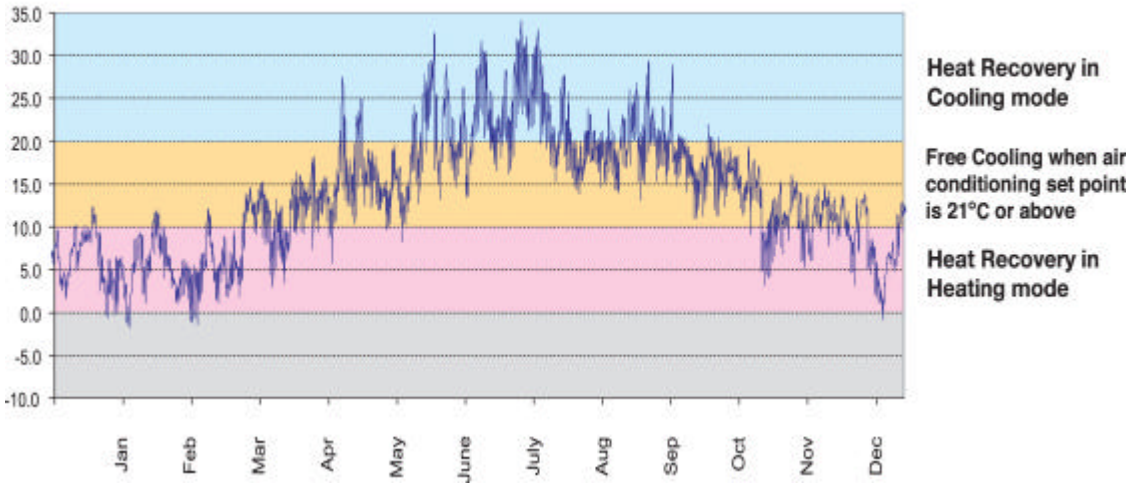
initiative 4

Initiative 4: Free Cooling & Heat Recovery

Build evidence data to support improved specification and business decision making.
Create an educational programme to expand knowledge for domestic and commercial markets.
Embed free cooling & heat recovery into heating & cooling system design.

Poor air quality can be attributed to many problems arising in the workplace or in the home. It is believed to contribute to a significant loss in productivity, low morale and higher rates of sickness amongst many employees. The object of providing good ventilation alongside air conditioning is to provide conditions under which people can live and work in comfort and safety.

Ambient Temperature, London 2006 8am-6pm



Temp Range	No. of hours	% of Total
T<8.0ºC	877	21.99%
8.0ºC - 20ºC	2314	58.02%
T>20.0ºC	797	19.99%

The critical aspect of free cooling and heat recovery is to utilise ambient temperatures. This graph shows the ambient temperatures in London, between 8am and 6pm, over 2006:

From this graph over 58% of the time the temperature was between 8ºC and 20ºC, allowing free cooling when the air conditioning set point was 21ºC in cooling mode. If the setpoint is higher, then free cooling is increased.

Developed and refined over the past 30 years, the Lossnay system from Mitsubishi Electric LES has perfected the recovery of waste energy. The units reduce overall energy costs by extracting stale air and then recovering the heating or cooling energy to either warm or cool incoming fresh air. By utilising this energy, the Lossnay system can save up to 30% on initial capital costs of heating and cooling plant, as well as giving 20 – 50% lower energy costs.

The Lossnay equipment ensures that only fresh air is introduced to the indoor environment, with a diaphragm made of specially processed paper fully separating the inlet and exhaust air supplies. The superior heat-transfer and moisture permeability of the special paper ensures highly efficient total heat exchange (temperature and humidity) when inlet and exhaust air supplies cross in the Lossnay element.

The main features of Lossnay are summarized below:

a. **Effective ventilation:** Lossnay's simultaneous air exhaust/supply provides effective ventilation. Conventional ventilators (i.e. extract propeller fans) do not work effectively within air tight buildings because of the negative air pressures involved

b. **Good energy recovery:** Total heat (sensible and latent) recovery provides a comfortable air temperature within the room. The energy saved by using Lossnay contributes towards lowering the heating or cooling requirement within the building, therefore reducing the energy requirement and running costs

c. **Free cooling function (LGH series):** When the outdoor temperature is lower than the indoor air conditioned

temperature in the summer, Lossnay provides fresh outdoor cool air to reduce the indoor air temperature

d. **Good sound attenuation:** As the Lossnay core is made of paper and the permeable holes are small, the Lossnay core provides outstanding soundproofing properties and is appropriate for sound proof rooms

e. **Part L2 Building Regulations:** With the introduction of Part L2 (Part J in Scotland), new building design is changing to become more airtight, as well as energy efficient. The need for fresh air has remained the same however and thus poses new challenges for modern design. Lossnay fully meets these challenges due to its basic principal and its efficient heat recovery

f. **Enhanced Capital Allowance (ECA):** the LGH-RX4 series of products qualifies for Enhanced Capital Allowances.

