APPENDIX A - DEFINITION of PROJECTS

Project: **Reference:**	**Building Management System installation - Warsash** **E1**
Ownership	PG
Department	Estates and Facilities
Description	The Warsash Campus provides the majority of its space and water heating by means of gas boilers located at various points across the site. There is very limited control provided on the boilers and heat supplied to buildings. This is being addressed, as the first stage of the process, by the installation of a Priva BMS system. The system will provide remote monitoring and control and will be integrated with an upgraded BMS to be installed at the City Campus.
Costs and Benefits	• Project cost: £23,000 • Financial savings: £7,004 p.a. • Payback period: 3.28 years • CO2 emissions reduction: 35.6 tonnes • Percentage of target 1.64% • Source of funding: Funded • Decision on funding: Approved Reduced heating bills, reduced emissions and improved conditions for occupants.
Ensuring Success	System to be fully commissioned and all necessary controls to be installed. Risks: BMS limited to Warsash "top site" in the initial phase, further work required to extend to whole of campus. Lack of staff resource to provide ongoing management of the BMS.
Measuring Success	Ability to monitor and control Warsash settings from City Campus. Measurement of overall reduced energy usage of site, later via sub-meters to be installed. Positive comments from occupants. Saving of staff time and effort in visiting remote site to monitor and change settings and repair faults.
Timing	From October 2009. The work is relatively non-disruptive so there is flexibility over the scheduling.
Notes	

Project: **Reference:**	**Insulation/lagging of pipework, valves and flanges** **E2**
Ownership	Estates Team
Department	Estates and Facilities
Description	Many areas have unlagged heating pipes. Approximately 800 metres of pipework including many large bore main risers and flanges were identified for insulation in the first phase of this project. Further opportunities are being identified and a survey of valves and flanges is scheduled at both Warsash and EPT sites (see also P1). Lagging of all uninsulated heating pipework should be undertaken wherever practicable.
Costs and Benefits	• **Project cost:** £ 10,000 **(first phase)** • **Financial savings:** £8,336 • **Payback period:** 1.2 • **CO_2 emissions reduction:** 24 tonnes • Source of funding: Funded • Decision on funding: Approved
Ensuring Success	• Key success factors: Reduction in kWh energy used. Positive feedback from building users. • Risks: No significant risks identified
Measuring Success	• Metrics**:** Sub-metering • Inspection to ensure quality of work.
Timing	From August 2009 Insulation work ongoing throughout the Carbon Management Programme, subject to availability of funding.
Notes	

Project: **Reference:**	**Draught proofing - corridor and external doors** **E3**
Ownership	Estates Team
Department	Estates and Facilities
Description	Corridor and external doors are sometimes kept wide open on tie-backs during opening hours, resulting in substantial heat losses. In key areas, the effect is greater than might be expected, with differential pressures on opposite sides of three adjoining buildings (Mitchell, Andrews and Cockerel) causing a "wind tunnel" effect, with cold air being drawn along the corridors and stairwells. A combination of good housekeeping, mechanical closers and draught proofing solutions is already having significant impact. Building occupants and Estates staff will identify further areas where action is necessary to reduce draughts and control heat loss via external doors.
Costs and Benefits	• **Project cost:** £14,400 • **Financial savings:** £2014 per annum • **Payback period:** 7.15 • **CO_2 emissions reduction:** 0.3 tonnes • **Source of funding**: Funded from Projects Budget • **Decision on funding**: Approved Reduced heating bills, reduced emissions and improved conditions for occupants.
Ensuring Success	Installation by competent contractor in appropriate locations.
Measuring Success	Measurement of reduced energy usage via submeters. Positive comments from occupants.
Timing	From December 2009

Project: **Reference:**	**Awareness Campaigns including "Green Impact" and "Student Switch Off"** **E4 and E5**
Ownership	MW and External Providers
Department	Estates and Facilities
Description	Raising awareness and a sense of responsibility for conserving energy is important amongst both staff and students. The University has had limited success in this area to date. The Green Impact and Student Switch Off campaigns have both had demonstrable success in University environments and will provide a base for future campaigns and activities. A network of Energy Champions needs to be established and supported to act as points of contact for driving energy initiatives across the Campuses; the Green Impact and Student Switch Off initiatives should assist in this process. As the University is just beginning the awareness raising process, it is anticipated that lower savings will be achieved initially, with increased benefits as awareness and participation grows. A 5% saving of energy in five halls would achieve 82 tons CO2 reduction, or over 4% of target - figures for October and November 2009 indicated this was being exceeded, but weather conditions were mild.
Costs and Benefits	• **Project cost:** £3000 each (annually to provide ongoing campaigns) • **Financial savings:** £12,000 per annum • **Payback period:** < 1 year • **CO_2 emissions reduction:** Initial estimate 61 tonnes **-** up to 80 tons per annum or 4% of target considered achievable
Funding	• **Operational costs:** Further requirements to be assessed, **campaign funding may increase ROI** • **Source of funding:** Environmental Initiatives budget
Resources	• Existing University staff and student time and resources • Student Switch Off campaign co-ordinator attending Campus meetings
Ensuring Success	• **Key success factors:** Well planned and branded awareness schemes with enough material/ideas to keep the project running. Sub-metering monitored and actions undertaken locally to reduce wastage • **Risks:** Lack of support or changes in key personnel / student union, problems with buy-in, not being able to recruit volunteers • **Main means of risk mitigation:** Develop a clear timetable. Maximise publicity, provide relevant information on progress and opportunities.
Measuring Success	• Halls performance assessed directly by sub-metering information. Achievements will be reported to participants.
Timing	• Start date: Students - Oct 2009, Staff Jan 2010 • On-going: monitoring of consumption and local awareness raising
Notes	Low awareness and no established network of champions may mean lower savings in first years.

