ESOS Phase II Energy Audit

Taylor Wimpey plc

STATUS: FINAL FOR RETENTION IN EVIDENCE PACK

29 November 2019

ESOS Phase II Energy Audit

Prepared for:
Ian Heasman
Director of Sustainability
Taylor Wimpey Plc
Gate House
Turnpike Road
High Wycombe
HP12 3NR

Tel: 07816 514 342
E-mail: Ian.Heasman@taylorwimpey.com

Prepared by:
Graham Hunter, BEng, PGDip
Associate, Business Services
Carbon Trust Advisory Limited
4th Floor, Dorset House
27-45 Stamford Street
London
SE1 9NT

Tel: +44 (0)7725 421883
E-mail: graham.hunter@carbontrust.com

ESOS Lead Assessor details:
Stroma Certification Ltd – ESOS Lead Energy Assessor certification
Lead Assessor ID: STR101147

NOTE
Unless otherwise stated, the energy consumption data contained in this report relates to the chosen ESOS Phase II 12 month reference period 1 Jan 2018 – 31 Dec 2018

Document Quality Review

The Carbon Trust is an independent, expert partner of leading organisations around the world, helping them contribute to and benefit from a more sustainable future through carbon reduction, resource efficiency strategies and commercialising low carbon technologies.

As a mission driven company, we strive to deliver a first class service to our clients to enable them to take action to reduce their environmental impact and make business sense of climate change. As part of our commitment to delivering a high quality service, this report has been checked and approved for issue as recorded below:

	REPORT AUTHOR & LEAD ASSESSOR:	**APPROVED FOR ISSUE:**
SIGNATURE:		
NAME:	Graham Hunter	Dominic Burbridge
POSITION:	Associate, Business Services	Associate Director, Business Services
DATE:	29/11/2019	29/11/2019
TELEPHONE:	07725 421883	07738 195106

Section

Executive summary

- This energy audit report summarises the energy saving potential across Taylor Wimpey sites based on energy audits conducted at six sample sites; Meadowsweet Farm (Leamington Spa), Hamlet Woods (Prescot), St Andrews Gardens (Morpeth), Torrance Gardens (Motherwell), Chy An Dowr (Falmouth), and Kilnwood Vale (Crawley).
- All six sites are residential new builds of 1-5 bed houses or flats ranging from 91 to 225 units per site. These sites were selected to provide a representation of typical developments operated by Taylor Wimpey.
- During the ESOS reference period, Taylor Wimpey used 90.7GWh of energy, equating to a ~£6.6m spend.
- The standard of formal energy management systems and observed energy efficiency during the site audits were adjudged to be 'GOOD'.
- A number of cost effective energy saving opportunities were identified during the audits, namely:

ENERGY SOURCE	REF	DESCRIPTION	SAVINGS (KWH)	SAVINGS (£)
Electricity (compound)	R1	Improved energy management, metering and zoning control	262,413	£35,843
	R2	Optimise heating controls	393,619	£47,234
	R3	Upgrade lighting to LED with controls	159,359	£21,767
	R4	Drying room dehumidification	785,628	£107,308
	R5	Install temporary solar PV system	48,600	£5,832
Electricity (show home and plots)	R1	Improved staff engagement	375,861	£51,338
Natural gas (show home and plots)	R1	Heating control optimisation	2,143,728	£65,210
	R2	Hot water optimisation	1,339,830	£40,756
Gas oil (generators)	R1	Early grid connection	5,524,784	£598,886
	R2	Use of hybrid generators	2,762,392	£209,610
Gas oil (mobile plant)	R1	Improved data management	775,615	£58,854

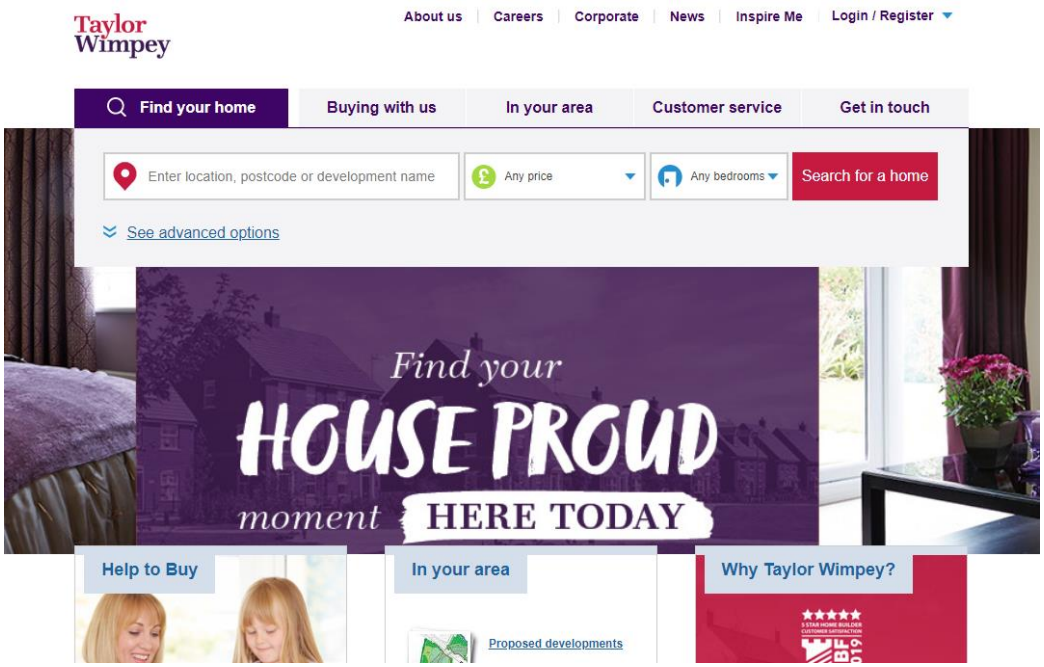
- Implementation of recommendations will reduce annual energy consumption by 14.6GWh (16%) and energy costs by £1.2m, and may be achieved mostly through internal time and marginal increases in site procurement/hire costs.

Section

1. Executive summary
2. Background to energy audit and audit methodology
3. Review of existing energy policy, strategy, audits & operational plans
4. Data analysis
5. Energy saving opportunities
6. Appendices

About Taylor Wimpey

https://www.taylorwimpey.co.uk/



- Taylor Wimpey are one of the UK's leading housebuilding and construction companies. They build houses on new sites across the country, typically 1-5 bedroom houses with multiple units on a single site.
- Sites typically have a small compound with cabin complex containing offices and site welfare (drying room, canteen, toilet block, etc..) powered from a mains electricity connection or diesel generators during early works. The majority of site cabins are owned by Taylor Wimpey and plant (generators, mortar silos, forklifts, tele handlers, etc..) are either hired or are the responsibility of sub-contractors.
- Other energy use on site is typically in the show homes (including sales offices) and in plots prior to customer hand-over.
- The audit sample includes sites in Scotland, the North East, the North West, the Midlands, the South West and South East of the UK to provide a geographic spread and a fair representation of a typical Taylor Wimpey site.

About the Carbon Trust

Our mission is to accelerate the move to a sustainable, low carbon economy

- We work with governments, multilateral organisations, businesses and the public sector, helping them contribute to and benefit from a more sustainable future
- We cut through uncertainty to provide insights that support better decisions
- We design and manage projects that overcome financial and behavioural barriers
- We recognise clients through assurance and certification of positive outcomes

ESOS Phase II energy site audit methodology

Approach:

The Carbon Trust conducted a comprehensive energy audit of the six Taylor Wimpey sites to :

- Review existing energy data over the reference period in order to understand energy demand at the site
- Systematically review all major energy using systems e.g. cabin lighting, heating, drying rooms, kitchen/catering equipment, bulk fuel usage as well as the standard of staff awareness & engagement
- Assess whether the provision of existing energy using systems are currently fully optimised
- Advise on how best to improve energy management standards and maximise energy cost savings
- Review the opportunity and cost benefit of implementing appropriate renewable energy technologies

Methodology & Key Deliverables:

The audit was conducted with reference to BS EN 16247-1:2012 and by drawing on the Carbon Trust's proprietary IP and experience of having managed and conducted over 35,000 energy audits since 2001. The audit included:

- A full review of energy data and performance with spot-checks to validate summary data to its original source
- A site visit by an experienced engineer to review the standard of energy management and identify opportunities to improve energy performance at the site (see Appendix A)

Report:

This report represents the audit findings and is presented in the Carbon Trust proprietary format which has been developed specifically to be engaging, accessible and to encourage implementation of recommendations. Additionally:

- As preferred under ESOS, life cycle cost analysis has been provided for all significant capital investment measures

Data and information sources

- We are grateful for the support provided throughout the conduct of the audit and assessment by Ian Heasman, Director of Sustainability, Taylor Wimpey, Dr Anthony Lavers, Sustainability Analyst, Taylor Wimpey, Andrew Read, Managing Director, AJR Management, and site management teams during the audits.

- Energy data records for each audited site were provided by AJR Management, a utility management company who manage and maintain records of energy consumption for each site on behalf of Taylor Wimpey. It was noted during the site audits that site management typically have very little (if any) visibility of site energy consumption.
- The following slides contain details of the approach taken to determine energy consumption for each of the sites visited during this audit programme, with explanations provided where estimates have been made.
- Folders containing source information obtained from each of the sites are held in the ESOS compliance pack for reference.

Data and information sources

Site: Meadowsweet Farm, Leamington Spa

Contact: Andrew Tromans, Site Manager

Energy source	Information available for audit
Electricity – grid to compound	No grid electricity connection at site during the ESOS reference period. Grid connection only recently established (on site Feb 2018), meter reading taken during site audit on 10/10/19.
Electricity – grid to show homes and plots	No grid connection until Q4 of 2018. Consumption for Q4 extrapolated to establish show home and plot consumption over a 12-month period and cross-checked against consumption modelled from site audit observations.
Natural gas – grid to show homes and plots	No consumption recorded until Q4 of 2018. Consumption for Q4 extrapolated to establish show home and plot consumption over a 12-month period – taking account of seasonal variations.
Gas oil	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant. Estimates for cabin electricity demand were therefore made by the lead assessor based on site audit observations in order to establish the fuel split between generator and plant use.

Data and information sources

Site: Hamlet Woods, Prescot

Contact: Paul Morris, Senior Site Manager

Energy source	Information available for audit
Electricity – grid to compound	No grid electricity connection at site during the ESOS reference period. Compound electricity provided via generator.
Electricity – grid to show homes and plots	No records of consumption during the ESOS reference period.
Natural gas – grid to show homes and plots	No records of consumption during the ESOS reference period.
Gas oil	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant. Estimates for cabin electricity demand were therefore made by the lead assessor based on site audit observations in order to establish the fuel split between generator and plant use.

Data and information sources

Site: St Andrew's Gardens, Morpeth

Contact: Stuart Fenwick, Site Manager

Energy source	Information available for audit
Electricity – grid to compound	Consumption figure for the reference period 01/01/18 to 31/12/18 provided by AJR Management. Compound was grid connected throughout 2018, however, compound has since been moved and new grid connection yet to be established. Meter box checked during site audit on 30/10/19 and found to be empty.
Electricity – grid to show homes and plots	Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Natural gas – grid to show homes and plots	Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Gas oil	No records of consumption during the ESOS reference period.

Data and information sources

Site: Torrance Gardens, Motherwell

Contact: Alan Meek, Senior Site Manager

Energy source	Information available for audit
Electricity – grid to compound	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Electricity – grid to show homes and plots	Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Natural gas – grid to show homes and plots	Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Gas oil	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant. Estimates for cabin electricity demand were therefore made by the lead assessor based on site audit observations in order to establish the fuel split between generator and plant use.

Data and information sources

Site: Kilnwood Vale, Crawley

Contact: Nathan Carrick, Senior Surveyor

Energy source	Information available for audit
Electricity – grid to compound	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Electricity – grid to show homes and plots	Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Natural gas – grid to show homes and plots	Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.
Gas oil	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant. Estimates for cabin electricity demand were therefore made by the lead assessor based on site audit observations in order to establish the fuel split between generator and plant use.

Data and information sources

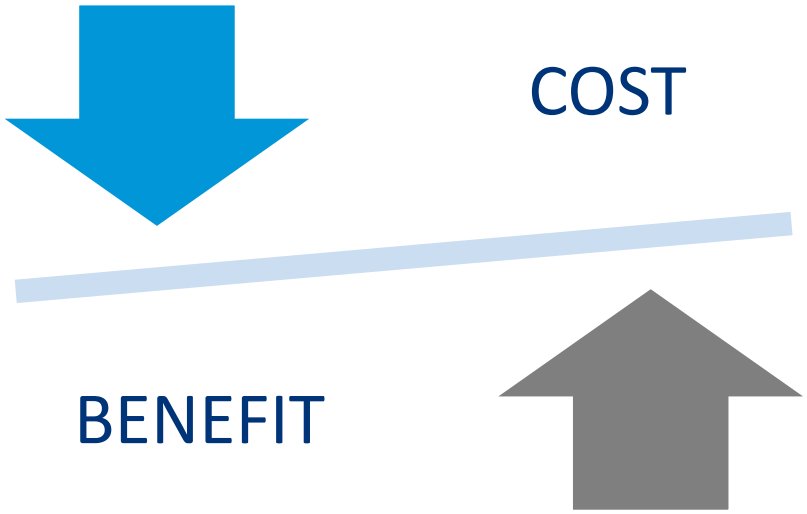
Site: Chy An Dowr, Falmouth

Contact: Ben Noakes, Site Manager

Energy source	Information available for audit
Electricity – grid to compound	No grid electricity connection at site during the ESOS reference period.
Electricity – grid to show homes and plots	No records of consumption during the ESOS reference period.
Natural gas – grid to show homes and plots	No records of consumption during the ESOS reference period.
Gas oil	Consumption figure for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant. Estimates for cabin electricity demand were therefore made by the lead assessor based on site audit observations in order to establish the fuel split between generator and plant use.

Investment criteria

- At each of the sites visited, most cabins were owned by the Taylor Wimpey business unit and these present the key opportunity for CAPEX investment for energy efficiency
- Generators and mobile plant were either hired as required, or were the responsibility of sub-contractors (e.g. ground workers) therefore offering little opportunity for investment
- Equally, plots and show homes are built for sale to customers so will not offer potential for investment
- The opportunities identified in the report will focus on optimising the use of existing equipment on site, site set-up and procurement practices to ensure that future Taylor Wimpey operations can be as optimised as possible
- For the purpose of conducting the life cycle cost analysis for capital investment in the cabins and compound we have used a discount rate of 6%



Section

1. Executive summary
2. Background to energy audit and audit methodology
3. Review of existing energy policy, strategy, audits & operational plans
4. Data analysis
5. Energy saving opportunities
6. Appendices

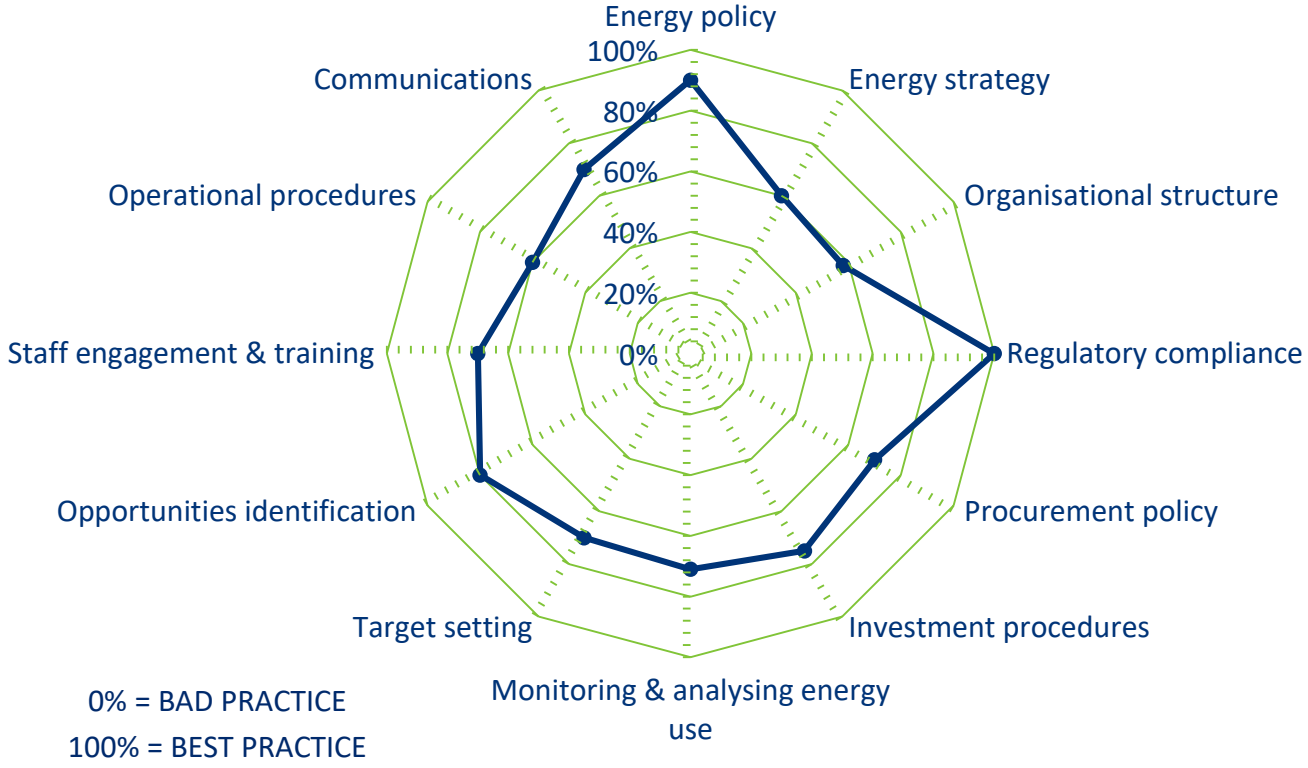
Energy Management high-level assessment

- The table below summarises the auditors' high-level assessment of key aspects of energy management efforts at Taylor Wimpey
- Subsequent slides provide more detail and make recommendations on how performance can be improved

LEVEL	ENERGY POLICY	ORGANISING	TRAINING	PERFORMANCE MEASUREMENT	COMMUNICATION	INVESTMENT
4	Energy Policy, Action Plan and regular reviews have active commitment of top management	Fully integrated into senior management structure with clear accountability for energy consumption	Appropriate and comprehensive staff training tailored to identified needs, with evaluation	Comprehensive performance measurement against targets with effective management reporting	Extensive communication of energy issues within and outside of organisation	Resources routinely committed to energy efficiency in support of organisational objectives
3	Formal policy but falls short of best practice i.e. written; reviewed annually; supported by detailed strategy	Clear line management accountability for consumption and responsibility for improvement	Energy training targeted at major users following training needs analysis	Weekly performance measurement for each process, unit, or building	Regular staff briefings, performance reporting and energy promotion	Same appraisal criteria used for energy efficiency as for other cost reduction projects
2	Un-adopted policy	Some delegation of responsibility but line management and authority unclear	Ad-hoc internal training for selected people as required	Monthly monitoring by fuel type	Some use of organisational communication mechanisms to promote energy efficiency	Low or medium cost measures considered if short payback period
1	An unwritten set of guidelines	Informal, mostly focused on energy supply	Technical staff occasionally attend specialist courses	Invoice checking only	Ad-hoc informal contacts used to promote energy efficiency	Only low or no cost measures taken
0	No explicit energy policy	No delegation of responsibility for managing energy	No energy related staff training provided	No measurement of energy costs or consumptions	No communication or promotion of energy issues	No investment in improving energy efficiency

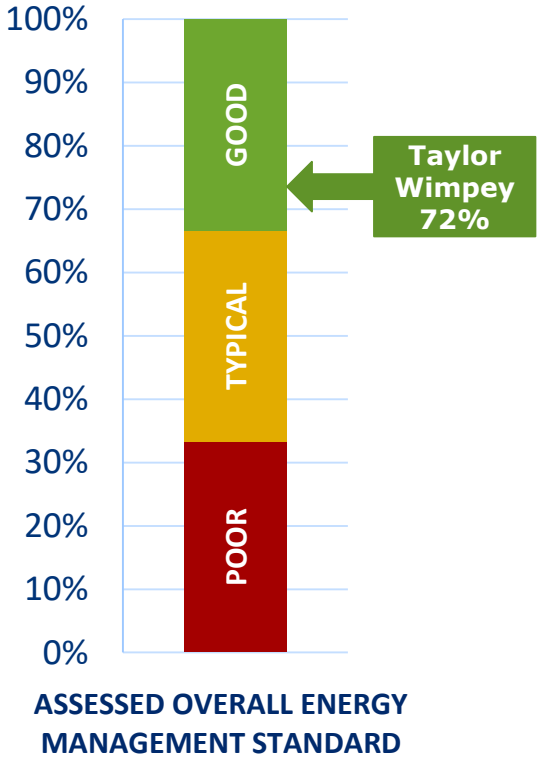
Energy management assessment

- Overall the standard of energy management systems at Taylor Wimpey is assessed as being “GOOD”.
- As can be seen in the radar diagram below there is scope for improvement across a number of important areas including: policy; responsibilities; opportunities identification; operational procedures; energy analysis; staff engagement & training and communications.
- The following slides provide further detail on the characteristics associated with energy management best practice highlighting areas for improvement.



