tga Consulting Engineers

TGA Building Energy Optimisation and Decarbonisation Study Capability

February 2025

- **Create a pathway to Net Zero Carbon**
- **Reduce Running Costs**
- **Improve Thermal Comfort**

Why?

Often the route taken in decarbonising a building is to replace fossil fuelled heat generation (typically gas or oil boilers) with heat pumps (typically Air Source Heat Pumps). This can be the right approach for some buildings, but can cause issues with running costs, thermal comfort and unnecessary risk in others (including electrical infrastructure and incoming supplies).

Performing energy modelling at the early stages of a project can allow the impact of building optimisation and interventions, including radiator upgrades and demand reduction, to be tested and quantified. The result can be significant in terms of performance (Table 1) and the impact on capital costs can result in an overall saving (**Error! Reference source not found.**) due to the demand on and the size of heat pumps required being reduced.

Table 1 Example of Performance Against Key Targets of a Recent Project

Target	ASHP	ASHP + Radiator Upgrade	ASHP + Radiator Upgrade + Demand Reduction
Pathway to Net Zero Carbon:	✓	✓	✓
Capital Costs:	✓	✗	✓
Reduced Running Costs:	✗	✓	✓
Achieve Thermal Comfort:	✗	✓	✓
Reduce Risk:	✗	✓	✓

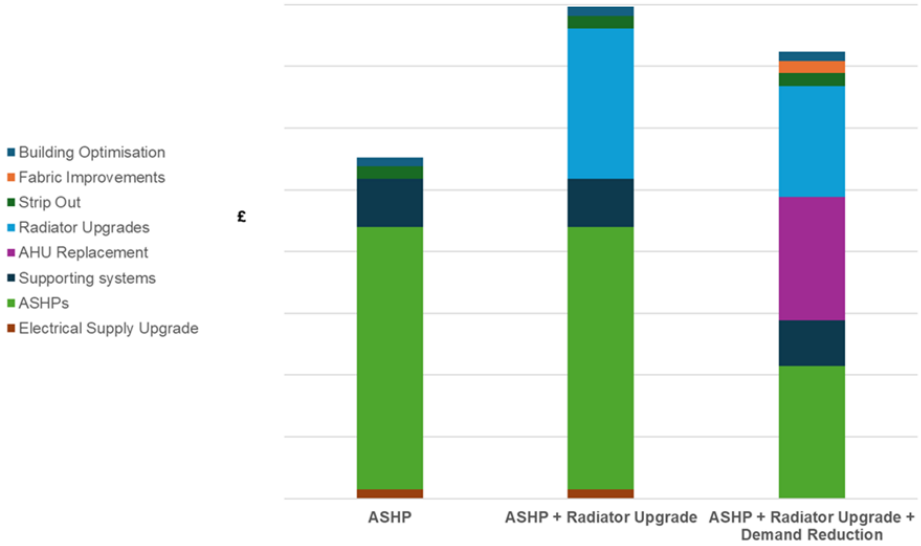


Figure 1 Example Capital Costs of a Recent Project

1. Newcastle City Council PSDS Discovery Museum (Image Credit – Discovery Museum), 2. Durham University LCSF, 3. Crook Civic Centre Durham County Council (Image Credit – Bryan Richardson), 4. Boldon House Durham University, 5. DLI Durham County Council, 6. KGVI Building Newcastle University (Image Credit – GSS Architecture)

Table 2 Example TGA Simplified Energy Calculation Results of a Recent Project

	ASHP	ASHP + Radiator Upgrade	ASHP + Radiator Upgrade + Demand Reduction
Capital Cost[1]	£550,000	£800,000 (increase £250,000)	£720,000 (increase £170,000)
Heat Require[2]	240 kW	240 kW	160 kW
Heating Temperature	80/70	60/40	60/40
Radiator Output	160 kW	210 kW	170 kW
SCOP[3]	1.8	2.7	2.7
Annual AHSP Heating Energy[4]	270,000 kWh	180,000 kWh	85,000 kWh
Annual AHSP Heating Cost[4,5]	£55,000	£35,000 (saving £20,000)	£15,000 (saving £40,000)
Simple Payback		13 years	5 years

1. Capital Cost excludes preliminaries, profit and contingency
2. Space heating (excludes fresh air load on AHUs and DHW)
3. Calculated based on COPs at desired output temperatures and hourly weather data
4. Addition energy and cost savings will be achieved as a result of improved fan and pump efficiency
5. Electricity @20p/kwh

How & How Much?