Project: **Reference:**	**Sub-Metering of Electricity at East Park Terrace and Warsash** **E6**
Ownership	
Department	Estates and Facilities
Description	Sub-meters connected to Monitoring & Targeting systems can provide data on utility consumption on a near real-time basis and can be used to help identify wasteful use of energy. Installation of individual building electricity sub-metering commenced in July 2009, with electricity sub-meters installed at EPT. This is the first stage of sub-metering, to build up a broad picture of usage patterns. Refinement via additional metering will be required, especially in areas of high usage, to maximise benefits.
Costs and Benefits	• **Project cost:** £32,000 • **Operational costs:** £4,000 (annual maintenance/reports - first stage) • **CO_2 emissions reduction:** 60 tonnes. N.B. Emissions will not be reduced purely by the installation of the system, but case study evidence suggests that acting appropriately on information provided by the system can typically reduce overall consumption by 5-10%. • **Financial savings:** £12,000 p.a. estimated • **Source of funding:** Internal University capital. Funding committed for electricity Phase 1 and some further AMR work. • **Payback period:** 3 years. Variable, dependent on associated activities • With all areas of the estate covered by such a system, and working in conjunction with other control measures, annual emission reductions could be up to 200 tonnes CO_2 per annum
Funding	• Capital funding allocated
Resources	• Estates Project Team • Future additional resource: Carbon Trust consultant to analyse
Ensuring Success	• **Key success factors:** Delivery of accurate and detailed data on energy and water consumption. Reduction in kWh consumed due to targeted action on 'hot spots' and anomalies shown by sub-metering data. • **Principal risks:** Under-resourced for analysis and acting on data. Lack of opportunities discovered for energy saving.
Measuring Success	• Monthly, quarterly and annual consumption data produced for specific buildings and campus-wide energy and water consumption • Sub-metering data shows a reduction in kWh consumed due to action to remove 'hot spots' and anomalies

Timing	• **Milestones / key dates:**
	  ○ start date: July 2009
	  ○ completion date: July 2011 for all main building utilities sub-meter installation; further refinement of system should then be undertaken.

Notes	IMServ's Energy Data Vision (EDV) will be the base monitoring system

Project: **Reference:**	**Install lighting controls - Matthews Building and Warsash Campus** **E7**
Ownership	
Department	Estates and Facilities
Description	None of the classrooms in the Matthews building are fitted with motion or presence detecting equipment and the lights are often left on when areas unoccupied. Offices, stairwells and washrooms will also have the potential for cost-justifiable savings from PIR installation. A similar situation exists in areas of the Warsash Campus. Other areas may be identified during this work and will be prioritised on a ROI basis where appropriate. Automatic controls will be retrofitted as the first phase of a longer-term campus wide programme.
Costs and Benefits	• **Project**(s) **Cost**: £20,000 SJM / EPT / Halls and £7,500 Warsash • **Financial savings**: £8,752 • **Payback period:** 3.1 years • **CO_2 emissions reduction:** 42 tonnes p.a.
Ensuring Success	Installation by competent contractors. Choice of appropriate equipment. Adjustment and setup of sensors to minimise waste. Risks: Increased occupancy of rooms would mean reduced savings. Inappropriate choice or setup of sensor equipment could result in malfunctions.
Measuring Success	Sub-metering. Monitoring functionality of areas when fitted with sensors. User feedback.
Timing	To commence early 2010. Access to areas may be limited during normal opening hours - weekend install of pilot areas. Workaround lectures to avoid disruption.
Notes	Different sensor requirements for classrooms and little-used stairwells. New Lutron PIR sensors will be considered for suitable areas as installation much easier.

Project: **Reference:**	**Pilot Projects - "Small Power"** **E8**
Ownership	
Department	Estates and Facilities
Description	A number of small projects are listed under this heading. Either the individual contribution to energy savings has been assessed as being small; or the project is to be piloted first in a number of areas, using different types of controls or technologies; or rollout will be over an extended period. Most of these projects will give fast payback (approximately 2 years) on investment and provide significant savings overall when rolled out across the whole of the Estate. The projects included here are: • LED lighting - replacement of halogen down lighters • LED lighting - corridor areas, pilot projects • LED lighting - external lighting pilot projects • Time switches on water heaters • Time switches on vending and similar machines • Occupancy lighting and fan controls in washrooms • Variable speed drive pilot in Library / Andrews • Monitor/optimize/replace fridges/freezers • Other small power projects to be confirmed
Costs and Benefits	• Project(s) cost: £15,000 (initially) • Financial savings: £7,100 per annum • Payback period: 2.2 years • CO_2 emissions reduction: 35 tonnes p.a. A small budget has been allocated after which further funds will be sought for extending projects that show good return on investment. When aggregated together, these small power projects are expected to contribute up to 2% saving toward the target. LED lighting technology is improving rapidly and will offer major benefits in the medium term; additional projects are being planned.
Ensuring Success	As appropriate for each project.
Measuring Success	Observe and measure savings by appropriate means
Timing	To commence January 2010
Notes	These projects may well have "spin-offs", for example, use of fridges and freezers needs to be reviewed and energy use assessed. Many appliances encountered to date are inefficient, outdated and misused e.g. not defrosted. Possibility of replacement with A++ devices and sharing to be investigated.

