

Table 5 – Plant and Thermal store sizing

DOMESTIC				
Gas CHP sizing				
Minimum total heat demand required per month	66852 kWh	September		
Heating delivery efficiency (including storage)	80%			
Heat input to system	83565			
Minimum total heat demand required per day	2786 kWh			
Estimated CHP run time per day	16 hours			
CHP operation days	365 days			
CHP Run time per year	5840 hours			
CHP thermal output	174 kWth			
Thermal efficiency	52%			
Electrical efficiency	33%			
CHP electrical output	110 kWel			
Annual gas consumption	1,955,214 kWh			
Heat generated	1,016,712			
Useful heat supplied	813,369			
Electricity output	645,221			
Back-up gas boiler sizing				
Domestic hot water	35 kW	per dwelling (assumed)		
Domestic Space heating	1.5 kW	per dwelling (assumed)		
Non-domestic	0.08 kW	per m2 (assumed)		
Peak heat demand domestic	14345 kW			
Peak heat demand non-domestic	0 kW			
TOTAL PEAK DEMAND - INDIVIDUAL	14345 kW			
Diversity	15%			
TOTAL PEAK DEMAND - INCLUDING DIVERSITY	2152 kW			
Design margin	10%			
Boiler size	2367 kW			
Biomass boiler sizing				
Total max heat demand required per month	104438 kWh			
Heating delivery efficiency (including storage)	80%			
Heat input to system	130548			
Minimum total heat demand required per day	4211 kWh			
Estimated Biomass boiler run time per day	8 hours			
Design margin	10%			
Boiler size	579 kW			
Thermal store sizing				
CHP and Biomass boiler capacity	753 kW			
Peak demand	2152 kW			
Shortage of demand	1399 kW			
Peak demand period	2.5 hours	Assumed		
Energy demand required to store	3496 kWh			
Specific heat capacity	0.001167 kWh/kg/K			
Htg F	85 degC			
Htg R	45 degC			
delta T	40 degC			
	One Store	Two stores		
Volume required	74922 litres	37461	37461	
Thermal store size	75 m3	37	37	
Height of store	6.0 m	5	5	
Diameter of store	3.99 m	3.09	3.09	

NON-DOMESTIC

Gas CHP sizing

Minimum total heat demand required per month	14996 kWh	September
Heating delivery efficiency (including storage)	80%	
Heat input to system	18745	
Minimum total heat demand required per day	625 kWh	
Estimated CHP run time per day	16 hours	
CHP operation days	365 days	
CHP Run time per year	5840 hours	
CHP thermal output	39 kWth	
Thermal efficiency	52%	
Electrical efficiency	33%	
CHP electrical output	25 kWel	
Annual gas consumption	438,596 kWh	
Heat generated	228,070	
Useful heat supplied	182,456	
Electricity output	144,737	

Back-up gas boiler sizing

Domestic hot water	35 kW	per dwelling (assumed)
Domestic Space heating	1.5 kW	per dwelling (assumed)
Non-domestic	0.08 kW	per m2 (assumed)
Peak heat demand domestic	0 kW	
Peak heat demand non-domestic	394.8 kW	
TOTAL PEAK DEMAND - INDIVIDUAL	395 kW	
Diversity	80%	
TOTAL PEAK DEMAND - INCLUDING DIVERSITY	316 kW	
Design margin	10%	
Boiler size	347 kW	

Biomass boiler sizing

Total max heat demand required per month	27945 kWh
Heating delivery efficiency (including storage)	80%
Heat input to system	34931
Minimum total heat demand required per day	1127 kWh
Estimated Biomass boiler run time per day	8 hours
Design margin	10%
Boiler size	155 kW

Thermal store sizing

CHP and Biomass boiler capacity	194 kW	
Peak demand	316 kW	
Shortage of demand	122 kW	
Peak demand period	2.5 hours	Assumed
Energy demand required to store	305 kWh	
% of max output to charge thermal store	35%	
Thermal store recharge	8 hours	Assumed
Energy from % of max output to charge thermal store	341 kWh	
Specific heat capacity	0.001167 kWh/kg/K	
Htg F	85 degC	
Htg R	45 degC	
delta T	40 degC	
	One Store	Two stores
Volume required	6528 litres	3264 3264
Thermal store size	7 m3	3 3
Height of store	6.0 m	5 5
Diameter of store	1.18 m	0.91 0.91

SCHOOL

Gas CHP sizing

Minimum total heat demand required per month	11466 kWh	September
Heating delivery efficiency (including storage)	80%	
Heat input to system	14333	
Minimum total heat demand required per day	478 kWh	
Estimated CHP run time per day	16 hours	
CHP operation days	365 days	
CHP Run time per year	5840 hours	
CHP thermal output	30 kWth	
Thermal efficiency	52%	
Electrical efficiency	33%	
CHP electrical output	19 kWel	
Annual gas consumption	335,356 kWh	
Heat generated	174,385	
Useful heat supplied	139,508	
Electricity output	110,668	

Back-up gas boiler sizing

Domestic hot water	35 kW	per dwelling (assumed)
Domestic Space heating	1.5 kW	per dwelling (assumed)
Non-domestic	0.08 kW	per m2 (assumed)
Peak heat demand domestic	0 kW	
Peak heat demand non-domestic	201.6 kW	
TOTAL PEAK DEMAND - INDIVIDUAL	202 kW	
Diversity	100%	
TOTAL PEAK DEMAND - INCLUDING DIVERSITY	202 kW	
Design margin	10%	
Boiler size	222 kW	

Biomass boiler sizing

Total max heat demand required per month	18024 kWh
Heating delivery efficiency (including storage)	80%
Heat input to system	22530
Minimum total heat demand required per day	727 kWh
Estimated Biomass boiler run time per day	8 hours
Design margin	10%
Boiler size	100 kW

Thermal store sizing

CHP and Biomass boiler capacity	130 kW		
Peak demand	202 kW		
Shortage of demand	72 kW		
Peak demand period	2.5 hours	Assumed	
Energy demand required to store	180 kWh		
% of max output to charge thermal store	35%		
Thermal store recharge	8 hours	Assumed	
Energy from % of max output to charge thermal store	201 kWh		
Specific heat capacity	0.001167 kWh/kg/K		
Htg F	85 degC		
Htg R	45 degC		
delta T	40 degC		
	One Store	Two stores	
Volume required	3847 litres	1923	1923
Thermal store size	4 m3	2	2
Height of store	6.0 m	5	5
Diameter of store	0.90 m	0.70	0.70