Ashford and St. Peter's Hospitals NHS
NHS Foundation Trust

TRUST BOARD

30th July 2015

TITLE	**Energy and Climate Change Adaptation Strategy**
EXECUTIVE SUMMARY	The Energy and Climate Change Adaptation Strategy sets out a 5-year plan to improve the resilience of our heating and electrical supplies. It also sets out how the Trust will reduce the cost of carbon emissions and to address the frequency and severity of summer indoor overheating attributed to climate change.
BOARD ASSURANCE (Risk) IMPLICATIONS	Summer indoor overheating presents a progressive risk to patient and staff comfort and safety. There are regulatory and financial risks from rising energy and taxation costs. The action plan has capital funding implications and funding will be secured through the Trust's normal business planning and capital planning processes.
LINK TO STRATEGIC OBJECTICE / BAF	**SO1:** Best Outcomes **SO2:** Patient Experience **SO3:** Skilled Motivated Teams **SO4**: Top Productivity
STAKEHOLDER / PATIENT IMPACT AND VIEWS	The strategy is geared towards the delivery of robust, flexible and improved indoor environmental conditions for patients and staff.
EQUALITY AND DIVERSITY ISSUES	None known.
LEGAL ISSUES	Compliance with NHS Health Technical Memoranda (HTMs) and carbon reduction targets within the NHS Sustainability Strategy are mandatory.
The Trust Board is asked to:	Approve the Energy and Climate Change Adaptation Strategy.
Submitted by:	Chris Bell, Associate Director of Estates and Facilities on behalf of Valerie Bartlett, Deputy Chief Executive
Date:	30th July 2015
Decision:	Approval

Ashford and St. Peter's Hospitals NHS
NHS Foundation Trust

Energy and Climate Change Adaptation Strategy

1. INTRODUCTION

A case for the development of a strategy was outlined in the Sustainable Development Board Report of November 2014. Three key related challenges facing the Trust are highlighted below:

1. Work to improve the resilience and flexibility of electricity and heating service infrastructure at SPH is necessary in order to meet growing site demands.
2. The increasing frequency and intensity of indoor overheating is a growing risk to patient health. To reduce patient risk and minimise ongoing cost pressures it is necessary to provide buildings that are adapted to overheating effects attributed to climate change. In order to achieve this, the design and operation of new and existing buildings requires specific review and additional investment where necessary.
3. The growth in energy demand arising from increased business activity will add to the Trust's annual energy costs of £2.25m. These costs can in part be mitigated through the adoption of energy efficient procurement standards for new and existing buildings and plant.

Work on these actions will make a significant contribution towards improving the resilience, safety and comfort of our buildings, this creating the firm foundations of a modern estate. It will also help the Trust to meet its Sustainable Development policy goals of achieving the NHS and government carbon reduction targets of 28% by 2020 and 80% by 2050.

The sections below describe the three main challenges in more detail.

2. CHALLENGE 1: INFRASTRUCTURE RESILIENCE

The Trust's electricity and gas supplies must have the capacity to accommodate future growth in activity. They also need to be able to adapt and respond to disruptions or adverse events whilst continuing to deliver heating and power to essential services. The Trust faces a range of emerging resilience issues that relate to service robustness, redundancy and re-configurability.

I. Robustness – our electricity and heating systems should be able to absorb the effects of growth or a supply failure event and continue to operate at the required level;

II. Redundancy – where robustness cannot be guaranteed, it is essential to provide more than one means to provide electricity or heating;

III. Re-configurability –Heating or electrical power sources and networks should be adaptable to cope with the effects of unexpected events.

The key resilience issues are summarised in the following sections. Infrastructure resilience objectives and key actions are also detailed within **Appendix 1**.

- Power supply to SPH

There are three main priority electrical power issues that the strategy addresses:

1. Electricity supplied to the SPH site by National Grid comes via two separate supplies. Whilst the supply cables take different routes to reach the site they are ultimately fed from the same sub-station. This was recently confirmed by the national grid operator, UK Power Networks (UKPN). In the event of a major power loss at this sub-station, the SPH site would lose some or even all of its grid power supplies. Whilst the Trust's own standby electrical generators would be able to step in and provide power to the majority of the site, it is not presently possible to provide 100% site coverage. In order to ensure continuity of supply the Trust must address this issue with UKPN in order to ensure a diversified supply with each supply being fed from a separate power source, as was previously the case. Any financial cost associated with any external infrastructure change is presently unknown.