Project: **Reference:**	**Energy housekeeping by cleaners, caretakers, caterers etc.** **E9**
Ownership	
Department	Estates and Facilities
Description	Caretaking and cleaning staff can assist greatly in monitoring and reducing the use of energy, especially if proactive in switching off lights, closing windows, and reporting overheated areas and equipment left on unnecessarily. Cleaning staff are now switching off lights when leaving rooms and being generally more vigilant of energy wastage. Caretakers ensure lights are switched off (except in stairwells) and windows closed at the end of the day. Catering staff have been instructed in energy saving opportunities. Involvement in the Green Impact campaign is anticipated by caretakers. Staff located at remote sites (such as Marchwood) need to be aware of the contribution they can make by good housekeeping, and have been contacted.
Costs and Benefits	• Project cost: No costs identified • Financial savings: £2,000 per annum • Payback period: N/A • CO_2 emissions reduction: 10 tonnes **Resource:** Time to meet and discuss opportunities and possibly some training activities.
Ensuring Success	Feedback from cleaners, caretakers and their managers will be important. Regular informal contact will be maintained with caretakers, cleaners and catering staff by the Environmental and Sustainability Manager, supplemented by annual meetings with Facilities Manager and Cleaners Manager.
Measuring Success	Visible evidence of switch off after cleaners leave rooms in mornings and lights switched off overnight.
Timing	Cleaners began switching off at City Campus from April 2009
Notes	A survey of practices at Warsash is required.

Project: **Reference:**	**Shutdown of non-essential services during vacation periods** **E10**
Ownership	PG/TL/MW/Staff teams and local energy champions
Department	Estates and Facilities and building occupiers
Description	There is a wide variation in energy requirements of different buildings at different times of the year. Energy use in most buildings over vacation periods should, however, be significantly lower than during term time. Buildings may be empty at times (e.g. over Christmas) or have a substantially reduced need for power due to reduced occupancy (e.g. over summer). A combination of better understanding of requirements, staff awareness, good housekeeping and improved controls will lead to significant savings. Lack of BMS functionality or controls on HVAC equipment in some areas prevents full shutdown being practical at present - for example, in winter, AHU's may need to be left on (at 100%) to avoid potential of frost damage when buildings are empty. Sub-metering will provide detailed information on energy use when installed. See also Project P2
Costs and Benefits	• Project cost: Awareness campaigns - costs to be assessed. • Financial savings: up to £5,000 per annum • Payback period: N/A • CO_2 emissions reduction: up to 25 tonnes p.a.
Ensuring Success	BMS and HVAC control improvements are fundamental to minimising energy consumption in unused areas. Key high usage areas such as IT Resource Centres, Labs, should be targeted Risks: Lack of buy-in from faculties and departments will impede progress.
Measuring Success	Via sub-metering - comparisons of use over vacation periods
Timing	In progress

Project: **Reference:**	**Wall, roof, pipework insulation - Phase 1** **P1**
Ownership	Estates Team
Department	Estates and Facilities
Description	The University has a variety of buildings of various constructions and ages. There is a wide range of opportunities to improve thermal insulation at City Campus, Warsash and possibly in the student halls. Initial surveys have been undertaken, as has some Library insulation work. More detailed surveys are required to establish the extent of the requirement. Some buildings with cavity walls may have no cavity insulation. Roof insulation has already been found to be minimal in the Library. The Millais building has many thin wall panels without either cavities or any form of insulation. Newer buildings may be found to have insulation falling short of current standards. A survey of boiler-room valves in Mitchell and Millais has also identified significant opportunities and Warsash survey is scheduled. (see also E2, N6/N7 Insulation and M5 - Building Fabric Upgrade)
Costs and Benefits	• Project cost: £23,000 • Financial savings: £5,500 • Payback period: 4.1 years • CO2 emissions reduction: 16 tonnes p.a. A small budget is in place and all these preliminary works will be undertaken up to the budget limit, targeting key areas. Subsequent works will require additional funding approval.
Ensuring Success	• Key success factors: Reduction in kWh energy used. Positive feedback from building users. • Risks: No significant risks identified
Measuring Success	
Timing	EPT Mountbatten Library roof insulation completed. Cavity surveys to commence March 2010. EPT valve survey completed. Warsash valve survey planned Feb 2010.
Notes	

Project: **Reference:**	**Improved space utilisation, control of energy use outside core hours** **P2**
Ownership	MW / MF / TL
Department	Estates and Facilities
Description	Unoccupied buildings often have significant energy use and this is becoming easier to detect with the increasing provision of sub-metering. By improved planning and collaboration with building users over use and timetabling, it will be possible to make significant energy savings by avoiding the non-essential use of use of fuel, HVAC equipment and lighting.
Costs and Benefits	• Project cost: No costs identified • Financial savings: £5,000 per annum • Payback period: N/A • CO2 emissions reduction: 25 tonnes p.a. Resources: Staff time for planning
Ensuring Success	Building users must be made aware of the need to avoid unnecessary use of heating and lighting when areas are not in use. The limited functionality of the existing BMS systems must be addressed to provide increased automation of the control process. Risks: Reduced heating times need to be carefully monitored to ensure temperature levels are reached and maintained during occupied hours. Buy-in from building users will be needed to maximise effectiveness.
Measuring Success	Sub-metering will provide data on energy use in specific buildings.
Timing	From 2010 - consideration required when planning new timetables
Notes	

