



SKANSKA

UNEP



Sustainable
United Nations

ENERGY EFFICIENCY IN BUILDINGS

*Guidance for
Facilities Managers*





Foreword

There are over 40 organizations in the UN system, with approximately 70,000 staff in more than 530 locations worldwide. This means that increasing the energy efficiency of UN facilities across the board will bring about significant reductions in greenhouse gas emissions, as well as operating costs.

The United Nations (UN) Secretary General Mr. Ban Ki-Moon at the World Environment Day on 5 June 2007 called for all UN agencies, funds and programmes to become climate neutral and adopt “greener” operational practices. This call was echoed in October 2007 in a decision of the UN Chief Executives Board for Coordination to move all organizations belonging to the UN system towards climate neutrality for facility operations and travel by the end of 2009.



Against this background, UNEP's Division of Technology, Industry and Economics (DTIE) in liaison with the Environment Management Group (EMG) secretariat has set up a new team, Sustainable United Nations (SUN), that will provide technical support and advisory services to the UN organizations. The aim of SUN is to assist the UN system to reduce its greenhouse gas (GHG) emissions from its operations, and move towards climate neutrality and overall sustainability.

SUN is supporting organizations to reduce their GHG emissions through several channels: improving energy efficiency measures in buildings and facilities, promoting sustainable procurement practices, encouraging sustainable organizational culture, including green meetings, training and awareness, and sustainable office system, as well as reducing the carbon footprint from travel.

As a first practical guide for reducing GHG emissions from buildings, “Energy Efficiency in Buildings: Guidance for Facilities Managers” takes you through various ways to identify energy saving opportunities in existing buildings. It contains easy-to-do tips on implementing energy efficiency measures and carbon management, and takes the facility managers through top ten actions to reduce energy use in an owned or leased building.

Although this guide has been prepared for buildings located preliminary in temperate climates, the general principles should be applicable to facilities around the world.

Acknowledgements



This guide was originally prepared by Skanska for their facility managers, and modified by UNEP to tailor it more to the UN context. The SUN team would like to thank Skanska for making this material freely available for the benefit of UN facility managers and other interested readers across the globe.

Energy Efficiency in Buildings - Guidance for UN facilities managers

Introduction to managing energy use

The purpose of this document is to empower you, as a facilities manager, to increase the energy efficiency of the buildings that UN occupies for its own operations, whether owned or leased; and to signpost you to the key information sources on energy efficiency and renewable energy, including the support programmes and best practice examples in your part of the world.

Although the newspapers seem to be full of stories about climate change, it is sometimes hard to see how we can have an impact and how we can benefit in our daily lives. So as a facilities manager, why should you improve the energy efficiency of your facility? Here are some useful arguments when you need to argue the business case:

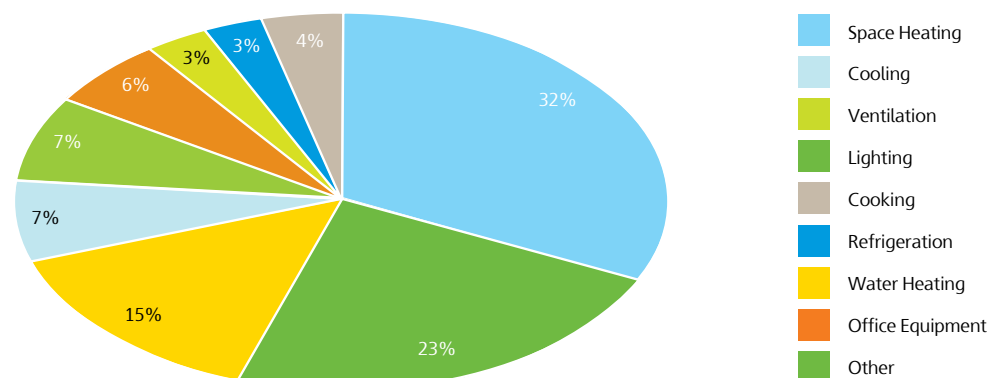
- **Economic:** Energy is not a fixed cost – being more efficient can help you meet your cost targets. A number of energy efficiency measures are available which are simple to implement and have a good payback time.
- **Security:** Global energy prices are rising as demand outstrips conventional supply, improving energy efficiency now will give you first mover advantage, and pay dividends in the future by ensuring your operational security.
- **Environmental:** Saving fossil fuel energy cuts the greenhouse gas emissions associated with business operations, helps demonstrate green credentials to UN's shareholders, and helps to meet ISO14001 commitments.

The role of Facilities Managers

Facilities managers are very important in making UN a greener company; your role puts you at the front-line of cutting UN's in-house carbon dioxide emissions. Whether the building you manage is owned by UN or leased, there will be opportunities for you to lead the drive to cut its operational carbon emissions. Energy used in buildings is a significant source of greenhouse gas emissions worldwide, and certainly in Europe, the energy used in buildings is more than that used by either the transport or industrial sectors.