2. In the event of the loss of one or both external electrical supplies the Trust's standby electrical generator system cannot provide 100% coverage. Growth in energy demand is outstripping the capacity of our standby electrical generator system. For instance, Departmental Block does not have 100% coverage and other areas too are also reaching the limits of what the standby generators can supply. In order to manage this risk it is planned to upgrade and replace the St Peters stand by generators as part of a three year phased capital programme. Structural feasibilities and commissions for an engineering design and report to resolve on-site and off-site supply issues are underway, and should be completed by October 2015.

3. If there were a loss of one of the external electrical supplies, the Trust's own on-site electricity network is not structured in a form that easily accepts an alternative power source. To avoid a partial loss of service and disruption to business continuity, the high-voltage (HV) electricity network, therefore, requires re-configuration.

- SPH heating

Whilst the boilers at SPH have 10-15 years useful life remaining, the overall distribution system is inefficient and at 46 years old has reached the economic end of its life. At least 40% (£260,000) of the gas consumed at SPH each year is wasted. Accordingly, a business case is being developed for alternatives involving the combined use of heat and power (CHP) and conventional gas boilers. By generating electricity as well as heating simultaneously, this technology can offer energy, carbon and maintenance cost savings of £350,000-£450,000 per year over 25 years. CHP would, however, incur a high capital cost at around £5.5m.

The St. Peter's Master-Plan identifies a potential increase in the building floor area of up to 26%. The prospect of site redevelopment presents a timely opportunity to review

current strategies to heat, cool and provide power using CHP. Given the low carbon credentials of CHP by local planning authorities, its on-site application would provide considerable leverage with the local planning authority as to the scale, nature and ultimate cost of future building development. Renewing the heating system with CHP would also de-risk heating system performance and reliability, reduce maintenance costs and offer the opportunity to renew and standardise aged infrastructure. Work to develop the technical and financial options for CHP will progress this year. It will be coordinated as part of the work to upgrade the resilience of the electricity supply at SPH.

3. CHALLENGE 2: ADAPTING OUR BUILDINGS TO CLIMATE CHANGE

Recently experienced climate change has caused most Trust buildings to overheat in the summer with increasing frequency and intensity. Overheating and high temperatures can be directly associated with illness and poor health and present a growing risk to the Trust. According to the UK Climate Change Sub-Committee, mortality in the UK associated with heat is expected to increase by 70%, 260% and 540% in the 2020s, the 2050s and the 2080s respectively, compared to the 2000s.

The Sub-Committee report also identifies that 90% of the UK hospital stock belongs to categories vulnerable to overheating. Consistent with the UK assessment, Trust building temperatures in some wards can approach 30˚C even at external temperatures of 22 ˚C. The definition of overheating is described in **Appendix 2**.

One of the causes of overheating in Trust buildings is outmoded building design and poor ventilation, which is exacerbated by the installation of window restrictors (installed for patient safety). Additional heat gains occur from increased staffing levels and electrical equipment. This has further compounded the problems associated with the building design.

Whilst actions within the Trust's Heatwave Plan can help on a short-term basis, temperatures for clinical areas are exceeding the Plan's maximum recommended temperature of 26^{o}C. Regular issues are occurring in the Duchess of Kent Wing, the 56-bed ward unit and Abbey Wing - especially in areas where there are no ventilation/air conditioning systems. To avoid overheating within our existing and new buildings an approach must be developed that is consistent with Health Building Note guidance. This provides suggestions to improve the design of the building envelope, including insulation, ventilation, cooling, shading and the use heat-reflective materials.

Some actions are already underway to address overheating - such as the upgrades to Operating Theatres ventilation systems. These form part of a planned capital programme that is due for completion by 2018. The list of climate change adaptation objectives and key actions are given within **Appendix 1**.