0% = BAD PRACTICE

100% = BEST PRACTICE



ASSESSED OVERALL ENERGY MANAGEMENT STANDARD

Energy management best practice [1/5]

- Inculcating best practice energy management structures, policies and procedures ensures that energy is treated as a controllable resource, managed proactively and that energy wastage is minimised.
- Taylor Wimpey adhere to some of these practices to some degree however each of the following aspects should be reviewed and where necessary improved policies, procedures and practices developed and implemented.
- Taylor Wimpey should take appropriate and proportional action to ensure existing systems are operated as efficiently as possible and that opportunities to procure more efficient equipment/systems are realised when necessary and planned purchases occur.

CATEGORY	EXPECTED CHARACTERISTICS
Energy policy	A written energy policy (may be part of an environmental or sustainability policy); Agreed by senior management; Communicated to all employees; Recently written, or reviewed and revised (within 3 years); Contains a commitment to the development / deployment of quantitative improvement targets; Contains a commitment to annual reporting (public or to all employees); Includes a date for review / revision. *Taylor Wimpey have not established a stand-alone energy policy, however their Sustainability, HSE, and Climate policies include many of the criteria of a good energy policy. Taylor Wimpey could benefit from developing a separate energy policy that succinctly states the company's commitment to better manage and reduce energy consumption and detail SMART quantitative improvement targets.*
Energy strategy	A written group level strategy document consistent with the energy policy; Agreed by senior management; Includes a live Action Plan for implementation; Includes a date for review/revision. *The absence of an up-to-date energy strategy document for the company is a weakness in Taylor Wimpey's energy management efforts and this should be updated, giving expression to targets, time-frames, procedures, plans and responsibilities.*

Energy management best practice [2/5]

CATEGORY	EXPECTED CHARACTERISTICS
Organisational structure	A manager at board (or equivalent) level has responsibility for energy; Appointment of person with designated responsibility for energy at the Site; Clear job description & assigned adequate resources for designated person; Regular management meetings to review energy use; Site energy 'managers' or champions appointed. *Taylor Wimpey have attributed accountability and responsibility for environmental management in the company's Sustainability Policy. Responsibility for energy performance is detailed in Taylor Wimpey's Sustainability Report and CDP disclosure.*
Regulatory compliance	Formal review completed to determine which regulations are applicable & which are not; Senior management have reviewed and understand the organisation's legal obligations; A compliance plan is in place, including identified responsible staff; Processes are in place to keep the organisation up to date with relevant developments; The organisation is fully compliant. *Taylor Wimpey have strong procedures and risk registers in place to ensure compliance with energy related regulation.*
Procurement policy	General policy should be to include consideration of energy consumption in all procurement including new buildings, IT projects, process plant etc.; Specific procurement policies used for particular products, e.g. catering equipment, lighting, boilers etc.. Equipment procured using life cycle costing analysis. *Explicit reference to energy performance and consideration of life cycle cost analysis in the company's procurement processes will advance attainment of their energy management and environmental objectives. Particular focus should be given to site set up, generator and cabin selection, and the use of renewables. Future cabin purchases should push for a higher standard of efficiency in cabins that will be used on Taylor Wimpey sites.*

Energy management best practice [3/5]

CATEGORY	EXPECTED CHARACTERISTICS
Investment procedures	Capital investment procedure exists to obtain funding for energy efficiency; Clear payback (or other) investment threshold for energy efficiency; All capital funding requests assessed for energy impact by person with responsibility for energy; Maintenance budgets include provision for repairs to save energy. *Taylor Wimpey should conduct a detailed assessment of the life-cycle running costs of a particular site set-up prior to starting the build process. Selecting more efficient cabins, reducing grid connection times, using hybrid generator sets or installing site renewables may all result in greater savings being achieved over the life of the project than will be incurred by higher purchase costs or continuing to use standard set-up procedures. This project life-cycle analysis should be considered for all projects.*
Monitoring & analysing energy	Regular collection of energy consumption and cost data through automatic metering, monitoring and targeting (aMM&T) systems; Analysis of consumption against energy drivers (e.g. occupancy levels, external temperature) and time; Regular and appropriate reporting; Comparison of energy data with utility bills; CO_2 emissions calculated/analysed. *Taylor Wimpey have accurate and regular reporting available for all energy used on each site for ready and up to date comparison of performance of various sites across the organisation. At present this is analysed by trained Sustainability Champions rather than Site Managers. It is recommended that Taylor Wimpey review the benefits of including Site Managers in this process, e.g. to improve site level awareness of energy performance.*
Target setting	Energy saving targets based on analysis; Targets challenging, but achievable; Performance compared with appropriate benchmarks (internal and/or external). *As part of wider environmental considerations, an energy reduction target should be set for all existing and future sites, informed by the findings of this audit reports & other investigations.*

Energy management best practice [4/5]

CATEGORY	EXPECTED CHARACTERISTICS
Opportunities identification	Automatic Metering, Monitoring and Targeting (aMM&T) system actively used to identify savings opportunities; Site energy surveys undertaken regularly; Other information used; e.g. TM44 reports, asset registers, etc.. *Although opportunities for savings are limited at existing sites, the production of site operating procedures and energy saving 'checklists' would enable site management teams to check that all systems and items of equipment (such as drying rooms) are managed effectively and switched-off when not needed*
Staff engagement & training	Appropriate training for staff key to energy management, e.g. Site Managers. Awareness campaigns held regularly; Wider active staff involvement initiatives (e.g. via 'green' programmes, quality improvement, etc.); Energy included in staff induction training. *Taylor Wimpey should establish an active 'Green Team' to assist in the delivery of objectives and targets. This team should be engaged to explain the targets to the wider workforce, provide best practice tips that help achieve them and undertake internal auditing to monitor compliance levels. The staff HSE induction programme should be reviewed to ensure it includes reference to energy management targets and ambitions*
Operational procedures	Active reporting systems for energy waste and suggestions (lights left on, over-heating, under-cooling, water leaks); Job/Priority sheets for reducing energy waste (e.g. repair leaking/dripping taps); Maintenance schedules include reducing energy wastage; Operating instructions include energy use issues (e.g. nightly shut down procedures). *Taylor Wimpey should develop clear and engaging 'start-up' and 'shut-down' procedures to minimise the 'on' time of all equipment and systems throughout a typical building site e.g. drying rooms, various site heaters, plots, IT equipment, plug-power loads. Posters/stickers should be used on notice boards and at switching points to identify items of equipment that should be switched-off when not in use and for guidance concerning effective management of the different types of electric heaters and drying rooms arrangements would bring great benefit.*

Energy management best practice [5/5]

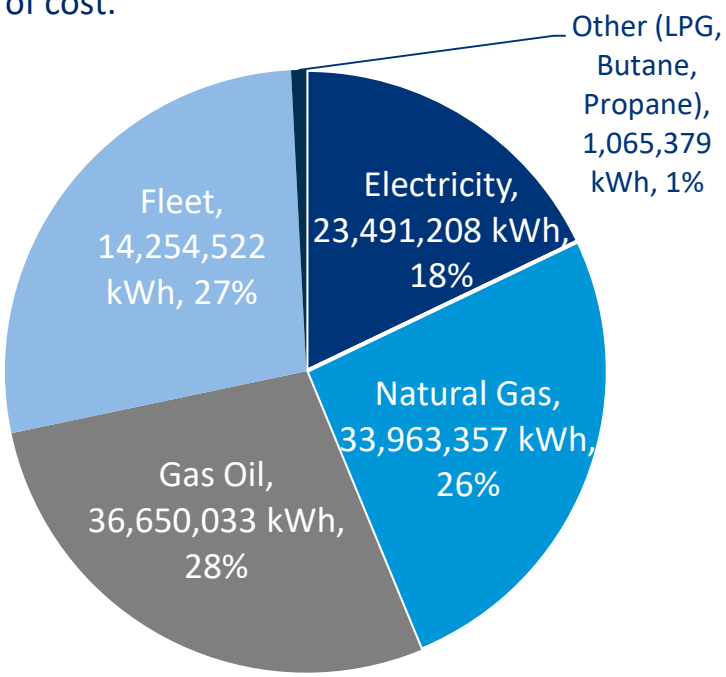
CATEGORY	EXPECTED CHARACTERISTICS
Communications	Regular communications to all employees on initiatives and progress against the strategy and targets; Performance against strategy and targets published publicly in organisation's annual reports or similar; Energy/carbon included in regular communications to wider stakeholders (local community, etc..) *Consider regular communications to staff (at least quarterly) to feedback progress/performance against energy reduction targets and maintain awareness levels*

Section

1. Executive summary
2. Background to energy audit and audit methodology
3. Review of existing energy policy, strategy, audits & operational plans
4. Data analysis
5. Energy saving opportunities
6. Appendices

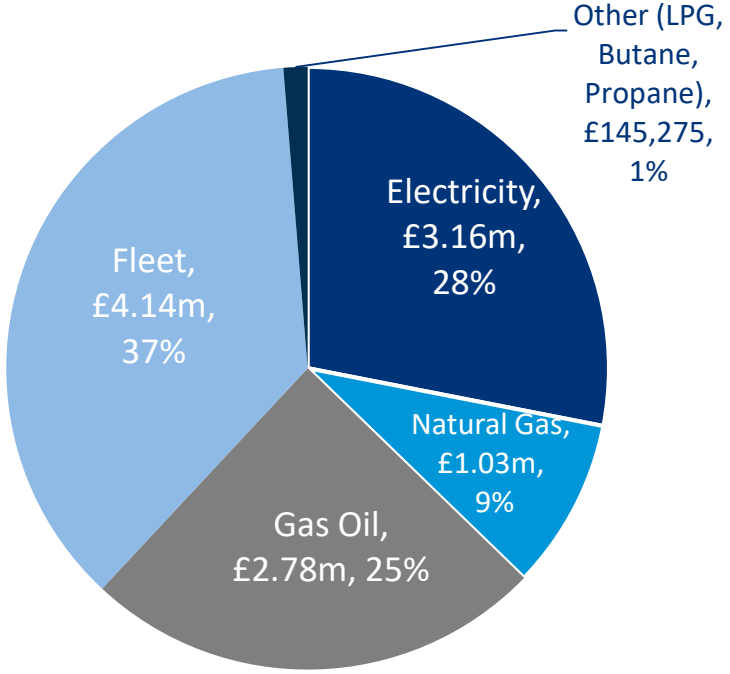
Taylor Wimpey overall energy consumption

- As outlined in the compliance strategy, energy consumption data at a Taylor Wimpey plc group level is recorded and verified by external accredited parties for annual GHG reporting requirements. As such, Taylor Wimpey have a strong understanding of their energy consumption as a whole across the business.
- The charts below illustrate the energy use and cost for Taylor Wimpey during the ESOS reference period. Gas oil represents the most significant contributor accounting for 28% of energy consumption (kWh) and 25% of cost.



CONSUMPTION

131.3 GWh



COST [1]

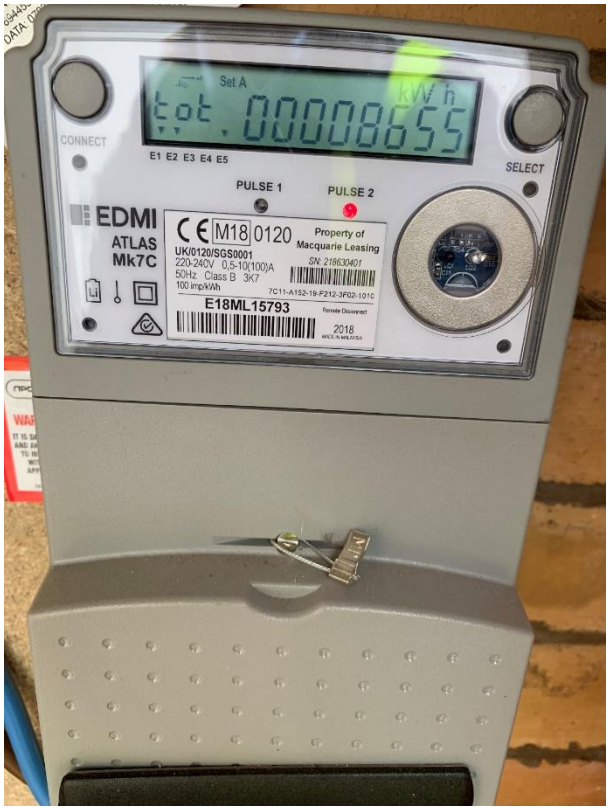
£11.3m

[1] Average unit rates applied to consumption to determine costs - see Compliance Strategy for details.

Meadowsweet Farm – Energy data

Electricity

- The compound is served by one mains electricity meter (meter ID 218630401), this meter was only recently installed, therefore no grid electricity was consumed during the ESOS reference period.
- A meter reading was taken during the audit, however, to determine levels of consumption for the cabin compound it was decided that creating an energy model based on site audit observations would be more accurate than attempting to extrapolate from the meter read – site staff could not confirm the date the meter was installed. During the ESOS reference period the cabin compound had power provided by a diesel generator.



Compound mains electricity consumption

Grid connection	2019
Meter read (10/10/2019)	8,655
Annual consumption estimate (kWh)	49,387
Measured consumption during reference period (kWh)	0

Meadowsweet Farm – Energy data

Gas Oil

- A consumption figure for the ESOS reference period 01/01/18 to 31/12/18 was provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant.
- In order to determine the split between generator fuel use and mobile plant use, estimates for cabin compound electricity use from the site audit energy model were used to establish an approximate split. A generator efficiency of 30% was assumed.

Site gas oil consumption

Gas oil use during ESOS reference period (kWh)	257,474
Annual cabin electricity requirement (kWh) - from previous slide	49,387
Generator efficiency	30%
Gas-oil to diesel generator (kWh)	164,458
Gas-oil to mobile plant (kWh)	93,017
Percentage of total to generator	64%
Percentage to mobile plant	36%

Meadowsweet Farm – Energy data

Energy to show homes and marketing suite

- No metered consumption was recorded until quarter 4 of 2018. In order to establish show home consumption over a 12-month period consumption for Q4 was extrapolated and cross-checked against the site audit energy model. Gas consumption extrapolation took account of seasonal demand variations.

Show homes mains electricity consumption

Grid connection	Q4 2018	
Measured consumption during reference period	4,076	kWh
Annual consumption estimate	16,304	kWh

Show homes mains gas consumption

Grid connection	Q4 2018	
Measured consumption during reference period	12,744	kWh
Annual consumption estimate	31,860	kWh

Meadowsweet Farm – Energy data

Energy to plots

- No metered consumption was recorded until quarter 4 of 2018. In order to establish plot consumption over a 12-month period consumption for Q4 was extrapolated and cross-checked against the site audit energy model. Gas consumption extrapolation took account of seasonal demand variations.

Plot mains electricity consumption

Grid connection	Q4 2018	
Measured consumption during reference period	588	kWh
Annual consumption estimate	2,352	kWh

Plot mains gas consumption

Grid connection	Q4 2018	
Measured consumption during reference period	19,950	kWh
Annual consumption estimate	39,900	kWh

Hamlet Woods – Energy data

Electricity

- The compound is served by one mains electricity meter (meter ID 218470283), this meter was only recently installed, therefore no grid electricity was consumed during the ESOS reference period.
- A meter reading was taken during the audit, however, to determine levels of consumption for the cabin compound it was decided that creating an energy model based on site audit observations would be more accurate than attempting to extrapolate from the meter read – especially as site staff could not confirm the date the meter was installed. During the ESOS reference period the cabin compound had power provided by a diesel generator.

Compound mains electricity consumption

Grid connection	2019
Annual consumption estimate (kWh)	62,317
Measured consumption during reference period (kWh)	0

Hamlet Woods – Energy data

Gas Oil

- A consumption figure for the ESOS reference period 01/01/18 to 31/12/18 was provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant.
- In order to determine the split between generator fuel use and mobile plant use, estimates for cabin compound electricity use from the site audit energy model were used to establish an approximate split. A generator efficiency of 30% was assumed.

Site gas oil consumption

Gas oil use during ESOS reference period (kWh)	230,775
Annual cabin electricity requirement (kWh) - from previous slide	62,317
Generator efficiency	30%
Gas-oil to diesel generator (kWh)	207,516
Gas-oil to mobile plant (kWh)	23,259
Percentage of total to generator	90%
Percentage to mobile plant	10%

Hamlet Woods – Energy data

Energy to show homes and marketing suite

- There are no records of show home consumption during the ESOS reference period.
- In order to establish show home consumption over a 12-month period an energy model was created based on site audit observations of energy using systems and control settings, as well as discussions with sales staff.

Show homes mains electricity consumption

Grid connection	2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	16,477	kWh

Show homes mains gas consumption

Grid connection	2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	13,824	kWh

Hamlet Woods – Energy data

Energy to plots

- There are no records of plot consumption during the ESOS reference period.
- Due to the lack of available data and access to site meters during the audit it has not been possible to establish show home consumption over a 12-month period at this site. The estimated figures below are based on measured plot consumption at another Taylor Wimpey site with the same number of plots completed.