Project: **Reference:**	**Voltage Reduction at Transformers** **P3**
Ownership	MW and Estates Team
Department	Estates and Facilities
Description	Incoming supply voltage is higher than required. Operating electrical devices at higher than optimum voltages leads to significantly higher energy consumption; mains frequency lighting and most motors consume more power at higher voltages. Two approaches can be used; in some locations, main incoming electricity transformers can safely be tapped down to reduce voltage. Elsewhere, Voltage Optimisation equipment can be installed. The programme will be phased, with tapping down undertaken first, where feasible. Surveys will be undertaken for suitable opportunities for installation of Voltage Optimisation equipment.
Costs and Benefits	Phase 1: Andrews, Millais and Library Buildings • **Financial savings:** £13,000 per annum • **Payback period:** N/A (combine tap down with maintenance work) • **CO_2 emissions reduction:** 64 tonnes p.a. • **Overall:** Typically **a** 4% voltage reduction in affected buildings, giving at least that percentage savings on electricity consumption, based on available case study information. In the areas specified, this will provide 3% of the 25% target reduction. **Other benefits:** • Lowering of maintenance costs on motors, lighting and other electrical equipment • Extension of the life of electrical components by avoiding operation at higher voltages than necessary • Reduction in operating temperatures of motors and lighting
Ensuring Success	• **Key success factors:** • **Principal risks:** Projected annual power saving not achieved as dependent on variables such as equipment in use and power factor. Incompatibility of very old equipment with lower voltages.
Measuring Success	• **Metrics for displaying performance:** Monitoring via sub-metering to show consumption before installation vs. after. • **How success will be measured:** kWh reduction after changes
Timing	• Andrews - December 2009 • Millais - to coincide with works to be planned for 2010.
Notes	Consultation will be necessary with ICT to ensure no equipment exists that has been calibrated/linked to our existing supply voltage - possible with some types of Uninterruptible Power Supply (UPS) equipment. See voltage optimisation literature and CIBSE guides for more information on Voltage Reduction / European harmonisation of supply

Project: **Reference:**	**Installation of AMR on main incoming water supplies** **P4**
Ownership	MW and Estates Team
Department	Estates and Facilities
Description	Automatic Metering of Water Supply will aid in faster detection and location of leaks and waste water.
Costs and Benefits	• Project cost: £17,500 - first stage only. • Revenue: c. £600 per annum • Financial savings: Not accurately predictable - dependent on prevalence of leaks, but could be substantial. It is not currently possible to monitor water consumption of buildings overnight, when consumption should be minimal, so leaks can go undetected. • Funding: A small budget of £17,500 is in place and preliminary works will be undertaken up to this budget limit on priority supplies. Subsequent works will be subject to further funding availability.
Ensuring Success	Two stages - pulsed meters need to be installed, followed by "banjo" units to transmit data to existing IMSERV Monitoring and Targeting system. (Note there is an annual charge for data collection.) Risks: Monitoring of equipment readings and detection of leaks will need a commitment of staff time. A service currently provided by ADSM includes analysis of data, monthly site visit to check and adjust equipment and read meters. This service will be required for the foreseeable future. It may not be possible to install meters in areas required due to inaccessibility of pipe runs.
Measuring Success	Identification of inconsistencies in demand profiles and follow -up investigations will lead to detection of leaks and reduction in consumption.
Timing	Water supply will need to be interrupted to fit pulsed meters. Summer vacation is likely to be the preferred time for this work. Mitchell and Millais pulsed meters have already been installed, banjo units and data collection now required.
Notes	Liaison will be also be undertaken with Southern Water to establish if pulsed output can be provided from their equipment in some locations. This may be an alternative where metering cannot be fitted due to lack of space on incomers.

Project: **Reference:**	**Lighting upgrade in Deanery Halls** **N1**
Ownership	Halls Team / MW
Department	Estates and Facilities
Description	The corridors and stairwells of the Deanery Halls of residence are continuously lit - i.e. 24 x 7. Automatic controls were installed some years ago in some areas, but removed when there were reliability issues due to lights failing more regularly. New lighting technology is now available to avoid this problem, by providing continuous low energy use with high light output. Installation would reduce energy costs in the Halls significantly and initial tests show improved light output. There are further opportunities in other Halls and stairwells around the University to use a variety of technologies (see Project M3)
Costs and Benefits	• Project Cost: £65,000 • Financial saving: £15,035 per annum • Payback: 4.5 years (conservatively: see note below) • CO_2 emissions reduction: 74 tonnes • Funding: To be approved
Ensuring Success	Equipment to be trialled and energy use / illumination levels measured in key areas. Halls managers have local knowledge of requirements and will be involved in decision making process and implementation.
Measuring Success	Sub-metering will indicate savings. Building occupants and managers to be consulted.
Timing	First trial in progress Feb 2010 - implementation date subject to funding approval.
Notes	Some quotations are indicating 2 year payback, especially when maintenance costs are taken into consideration.