4. CHALLENGE 3: MITIGATING UTILITY COSTS AND CARBON EMISSIONS

This strategy also considers the means to mitigate rising fuel costs and carbon emission taxes through high quality design, specification and operation of buildings and plant.

Building Regulations and planning policy dictate increasingly higher-performance environmental designs that can have long-term cost implications for the Trust. **Appendix 3**

provides further detail on regulation, standards and carbon taxation costs. Arising from this, it is important to consider the regulatory impact of new building legislation and apply this to building design, site redevelopment and any future impact on the capital planning process. High quality building design is, above all, critical to achieve the best in terms of building performance and operating cost. Overall, energy efficiency can offer the following benefits:

- Patient comfort and experience is improved by reducing the incidence of over and under-heating.
- High efficiency design can deliver significant lifetime maintenance and operating cost savings. It also minimises any further demands on the Trust's electricity infrastructure.

To implement high quality design, the Capital Projects Team is developing a series of Design Guide specifications. These will aim to develop consistent and compatible higher quality design for new buildings and refurbishments. The Guide will drive forward improvements to specifications, commissioning and handover. These will also consider climate change building adaptation measures as part of the brief, and in this way, overheating issues should also be minimised.

Overall the Trust strategy will be to follow the guidance as set out in professional guidance established in Health Technical Memorandums and relevant best practice publications. Deviations from best-practice should be logical and justified and agreed by clinical, capital and maintenance teams.

A range of completed or planned (funded) capital works and unfunded options such as combined heat and power (CHP) and solar electric panels are included within **Appendix 4**.

4. FIVE YEAR STRATEGIC PLAN

The five year strategic plan performance targets are:

- To complete the standby generator upgrade.
- To complete the national grid and SPH electrical supply upgrade.
- To complete the CHP business case for the SPH campus.
- To improve the energy performance to meet or exceed the national average.
- To reduce intensity and frequency of indoor overheating within existing buildings.
- To meet or exceed NHS England's carbon reduction targets

The strategy is divided into the three discreet areas:

1. Infrastructure resilience
2. Adaptation measures to buildings to prevent indoor overheating
3. Mitigating utility costs and carbon emissions

The objectives are set out in **Appendix 1.**

The key actions planned and annual milestones to deliver the strategic plan are set out overleaf:

YEAR	ACTIONS
1 (2015/16)	• Commission a design and business plan to revise the SPH High voltage (HV) electricity network so that it provides sufficient flexibility to meet the site's total electrical demand from any alternative source at any point along the network. • Open dialogue and negotiate with UKPN regarding the risks and mitigation options of reinstating a fully diversified electricity supply source to the SPH site. • Develop the Combined Heat and Power (CHP) proposal for the SPH site. • Review existing and new building refurbishment options using climate change building modelling methods. Prepare and agree action plan and capital programme options to manage the risks associated with indoor overheating. Review the Trust Heatwave Plan. • Adopt and apply the use of the Building Design Guide. • Capital works programme: upgrade of Ashford Theatre ventilation system and corridor lighting. • Undertake a regulatory impact assessment to consider the risks to the Trust arising from expected changes in energy-related building regulations (e.g. 2018 Building Energy Performance Regulations).
2	• Planned start to SPH (HV) and UKPN electricity network upgrade. • Capital works programme: completion of upgrade to Ashford Boilers, SPH Theatre 1 and 3 ventilation systems. • Anticipated start to future planned capital programme to manage building overheating issues. • Feasibility of disconnecting 3rd party users of Trust electricity supplies to be determined. • Design Guide review and update. Cost options for Master Plan building design and plant agreed in principle.
3	• Complete the SPH (HV) and UKPN electricity network upgrade. • Completion of any necessary retrofit works to improve the energy efficiency of areas implicated in the Master Plan that are affected by

	new building energy efficiency regulations. • 3rd Party use of Trust electricity supplies ends, providing the Trust with an additional 10% more power supply capacity.
4	• Complete the SPH (HV) and UKPN electricity network upgrade. • Further / ongoing capital programme to manage existing building overheating issues. • Ventilation upgrades to Wards, remaining Theatres and offices complete.
5	• CHP facility completed and operational (conditional on proposal viability). • High performance building designs incorporated into all new facilities the Master-plan. Costs and overheating mitigated from outset. • All building adaptations to existing buildings complete. Summer overheating issues and risks mitigated. • Improvements to building energy efficiency completed across the whole estate. The Trust meets or exceeds the national average DEC certificate standard.