Plot mains electricity consumption

Grid connection	2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	13,751	kWh

Plot mains gas consumption

Grid connection	2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	183,315	kWh

St Andrews Gardens – Energy data

Electricity

- Consumption figure for the reference period 01/01/18 to 31/12/18 provided by AJR Management. The compound was grid connected throughout 2018, however, it has since been moved and a new grid connection is yet to be established. Meter box checked during site audit on 30/10/19 and found to be empty.

Compound mains electricity consumption

Grid connection	Pre 2018
Measured consumption during reference period (kWh)	23,902

St Andrews Gardens – Energy data

Gas Oil

- No records of consumption during the ESOS reference period.
- The compound was grid connected throughout 2018.

Site gas oil consumption

Gas oil use during ESOS reference period (kWh)	0
Gas-oil to diesel generator (kWh)	0
Gas-oil to mobile plant (kWh)	0
Percentage of total to generator	0%
Percentage to mobile plant	0%

St Andrews Gardens – Energy data

Energy to show homes and marketing suite

› Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.

Show homes mains electricity consumption

Grid connection	Pre 2018	
Measured consumption during reference period	15,094	kWh

Show homes mains gas consumption

Grid connection	Pre 2018	
Measured consumption during reference period	57,121	kWh

St Andrews Gardens – Energy data

Energy to plots

› Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.

Plot mains electricity consumption

Grid connection	Pre 2018	
Measured consumption during reference period	11,192	kWh

Plot mains gas consumption

Grid connection	Pre 2018	
Measured consumption during reference period	164,875	kWh

Torrance Gardens – Energy data

Electricity

- Consumption figure for the reference period 01/01/18 to 31/12/18 provided by AJR Management. The compound was grid connected at the beginning of 2018, however, it is understood from AJR Management that this was not maintained for the whole 12-month period, with the grid connection being disconnected during Q2. The compound was grid connected during the site audit on 30/10/19.
- In order to establish compound electricity consumption over a 12-month period an energy model was created based on site audit observations of energy using systems and control settings, as well as discussions with site management.

Compound mains electricity consumption

Grid connection	Pre 2018
Measured consumption during reference period (kWh)	23,902
Annual consumption estimate (kWh)	37,249

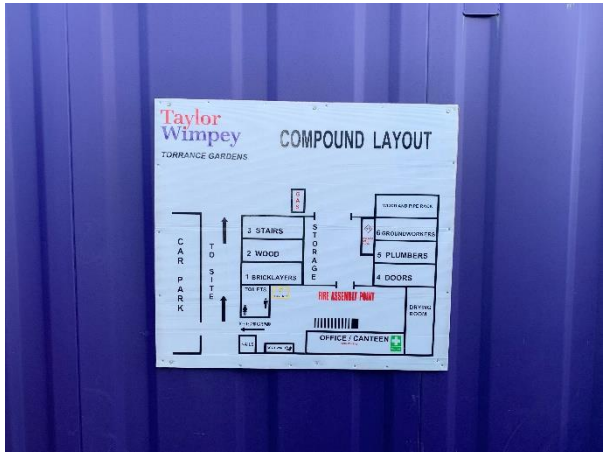
Torrance Gardens – Energy data

Gas Oil

- A consumption figure for the ESOS reference period 01/01/18 to 31/12/18 was provided by AJR Management. It has been assumed that the compound was grid connected for 3 out of the 4 quarters in 2018.
- In order to determine the split between generator fuel use and mobile plant use, estimates for cabin compound electricity use from the site audit energy model were used to establish an approximate split. A generator efficiency of 30% was assumed.

Site gas oil consumption

Gas oil use during ESOS reference period (kWh)	54,227
Annual cabin electricity requirement (kWh) – 25% of figure from previous slide	9,312
Generator efficiency	30%
Gas-oil to diesel generator (kWh)	31,010
Gas-oil to mobile plant (kWh)	23,217
Percentage of total to generator	57%
Percentage to mobile plant	43%



Torrance Gardens – Energy data

Energy to show homes and marketing suite

› Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.

Show homes mains electricity consumption

Grid connection	Pre 2018	
Measured consumption during reference period	14,195	kWh

Show homes mains gas consumption

Grid connection	Pre 2018	
Measured consumption during reference period	27,648	kWh

Torrance Gardens – Energy data

Energy to plots

› Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.

Plot mains electricity consumption

Grid connection	Pre 2018	
Measured consumption during reference period	8,814	kWh

Plot mains gas consumption

Grid connection	Pre 2018	
Measured consumption during reference period	128,230	kWh

Kilnwood Vale – Energy data

Electricity

- Consumption figure for the reference period 01/01/18 to 31/12/18 provided by AJR Management. The compound was grid connected throughout the reference period and during the site audit on 30/10/19.
- An energy model based on site audit observations of energy using systems and control settings aligns with measured consumption.

Compound mains electricity consumption

Grid connection	August 2017
Measured consumption during reference period (kWh)	63,411

Kilnwood Vale – Energy data

Gas Oil

- A consumption figure for the ESOS reference period 01/01/18 to 31/12/18 was provided by AJR Management.
- As the compound was grid connected throughout the reference period it has been assumed that 100% of fuel use was by mobile plant.

Site gas oil consumption

Gas oil use during ESOS reference period (kWh)	177,568
Gas-oil to diesel generator (kWh)	0
Gas-oil to mobile plant (kWh)	177,568
Percentage of total to generator	0%
Percentage to mobile plant	100%

Kilnwood Vale – Energy data

Energy to show homes and marketing suite

› Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.

Show homes mains electricity consumption

Grid connection	August 2017	
Measured consumption during reference period	7,134	kWh

Show homes mains gas consumption

Grid connection	August 2017	
Measured consumption during reference period	16,247	kWh

Kilnwood Vale – Energy data

Energy to plots

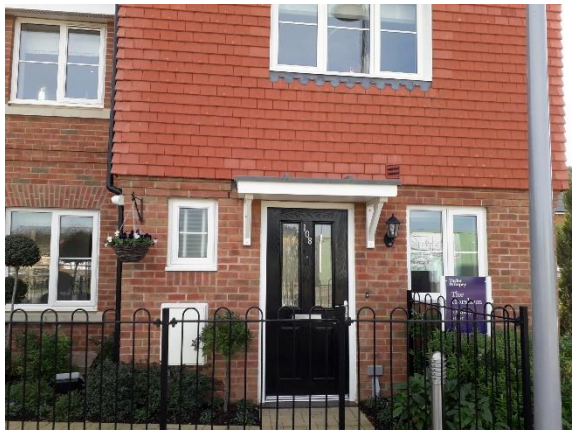
› Consumption figures for the ESOS reference period 01/01/18 to 31/12/18 provided by AJR Management.

Plot mains electricity consumption

Grid connection	August 2017	
Measured consumption during reference period	13,751	kWh

Plot mains gas consumption

Grid connection	August 2017	
Measured consumption during reference period	183,315	kWh



Chy An Dowr – Energy data

Electricity

- The compound is served by one mains electricity meter (meter ID 219020504), this meter was only recently installed, therefore no grid electricity was consumed during the ESOS reference period.
- A meter reading was taken during the audit, however, to determine levels of consumption for the cabin compound it was decided that creating an energy model based on site audit observations would be more accurate than attempting to extrapolate from the meter read – especially as site staff could not confirm the date the meter was installed. During the ESOS reference period the cabin compound had power provided by a diesel generator.

Compound mains electricity consumption

Grid connection	May 2019
Annual consumption estimate (kWh)	TBC
Measured consumption during reference period (kWh)	0

Chy An Dowr – Energy data

Gas Oil

- A consumption figure for the ESOS reference period 01/01/18 to 31/12/18 was provided by AJR Management. There are no records of whether gas oil was used for generators or mobile plant.
- In order to determine the split between generator fuel use and mobile plant use, estimates for cabin compound electricity use from the site audit energy model were used to establish an approximate split. A generator efficiency of 30% was assumed.

Site gas oil consumption

Gas oil use during ESOS reference period (kWh)	78,012
Annual cabin electricity requirement (kWh) - from previous slide	23,330
Generator efficiency	30%
Gas-oil to diesel generator (kWh)	77,689
Gas-oil to mobile plant (kWh)	323
Percentage of total to generator	99.6%
Percentage to mobile plant	0.4%

Chy An Dowr – Energy data

Energy to show homes and marketing suite

- There are no records of show home consumption during the ESOS reference period.
- In order to establish show home consumption over a 12-month period an energy model was created based on site audit observations of energy using systems and control settings, as well as discussions with sales staff.

Show homes mains electricity consumption

Grid connection	May 2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	2,414	kWh

Show homes mains gas consumption

Grid connection	May 2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	30,000	kWh

Chy An Dowr – Energy data

Energy to plots

- There are no records of plot consumption during the ESOS reference period.
- Due to the lack of available data and access to site meters during the audit it has not been possible to establish show home consumption over a 12-month period at this site. The estimated figures below are based on measured plot consumption at another Taylor Wimpey site with the same number of plots completed.

Plot mains electricity consumption

Grid connection	May 2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	2,352	kWh

Plot mains gas consumption

Grid connection	May 2019	
Measured consumption during reference period	0	kWh
Annual consumption estimate	39,900	kWh

Static energy profile – audited Taylor Wimpey sites

- The information on the previous slides was used to determine the breakdown of energy consumption at each Taylor Wimpey site during the ESOS reference period.

Sites		Meadowsweet Farm				Torrance Gardens				Hamlet Woods			
Fuel	**Use**	**kWh**	**%**	**£**	**%**	**kWh**	**%**	**£**	**%**	**kWh**	**%**	**£**	**%**
Electricity	Electricity (compound)	0	0%	£0	0%	23,902	51%	£2,868	51%	0	0%	£0	
	Electricity (show home and plots)	18,656	100%	£2,239	100%	23,009	49%	£2,761	49%	0	0%	£0	0%
	Total	**18,656**		**£2,239**		**46,911**		**£5,629**		**0**		£0	
Natural gas	Natural gas (show home and plots)	71,760	100%	£2,153	100%	155,878	100%	£4,676	100%	0	0%	£0	0%
	Total	**71,760**		**£2,153**		**155,878**		**£4,676**		**0**		£0	
Gas oil	Gas oil (generators)	164,458	64%	£10,690	76%	37,212	69%	£2,419	69%	191,205	83%	£12,428	83%
	Gas oil (mobile plant)	93,017	36%	£6,046	24%	17,015	31%	£1,106	31%	39,570	17%	£2,572	17%
	Total	**257,474**		**£16,736**		**54,227**		**£3,525**		**230,775**		**£15,000**	
All	**TOTAL**	**347,890**		**£21,127**		**257,016**		**£13,830**		**230,775**		**£15,000**	

Static energy profile – audited Taylor Wimpey sites

- The information on the previous slides was used to determine the breakdown of energy consumption at each Taylor Wimpey site during the ESOS reference period.

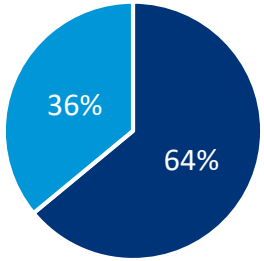
Sites		St Andrews Gardens				Kilnwood Vale				Chy An Dowr			
Fuel	**Use**	**kWh**	**%**	**£**	**%**	**kWh**	**%**	**£**	**%**	**kWh**	**%**	**£**	**%**
Electricity	Electricity (compound)	47,865	65%	£5,744	65%	63,411	75%	£7,609	75%	0	0%	£0	
	Electricity (show home and plots)	26,286	35%	£3,154	35%	20,885	25%	£2,506	25%	0	0%	£0	0%
	Total	**74,151**		**£8,898**		**84,296**		**£10,116**		**0**		£0	
Natural gas	Natural gas (show home and plots)	221,996	100%	£6,660	100%	199,562	100%	£5,987	100%	0	0%	£0	0%
	Total	**221,996**		**£6,660**		**199,562**		**£5,987**		**0**		£0	
Gas oil	Gas oil (generators)	0	0%	£0	0%	0	0%	£0	0%	77,689	99.6%	£5,050	99.6%
	Gas oil (mobile plant)	0	0%	£0	0%	177,568	100%	£11,542	100%	323	0.4%	£21	0.4%
	Total	**0**		**£0**		**177,568**		**£11,542**		**78,012**		**£5,071**	
All	**TOTAL**	**296,147**		**£15,558**		**461,426**		**£27,644**		**78,012**		**£5,071**	

Static energy profile – typical Taylor Wimpey site

› The information on the previous slides was used to determine a typical breakdown of energy consumption for a typical Taylor Wimpey site during the ESOS reference period.

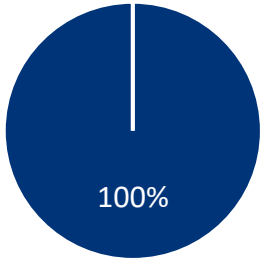
Sites		Average % Split	Overall	
Fuel	**Use**		**kWh**	**£**
Electricity	Electricity (compound)	64%	13,120,647	£1,792,132
	Electricity (show home and plots)	36%	7,517,227	£1,026,768
	Total		20,637,874	£2,818,900
Natural gas	Natural gas (show home and plots)	100%	33,495,752	£1,018,900
	Total		33,495,752	£1,018,900
Gas oil	Gas oil (generators)	72%	23,084,707	£1,996,285
	Gas oil (mobile plant)	28%	13,565,321	£784,715
	Total		36,650,029	£2,781,000

Grid electricity consumption



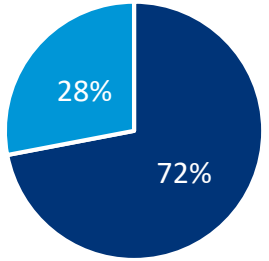
■ Compound ■ Show homes and plots

Natural gas consumption



■ Show homes and plots

Gas oil consumption



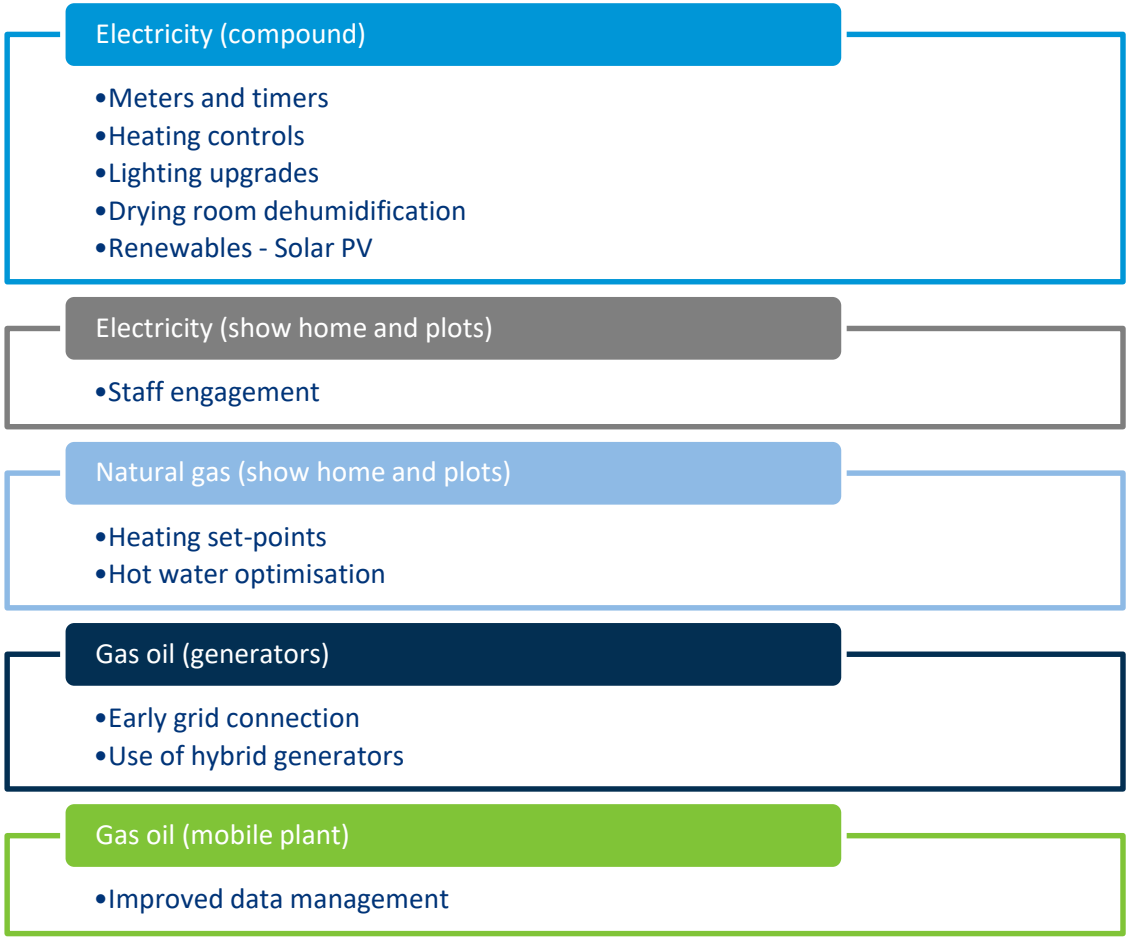
■ Generators ■ Mobile plant

Section

1. Executive summary
2. Background to energy audit and audit methodology
3. Review of existing energy policy, strategy, audits & operational plans
4. Data analysis
5. Energy saving opportunities
6. Appendices

Site observations

- The overall standard of formal energy management and observed energy efficiency during the site audit were adjudged to be 'TYPICAL'
- A number of energy saving measures were identified and these are summarised to the right and detailed in subsequent slides

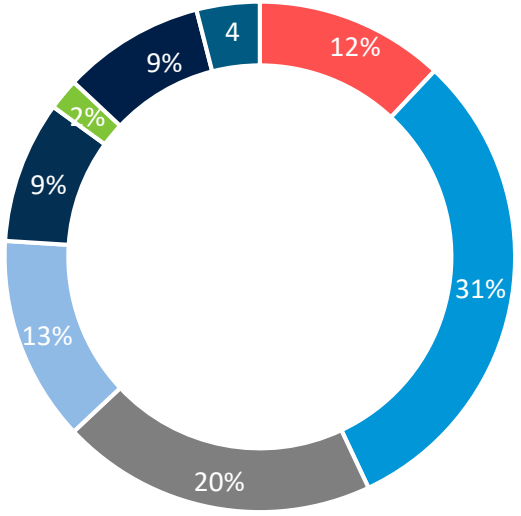


[1] NB: Where stated, investment costs are given as estimates based on our experience and are provided for guidance purposes only. Full, detailed business plans should be prepared for all capital investments being considered as a result of this report

Cabin Compound - Assessed breakdown of energy use[1]

Key point: Based on observations of cabin compound energy use during sample site visits, cabin heating and drying room energy are the major contributors to energy use.