The way a heat recovery systems works within a ventilation system in winter is that warm, stale air is extracted from a building and passes over a diaphragm of specially processed paper. At the same time, cold air is introduced to the system from outside. It too passes over the diaphragm where heat is exchanged and the fresh air temperature is raised before entering the building.

In summer, cooled air from an air conditioned office is extracted and crosses with warm air being drawn into the building. The external air temperature is cooled before it enters the cooling system, thereby lowering energy requirements of the air conditioning units. The superior heat transfer and moisture permeability of the paper ensure highly efficient total heat exchange (temperature and humidity) when inlet and exhaust air supplies cross. This paper core exchanges around 80% of heat energy which would normally be lost.

Heat loads in Summer

In summer using a heat recovery system can reduce the outdoor air load, therefore the overall cooling load, by up to 18% at an ambient temperature of 27%ºC.

Type of Load	Estimated Load (W/m²)	
	No heat recovery	With heat recovery
Indoor infiltration load Heat loss from walls Heat loss from glass - from direct sun - from conduction & convection Accumulated heat loads in walls	47.6	47.6
Indoor generated load Generated heat from people - Sensible heat - Latent heat Generated heat from electrical equipment (lighting etc.) - Sensible heat - Latent heat	24.6 30	24.6 30
Re-heating load	-	-
Outdoor air load Sensible heat Latent heat	35.8	10.7
Total	**139.8**	**114.7**

Heat loads in Winter

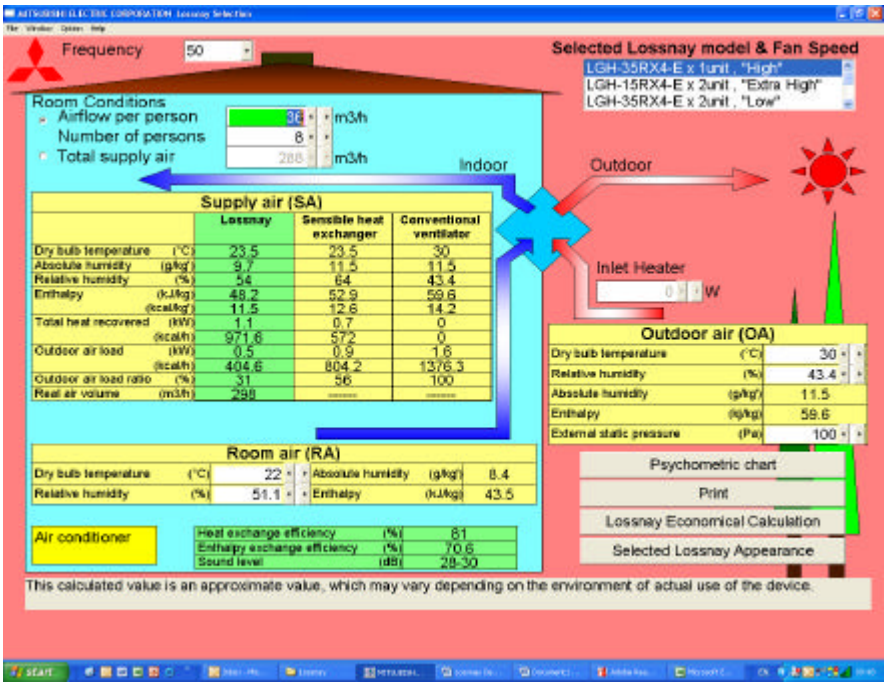
In winter, air loads for a building will be greater. At an ambient temperature of 2.5 ºC, the overall heating load can be reduced by 30%.