It is proposed that progress is monitored through the Estates Infrastructure Group which will report to the Capital Control Group.

The Trust will receive an annual report that updates progress and performance against the strategic plans outcomes, objectives and action plan.

5. CONCLUSION

The Energy and Climate Change Adaptation Strategy sets out a 5-year plan to improve the resilience of our heating and electrical supplies and to address the growing issue of overheating caused by climatic change. Progress shall be measured using the targets set out in Appendix 1.

Energy efficiency measures to reduce the growth in energy demand are already saving £250,000 per year. Comparable savings could also be achieved by the planning and delivery of a range of projects once funding has been secured. The aim is to reduce relative utility costs by up to 25%. Overall, the design and operation of new buildings has the greatest long-term impact as design considerations factor-in preventative building adaptation measures to minimise indoor overheating, carbon emissions and cost.

6. RECOMMENDATION

The Trust Board is asked to approve the strategy.

Appendix 1: Performance targets, objectives and key actions.

Performance Targets

To measure progress in these areas the following targets are proposed:

1. Complete the upgrade to the standby generators, National Grid and SPH electricity supply networks by 2018.
2. Complete the combined heat and power (CHP) business case for the SPH campus by 2016.
3. Improve the overall energy performance, operating cost and indoor comfort of existing Trust buildings. The target will be to achieve or exceed the national average by 2020.
4. Each new capital project designs shall consider options to adopt high quality building design standards (e.g. BREEAM “excellent”) to help deliver long-term value and comfort.
5. Meet or exceed the NHS England’s carbon reduction target of 28% by 2020 against a 2007/8 baseline

CHALLENGE 1: INFRASTRUCTURE RESILIENCE

OBJECTIVES

- Ensure continuous electricity supply from both on and off-grid sources.
- Develop a low-carbon heating system that provides flexibility, contingency and economy.
- Consider future building and infrastructure resilience issues early in the procurement, planning and design processes.

KEY ACTIONS

- Commission a design and business plan to revise the SPH High voltage (HV) electricity network so that it provides sufficient flexibility to meet the site’s total electrical demand from any alternative source at any point along the network.
- Discuss with UKPN the risks and mitigation options of reinstating a fully diversified electricity supply source to the SPH site.
- Proceed with the capital programme to upgrade of the standby electrical generators, uninterruptable power supplies and local power distribution boards.
- Develop the CHP proposal in tandem with the upgrade of the HV network and standby generators.

- Review options to reduce energy cost by generating, selling and exporting excess electricity back to the grid.
- Reduce overall demand for electricity and gas through the use of technical projects and reducing 3rd party demand to place less stress on internal and external systems.

CHALLENGE 2: ADAPTATION TO OVERHEATING CAUSED BY CLIMATE CHANGE

OBJECTIVES

- Manage and record building–related climate change risks to patients, visitors and staff within the Trust Risk Management systems.
- Ensure new building and refurbishment options apply climate change modelling methods in order to incorporate an appropriate and economic balance of measures to avoid overheating.

KEY ACTIONS

- Review existing and new building refurbishment options using climate change building modelling methods such as BSEN15251. Prepare an action plan to manage the risks associated with indoor overheating.
- Review and amend Heatwave Plan and Temperature Policy to reflect current and future overheating issues.
- Ensure adequate ventilation to provide fresh or air-conditioned cooled air (a particular problem since window restrictors were introduced).
- Insulate buildings to keep air cooler for longer.
- Provide a means to reduce the amount of heat gained through the window.
- Limit the use of certain cooled air services presently used in the Trust which have an adverse effect on other adjacent areas. For example, wards can overheat because of the use of air conditioning units used in drug storage areas.