TGA's Simplified Energy Calculation allows TGA's Net Zero Carbon 10 Point Plan to be implemented at the early stages of a project (or even before a project is realised).

The aim of the calculation is that it is a relatively quick process (for a simple building it could be around a day to survey, plus a day of calculation per building – which will then give the output). More complex buildings can also be assessed, as well as multiple buildings being combined to represent an estate and sitewide strategy.

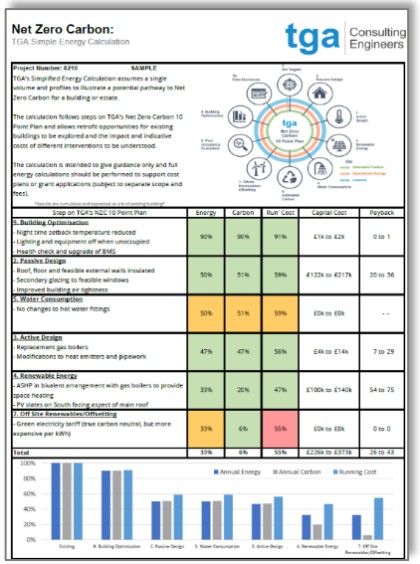


Figure 1 Output from TGA's Simplified Energy Calculation

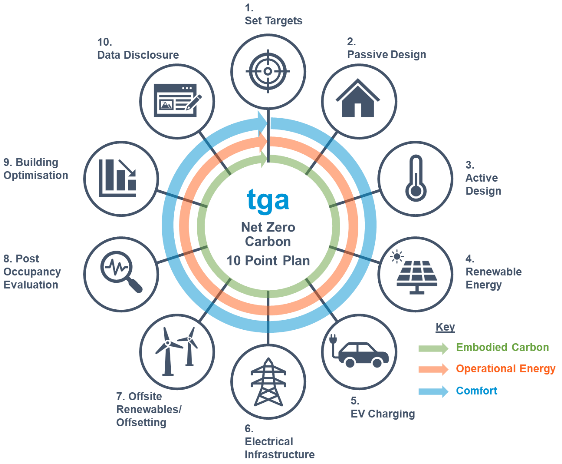


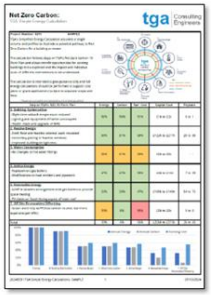
Figure 2 TGA's Net Zero Carbon 10 Point Plan

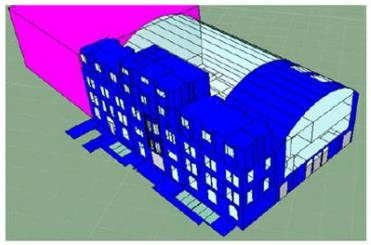
7. St Anne's Church, Historic England/Durham County Council, 8. Salford Cathedral, 9. Portsmouth Cathedral, 10. Durham Cathedral, 11. Beverly Minster, 12. Newcastle Cathedral

When?

The calculation can be performed at RIBA Stage 1 and could be a project enabler. The intention would be that more detailed energy modelling would be performed from late RIBA 2/early RIBA 3.

	Week	NZC Plan Activities	Design Team Workshop	Client Workshop	Tasks
RIBA Stage 1	1	1. Set Targets	Propose Project Targets		Construct Building Geometry in Sketchup
	2				
	3			Agree Project Targets	Develop IES Virtual Environment Dynamic Thermal Model
	4	2. Passive Design	Propose Fabric Interventions		Perform Fabric Improvements Loads and Annual Energy Calculations
	5				
RIBA Stage 2	6			Agree Fabric Interventions	
	7	3. Active Design	Propose HVAC Active Interventions		Perform Active Design Loads and Annual Energy Calculations
	8				
	9				
	10			Agree HVAC Interventions	Propose Active Design Improvements
	11				
	12				
	13	4. Renewable Energy	Propose Renewable Options		
	14			Agree Renewable Options	Propose Renewable Technologies





Who?

TGA Consulting Engineers operate in an integrated team with the Building Performance Engineers working directly together with Mechanical and Electrical Engineers (together with BIM Technicians and Specialist Lighting Designers where required). TGA work nationally with offices in 5 locations.

Figure 3 TGA's Integrated Building Services Structure

Figure 4 TGA Offices

13. Durham Miners Hall, 14. Raby Rising, 15. Royal Horticultural Society, 16. Hitachi Rail, 17. Morrison Busty, 18. Farne Islands National Trust

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