As the graph below illustrates – the energy used for space and water heating, air conditioning, cooling, and for lighting a commercial building is significant, and it is by focussing on these areas that the largest savings can be made:

How energy is used in commercial buildings (Temperate Climate)



1 EIA <http://www.eia.doe.gov/kids/energyfacts/uses/commercial.html>

The UN System

The Chief Executive Board human resources data indicates that there are some 40 organizations in the UN system, with approximately 70,000 employees worldwide from 189 nationalities present in 176 countries and 533 duty stations. The main UN headquarter duty stations locations include New York, Montreal, Paris, Vienna, Geneva, Bonn and Nairobi.

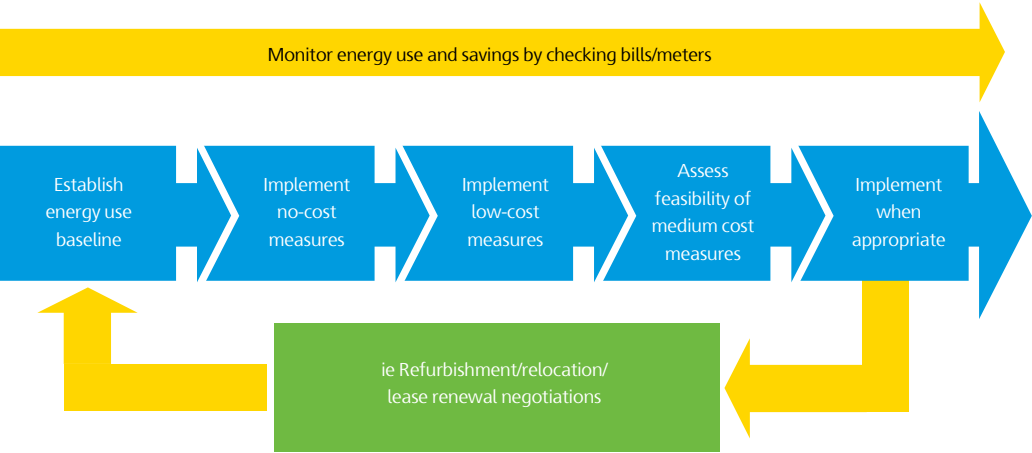
Key UN Facilities Management Contacts

Country	Number and Type of Facilities	Key Contacts	Contact Details
Latin America			
Argentina			
Brazil			
Czech Republic / Slovakia			
Finland / Estonia			
Norway			
Poland			
Sweden			
UK			
USA			

The energy efficiency process

Energy efficiency and carbon management should be thought of as an ongoing process. The diagram below shows you how to approach this process in a logical way that empowers you to keep striving for continuous improvement.

The energy management decision process



- 1 The key to energy efficiency is management – it doesn't matter how much you spend on technology, without management you will waste money. The first maxim of energy management is that you can't manage what you don't measure, thus establishing a baseline of energy use should be your top priority as a facilities manager. Get the bills out and check consumption – keep a record of it. If in doubt check the meters, and consider how operational changes and external factors such as the weather have affected energy consumption.
- 2 After a baseline has been established, you should then tackle the 'no cost' then 'low cost' measures suggested in this guide. A no-cost measure is one that is free to implement (although it may take an hour or so of your time), and low cost measures are ones that will pay for themselves within six months. No cost measures are applicable to both leased and owned buildings as they do not involve changing the building's services.
- 3 Once these have been completed, the 'medium cost' measures suggested should be considered. These measures should pay for themselves in less than two years. If you are the manager for a leased building, these should be discussed with your landlord using a cost-benefit argument. Lease renewal negotiations are an ideal time to request energy efficiency changes, as landlords may prefer a small capital spend to keep a tenant rather than risk an empty building.
- 4 It may be that immediate implementation of an action, is not appropriate but when any major change is planned for the building portfolio the decision making process should be repeated, to see if any measures which were not previously possible could be implemented during the refurbishment / relocation.
- 5 Throughout this process energy use should be monitored and energy savings reported to enhance the business case for future energy efficiency plans. Meter readings or bills should be compared on at least a quarterly basis with data from the previous year to see if unit consumption has fallen. Set up a simple spreadsheet to track monthly consumption and record savings.

Special tips for Facilities Managers of Leased Buildings

Whilst this guide aims to provide carbon saving tips for managers of both owned and leased premises, we recognise that facilities managers responsible for leased buildings face different challenges and unique constraints to improving energy efficiency, and that not all of the major carbon saving actions will be applicable in your circumstances. This section details advice specifically to those facilities managers in charge of leased buildings.