CHALLENGE 3: MITIGATING UTILITY COSTS AND CARBON EMISSIONS

OBJECTIVES

- Apply a consistent high-quality design specification to new buildings, refurbishments and associated plant. This must address overheating and consider the longer-term plans for heating and electrical supplies.
- Ensure that future building or plant design does not compromise the efficient operation of other systems.

KEY ACTIONS

- Implement planned measures to existing buildings to offset future growth in energy demand.
- Evaluate and develop business cases for unfunded energy efficiency projects.
- Undertake a regulatory impact assessment to consider the risk to the Trust arising from expected changes in energy-related building regulations (e.g. 2018 Building Energy Performance Regulations).

Appendix 2: Overheating Definition:

What constitutes overheating?

Health Technical Memorandum (HTN) 03-01: Overheating occurs where internal temperatures exceed 28˚C dry bulb temperature for more than 50 hours per year.

Health Technical Memorandum (HTN) 03-01 also recommends temperatures from 18˚C to 28˚C in general wards, and 18˚C to 25˚C for more sensitive areas, such as birthing and recovery rooms.

Appendix 3: National policy, targets & carbon taxation

Below is a summary of applicable national regulations and design standards that will directly affect the Trust through building development and refurbishment programmes and through a combination of taxation and public profile.

Energy White Paper and Climate Change Act 2008

The Energy White Paper published in 2007 describes the obligation of all public sector organisations to reduce their carbon emissions, and to lead on energy efficiency.

In 2008 the Climate Change Act made these a legally binding set of two-stage UK-wide targets. Against a 1990 baseline, the UK has committed to reduce emissions initially by 34% by 2020 then to an 80% reduction by 2050. For the NHS, against a 2007 baseline this translates to an interim reduction target of 28% by 2020 and 80% by 2050.

Building regulations – Part L

The Building Regulations – Part L prescribe the minimum legal development standards for new and refurbished buildings. With each iteration of the Regulations, the government has set increasing more stringent standards, with the aim of achieving of zero emissions from all new non-domestic builds by 2019/20.

BREEAM (environmental assessment method)

BREEAM is a lifecycle cost assessment to ensure buildings provide long-term value for money; it also provides the means to demonstrate that our designs adequately consider sustainability and climate change adaptation. The Department of Health requires that new healthcare buildings seeking an Outline Business Case (OBC) approval will achieve an 'Excellent' BREEAM rating and all refurbishments achieve a minimum 'Very Good' rating. The refurbishment thresholds are as follows:
< 10% floor area – Very Good
≥ 10% floor area – Excellent
< £2m capital costs – No assessment required

Display Energy Certificates and Energy Performance Certificates (DECs and EPCs).

DECs provide a useful measure of the energy-efficiency of a building in use. On a scale of A-G where A is the best and G the worst performance, the Trust's Display Energy Performance Certificates are currently grade E for St Peters and grade F for Ashford.

It should be noted that the data used for DECs always runs 12-18 months retrospectively and so is not a measure of present day performance. The data does not therefore reflect the major changes and improvements undertaken in 2014 at cost of more than £1.6m. Updated DEC certificates this year will better illustrate our current performance and reflect the considerable amount of work undertaken.

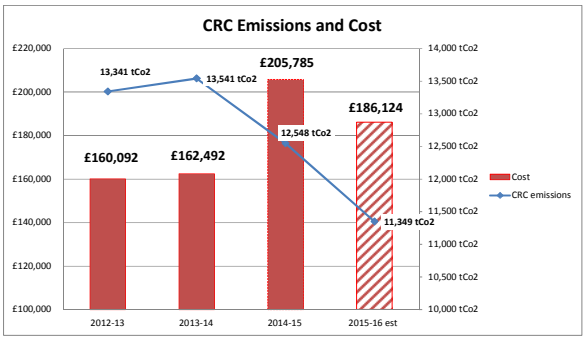
Whilst DECs measure actual operational performance, EPCs provide an efficiency measure of the building design. EPCs are required when the Trust sells or lets a building. Importantly,

from April 2018 it will become illegal to sell or let a building whose performance falls within the two lowest standards - grades F or G. Actions defined within this strategy will contribute to improving our DEC and EPC performance.