Cabin compound energy breakdown	Meadow sweet Farm	Torrance Gardens	Hamlet Woods	St Andrews Gardens	Kilnwood Vale	Chy An Dowr	Average
Cabin and Compound Lighting	20%	25%	10%	3%	4%	12%	12%
Cabin heating	35%	17%	39%	44%	38%	12%	31%
Drying room heating	17%	16%	16%	9%	21%	40%	20%
DHW	14%	5%	10%	26%	8%	15%	13%
Catering and small appliances	9%	12%	8%	12%	7%	4%	9%
IT equipment	2%	2%	1%	2%	4%	1%	2%
Mortar silos	0%	20%	13%	0%	13%	9%	9%
Other (CCTV, equipment charging, small electrics)	4%	4%	3%	4%	4%	7%	4%



CLOCKWISE:
- Cabin and Compound Lighting
- Cabin heating
- Drying room heating
- DHW
- Catering and small appliances
- IT equipment
- Mortar silos
- Other (CCTV, equipment charging, small electrics)

[1] Based on auditor's assessment during the site visits. No sub-metering in-situ

Cabin Compound
R1: Improved energy management, metering and zoning control

Site energy data analysis

- Electricity supply to the cabin compounds was metered at five of the six sample Taylor Wimpey sites visited during the audits – one compound had no mains grid connection. Most of these are 'dumb' meters which have no capacity to automatically send consumption data to the supplier and need to be manually read by a Taylor Wimpey contractor. What was also common was that site compound energy data was not analysed at site level; site management had no visibility of site energy performance.
- Electricity metering data should be utilised to maintain accurate records of compound consumption and to track benchmark performance to drive and inform ongoing efficiency efforts. Given the irregularity of meter reads at the sampled Taylor Wimpey sites it is recommended that automated half hourly metering be installed as standard for site compounds.

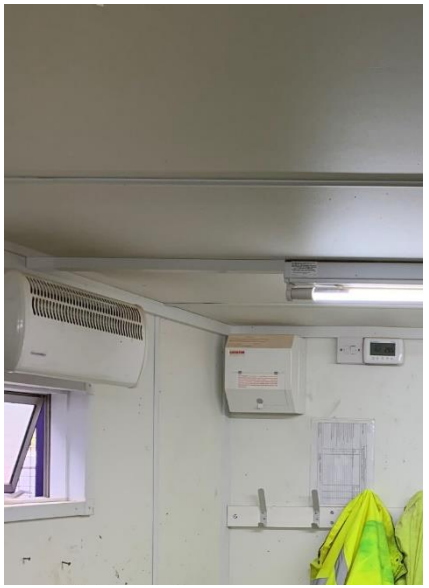
Zoning control

- Each of the cabin compounds have their own consumer unit, with individual supply to cabins providing clear electrical supply distinction across the compound.
- With this arrangement, the addition of a timer control for individual cabin supplies should be considered.
- Temporary electric contractors responsible for connecting power to the cabins should be required to provide timer controls to allow cabin zonal switching for any cabins that are not required 24 hours. This reduces the reliance on staff control, and prevents unwanted out of hours use.
- It may also be possible to control multiple cabins from a single timer, reducing installation costs.
- The images on the following slide show examples of the cabin compounds across the sample of audited sites which have their own consumer unit.

Cabin Compound
R1: Improved energy management, metering and zoning control

Existing site temporary electrics arrangement

- The cabin compounds across the sample of audited sites all had their own consumer unit (examples below show consumer units in the site offices at Meadowsweet Farm and Torrance Gardens and in the drying room at Chy An Dowr). The consumer units and distribution boards could not be opened at the sample sites, but distribution boards should have clear labelling for individual supplies.
- Timers on each of the fused ways would allow cost effective automated switching of cabins .



Cabin Compound, Recommendation R1:

Improve standard of energy management, AMM&T and zoning control

ISSUE	Current energy management system is 'FAIR', but could be improved.
RATIONALE	Improving energy management efforts through improved metering and enhanced energy analysis will allow Taylor Wimpey to better understand energy use across the site. Zonal timing will help prevent equipment and heating being left on unnecessarily out of hours.
BENEFITS	Improved energy data will enhance energy management efforts. Increased automation of timers will reduce out of hours site consumption. We have conservatively estimated that this could reduce cabin compound electricity consumption by 2% across Taylor Wimpey sites.
RISKS	None.
NEXT STEPS	Review site set-up and procurement policies to ensure automated HH metering and zoning timer controls for cabins are provided when site compounds and key areas are being established.
BY WHOM	Central SHE teams in conjunction with site planning and procurement teams
BY WHEN	ASAP

Time setting	Loads
Always on	CCTV, security systems, fridges (unless emptied at weekends)
Working hours (~50 hours per week)	Offices, WCs, changing rooms
Drying room (working hours plus intermittent at weekend)	Drying room heating

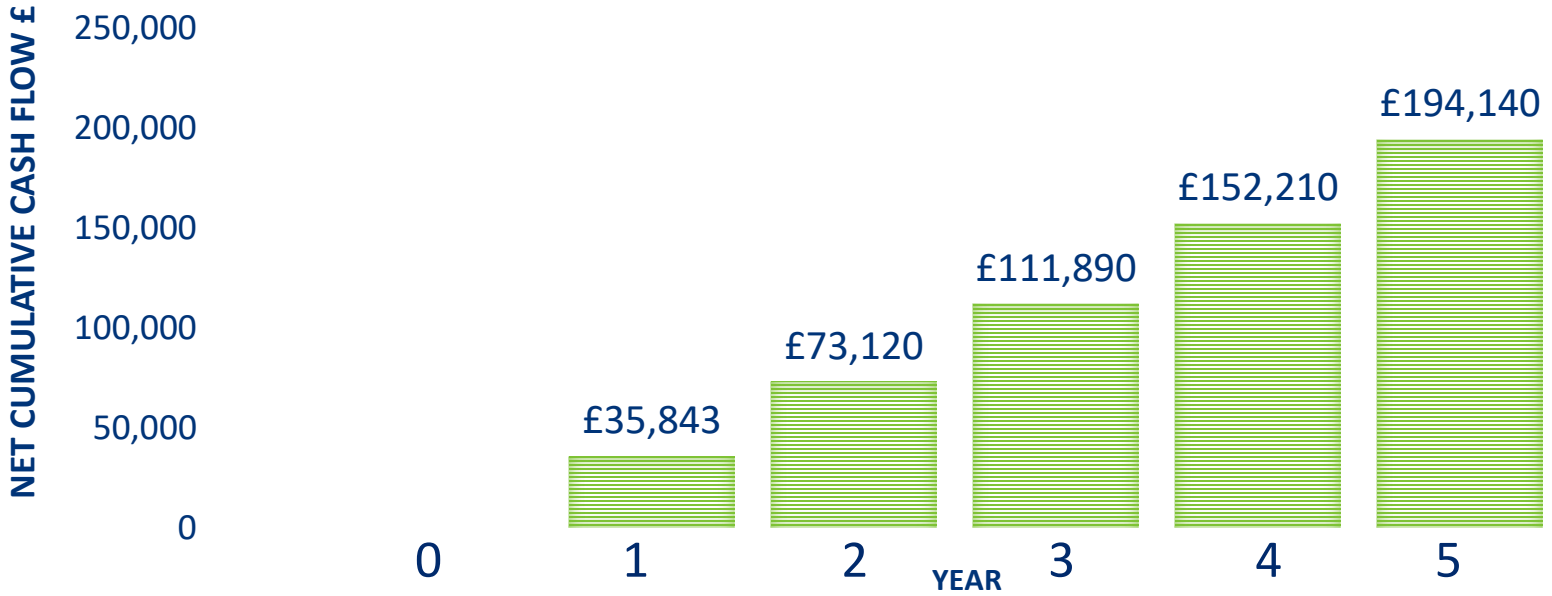
ABOVE: Suggested time schedules for cabins on a typical site compound.

Cabin Compound, Recommendation R1:

Improve standard of energy management, AMM&T and zoning control

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£35,843	instant	-	-	67.1

CUMULATIVE NET CASH FLOW YEAR[1] 0-5



[1]Whole year effect; assuming annual energy price inflation of 4%. Assumes 2% site compound grid electricity saving during the reference period.

[2] Zero CAPEX measure as costs will form part of cabin and temporary electrics procurement. A marginal cost may be incurred for HH metering and zoning which Taylor Wimpey should investigate with suppliers/contractors.

Cabin Compound
R2: Optimise heating control

- Heating was provided to all cabins observed during the audit programme via electric heaters. The type of heater was not consistent and various manufacturers and models were used.
- Generally, all radiators were provided with some form of control. This ranged from basic on/off switches to analogue timers and basic thermostats. Very few were provided with user friendly digital thermostats and timers.
- Given the variety of heaters in use, it was apparent that most were simply used with on/off switching and full temperature.
- Improving guidance locally on how to optimally control the various types of radiators will enable staff to manage them more effectively. When specifying new cabins, user friendly digital thermostats should be requested to allow closer temperature control in space.



Above: Various electric convection, fan, and oil filled radiators used in the cabins. **Below:** Basic thermostats and analogue timers were rarely used to optimal effect.



Cabin compound, Recommendation R2:

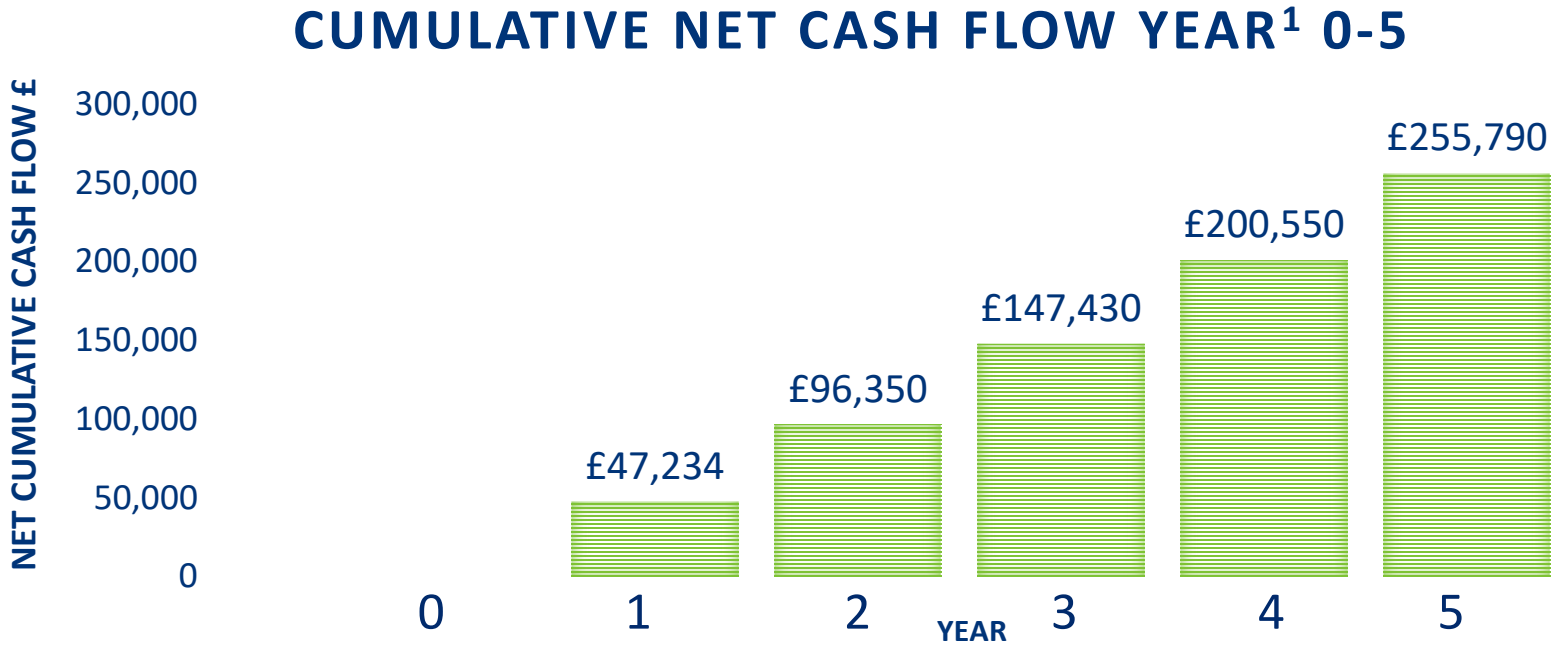
Optimise heating control

Issue	Heating is very much reliant on staff understanding control systems and setting controllers accordingly
Rationale	Heating systems (excluding drying room heating) account for ~31% of cabin compound energy consumption. Cabins were typically equipped with direct electric heaters with on/off control or analogue timers and thermostats. No guidance on control settings is provided, relying on staff to set appropriate temperatures and time schedules, which could result in over heating and out of hours operation. Many heaters were found to be switched to 'hand' rather than 'time' control. New sites should require all cabin heating to be provided with user friendly and accurate digital thermostatic and timer controls.
Benefits	A 1^{o}C reduction in heating temperature can reduce heating energy by 8%. Therefore a 10% saving has been conservatively estimated for heating systems through improved management of temperatures and run times.
Risks	Failing to undertake such a review risks sub-optimal control logic and settings resulting in inefficient equipment operation.
Next steps	Provide site staff with guidance on typical heating operating procedures expected for each common type of cabin heater, and site management teams if necessary to ensure optimised controls are implemented. Ensure procurement documentation specifies that all cabin heating is provided with digital thermostatic and timer control.
By whom	Site representative reporting to central SHE and procurement teams
By when	ASAP

Cabin Compound, Recommendation R2:

Optimise heating control

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£47,234	instant	-	-	100.6



[1]Whole year effect; assuming annual energy price inflation of 4%. Assumes 10% Taylor Wimpey cabin HTG energy saving during the reference period.

[2] Zero CAPEX measure as associated costs will form part of planned replacement of ageing heaters. A marginal cost may be incurred for digital controls which Taylor Wimpey should investigate with the supplier.

Cabin Compound
R3: Upgrade lighting to LED with controls

- Lighting is assessed to account for around 12% of the electricity usage/expenditure in the cabin compounds.
- Artificial lighting observed during the audit was achieved chiefly through the use of LED luminaires (see Appendix C photographs), however, on average ~20% of lighting was T5/T8 fluorescent (examples below of luminaires observed in use at Meadowsweet Farm and Hamlet Woods).
- Good quality, LED luminaires can offer superior illumination, control and energy performance over the incumbent fluorescent lamp types.
- LED technology has improved substantially in recent years and is now a viable alternative to most conventional lighting sources (see slide over). High quality LED lamps and luminaires now offer good spectral distribution, colour temperatures and can last over 50,000 hours (to L70B10).
- The existing T5/T8 fluorescent luminaires can be replaced with LED alternatives typically having half the power rating and – properly designed – can provide enhanced illumination levels.
- In addition to being intrinsically more efficacious than most other lamp types, LED offers additional advantages through significantly reduced maintenance costs.
- Most of the lighting is controlled by automated motion sensors, with timers for external yard luminaires. This is good practice.
- Replacing the existing non-LED lighting with suitable LED alternatives would reduce existing lighting energy consumption by ~10% on average based on the six sites surveyed (i.e. a 50% saving on 20% of all lighting).

R3: Summary of benefits & characteristics of LED

CARBON TRUST

high efficacy

controllability

reduced environmental impact

durability

long lamp life

compact size

operate in low temperatures

instant-on

frequent switching

no UV

continuing to improve…

BENEFITS OF LED LIGHTING

LAMP TYPE	lm/W[1]	LAMP HOURS
Incandescent	5-20	1,000
Tungsten halogen	15-24	2,000
Tubular fluorescent	60-105	10,000-20,000
Compact fluorescent	45-80	6,000-15,000
HP Sodium	85-150	12,000-30,000
LP Sodium	100-200	18,000-20,000
Metal halide	50-115	6,000-20,000
Mercury	35-65	7,000-20,000
Induction	70-90	60,000-100,000
LED	70-150+	25,000-75,000+

COMPARISON OF LAMP EFFICACY & LIFE

[1]lm/W : lumens / watt. Measure of light output (lumen) per unit of power input (watt)

Cabin Compound, Recommendation R3:

Upgrade lighting to LED with controls

ISSUE	Some of existing lighting provision does not represent best practice – estimated ~20% based on site audits
RATIONALE	Replacing existing fluorescent luminaires with suitable controlled LED alternatives would reduce total lighting consumption by ~10%
BENEFITS	Significant energy savings; improved lamp life reducing maintenance frequency and costs
RISKS	Technical risks will be mitigated through the use of quality luminaires, controls and trials
NEXT STEPS	Taylor Wimpey should implement a process to ensure that 100% of cabin compounds are provided with LED lighting with optimised automated control
BY WHOM	Site representative reporting to central SHE and procurement teams
BY WHEN	ASAP

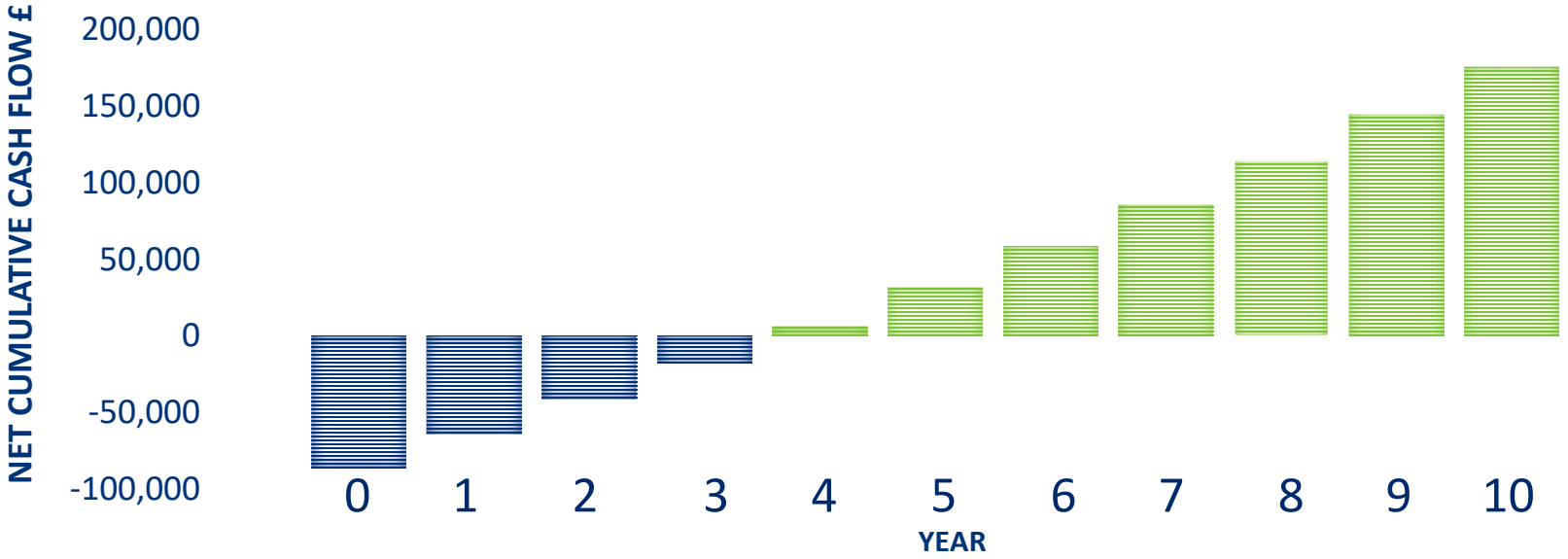
LIGHTING DESIGN CONSIDERATIONS

Cabin Compound, Recommendation R3:

Upgrade lighting to LED with controls

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£86,200[2]	£21,767	4.0 years	£258,587	29%	19.1

CUMULATIVE NET CASH FLOW YEAR[1] 0-10



[1]Whole year effect; assuming energy price inflation of 4%; excludes maintenance cost savings. Saving based on 50% reduction across 20% of cabin compound lighting costs during reference period.