This guidance should be followed before leased space is acquired and during lease re/negotiations to ensure that leased premises meet UN's carbon management requirements. Make sure that your landlord knows that UN takes carbon management seriously and requires that its suppliers and business partners do too.

- 1 Ensure that the UN team responsible for the lease negotiations are aware of the importance of energy efficiency when specifying premises. Present a business case to show the cost benefits to UN, for example:
 - Legislation is tightening to encourage companies to cut their carbon emissions. To avoid future financial liability associated with emissions, it is sensible to 'future proof' your premises choice from this perspective.
 - Operating from an energy efficient building sends an important message to stakeholders of UN's commitment to cutting carbon, to encourage business, recruitment and investment.
 - Energy is not a fixed cost - careful energy management is vital to reduce operating costs, and energy efficiency has no negative impacts on quality or output.
 - Energy costs are rising - a building which is financially feasible to operate now, may become too expensive within the next decade as the cost of carbon is passed on to end users of energy, and the cost of fossil fuels rises.
- 2 Specify from the outset of your property search / lease negotiations that an energy efficient building is a top priority for UN. Understand what your existing energy spend / energy intensity is and what best practice energy intensity benchmarks exist for offices in your country, for example LEED, BREEAM etc to include in your specification.
- 3 Ask to see the energy performance statistics for the building, for example an energy performance certificate in the EU. Use this to specify buildings with a good rating. If there is no certification system, ask to see previous energy consumption figures to establish the cost per sq foot / employee, as applicable.

If this cost is higher than your current premises, it is important to negotiate energy efficiency measures with the landlord.

- 4 Ask what energy efficiency measures have been carried out to the building already, using the top ten actions identified in this guide as a basis for discussions. If no and low cost measures haven't been carried out, explore whether this is possible.
- 5 Ask the landlord to increase the energy efficiency of the building as a condition of taking the lease. If the landlord pays the utility bills, they will benefit from this financially and potentially meet a forthcoming regulatory requirement. If UN pays the utility bills, and the lease is for longer than five years, consider contributing towards capital spend as you will benefit from reduced energy bills.. At this stage, you have a strong bargaining position - after a lease is signed there is little scope for change.
- 6 If you are renegotiating your lease as an existing tenant, ask the landlord to increase the energy efficiency of the building as discussed above. A sitting tenant is in a strong position as the landlord knows that you are a good tenant and you have built up a relationship with your managing agent, who will not want the property to risk becoming empty.
- 7 Features you should look for when analysing the energy efficiency of a building include: district heating / cooling systems, advanced control systems, solar water heating, integrated renewables, hybrid or natural ventilation, passive solar design to maximise natural light but reduce overheating, a highly efficient building envelope including wall construction with high levels of insulation, double or triple glazing, roof insulation, draught proofing, energy efficient lighting systems including timers, occupancy sensors, and CFL (compact fluorescent lightbulbs) bulbs / high efficiency tubes, energy efficient space / water heating systems including timers, individual room thermostats, heat exchangers on ventilation, thermostatic radiator valves, and pipe insulation.
- 8 If none of the above advice is applicable, and it is not feasible to move premises, it is important to focus on 'user actions' to reduce carbon emissions and energy spend. Refer to the companion to this guide on encouraging energy efficient behaviour.

Top ten actions to reduce energy use

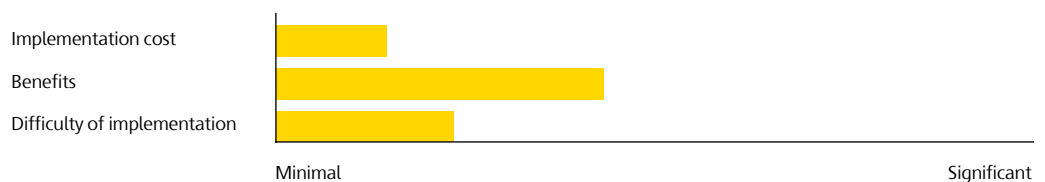
This section presents the top ten actions to carry out to reduce the energy costs and carbon emissions of your facility. The actions are based on a review of the international literature on energy efficiency and draw upon experience from a number of sectors and best practice case studies. The information sheets on the top ten actions can be printed out and put up on the notice board, presented to your landlord or used in office briefings. Whilst not all of the tips will be applicable to your specific premises, or you may already have completed some, the guidance aims to provide you with a useful checklist of ideas

- 1 No cost – Establish current energy usage and check bills to make sure you are on the right tariff
- 2 No cost – Incorporate energy efficiency into maintenance activities
- 3 Low cost – Exclude draughts
- 4 Low cost – Increase the energy efficiency of water heating systems
- 5 No cost / Low cost – Improve the efficiency of air conditioning / ventilation systems
- 6 Low cost – Improve the efficiency of lighting systems
- 7 Low cost – Install or top up loft / roof space insulation
- 8 Medium cost – Insulate walls
- 9 Low cost – Increase the efficiency of space heating systems
- 10 Medium cost – double or triple glaze all windows