Project: **Reference:**	**Control of small power - automated computer shutdown** **N2**
Ownership	To be agreed
Department	LIS – ICT
Description	Install network-based software system to automatically shut down unused networked computers, reducing power wasted by machines turned on but idle, including overnight. An increasing range of suppliers offer software that can be tailored to suit most environments and requirements. Software includes extensive monitoring information to indicate savings achieved or achievable. To be supplemented by good housekeeping measures, including avoiding unnecessary computer power up during off-peak and low usage periods in Resource centres, Libraries, Computer Labs etc. The integration of Carbon Management principles into IT strategy is a key issue: a wide range of opportunities exist for energy saving in this area.
Costs and Benefits	• **Project cost:** £20,000 for software purchase • **Operational costs:** Support contract required for first year of operation should be included in purchase cost. Ongoing software support estimated at 15% of initial cost. Any ICT operational costs to be agreed. • **Financial savings:** £36,580 per annum • **Payback period:** less than 1 year • **CO_2 emissions reduction:** 180 tonnes per annum Reduced heat gain from computers will also have the potential to reduce air conditioning costs in many areas.
Ensuring Success	Funding to be secured by ICT or Estates. ICT will need to ensure full rollout, monitor user feedback and adjust software settings accordingly to suit any exceptional user requirements. Level of savings will depend on configuration of software and extent of rollout.
Measuring Success	• Software has built in monitoring and targeting which will indicate level of savings and further opportunities. • Sub-meter statistics should provide additional verification of savings
Timing	start date: when software purchased end: when all suitable computers have software installed and software has been configured to maximise savings. This will be a gradual process.
Notes	To be supplemented by good housekeeping measures, including avoiding unnecessary computer power up during off-peak and low usage periods in Resource centres, Libraries, Computer Labs etc. The integration of Carbon Management principles into IT strategy is a key issue: a wide range of opportunities exist for energy saving in this area. The British Computer Society (BCS) has a Low Carbon Group and can provide further advice. Calculation based on 3,000 desktop computers in use across sites. Note: Some Universities (including Liverpool) are beginning to offer their software on a free usage basis - if funds are an issue, this route could be investigated.

Project: **Reference:**	**Light Fitting Replacement - Mitchell and Collins buildings** **N3**
Ownership	MW and Estates Team
Department	Estates and Facilities
Description	A detailed survey identified 549 inefficient light fittings in Mitchell Building and a further 330 in Collins. Replacing the light fittings and tubes with high frequency T5 tubes and ballasts will result in substantial savings on energy and maintenance. Although many areas of these buildings are fitted with PIR motion detectors, some control gear is not functioning. The opportunity will be taken to upgrade to newer technology if sufficient funds are available.
Benefits	• **Project cost**: £85,000 • **Financial savings:** £23,500 p.a. • **Payback period:** 3.7 years • **CO_2 emissions reduction:** 115 tonnes per annum • **Other benefits:** Lower maintenance costs
Funding	• **Operational costs:** N/A • **Source of funding:** Internal capital • **Decision on funding:** To be advised
Resources	• Project Team & contractors; additional resources to be identified
Ensuring Success	• **Key success factors:** Reduction in kWh energy used. Positive feedback from building users.
Measuring Success	• **Metrics:** Sub-metering • When success will be measured / evaluated: pre and post installation
Timing	Commencing 2010 if funds approved
Notes	

Project: **Reference:**	**Install Variable Speed Drives and link to BMS** **N4**
Ownership	MW / PG / TL
Department	Estates and Facilities
Description	Variable Speed Drives are electronic controllers for large electric motors such as those used for building ventilation and heating system pumps. They reduce energy consumption by reducing motor speeds (frequency) at times when full output is not required, by matching motor speed to required load. A survey of City campus has already established potential for substantial energy savings, especially when linked into an upgraded Building Management System provided with suitable sensor apparatus (temperature/CO2 etc.) There are opportunities beyond this initial project for further use of this technology around the University. With full BMS integration of variable speed drives and suitable usage monitoring controls, savings over 200 tonnes CO2 may be achieved.
Costs and Benefits	• **Project cost**: £50,000 • **Financial savings:** £14,400 p.a. • **Payback period:** 3.5 years • **CO_2 emissions reduction:** 71 tonnes per annum • **Other benefits:** Extended motor life.
Ensuring Success	VSD's work by adjusting motor speed to accurately match load requirements which will be determined by factors such as time of day, occupancy, external temperature etc. Services of a consultant/installer with experience of variable speed drives, careful commissioning, choice of suitable equipment and BMS integration where possible, will be required to maximise benefits.
Measuring Success	Calculate savings from each installation by metering before and after where possible.
Timing	Initial survey already undertaken and pilot project being planned (see E8) Full project subject to funding.
Notes	Library AHU / VSD work in progress. Millais film studios in progress. Andrews building AHU's under consideration.

Project: **Reference:**	**Upgrade and extend BMS to control all HVAC related equipment** **N5**
Ownership	MW /PG/TL
Department	Estates and Facilities
Description	The existing BMS systems have very limited functionality and do not provide requisite features to closely monitor, control and automatically adjust according to requirements, such as occupancy and weather conditions. Close control of heaters, chillers and air handling units is essential to avoid energy waste. There is limited BMS automation, with many AHUs controlled by simple time switches or dependent on manual setting. Full functionality of proposed energy saving measures such as variable speed drives will be dependent on automation and cross-campus integration of BMS control. Full control of plant during times of low occupancy can only be achieved by improving BMS functionality across the sites.
Costs and Benefits	• Project cost: £50,000 • Financial savings: £18,335 per annum • Payback period: 3 years • CO2 emissions reduction: 90 tonnes p.a. Major savings through identification and control of wastage, estimated 5% of target.
Ensuring Success	Complexity of BMS installation and choice of equipment means that ability of installer is critical to functionality. Adequate staff resource - time and expertise - essential to provide ongoing management of the BMS.
Measuring Success	
Timing	Ongoing from 2011
Notes	