[2] Estimate based on replacing 86.2 kW of fluorescent lighting across Taylor Wimpey sites with LED luminaires. Assumes a cost of £1k/kW of LED lighting and that installation can be carried out internally by qualified electricians.

Cabin Compound
R4: Drying room dehumidification

- The purpose of drying rooms is to dry wet clothes belonging to the trades that work externally.
- A typical drying room arrangement for a Taylor Wimpey site is to have 1 or 2 electric heaters or fan heaters on throughout the day, especially in winter months.
- As observed during the site accommodation review of the six sample sites, there are a number of issues and inefficiencies with drying rooms that can result in unnecessary energy wastage. These typically include:
  - Overheating and poor temperature control
  - Requires fresh air to vent moisture, but also heat
  - Ineffective unless clothes close to heater, so longer run hours required
- A recent a study by Balfour Beatty & El-Bjorn[1] demonstrated that purpose built drying room dehumidifiers can result in significant savings in drying room energy consumption (approx. 50% reduction in drying time). The solution consists of a combo heater and de-humidifier unit plus an air circulation fan made by El-Bjorn. The results show that the El-Bjorn solution offers a more energy efficient approach than the traditional fan heater arrangement, and Balfour Beatty are now specifying this in all A-plant drying rooms.

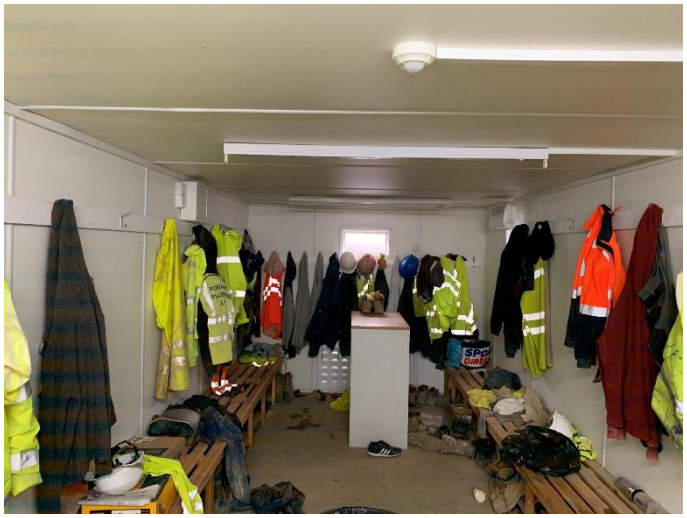
ABOVE: Audit photo taken at the Hamlet Woods site shows drying room fan heaters creating a room temperature of over 32°C. This is clearly excessive, a result of limited on/off control of the fan heater. Another drying room at this site was observed with the door open and the self-close closer broken while oil filled radiators were running. The drying room arrangement at Meadowsweet Farm is typical of those observed, with fan heaters turned up high to try and dry out clothing.

[1] https://ccsbestpractice.org.uk/entries/developing-a-more-efficient-dehumidifier-for-site-accommodation/

Cabin Compound, Recommendation R4:

Drying room dehumidification

ISSUE	Existing drying room arrangements are energy intensive, wasteful and often ineffective.
RATIONALE	Using purpose built units to provide and circulate heat, and remove moisture from the air of the drying room will result in reduced drying times and reduce levels of wasted energy.
BENEFITS	Reduced drying times, lower energy consumption, less humid environment in room. Based on test data it is estimated that this solution reduces drying times by 50%, we have therefore assumed a 30% reduction in drying room energy consumption.
RISKS	This solution is in its early stages but extensive testing suggests this is an effective and reliable solution which may be considered by major site accommodation providers.
NEXT STEPS	Engage site accommodation providers to provide optimised drying room solutions for future cabin set-ups
BY WHOM	Central SHE and procurement teams
BY WHEN	ASAP following internal review



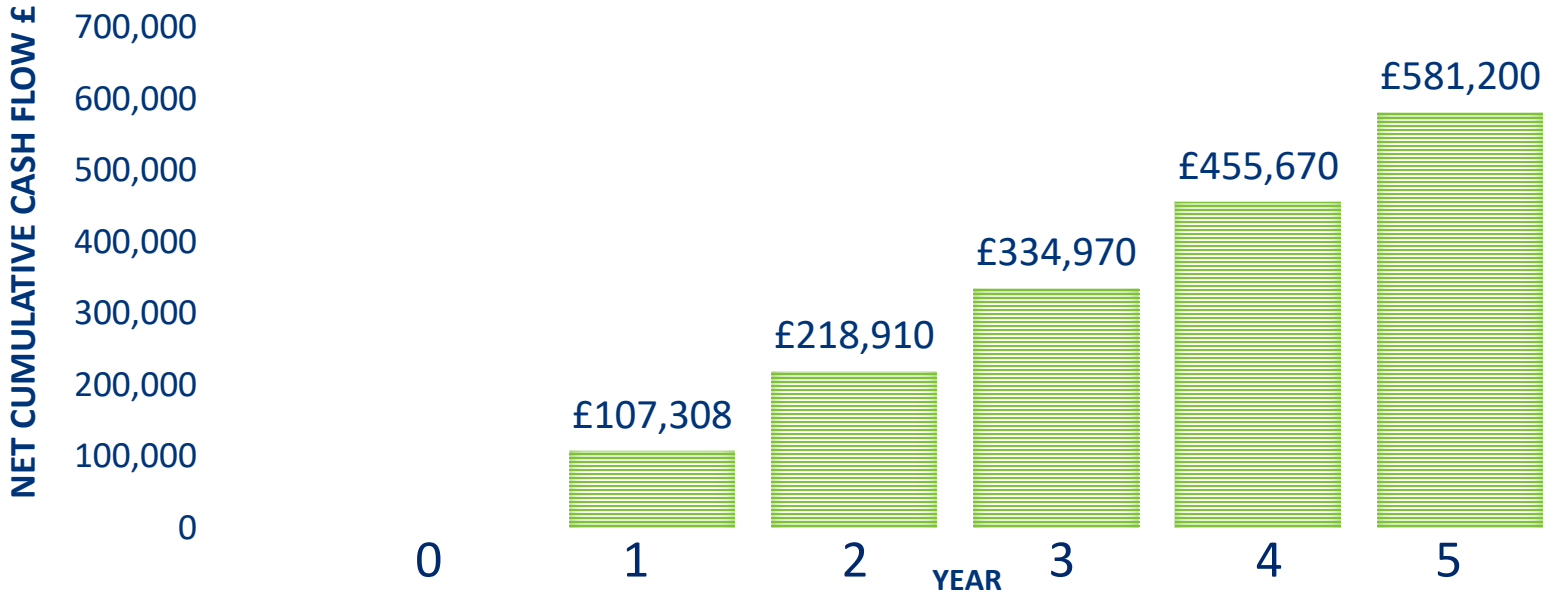
ABOVE: Example of a drying room arrangement at Chy An Dowr which is likely to be ineffective at drying clothes in a short timeframe.

Cabin Compound, Recommendation R4:

Drying room dehumidification

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£107,308	instant	-	-	200.8

CUMULATIVE NET CASH FLOW YEAR[1] 0-5



[1]Whole year effect; assuming annual energy price inflation of 4%. Saving based on a 30% reduction in Taylor Wimpey sites drying room energy consumption.

[2] Zero capex measure as costs will be factored in to ongoing procurement costs of cabins. Dehumidification solution likely to have a premium over standard drying room heaters.

Cabin Compound, Recommendation R5:

Install temporary solar PV system

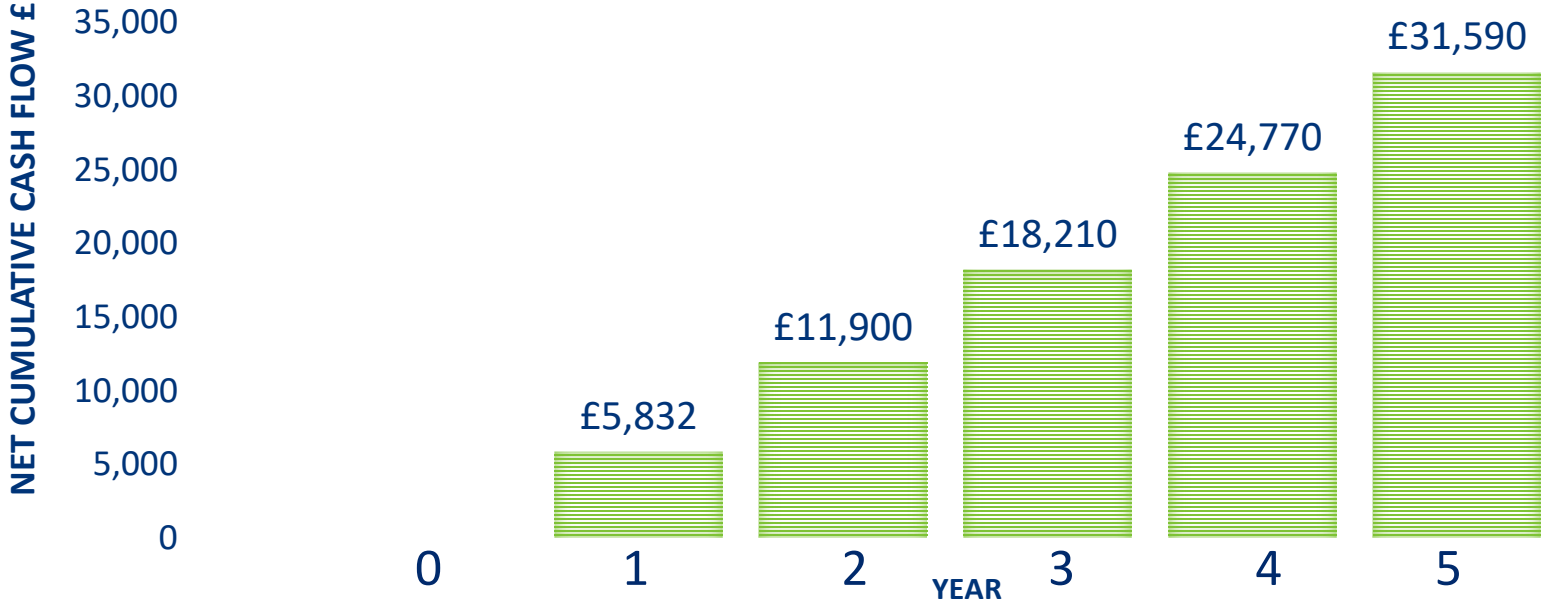
Issue	Energy management and efficiency can only reduce a building site's energy demand and carbon emissions so far. Once these have been optimised, ways of generating clean, renewable energy need to be considered.
Rationale	For open sites and sites with large unshaded roof area cabins, solar PV is a good fit to unlocking sustainable, carbon-free energy. Suitably sized, PV systems can generate a useful year-round baseload for longer term sites reducing its dependency on the grid and improving its environmental performance and credentials. This may also help reduce the need for diesel generators on some sites, and limit the size of temporary grid connections.
Benefits	A 4 panel, 1.2kWp (dc) solar PV system could be accommodated on most cabin compound arrangements based on site observations. Assuming an average solar irradiance on 900kWh/kWp, and a shading factor of 0.9 an array of this size could generate 972kWh per annum for cabin compound use. Assuming this type of array could be accommodated on ~50 Taylor Wimpey sites would result in 48,600kWh of free energy being generated.
Risks	With no mechanical moving parts, solar PV is a low maintenance source of electricity. The technology is mature, well developed and widely deployed. There is a vibrant supply chain in the UK leading to an efficient market and there are a wide range of solutions on offer from site accommodation providers. Positioning the panels in an optimal location, with minimal shading, and cleaning regularly will ensure maximum generation.
Next steps	Taylor Wimpey should review their procurement practices to ensure that solar PV systems are always specified for longer term cabin and site installations where possible.
By whom	SHE team working with site planning and procurement
By when	ASAP

Cabin Compound, Recommendation R5:

Install temporary solar PV system

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£5,832	instant	-	-	12.4

CUMULATIVE NET CASH FLOW YEAR[1] 0-5



[1]Whole year effect; assuming energy price inflation of 4%

[2] Zero CAPEX as cost would be an ongoing hire cost to the site rather than a purchase

Other potential energy saving opportunities in the Cabin Compound

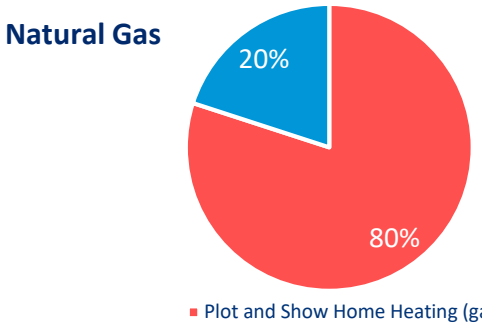
- A number of other potential energy saving opportunities were identified during the audit as summarised below:

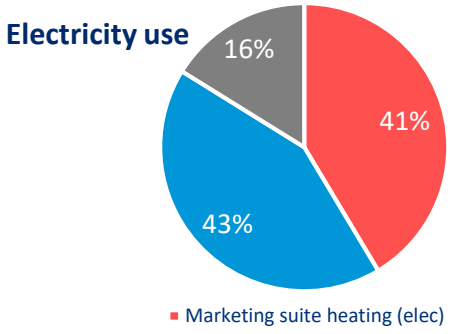
Measure	Typical payback (years)
Ensure all point of use hot water heaters are set to their 'Eco' setting. Many were observed to be set to higher temperature which is unnecessary.	instant
For ground workers with their own site accommodation, provide them with a minimum specification for any cabins that will be located on a Taylor Wimpey site and be using Taylor Wimpey's energy.	instant
Ensure all WCs are provided with low energy hand dryers rather than standard heater versions observed.	instant

Show home and building plots - Assessed breakdown of energy use[1]

Key point: Gas use is predominantly for show home and plot heating and hot water. Electricity is split between the show home/marketing suite and plots, with electric heating in the marketing suite and lighting the main consumers.

Show home and plot energy breakdown	Meadowsweet Farm	Torrance Gardens	Hamlet Woods	St Andrews Gardens	Kilnwood Vale	Chy An Dowr	Average
Gas							
Plot and Show Home Heating (gas)	80%	80%	80%	80%	80%	80%	80%
Plot and Show Home Hot water (gas)	20%	20%	20%	20%	20%	20%	20%
Electricity							
Marketing suite heating (elec)	16%	44%	69%	37%	37%	44%	41%
Lighting (elec)	75%	40%	21%	48%	31%	40%	42%
Other (elec)	9%	16%	10%	15%	32%	16%	16%





[1] Based on auditor's assessment during the site visits. No sub-metering in-situ

Show home and building plots
R1: Improve staff engagement

ABOVE: Images of common practice observed in show homes and sales offices. Left: show home lighting which was switched on at the beginning of the day and off at end of sales staff shift, regardless of whether show homes were being viewed. Middle: electric towel rail turned to highest setting being used to heat sales office kitchen space (as well as dry dish and hand towels). Right: electric convection heater with 24 hour time control switched to ‘hand’ and being switched on/off as required on highest temperature setting.

Show home and building plots, Recommendation R1:

Improve staff engagement

ISSUE	Heating control in the marketing suites, and lighting across the show homes and all plots is controlled manually by sales and construction staff, which has potential for inefficiency if not managed closely.
RATIONALE	Improving energy management in the marketing suite, show home and plots will only happen through improved understanding by operatives working in those areas of the potential benefit of ensuring the site energy use is minimised. Improvements in lighting and marketing suite heating control optimisation could have a significant impact across the business.
BENEFITS	Potential for no-cost energy savings. We have conservatively estimated that this could reduce show home, marketing suite and plot electricity consumption by 5% across Taylor Wimpey sites.
RISKS	None.
NEXT STEPS	Based on the findings of this report, inform site operatives of the costs associated with plot and showroom energy and provide guidance on how to optimise consumption.
BY WHOM	Central SHE teams in conjunction with site management and sales teams
BY WHEN	ASAP

ABOVE: Ensure sales staff are aware of how to effectively control the various types of electric heaters used in sales offices (top image is inefficient use of portable heaters at Meadowsweet Farm).

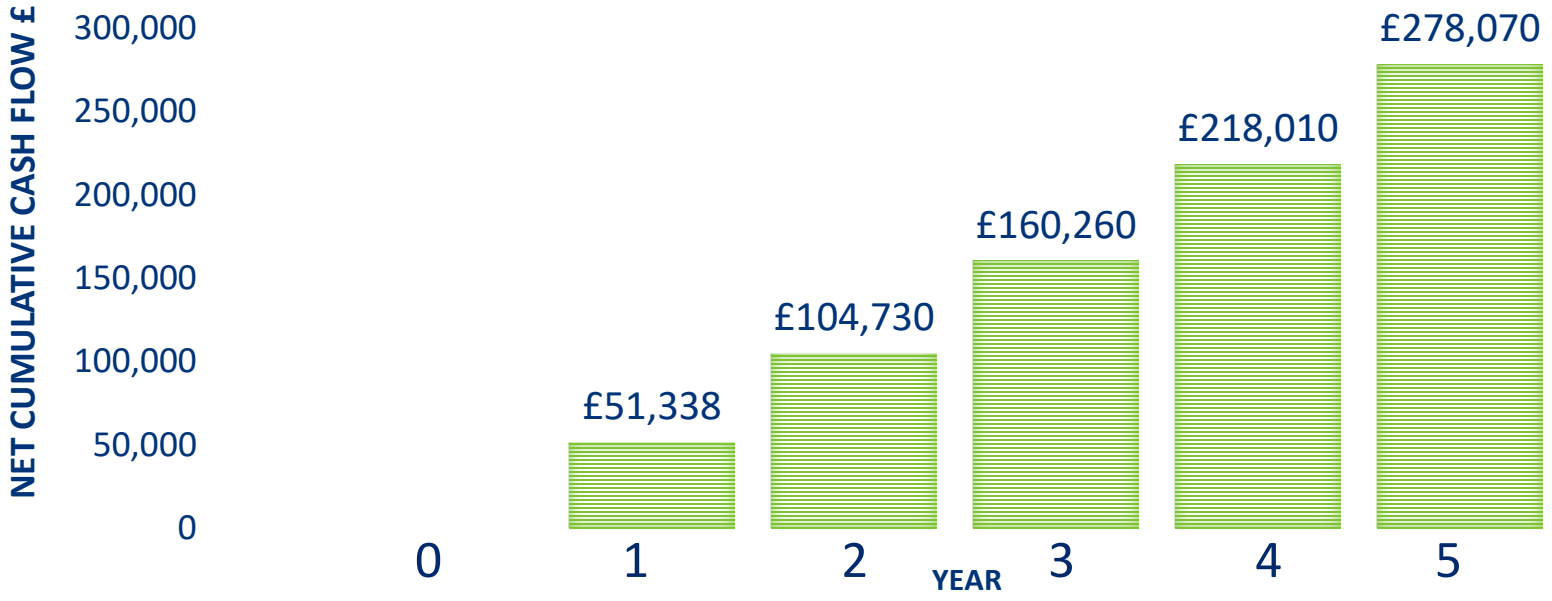
Lighting in show homes and plots should be switched off by staff when unoccupied.