Type of Load	Estimated Load (W/m²)	
	No heat recovery	With heat recovery
Indoor heat loss Heat loss from walls Heat loss from glass Heat loss from conduction & convection Accumulated heat loss on walls	77.7	77.7
Outdoor air load Sensible heat Latent heat	78	23.4
Total	**155.7**	**101.1**

Another important aspect of ventilation is control of sound, as commercial premises can have local planning restrictions on noise. A heat recovery system using paper and with small permeable holes provides excellent soundproofing properties and is even appropriate for soundproof rooms.

Further savings can be made using the bypass damper which operates in summer when outdoor temperatures are lower than indoor air conditioning temperatures. This allows free cooling using outdoor air. Significant additional reductions in heat load can be achieved by operating a night cooling and ventilation strategy.

Mitsubishi Electric LES use software to calculate which Lossnay models should be installed. It also estimates the amount of free cooling and heat recovery available as shown below:



Build evidence data to support improved specification and business decision making.

The table below demonstrates the heating and cooling loads in a 3 storey office building (built to 2006 building regulations) without heat recovery, and with Lossnay and night ventilation. There is a 28% saving for the heating load, and 38% saving for the cooling load. This illustrates the clear advantage of installing Lossnay heat recovery products.

Example of reduction in building heating & cooling loads using Lossnay: 3 storey office built to 2006 building regulations:

	Without Heat recovery	With Lossnay & night ventilation	Saving
Heating Load kWh	63,000	45,300	28%
Cooling Load kWh	32,000	20,000	38%

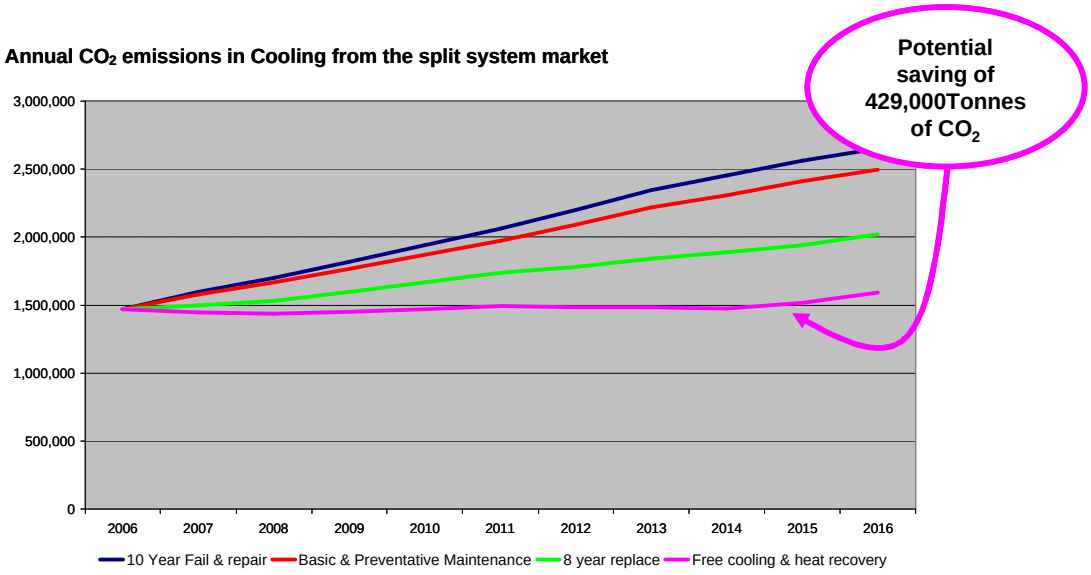
Create an educational programme to expand knowledge for domestic and commercial markets.

From system designers through to installers – there is a need to develop new knowledge in the sector and share best practice. Mitsubishi Electric LES has recently set-up an independent advisory panel to help the company direct its technology and educational focus. The Company also plans to build upon its highly successful regional educational programmes.

Embed free cooling & heat recovery into heating & cooling system design.

Mitsubishi Electric LES has always promoted the use of technology to ensure that best practice is employed throughout all stages of the specification process – from initial enquiry and specification through to site supply. The integrity of the system specification, from the perspective of CO_2 reduction is key, this is why the Company will invest heavily during 2007/8 in its IT infrastructure.

Expected outcomes from this initiative:



Market assumptions: 1.66 million split systems operating in the market in 2006, growing to 3.697 million units in 2016. This graph shows the potential cumulative effect if the principles of the Green Gateway Initiative were adopted across the whole market.