Boiler 1 Setpoint as 0-10VDC 0.00
Boiler 1 Fault Off
Boiler 2 Enable Off
Boiler 2 Setpoint as 0-10VDC 0.00
Boiler 2 Fault Off
Boiler 3 Enable Off
Boiler 3 Setpoint as 0-10VDC 0.00
Boiler 3 Fault Off
Boiler 4 Enable Off
Boiler 4 Setpoint as 0-10VDC 0.00
Boiler 4 Fault Off
CHP Boiler Time Schedule On
Change Duty Boiler Select Off
CHP Not Running - Boilers Only Off
14.07
Off
0.00 %
Boiler 1 Pump P5 Fault Off
15.88
14.20
Off
0.00 %
Boiler 2 Pump P6 Fault Off
16.05
25.21
Off
0.00 %
Boiler 3 Pump P7 Fault Off
25.52
13.96
Off
0.00 %
Boiler 4 Pump P8 Fault Off
15.86
Leisure Centre Dist Flow Temp 78.62 DegC
Leisure Centre Dist Return Tem 72.49 DegC
Remote Enable For Leisure Pmps On

BMS Control Strategies

- Frost protection
- Fault alarms
- Energy excess alarms
- Timed control and Optimum Start/ Stop
- High Outside Ambient Limit
- Remote Monitoring and Control

The benefits of well-maintained EMS and BMS

- Access to instantaneous data
- Time saving
- Identify anomalies
- Remote monitoring
- Automatic control
- Compare performance of:
  - Whole estate
  - Individual buildings

The Net Zero Journey

- Get your data and estate in order
- Calculate emissions
- Do a Net Zero trajectory
- Carry out on-site energy audits
- Engineering design
- Procurement
- Installation
- Measurement and verification

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