Show home and building plots, Recommendation R1:

Improve staff engagement

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£51,338	instant	-	-	96.1

CUMULATIVE NET CASH FLOW YEAR[1] 0-5



[1]Whole year effect; assuming annual energy price inflation of 4%. Assumes 5% saving on show home, marketing suite and plot electricity use during the reference period

[2] Assumes internal time only.

Show home and building plots
R1: Heating control optimisation

ABOVE: There is limited guidance on ideal heating control set-points for plots and the show homes, which, as observed during the site audits, has resulted in varied approaches and inefficiency. Controls in show homes were set to maintain temperatures between 15 and 22C depending on the site. One heating controller had been set up to maintain a show home temperature of 21C from 16:30 until 22:30pm each evening despite show home opening hours being 10:00 to 17:00.

Show home and building plots, Recommendation R2:

Heating control optimisation

ISSUE	There is limited guidance on ideal heating control set-points for plots and the show home, resulted in varied approaches and inefficiency.
RATIONALE	Heating of plots and show homes accounts for ~80% of Taylor Wimpey natural gas consumption. While show homes might need to feel warm when potential buyers are walking around, out of hours temperatures should be frost protection only, and day time temperatures shouldn't need to exceed 21°C. Plots require background heating and frost protection only, so setting thermostats to frost protect or a background temperature of 10-12°C to avoid condensation would suffice.
BENEFITS	A 1°C reduction in heating temperature can reduce heating energy by 8%. Therefore a 8% saving has been estimated for heating systems through improved management of temperatures and run times.
RISKS	Failing to undertake such a review risks sub-optimal control logic and settings resulting in inefficient plant operation
NEXT STEPS	Provide site management and sales staff with guidance on ideal heating temperatures for plots and show homes.
BY WHOM	Site representative reporting to central SHE teams
BY WHEN	ASAP

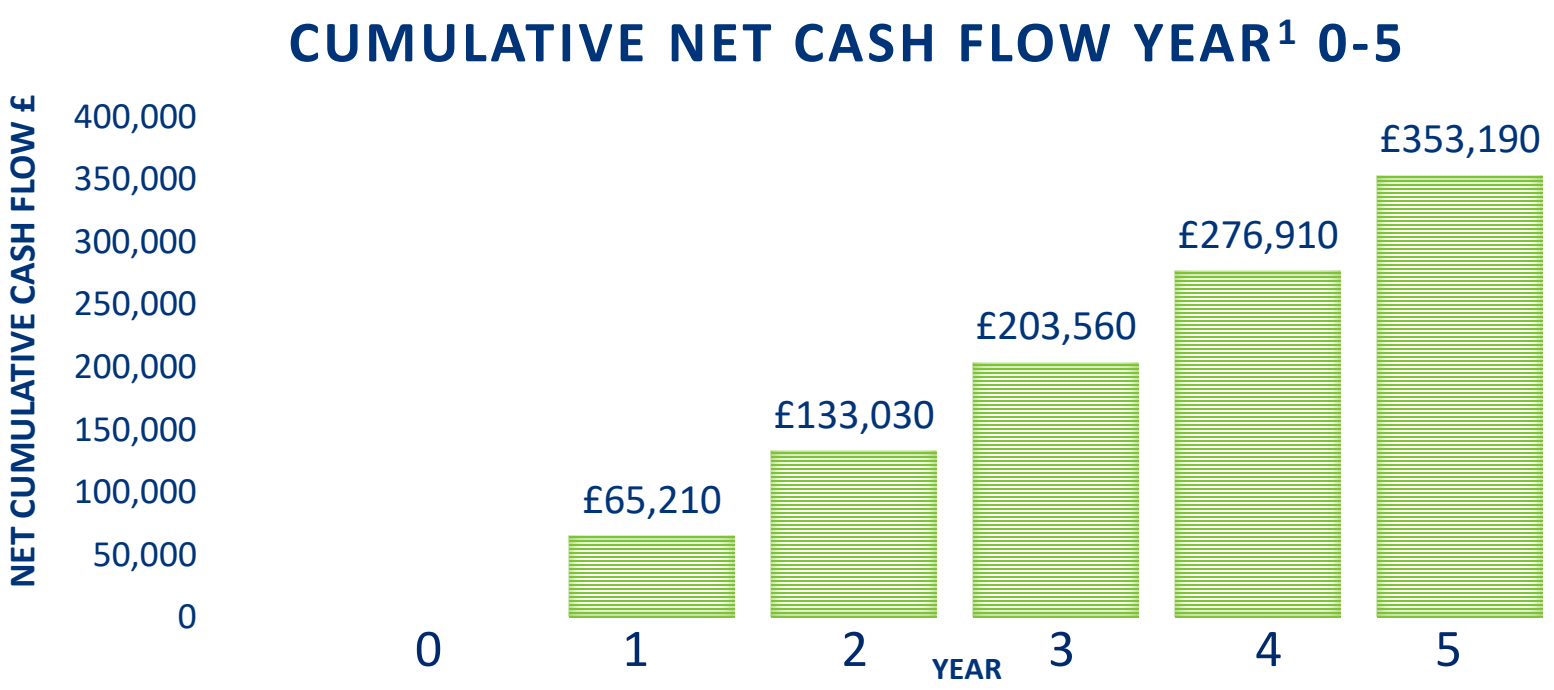
Site	Show home temperature set-point	Sample plot temperature set-point
Meadow-sweet Farm	21°C	16°C
Kilnwood Vale	19.5°C	No, heating on
Torrance Gardens	17.5°C	21°C

ABOVE: Varied show home and plot temperature set-points across the sample of audited sites suggest no uniform approach is taken, which is resulting in excessive temperature settings across the Taylor Wimpey estate. Show home heating at one site was set to stay on until 10:30pm.

Show home and building plots, Recommendation R2:

Heating control optimisation

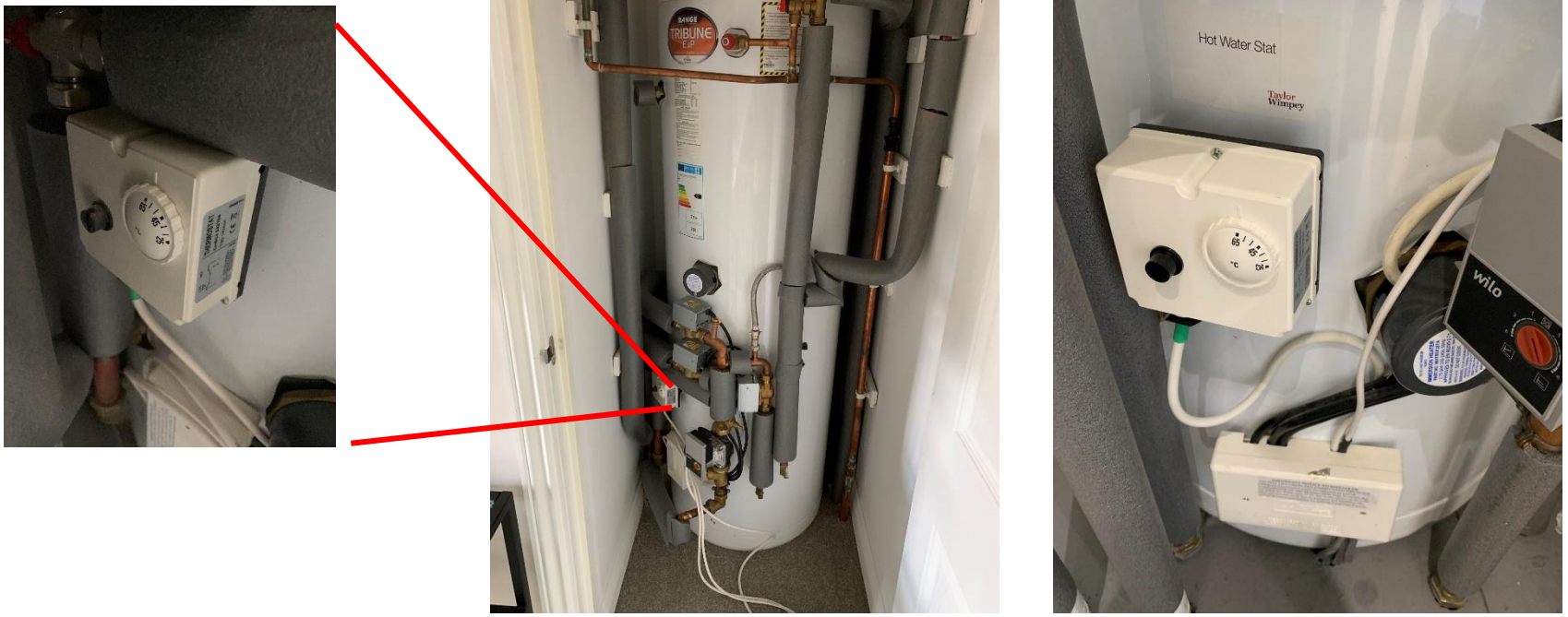
Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£65,210	instant	-	-	394.1



[1]Whole year effect; assuming annual energy price inflation of 4%. Assumes 8% saving on show home and plot heating natural gas use.

[2] Assumes internal time only.

Show home and building plots
R3: Hot water optimisation



ABOVE: Images of common practice in show homes and plots for maintaining hot water at temperature. Left at 65°C at St Andrews Gardens, right at 65°C at Torrance Gardens. The need for testing these systems requires them to be raised to temperature, but maintaining them at this temperature while awaiting sale (typically 4 months for a plot) is potentially resulting in avoidable energy use.

Show home and building plots, Recommendation R3:

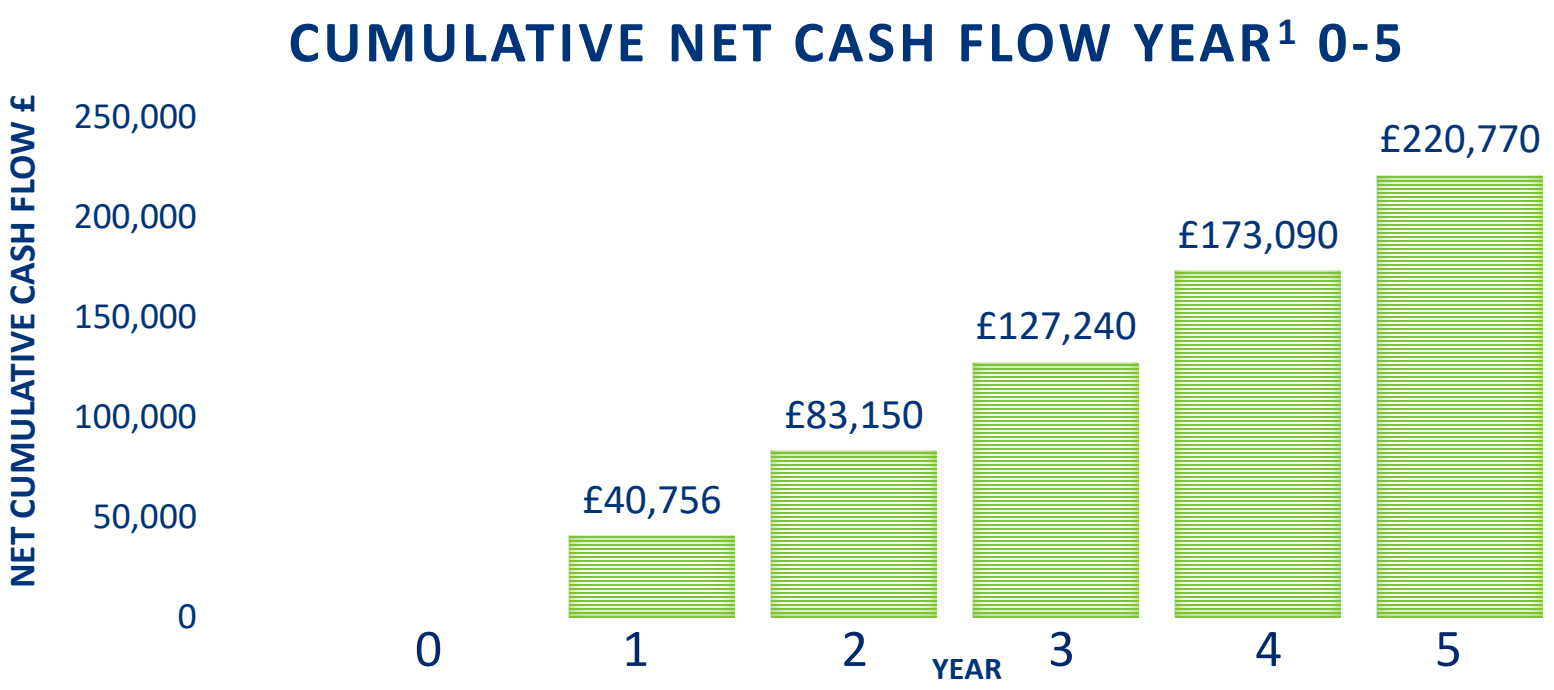
Hot water optimisation

ISSUE	Hot water in show homes and plots is routinely maintained at high temperatures while awaiting sale, resulting in significant, and potentially avoidable energy waste.
RATIONALE	Heating hot water in show homes and plots is estimated to account for 20% of Taylor Wimpey natural gas usage (equivalent to a ~£203.8k spend). While testing and commissioning of hot water systems requires them to be raised to temperature, maintaining these temperatures for several months is wasteful. Consider switching off water systems and maintaining below 20°C (for legionella protection) while sites are unoccupied to reduce energy waste.
BENEFITS	Switching off hot water systems could prevent months of gas use in heating hot water. We have conservatively estimated that this will reduce hot water gas consumption by 20%.
RISKS	Follow HSE guidance and undertake effective testing to reduce legionella risks, but avoiding system temperatures between 20-45°C should limit risks.
NEXT STEPS	Provide site management and sales staff with guidance on hot water control for plots and show homes.
BY WHOM	Site representative reporting to central SHE teams
BY WHEN	ASAP

Show home and building plots, Recommendation R3:

Hot water optimisation

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£40,756	instant	-	-	246.3



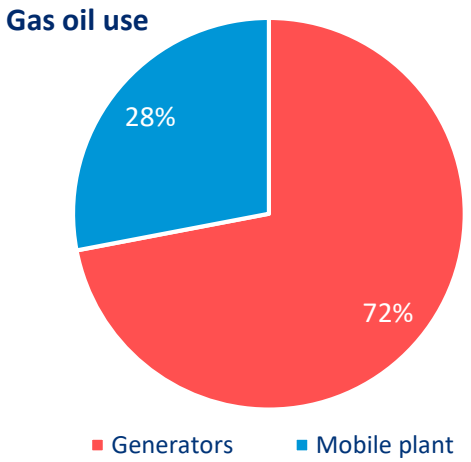
[1]Whole year effect; assuming annual energy price inflation of 4%. Assumes 20% saving on show home and plot hot water natural gas use.

[2] Assumes internal time only.

Gas oil - Assessed breakdown of energy use[1]

Key point: Gas oil usage on site is very much dependent on how quickly a mains electricity connection can be established on site. While the majority of gas oil use is for temporary generator power, gas oil accounts for 34% of Taylor Wimpey energy consumption – more than any other single fuel source

Gas oil energy breakdown	Meadow-sweet Farm	Torrance Gardens	Hamlet Woods	St Andrews Gardens	Kilnwood Vale	Chy An Dowr	Average of first 3 sites
Gas oil							
Gas oil (generators)	64%	69%	83%	0%	0%	100%	72%
Gas oil (mobile plant)	36%	31%	17%	0%	100%	0%	28%

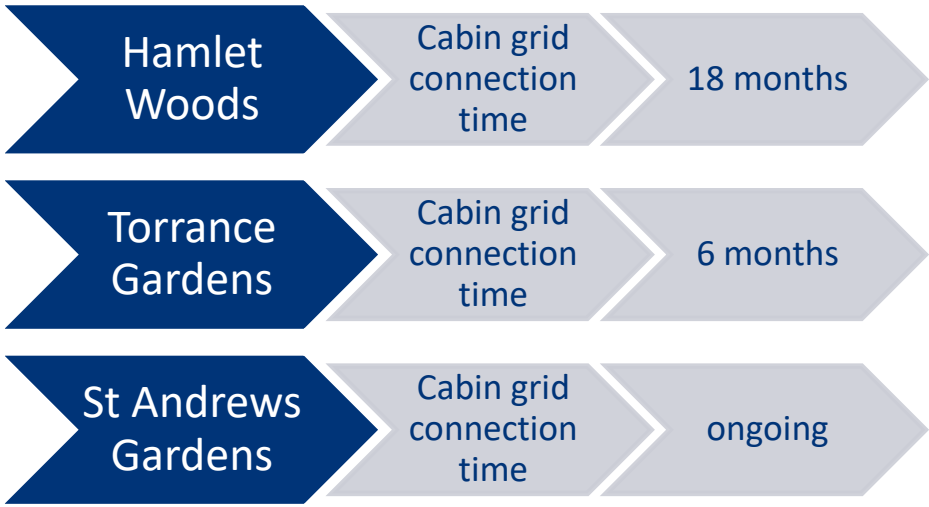


[1] Based on auditor's assessment during the site visits and data provided. No sub-metering in-situ

Gas oil
R1: Reduce grid connection time

- The use of gas oil for early stage generator power is estimated to cost Taylor Wimpey in the region of £2m per annum.
- Generators generally only have electrical generating efficiencies of ~30%, with the rest of the energy contained in the gas oil being lost as heat. Preventing this waste by connecting to grid electricity as early as possible is essential.
- Connecting to the electricity grid is not always a straightforward process, and can vary from site to site. However, Taylor Wimpey sites are normally occupied by ground workers prior to occupation by Taylor Wimpey, and lead in time should be used to effectively plan for grid connections well ahead of Taylor Wimpey arriving on site.
- Targets should be established for the maximum time a site can operate on diesel generators without a mains grid connection. This will help drive down generator use.