Project: **Reference:**	**Improve thermal performance of buildings - insulation, draught proofing and lagging - year 2 bid allocation - City Campus** **N6**
Ownership	Estates Team
Department	Estates and Facilities
Description	The University has a variety of buildings of various constructions and ages. There is a wide range of opportunities to improve thermal insulation at City Campus, Warsash and possibly in the student halls. Initial surveys have been undertaken, as has some Library insulation work. More detailed surveys are required to establish the extent of the requirement. Some buildings with cavity walls may have no cavity insulation. Roof insulation has already been found to be minimal in some buildings. The Millais building has many thin wall panels without either cavities or any form of insulation; some areas of Collins are similar. Newer buildings may be found to have insulation falling short of current standards.
Cost and Benefits	Funding - capital bid submitted for 2010/11. A small budget is in place and preliminary works will be undertaken up to the budget limit (see P1). These and any subsequent works will require further funding approval (See P1, N7 Insulation-Warsash and M5 - Building Fabric Upgrade) • Project cost: £45,000 • Financial savings: £9,000 per annum • Payback period: 5 years • CO2 emissions reduction: 50 tonnes p.a.
Ensuring Success	• Key success factors: Reduction in kWh energy used. Positive feedback from building users. • Risks: No significant risks identified
Measuring Success	Reduced energy use as indicated by sub-meter information. Improved comfort of building users.
Timing	Subject to funding, work commencing late 2010
Notes	

Project: **Reference:**	**Improve thermal performance of buildings - insulation, draught proofing and lagging - year 2 bid allocation - Warsash** **N7**
Ownership	Estates Team
Department	Estates and Facilities
Description	The University has a variety of buildings of various constructions and ages. There is a wide range of opportunities to improve thermal insulation at Warsash. Surveys are required to establish the extent of the requirement. Some buildings with cavity walls may have no cavity insulation. Roof insulation has already been found to be minimal in some buildings
Costs and Benefits	• Project cost: £25,000 • Financial savings: £6,000 per annum • Payback period: 4.2 years • CO2 emissions reduction: 33 tonnes Funding - capital bid submitted for 2010/11 (see also N6 Insulation and M5 - Building Fabric Upgrade)
Ensuring Success	• Key success factors: Reduction in kWh energy used. Positive feedback from building users. • Risks: No significant risks identified
Measuring Success	Sub-meter information. Improved comfort of building users.
Timing	Ongoing from August 2010 by arrangement with building users
Notes	

Project: **Reference:**	**Replacement of small gas boilers - Warsash site** **N8**
Ownership	Estates Team
Department	Estates and Facilities
Description	Warsash Mountbatten Library and the two Fire School gas boilers are old and inefficient, with minimal control. Maintenance costs will rise substantially if no action is taken to replace these boilers. A recent survey has indicated that significant savings could be made by replacing them with modulating control condensing boilers. The work will also incorporate improved monitoring and control systems linked to the BMS for enhanced savings.
Costs and Benefits	• Project cost: £21,000 • Financial savings: £3566 per annum • Payback period: 5.9 • CO2 emissions reduction: 18 tonnes p.a. Reduced energy consumption, improved functionality and comfort for building occupants. Reduced maintenance costs and increased reliability.
Ensuring Success	Gas sub-metering to be fitted as soon as possible to provide precise measurement of existing use. This will ensure comparisons can be made before and after installation of new boilers and controls.
Measuring Success	Sub-meter information. Improved control should have beneficial effects on comfort and temperature stability for building users.
Timing	Preferably after gas submeter installation. To coincide with summer switch off of gas boilers or other maintenance work. By consultation with building occupants.
Notes	Lack of gas sub-metering makes precise calculation of energy use difficult at present; apportionment of usage by floor area is likely to provide an under-estimate due to nature of use of these buildings. The Library is heated using an underfloor heating system and without precise control, such systems can be very inefficient. Savings calculated may therefore be understated.

Project: **Reference:**	**Install AMR on Gas and Geothermal incoming supplies** **N9 / N10**
Ownership	Estates Team
Department	Estates and Facilities
Description	Warsash Campus - has two fiscal gas meters measuring all gas supply to the site. It is not possible to establish the gas usage of *any individual building* at present. Gas sub-meters (or heat meters where buildings are supplied from a central boiler house) are required for this purpose and will be connected to the existing IMServ monitoring system to provide accurate and accessible information. Additionally, AMR is required on the two Fiscal Meters and GDF have been contacted. City Campus - Four geothermal meters provide limited data, but no real-time or historical information for monitoring and targeting. Connection to the IMServ system will provide improved capability. If possible extra connections will be provided to link to BMS controls. Installation of AMR will greatly assist in identification of waste energy (especially if control faults arise) and will result in additional savings.
Costs and Benefits	• Project cost: Subject to survey - budget cost £28,000 • Financial savings: £14,000 p.a. • Payback period: Subject to survey – typically less than 3 years • CO2 emissions reduction: 51 tonnes Major savings through identification of wastage, estimated at up to 5% of target.
Ensuring Success	Risk factors include ability to connect suitable pulsed output AMR meters for Gas and Geothermal - surveys have been commissioned. Utilicom agreement required for Geothermal meter connections. IMServ compatibility essential.
Measuring Success	Ability to monitor and act on data acquired to make savings after installation.
Timing	Feasibility surveys have already been commissioned. Subject to favourable report and feedback, work will begin when funds are available. The gas installation will need to coincide with periods of low demand on gas supply, commence summer 2010 earliest.
Notes	

Project: **Reference:**	**Reduce waste to landfill - reduce to 80% of baseline** **N11**
Ownership	Estates and Facilities Teams
Department	Estates & Facilities
Description	As part of waste management programme
Costs and Benefits	• Carbon saving : 123 tons (from baseline)
Ensuring Success	• Ensure wider awareness via campaigns
Measuring Success	• Monitoring returns from Waste contractor
Timing	Work is already in progress
Notes	Improved waste handling to be supplemented by a variety of awareness raising campaigns and information targeted at both students and staff throughout the course of the programme