Carbon Reduction Commitment Regulations (CRC).

The Carbon Commitment Regulations (CRC) is a tax on carbon emission generated through the use of electricity and gas. The tax is charged per tonne of CO2 emitted and adds 7% to the total cost of electricity and 9% to the total cost of gas.

As electricity generation and use creates nearly three times more CO2 , those like the Trust that have high electricity usage will inevitably pay more. Below is a graph showing CRC taxed emissions over time and the impact of CRC charges. Whilst emissions arising from energy efficiency measures have fallen (blue line) the cost of emissions payable for the 2014-15 period have risen. This is because the unit cost per tonne has risen 38% from £12 to £16.40 per tonne. With further unit cost rises expected, the financial argument for further energy efficiency measures becomes stronger.



Appendix 4: Energy efficiency projects

Below is a summary of energy efficiency projects grouped according to their maturity level – starting with those already being implemented, through to quantified and approved projects to medium term and long-term projects requiring further quantification work. Further detail is given in the action plan.

- Completed projects (those currently commission and operating)
- Commissioned projects (measures have been identified and funding secured, implementation starting or already underway)
- Projects requiring detailed feasibility to refine the assumptions and confirm their application
- Long term projects - projects at the initial ideas stage or suitable only to progress when service, technological or financial issues change.

	£ Cost	£saving/year	Lifetime saving	CO2 saving (tonnes)	% of CO2 target reduction
Completed projects	£1.4m	£260,000	£2.7m	1695	15%
Commissioned projects	£2.1m	£348,000	£3.7m	1311	12%
Projects requiring feasibility	£7.1m	£660,000	£16m	2295	23%

Completed projects include:

	Data	
Issue	Sum of Potential Annual financial savings (£)	Sum of Capital cost (£)
AHU upgrade	112,209	553,500
boiler plant	1,700	350
Lighting upgrade	102,500	624,200
Steam metering		
maintenance and development of BMS	135,081	704,000
Ventilation: Upgrade clinical block, dept block	47,970	239,850
Grand Total	399,460	2,121,900

Planned and funded project include:

	Data	
Option	Sum of Potential Annual financial savings (£)	Sum of Capital cost (£)
• Extend the current upgrade replacement of redundant to other suitable plant	112,209	1,107,000
• Install cavity wall insulation to the Departmental block	8,143	57,000
• upgrade replacement of redundant T12 and T8 strip lights and light fittings	22,750	112,100
• replace dept block and theatre block with plate heat exchangers	18,857	66,000
• adapt existing system to provide comfort cooling to Rowley Bristow and A&E	2,000	3,900
• Ashford boiler upgrade: a phased upgrade of lifecycle-expired boilers is underway	10,000	300,000
Grand Total	173,959	1,646,000

Unfunded projects and deferred projects are listed below. Funding for these will follow the capital bid process; some such as CHP and solar PV subject to full business cases.

	Data		
Issue	Forecast savings (£) /year	Lifetime £ savings	Sum of Capital cost (£)
boiler plant	47,015	460,000	226,500
CHP Combined Heat and Power	466,000	9,320,000	5,100,000
climate change adaptation	-	-	-
Design Guide	-	-	-
End 3rd party use of Trust Supplies	10,000	50,000	-
insulation	31,071	751,786	200,000
metering	2,500	25,000	10,000
Photovoltaic (PV) electricity supply	15,000	450,000	-
Power supply quality	27,000	810,000	166,950
recharging	10,240	102,400	-
Risk management	-	-	-
Robustness, redundancy and re-configurability	-	-	-
steam distribution	21,414	80,058	31,000

Steam distribution	14,000	42,000	2,257
training and awareness	-	-	-
Variable speed drive to vent. Motors	14,391	143,910	71,955
Ventilation: provide comfort cooling	15,000	600,000	150,000
window replacement and upgrade	19,000	570,000	1,350,000
Grand Total	692,632	13,405,153	7,308,662