Examples of approximate time periods from Taylor Wimpey site occupation to mains grid connection for cabin compound electricity supply



Gas oil, Recommendation R1:

Reduce grid connection time

ISSUE	Excessive use of diesel generators prior to establishing mains electricity grid connections is a costly and carbon intensive exercise.
RATIONALE	While grid connections were established at all but one sample sites, diesel generators were used extensively prior to this date for early site works on some, which accounted for approximately 72% of the diesel used on site during the sample projects (remaining used mobile plant). Depending on loading, diesel generator efficiency in converting fuel oil to useable electricity can range from 15-35%, making it a wasteful, costly, and carbon intensive way of generating energy for the site.
BENEFITS	Early electricity supply from the grid reduces the cost and carbon impact of powering a building site. It also means that rental costs for the generator can be avoided. We have estimated that a 30% reduction in diesel generator use could be achieved through progressive targets.
RISKS	None with proper planning.
NEXT STEPS	Review site set-up and procurement policies and set targets for site grid connection times, limiting diesel generator use.
BY WHOM	Central SHE teams in conjunction with site planning and procurement teams
BY WHEN	ASAP

If diesel generator use was reduced by 30%, the equivalent savings through using grid electricity would be as follows…

Diesel generator
- 7,892 MWh fuel
- Costs £598k
- Carbon 2,026 tCO2e

Electricity generated
- Assuming 30% efficiency
- Generates 2,367 MWh

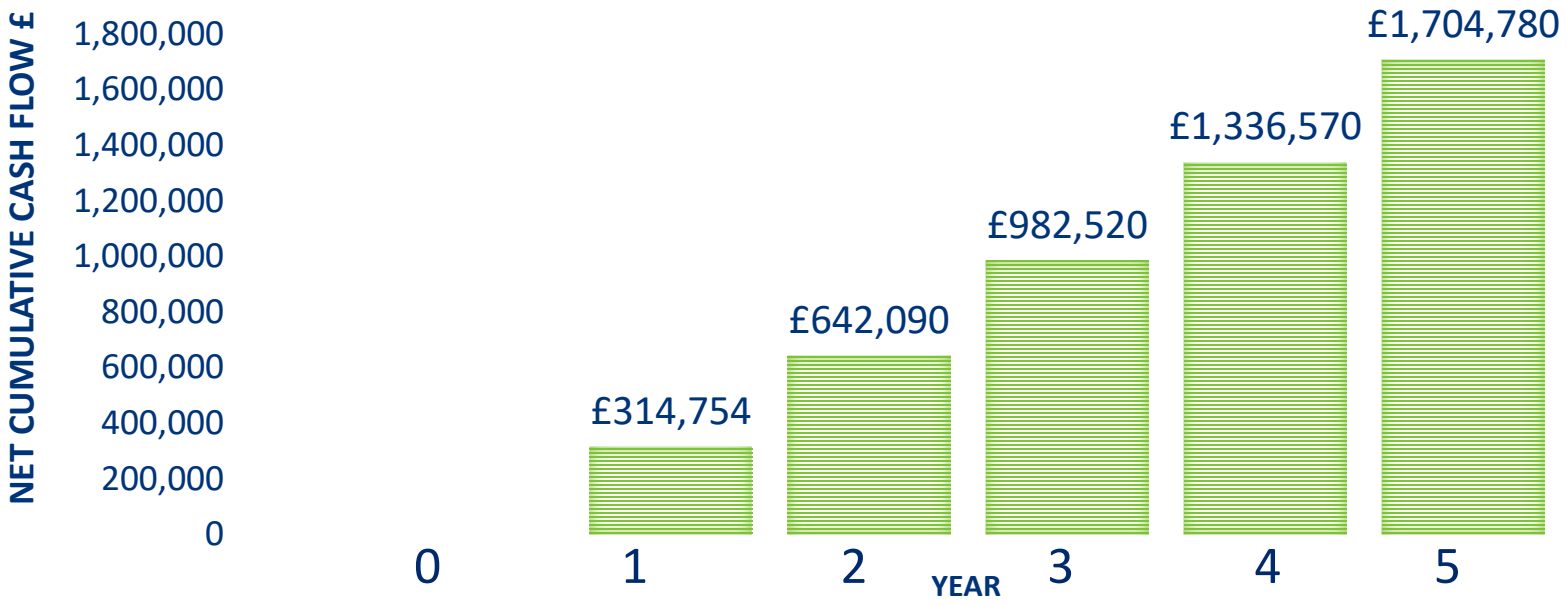
Grid supply
- Grid supplies 2,367 MWh
- Cost £284k
- Carbon 605 tCO2e

Saving
- Cost £314k (energy only, excludes hire cost savings)
- Carbon 1,421 tCO2e

Gas oil, Recommendation R1:

Reduce grid connection time

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2 reduction
£nil[2]	£314,754	instant	-	-	1,421.3



[1]Whole year effect; assuming annual energy price inflation of 4%. Based on reducing generator use by 30% (using grid electricity as an alternative).

[2] Assumes internal time only

Gas oil, Recommendation R2:

Use hybrid generators

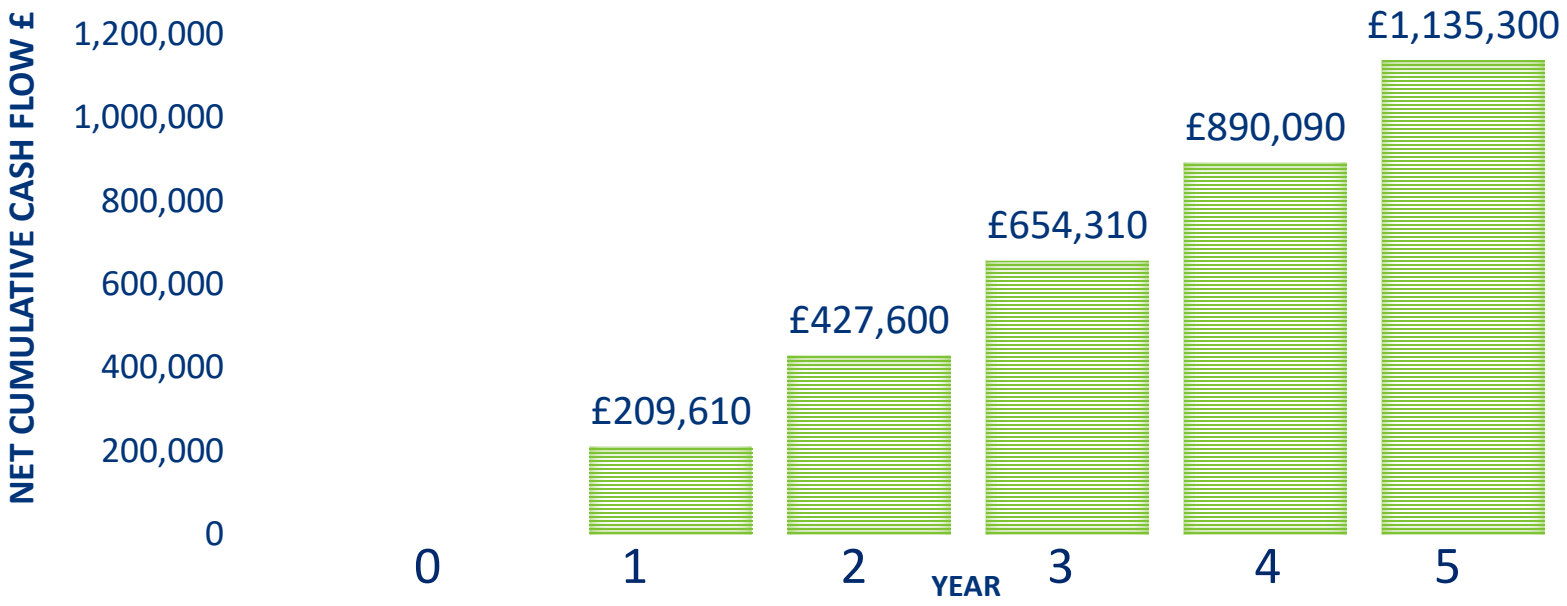
ISSUE	Where diesel generators have to be used, the most efficient systems available should be hired
RATIONALE	Where grid connection is not possible and diesel generators must be used to provide power to the site, hybrid diesel/battery powered generators offer the potential to significantly reduce the diesel fuel required to power the site, particularly when the compound requires only a small baseload of consumption which can be supported via the battery rather than a generator running at part load.
BENEFITS	Many hire companies now have hybrid generators as standard options in their generator portfolio. These offer fuel savings of up to 20% compared to standard diesel generators. We have conservatively estimated a 15% saving against remaining site diesel generator use (post R1 for shorter grid connection timeframes).
RISKS	Slight increase in equipment rental costs should be offset by fuel savings.
NEXT STEPS	Review procurement policies to specify hybrid generators for all future temporary power hire requirements.
BY WHOM	Central SHE teams in conjunction with site planning and procurement teams
BY WHEN	ASAP

Bruno, who manufacture the generator observed at St Andrews Gardens, have a range of hybrid generators available for hire with various kVA sizes to suit site requirements. Other hybrid generators are also available.

Gas oil, Recommendation R2:

Use hybrid generators

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2e reduction
£nil[2]	£209,610	instant	-	-	709.3



[1]Whole year effect; assuming annual energy price inflation of 4%. Based on reducing remaining generator diesel consumption (post R1) by 15% based on improved generator efficiency.

[2] Assumes internal time only

Gas oil, Recommendation R3:

Improved fuel monitoring

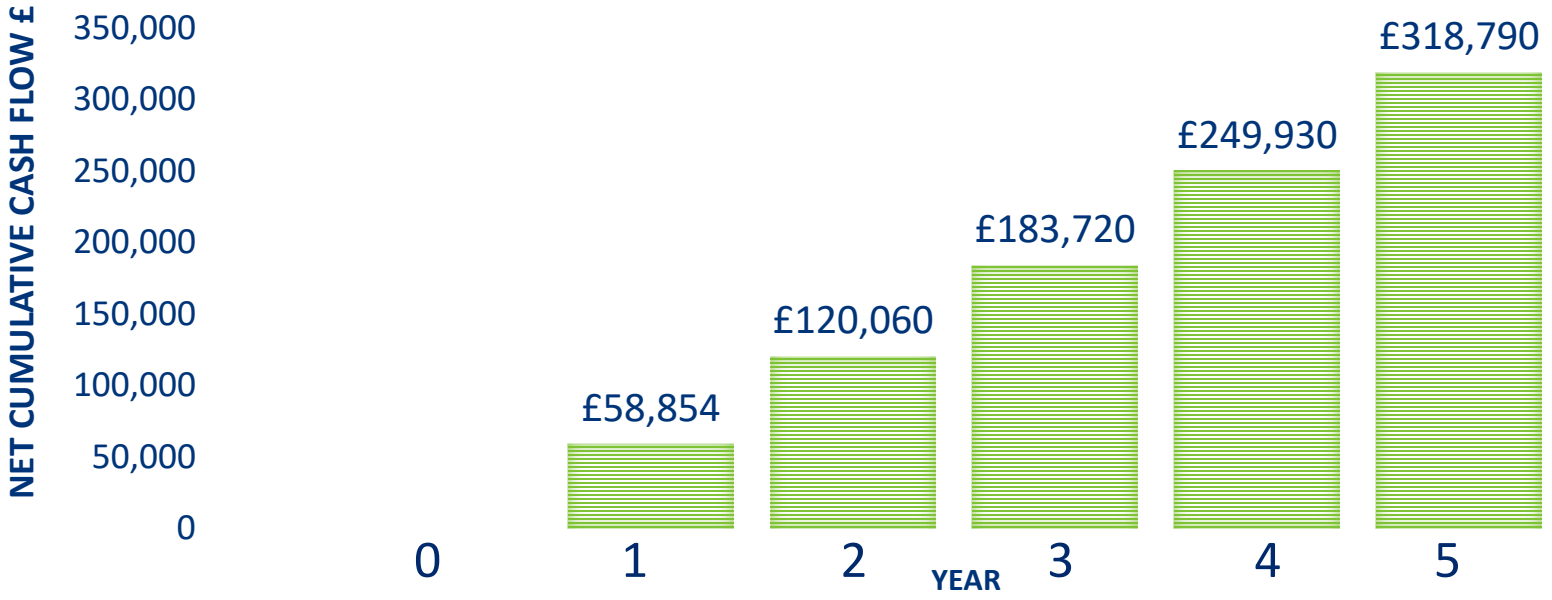
ISSUE	Bulk fuel use on Taylor Wimpey sites is recorded based on invoices from the fuel supplier with no accounting for how fuel is being used.
RATIONALE	In terms of managing the way bulk fuel is being used on site, Taylor Wimpey are 'flying blind' with respect to how their use of mobile plant at each site impacts on energy consumption. Improving definition of how bulk fuel is used will help provide the necessary feedback to optimise how mobile plant is used across the business if supported by effective driver and end user training on efficient operation.
BENEFITS	Data monitoring improvements commonly deliver 10%+ energy savings. We have estimated a conservative 7.5% saving on gas oil consumption based on greater information being used to drive better end user management.
RISKS	Failure to implement an appropriate monitoring system will undermine efforts to manage-down energy wastage
NEXT STEPS	Review options for separating out site gas oil consumption to create greater definition between mobile plant use and generator consumption.
BY WHOM	Central SHE teams in conjunction with site planning teams
BY WHEN	ASAP

Rather than relying on supplier invoicing, Taylor Wimpey should try to improve definition of whether fuel is used in generators or in tanks for mobile plant use.

Gas oil, Recommendation R3:

Improved fuel monitoring

Financials / Annual savings					
Cost	Year 1 saving[1]	Simple payback	NPV	IRR	tCO_2 reduction
£nil[2]	£58,854	instant	-	-	199.1



[1]Whole year effect; assuming annual energy price inflation of 4%. Based on reducing mobile plant gas oil use by 7.5% during the reference period.

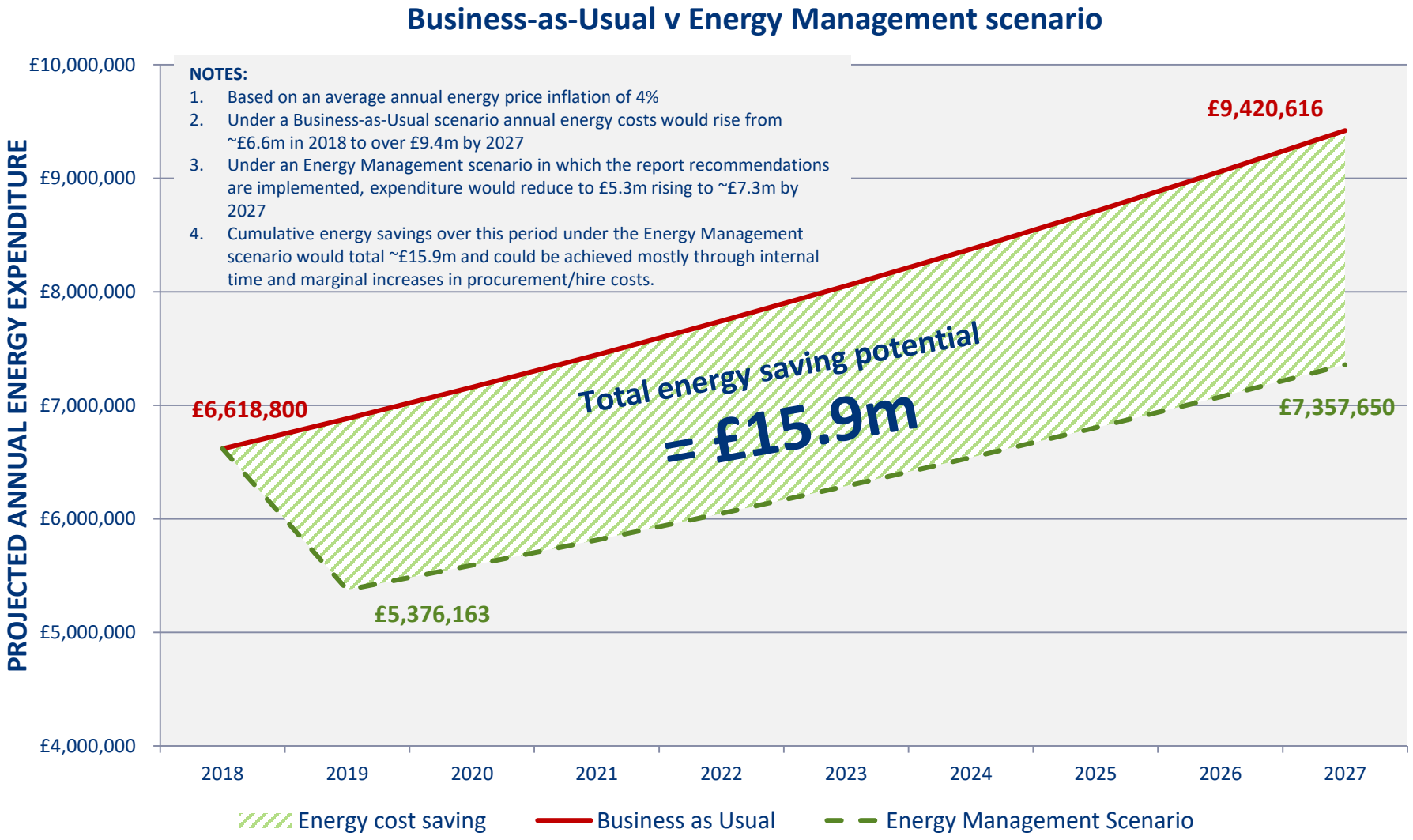
[2] Assumes internal time only

Summary of key energy saving opportunities

RECOMMENDATION			ANNUAL SAVINGS			ECONOMICS	
ENERGY SOURCE	***REF***	***DESCRIPTION***	***kWh***	***£***	***tCO_2e***	***INVESTMENT***	***PAYBACK YEARS***
Electricity (compound)	R1	Improved energy management, metering and zoning control	262,413	£35,843	67.1	Time only	-
	R2	Optimise heating controls	393,619	£47,234	100.6	Time only	-
	R3	Upgrade lighting to LED with controls	159,359	£21,767	19.1	£86,200	4.0
	R4	Drying room dehumidification	785,628	£107,308	200.8	inc in budget	-
	R5	Install temporary solar PV system	48,600	£5,832	12.4	Hire cost	-
Electricity (show home and plots)	R1	Improved staff engagement	375,861	£51,338	96.1	Time only	-
Natural gas (show home and plots)	R1	Heating control optimisation	2,143,728	£65,210	394.1	Time only	-
	R2	Hot water optimisation	1,339,830	£40,756	246.3	Time only	-
Gas oil (generators)	R1	Early grid connection	5,524,784	£598,886	1,421.3	Time only	-
	R2	Use of hybrid generators	2,762,392	£209,610	709.3	Hire cost	-
Gas oil (mobile plant)	R1	Improved data management	775,615	£58,854	199.1	Time only	-
TOTAL			**14,571,831**	**£1,242,637**	**3,466.3**	**£86,200**	**0.07**

Implementation of the recommendations contained within this report will reduce annual energy consumption by 16% and annual energy costs by 19%

Projected annual energy costs



6.0 Appendices

- Appendix A : Summary CV of Lead Assessor and auditor
- Appendix B : Audit details
- Appendix C : Site visit photographs
- Appendix D : Life Cycle Cost Analysis
- Appendix E : Implementation support
- Appendix F : Further reading

Summary CV of Lead Assessor and auditor

LEAD ASSESSOR & AUDITOR DETAILS	
NAME & JOB TITLE	Graham Hunter, Associate, Carbon Trust Advisory
ESOS LEAD ASSESSOR DETAILS	Stroma Certification Ltd, ESOS Lead Energy Assessor certification
	Lead Assessor ID: STR101147
QUALIFICATIONS	BEng Mechanical Engineering PGDip Renewable Energy and the Built Environment
PROFESSIONAL MEMBERSHIPS	ESOS Lead Assessor
OVERVIEW OF EXPERIENCE	Over 10 years experience in delivering successful energy reduction audits, programmes and projects across both public and private sectors throughout the UK. Key areas of expertise and skills include: • Energy data analysis and reporting • Energy policy, strategy and management system development • Energy auditing • Technical and financial due diligence of energy efficiency and renewable energy projects • Design and delivery of energy reduction training programmes • Design of new environmental standards for UK public sector organisations and charities