Project: **Reference:**	**Extend Warsash BMS across site and improve main boiler control** **N12**
Ownership	Team
Department	Estates
Description	An upgraded BMS has only recently been installed at Warsash and is initially being used to provide basic control over buildings on the top part of the site. This control needs to be gradually extended to encompass most buildings and improve the nature of the control, by installation of improved sensor equipment. Additionally, as part of this project, it is intended to provide more accurate control over firing of the three main (Moyana) boilers and on the flow/return temperatures of the various buildings.
Costs and Benefits	• Project cost: Subject to survey - budget cost £30,000 • Financial savings: £7,260 p.a. • Payback period: 4.2 yrs • CO2 emissions reduction: 37 tonnes
Ensuring Success	System to be fully commissioned and all necessary controls to be installed. Risks: Complexity of BMS installation and choice of equipment means that ability of installer is critical to functionality. Adequate staff resource - time and expertise - essential to provide ongoing management of the BMS.
Measuring Success	Ability to monitor and control Warsash settings across full site from City Campus. Measurement of overall reduced energy usage of site, later via sub-meters to be installed. Positive comments from occupants. Saving of staff time and effort in visiting remote site to monitor and change settings and repair faults. Faster diagnoses of faults. Automation of processes.
Timing	Ongoing from 2011
Notes	Gas and Electric Submeter installation required for accurate measurement, especially of improved local controls on main boilers. With full sub-metering, measured trials of boiler control equipment will be feasible before final decision is made..

Project: **Reference:**	**Remedy District Heating (Geothermal) inefficiencies** **M1**
Ownership	
Department	Estates and Facilities
Description	The City Campus is supplied with much of its heating capacity from the Southampton district heating (geothermal) scheme. The heating distribution arrangements were adapted many years ago from a system initially devised for heating provided by gas boilers. Temperatures provided are often inadequate, as are controls regulating space temperatures around the site, leading to both under and overheating and wasted energy. A full review of control and supply arrangements, including Constant and Variable Temperature circuits is required, followed by appropriate action.
Costs and Benefits	• **Project cost:** £100,000 initially • **Financial savings:** £31,130 • **Payback period:** 3.2 years • **CO_2 emissions reduction:** 89 tonnes of per CO_2 per annum • **Other benefits:** Lower maintenance costs, improved consistency of temperatures and comfort for building users
Ensuring Success	• **Key success factors:** Reduction in kWh energy used. Positive feedback from building users. • **Risks**: Supply temperature is not under the control of the University. Close collaboration with the scheme providers will be required to ensure benefits are maximised. Further issues may be identified in the review process. Existing metering is inadequate for more refined monitoring of geothermal energy use.
Measuring Success	• Reduction of consumption will be monitored via existing metering, supplemented by connection of meters to IMServ system and extra metering where possible.
Timing	Work will require draining down of circuits, to be coincided with maintenance work where possible. Work to be carried out when minimum disruption will be caused; will require isolation of circuits or geothermal heating to be turned off. Faulty TRVs need to be detected in winter, plan to fit during summer months.
Notes	Figures for savings based on Carbon Trust surveys and known issues with systems. A detailed survey is required of all City Campus provision. Some areas may be more economically and efficiently served by installation of alternative forms of water or space heating. Many areas have no thermostatic controls. Full survey required - further opportunities are likely to be discovered as work progresses.

Project: **Reference:**	**Voltage Optimisation using VPO units** **M2**
Ownership	Team
Department	Estates and Facilities
Description	Voltage reduction will provide significant energy savings. Due to transformer and distribution configurations, voltage reduction of some buildings is only possible by installing voltage optimising or "VPO" equipment. This will provide additional benefits over simple tapping down of voltage at the transformers.
Costs and Benefits	• **Project cost:** £35,000 • **Financial savings:** £9,800 per annum • **Payback period:** 3.6 years • **CO_2 emissions reduction:** 48 tonnes p.a. **Other benefits:** • Lowering of maintenance costs on motors, lighting and other electrical equipment • Extension of the life of electrical components by avoiding operation at higher voltages than necessary • Reduction in operating temperatures of motors and lighting • Improvement of power quality, further improving the operating efficiency of electrical equipment • Protection of electrical and electronic equipment from voltage transients and short-term power surges • Correction of phase voltage imbalance • Suppression of harmonics that can damage sensitive equipment. • **Payback period:** • **CO_2 emissions reduction:** per CO_2 per annum • **Other benefits:** Lower maintenance costs
Ensuring Success	• **Key success factors:** Reduction in kWh energy used. • Risks: potential for savings is dependent on nature of equipment and electrical load.
Measuring Success	• **Metrics:** Sub-metering • When success will be measured / evaluated: pre and post installation
Timing	Power Perfector have undertaken Voltage measurements at EPT and savings of over 8% are predicted where equipment is installed in appropriate locations. Detailed survey of opportunities to be arranged early 2010.
Notes	Subject to further survey of transformer distribution and pre-installation surveys of proposed locations for installation of VO units.