6.0 Appendices

- Appendix A : Summary CV of Lead Assessor and auditor
- Appendix B : Audit details
- Appendix C : Site visit photographs
- Appendix D : Life Cycle Cost Analysis
- Appendix E : Implementation support
- Appendix F : Further reading

Audit details [1/2]

SITE DETAILS			
SITE NAME & ADDRESS	Meadowsweet Farm, Land off Harbury Lane, Leamington Spa, Warwickshire, CV33 9QF	Hamlet Woods, Carr Lane, Prescot, Merseyside, L34 1JZ	St Andrews Gardens, Former NHS Trust Land at Northgate Hospital, Morpeth, Northumberland, NE61 3BP
SITE CONTACT FACILITATING AUDIT	Andrew Tromans, Site Manager	Paul Morris, Senior Site Manager	Stuart Fenwick, Site Manager
	Phone: 07816 514 003 *Email*: Andy.Tromans@taylorwimpey.com	*Phone*: 07816 517 378 *Email*: Paul.Morris@taylorwimpey.com	*Phone*: 07823 418 598 *Email*: Stuart.Fenwick@taylorwimpey.com
DATE OF AUDIT	10th October 2019	24th October 2019	30th October 2019
ACCESS REQUIREMENTS	No special access requirements		
PERSONAL PROTECTIVE EQUIPMENT NEEDED	Protective footwear; High-vis vest, hard hat, gloves		
OVERVIEW OF BUILDING & FACILITIES	Residential New Build; a collection of 194 No. 1/2/3/4/5 bedroom homes. Project started February 2018 (Taylor Wimpey on site)	Residential New Build; a collection of 173 No. 3/4 bedroom homes. Project started April 2018 (Taylor Wimpey on site)	Residential New Build; a collection of 225 No. 3/4/5 bedroom homes. Project started October 2016 (Taylor Wimpey on site)

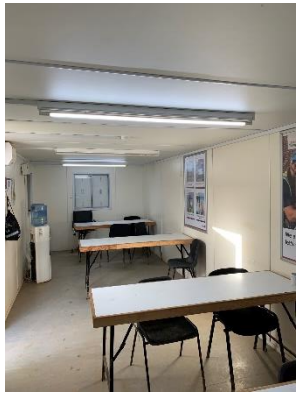
Audit details [2/2]

SITE DETAILS			
SITE NAME & ADDRESS	Torrance Gardens, Carmuirs Drive, Newarthill, Holytown, Motherwell, North Lanarkshire, ML1 5US	Kilnwood Vale, Off Horsham Road, Faygate, West Sussex, RH12 0BL	Chy An Dowr, Bickland Water Road, Falmouth, Cornwall, TR11 4SD
SITE CONTACT FACILITATING AUDIT	Alan Meek, Senior Site Manager	Nathan Carrick, Senior Surveyor	Ben Noakes, Site Manager
	Phone: 07796 253 099 *Email*: Alan.Meek@taylorwimpey.com	*Phone*: *07818 528 059* *Email*: Nathan.Carrick@taylorwimpey.com	*Phone*: *07866 033 186* *Email*: Ben.Noakes@taylorwimpey.com
DATE OF AUDIT	31st October 2019	30th October 2019	11th October 2019
ACCESS REQUIREMENTS	No special access requirements		
PERSONAL PROTECTIVE EQUIPMENT NEEDED	Protective footwear; High-vis vest, hard hat, gloves		
OVERVIEW OF BUILDING & FACILITIES	Residential New Build; a collection of 91 No. 3/4/5 bedroom homes. Project started July 2018 (Taylor Wimpey on site)	Residential New Build; a collection of 170 No. 1/2/3/4 bedroom homes. Project started - (Taylor Wimpey on site)	Residential New Build; a collection of 94 No. 2/3/4 bedroom homes. Project started September 2018 (Taylor Wimpey on site)

6.0 Appendices

- Appendix A : Summary CV of Lead Assessor and auditor
- Appendix B : Audit details
- Appendix C : Site visit photographs
- Appendix D : Life Cycle Cost Analysis
- Appendix E : Implementation support
- Appendix F : Further reading

Site visit photographs: Meadowsweet Farm



ABOVE: Most lighting in cabins was LED (standard fluorescent observed in ground workers cabin only), and while control was automated, settings were often observed to be at high light output, which is not the most efficient set-up. Lamps had been removed in some cabins and light levels were still adequate. Reviewed output settings would bring savings. Point of use water heaters provide hot water to the cabins.

BELOW: Various electric heaters all add to the electrical load in the cabins and could benefit from improved control as noted in the main report. Catering equipment and hand dryers also contribute to the electrical load of the compound.

Site visit photographs: Hamlet Woods

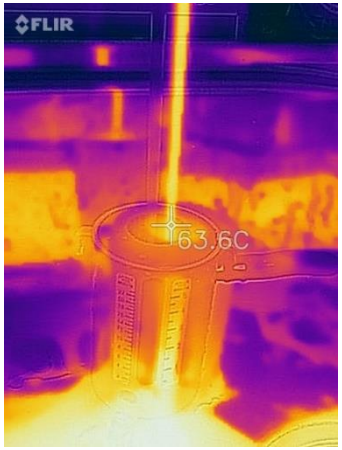
ABOVE: Lighting in cabins was a mixture of T5 fluorescent and LED, and while control was automated PIR settings were often observed to be at highest light output and run time, which is not the most efficient set-up. Point of use water heaters had been turned up to maximum output and an excessive water temperature of ~78C was recorded in the canteen.

BELOW: Heating control in cabins and drying room could be improved as noted in report.

Site visit photographs: St Andrews Gardens

ABOVE: Good control of light levels in cabins. Heater efficiency reduced by placement of furniture in canteen. Generator with an output of 36kW observed to be drawing only 5.7kW during site visit. Apart from the unnecessary cost of hiring a larger generator than required Taylor Wimpey will be incurring and additional energy cost as a generator running on part-load will have a reduced efficiency.

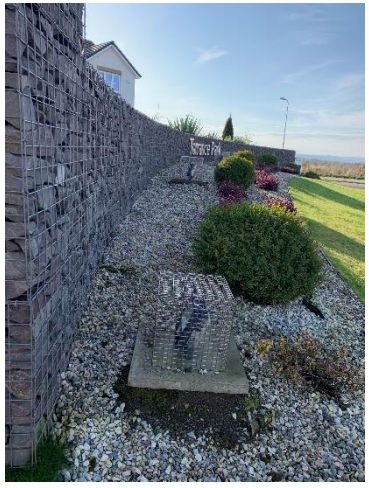
BELOW: 3 kW electric immersion heater being used to store hot water at above 63C. There was no obvious demand for this at site. Show home hot water storage was also set to 65C, this is unnecessary. Heater next to sink in site office giving out minimal heat should be removed as unnecessary.



Site visit photographs: Torrance Gardens

ABOVE: Most lighting in cabins was by LED or T5 fluorescent. Time controller on site office fan heater was 2 hours ahead of time and set to 'advance' suggesting this was being used as on on/off switch instead of its intended use.

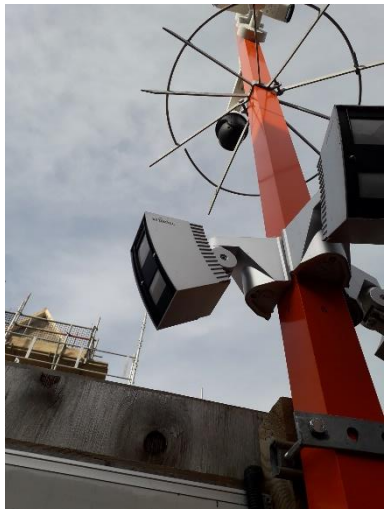
BELOW: Above door fan heater and humidistat control temperature/humidity in drying room. Extensive use of external LED lighting to promote the site to passing traffic. As was common across audited sites, point of use water heaters had been turned to highest temperature setting and tap temperatures were measured to be excessive.

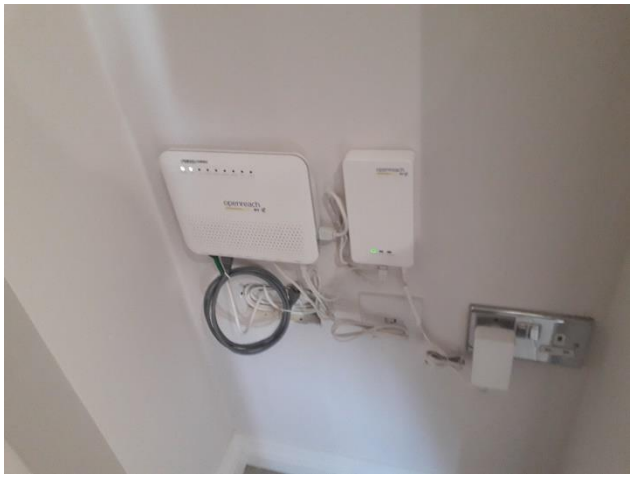


Site visit photographs: Kilnwood Vale

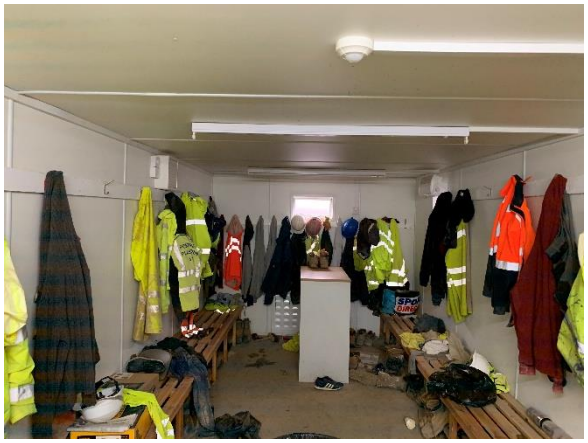
ABOVE: Electric heating in the compound set to 'hand' rather than utilising 24 hour time control. The combination of electric and gas central heating in sales office is excessive and inefficient.

BELOW: More extensive use of external security lighting and IT equipment was observed at this site. Compact fluorescent can easily be replaced with LED lamps.





Site visit photographs: Chy An Dowr



ABOVE: Additional fan and convection heaters had been added in drying room to try and dry out clothes quicker. These types of heaters are inefficient at drying out clothes, especially in the layout observed with clothing covering convection heaters.

BELOW: Tap flow rates were measured at ~12 litres per minute. 4 litres per minute should be adequate and flow restrictors should be applied. All show home lighting was observed to be switched on during the site audit despite no visitors being present.

6.0 Appendices

- Appendix A : Summary CV of Lead Assessor and auditor
- Appendix B : Audit details
- Appendix C : Site visit photographs
- Appendix D : Life Cycle Cost Analysis
- Appendix E : Implementation support
- Appendix F : Further reading

Cabin Compound
R3: Upgrade lighting to LED with controls

Project Ref: TW R3						YEARS					
Light fittings: internal	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CAPITAL COST											
Luminaires	£86,200										
Installation	£0										
Total capital cost	**£86,200**										
UTILISATION COST	% ESCALATOR										
Fuel cost	4.0%	£195,900	£203,736	£211,885	£220,361	£229,175	£238,342	£247,876	£257,791	£268,103	£278,827
CCL			£0	£0	£0	£0	£0	£0	£0	£0	£0
Other			£0	£0	£0	£0	£0	£0	£0	£0	£0
Total utilisation cost		**£195,900**	**£203,736**	**£211,885**	**£220,361**	**£229,175**	**£238,342**	**£247,876**	**£257,791**	**£268,103**	**£278,827**
MAINTENANCE/OTHER COSTS	% ESCALATOR										
Maintenance	0.0%		£0	£0	£0	£0	£0	£0	£0	£0	£0
Other			£0	£0	£0	£0	£0	£0	£0	£0	£0
Total maintenance/other costs		**£0**	**£0**	**£0**	**£0**	**£0**	**£0**	**£0**	**£0**	**£0**	**£0**
COUNTER FACTUAL COSTS	% ESCALATOR										
Fuel cost	4.0%	£217,667	£226,374	£235,429	£244,846	£254,640	£264,825	£275,418	£286,435	£297,892	£309,808
CCL			£0	£0	£0	£0	£0	£0	£0	£0	£0
Maintenance	0.0%		£0	£0	£0	£0	£0	£0	£0	£0	£0
Other			£0	£0	£0	£0	£0	£0	£0	£0	£0
Total counter factual cost		**£217,667**	**£226,374**	**£235,429**	**£244,846**	**£254,640**	**£264,825**	**£275,418**	**£286,435**	**£297,892**	**£309,808**
NET CASH FLOW	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Net benefit/(cost)	£(86,200)	£21,767	£22,638	£23,543	£24,485	£25,464	£26,483	£27,542	£28,644	£29,790	£30,981
Cumulative cash flow (out)/in	£(86,200)	£(64,433)	£(41,795)	£(18,252)	£6,233	£31,697	£58,180	£85,722	£114,366	£144,156	£175,137

RETURN ON INVESTMENT (TO MAX 20-YEARS)	
Reference economic life (years)	20
Estimated economic life (years)	20
Discount rate	6.00%
NPV - Net Present Value (real)	£258,587
IRR - Internal Rate of Return	29%
Break even (year)	4

LCCA not undertaken for any other projects as these opportunities could be implemented by internal time and marginally increased procurement/hire costs, not expected to be separate CAPEX investments

6.0 Appendices

- Appendix A : Summary CV of Lead Assessor and auditor
- Appendix B : Audit details
- Appendix C : Site visit photographs
- Appendix D : Life Cycle Cost Analysis
- Appendix E : Implementation support
- Appendix F : Further reading

Implementation support

- ESOS has been enacted to enable companies to better understand the energy and cost saving opportunities that exist within their buildings, processes and transport facilities and assets
- The identification of energy saving opportunities is the first step towards enjoying reduced energy costs and improved competitiveness
- As a mission driven company, the Carbon Trust has developed and supported a number of services designed to ease, facilitate and maximise the benefit of implementing energy saving projects
- These include:
  - Green Business Directory
  - Green Business Fund
  - Energy Technology List

For further details visit

www.carbontrust.com

Beyond ESOS compliance

IMPLEMENTATION SUPPORT

Carbon Trust can help your business put the cost-saving recommendations resulting from ESOS compliance into practice. We offer tailored expertise and knowledge to help your organisation procure and implement the best-value low carbon solutions that will reduce your energy costs and increase profits.

ACCREDITED SUPPLIERS

Looking to implement one or more of the recommendations resulting from your ESOS assessment? Find your ideal supplier and installer in our directory of independently assessed accredited businesses. Our Green Business Directory removes other significant barriers to investment – confidence in supplier claims, differentiating within a crowded market and understanding complex technologies.

BUSINESS ADVICE

We help companies turn good environmental performance into competitive advantage. We can offer support in areas such as: ISO 50001:2011 implementation, target-setting, supply chain engagement, corporate sustainability strategy, employee engagement, and business model innovation.

CERTIFYING

Providing independent verification of organisational and product footprints to endorse sustainable leadership. We also offer certification to ISO 14001:2015 either as a stand alone certification, integrated with ISO 50001:2011 certification, or as complementary to the Carbon Trust Standards for Carbon, Water, Waste, Supply Chain and Zero Waste to Landfill

4,500

Number of businesses provided with loans for investment in energy efficiency

CARBON TRUST ACCREDITED SUPPLIER

CARBON TRUST STANDARD
REDUCING CO2 YEAR ON YEAR

reducing with the Carbon Trust
CO2
carbon-label.com

CARBON TRUST | ACCREDITED SUPPLIER

CARBON TRUST

Find your ideal energy efficiency or renewable technology supplier with the Carbon Trust *Green Business Directory*

If you're looking to install an energy efficient or renewable technology there can be a number of barriers, including:

- Knowing which supplier claims to trust
- Differentiating between suppliers in the market
- A lack of customer understanding
- No time to assess all of the options

The Carbon Trust Green Business Directory is the market leading supplier directory, providing users with the following benefits:

- A free-to-use resource
- A trusted quality standard
- Independent assessment and validation of a supplier's skills and services
- Easily filterable and searchable database of 'best in class' suppliers

The UK Government encourages businesses to invest in energy saving technologies through accelerated tax relief

CARBON TRUST

- Energy Technology List
  - A procurement list of over 17,000 government verified energy saving products used by enterprises
  - Products have top quartile energy saving performance
  - Provides ready-made equipment specifications
  - Supports compliance with SKA Rating and BREEAM
- Enhanced Capital Allowance
  - Purchase of ETL listed technologies qualify for 100% capital allowances, thereby giving a cash flow boost to the enterprises bottom line.

To find out about the ETL and ECA scheme visit:

www.gov.uk/energy-technology-list

Technologies supported include:

- AM&T equipment
- Lighting
- Motors & VSDs
- Packaged chillers
- Boilers
- Heat pumps

Example of financial benefit

An enterprise spends £50k on ETL qualifying products:

Tax relief = purchase price x capital allowance x corporation tax

ECA relief = £50k x 100% x 20% = £10k

CA relief = £50k x 18% x 20% = £1.8k

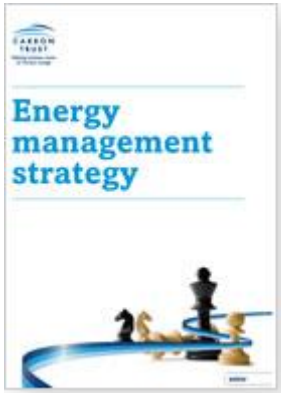
The ECA delivers £8.2k more cash flow in the first year.

6.0 Appendices

- Appendix A : Summary CV of Lead Assessor and auditor
- Appendix B : Audit details
- Appendix C : Site visit photographs
- Appendix D : Life Cycle Cost Analysis
- Appendix E : Implementation support
- Appendix F : Further reading

Further reading [1/2]

› To support Taylor Wimpey's efforts to improve their energy and environmental performance and to implement the recommendations within this report, we recommend and can supply (free of charge) the following Carbon Trust best practice guides.



Strategic energy management overview (CTV022)

This publication introduces energy management at a strategic level, and puts it in a business context.

Successful energy management must combine an effective strategy with the right practical interventions. It needs to begin with the key decision makers, and then involve every employee on a day-to-day basis. This guide includes a sample energy management matrix and a sample energy policy.

Creating an awareness campaign pack (CTG001)

This guide provides ideas and resources to motivate every individual within your organisation to save energy, ensuring long-term benefits for people, the business and the environment.
Creating an energy awareness programme depends on an organisation's particular circumstances. Some companies are more advanced than others, while some individuals are less energy aware than their colleagues.
This guide will help to make energy awareness part of your organisation, using four essential steps: planning, implementation, reviewing and maintaining commitment.

Further reading [2/2]

Heating controls (CTG065)

This guide will help the reader:
• Understand their existing controls and ensure controls are set up correctly
• Choose the best types of control, particularly when considering upgrading a heating system.

Lighting: Bright ideas for efficient illumination (CTV049)

Reducing energy use makes perfect business sense; it saves money, enhances corporate reputation and helps everyone in the fight against climate change. This technology overview introduces the main energy saving opportunities for lighting and demonstrates how simple actions can save energy, cut costs and may increase profit margins.