Project: **Reference:**	**Lighting and Control Upgrades - Campus wide programme** **M3**
Ownership	Team
Department	Estates and Facilities
Description	Much older lighting still exists with inefficient lamps and ballasts, and there is little automatic control. Lighting is frequently left on when rooms are empty and when there is adequate daylight. A programme is required to move in stages to high frequency control gear, T5 tubes, provide automated control and reduce the number of tubes - or fittings - where feasible. LED technology will be appropriate for some areas. Movement and/or daylight sensing PIR/microwave can be retrofitted to existing lighting in corridors, teaching rooms, offices, toilets, kitchens and other appropriate areas, including the student residences. Further works will be identified as the project progresses.
Benefits	• **Project cost:** £250,000 • **Financial savings:** £79,656 per annum • **Payback period:** 3.1 years • **CO_2 emissions reduction:** 391 tonnes of per CO_2 per annum • **Other benefits:** Lower maintenance costs
Funding	• **Operational costs:** N/A • **Source of funding:** Internal capital • **Decision on funding:**
Resources	• Project Team & contractors; additional resources to be identified
Ensuring Success	• **Key success factors:** Reduction in kWh energy used. Positive feedback from building users.
Measuring Success	• **Metrics:** Sub-metering
Timing	Start date: Minor projects already funded will commence January 2010. Larger projects will commence when funds are available.
Notes	Fastest return on investments will be achieved where lighting is on for longest periods and where alterations can be made without redesign of lighting grids and/or fittings. Work should be prioritised accordingly. Some areas can be upgraded with inexpensive solutions which provide fast payback but are less satisfactory in terms of appearance, such as "Save it Easy" fittings. Evaluation on a case by case basis will be necessary; location, nature of building use and future plans should all be considered when choosing the preferred solution. LED technology is being considered where appropriate, savings potential is substantial.

Project: **Reference:**	**Replace obsolete HVAC in City Campus Mountbatten Library** **M4**
Ownership	Team
Department	Estates and Facilities
Description	The Library Heating, Ventilating and Air Conditioning system has significant shortcomings that have been identified in surveys undertaken as long ago as 1998, but little action has been taken. Lack of proper controls mean that heating and cooling work against each other with substantial waste of energy. Much of the equipment is now reaching the end of its life and maintenance costs will rise rapidly. A full building survey should be undertaken to provide detailed recommendations for replacement and revision of the Library HVAC services and controls.
Costs and Benefits	• **Project cost:** £250,000 • **Financial savings:** £19,600 • **Payback period:** 12.7 years • **CO_2 emissions reduction:** 96 tonnes per annum • **Other benefits:** Improved environment. Replacement of obsolete equipment and reduced maintenance requirement. Compliance with EPBD legislation.
Funding	• **Operational costs:** • **Source of funding:** • **Decision on funding:**
Ensuring Success	**Disruption - co-ordination with other changes - review of long term requirements - ICT and Library use** **Maintenance - existing equipment nearing end of useful life** **Key success factors:** Reduction in kWh energy used. Positive feedback from building users.
Measuring Success	• **Metrics:** Sub-metering • When success will be measured / evaluated: pre and post installation
Timing	• **Milestones / key dates:**
Notes	Many library air conditioning units use R22 refrigerant which is no longer available - replacement of units is already overdue.

Project: **Reference:**	**Building fabric upgrade across campuses** **M5**
Ownership	Team
Department	Estates and Facilities
Description	The University has a variety of buildings of various constructions and ages. There is a wide range of opportunities to improve thermal insulation at City Campus, Warsash and possibly in the student halls. Initial surveys have been undertaken, as has some Library insulation work. More detailed surveys are required to establish the extent of the requirement. Some buildings with areas of cavity walls have no cavity insulation. Roof insulation has already been found to be minimal in some buildings. The Millais building has many thin wall panels without either cavities or any form of insulation. Newer buildings may be found to have insulation falling short of current standards. A small budget is in place for preliminary works (Projects N6/N7), which will be undertaken up to the budget limit. Subsequent works will require funding approval
Costs and Benefits	• **Project cost:** £500,000 • **Financial savings:** £42,550 per annum • **Payback period:** 11.8 years • **CO_2 emissions reduction:** 148 tonnes per annum • **Other benefits:** • **Operational costs:** • **Source of funding:** TBA • **Decision on funding:**
Ensuring Success	• **Key success factors:** Reduction in kWh energy used. Positive feedback from building users.
Measuring Success	• **Metrics:** Sub-metering • **When success will be measured / evaluated:** pre and post installation
Timing	Surveys to be initiated in 2010. Work will commence as funds are allocated.
Notes	Based on preliminary figures from Carbon Trust Extended Carbon Survey. Further detailed surveys will be required to establish priority of work and calculate savings from individual building works. Opportunities will be prioritised and based on calculated returns on investments.

Project: **Reference:**	**Control of air conditioning units from BMS** **M6**
Ownership	Team
Department	Estates Team
Description	Localised air conditioning and comfort cooling systems have, in most cases, very limited and local control. Some units are located near radiators and instances of cooling and heating from different sources operating simultaneously are not uncommon. This is primarily due to lack of centralised control. Many units could be adapted by installation of a module to connect to the Building Management System, providing control over operational hours and function. Where this is not possible, improved local management and information could avoid excessive use.
Costs and Benefits	• **Project cost:** £24,000 • **Financial savings:** £3,830 per annum • **Payback period:** 6.2 years • **CO_2 emissions reduction:** 19 tonnes per annum
Ensuring Success	• **Key success factors:** Reduction in kWh energy used. Positive feedback from building users. • Collaboration with local users will be necessary , especially where process cannot be fully automated
Measuring Success	• **Metrics:** Sub-metering • **When success will be measured / evaluated:** pre and post installation
Timing	
Notes	

Project: **Reference:**	**Waste to Landfill - reduce to 60% of baseline** **M7**
Ownership	Team
Department	Estates & Facilities
Description	As part of waste management programme
Costs and Benefits	• Carbon saving : 98.4 tons (from baseline)
Ensuring Success	• Ensuring wider awareness via campaigns
Measuring Success	• Monitoring returns from Waste contractor
Timing	Second stage of gradual reduction – 2012 onwards
Notes	