No Cost – Establish current energy usage and check bills to see if you are on the right tariff²

Top Ten Action	Why?	How?	When?
Ensure that the building is on the most appropriate (i.e. hours of usage) tariff for gas, electricity and other fuels used and that bills are checked regularly. Check unit rates and power factors. Conduct an energy audit if waste is suspected.	If more than 15% of total electricity usage occurs in the off-peak period, it is worth considering switching to a day/night tariff. Additionally, Some monthly tariffs penalise users for poor power factors.	Tariffs should be checked annually to see that you are on the most appropriate one. Check yours today. Every two years a full energy audit should be carried out. Bills should be monitored and compared to previous equivalent bills as soon as they arrive. Pay particular attention to overnight energy usage as this can indicate areas of needless waste such as lighting being left on.	This action should be carried out immediately, and monitoring of energy usage should be maintained regularly. Check bills monthly, and evaluate other tariff options annually. Read meters monthly, and on occasion during out of hours periods to understand how much energy is wasted by equipment being left on, or HVAC systems operating needlessly. Check best use is being made of off peak rates.

At a Glance



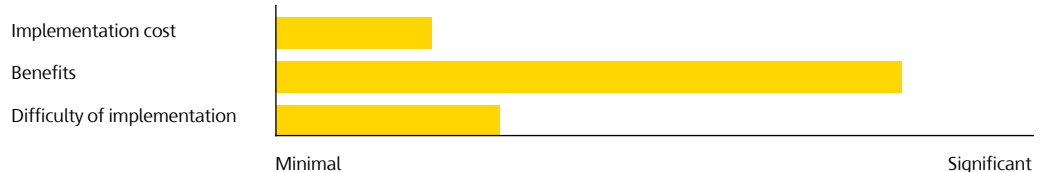
² The power factor of an AC electric power system is defined as the ratio of the real power to the apparent power, and is a number between 0 and 1. Real power is the capacity of the circuit for performing work in a particular time. Apparent power is the product of the current and voltage of the circuit. Due to energy stored in the load and returned to the source, or due to a non-linear load that distorts the wave shape of the current drawn from the source, the apparent power can be greater than the real power. Low-power-factor loads increase losses in a power distribution system and result in increased energy costs.

Notes	Regions	
A professional tariff consultant could be used if energy consumption patterns are complex, but this is unlikely to be necessary in an office setting and the task can be done without expert help.	Argentina	Recommended
	Brazil	Recommended
	Czech Republic	Recommended
The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of windows / doors.	Finland	Recommended
	Norway	Recommended
This action is a priority and should be undertaken immediately before any other actions are considered.	Poland	Recommended
This action costs no money directly and will only use an hour per month of a staff members time. The potential savings are likely to repay this investment in a matter of weeks.	Sweden	Recommended
	UK	Recommended
	USA	Recommended
Office Compatibility		
There are no additional maintenance costs associated with this action.	Owned	Compatible
It is important that one staff member is given responsibility for checking bills and monitoring consumption. This person may need some training to improve their understanding of tariffs and energy data.	Leased	Compatible, although some tenancies may preclude changing utility suppliers so if in doubt check your tenancy agreement
No behavioural issues, although the knock on effect is that the profile of energy efficiency is likely to be raised and less energy wasted if staff are aware that consumption is being monitored and prioritised.	In house FM	Compatible
	Outsourced FM	Compatible
This action should continue for the foreseeable future, with at least once monthly checks of consumption and bills, and annually for tariffs.	Old Properties	Compatible
	New Build	Compatible
Record whether bills are estimated or actual, number of units, maximum demand, day and night demand, supply capacity and power factor if quoted. Compare consumption and costs against equivalent periods the previous year. Investigate any unexplained increases and especially that which occurs out of hours. Check to see the impact of new equipment.		
May apply in the home.		

No Cost / Low Cost – Incorporate energy efficiency into maintenance activities

Top Ten Action	Why?	How?	When?
Incorporate energy awareness into maintenance activities.	Poor maintenance can hamper the energy efficiency of lighting, heating and air conditioning systems. Additionally, regular maintenance checks can be invaluable at spotting problems and sources of waste.	Train maintenance teams to identify warning signs that heating and cooling systems are operating inefficiently. Check the following regularly: plant control valves, dampers, warning lights, signs of leakage, gas smells, oil leaks, damage and burn marks on boilers, undue noise from pumps and burners, blockage in air vents and filters, thermostat settings, blockages / obstacles in front of heating vents or radiators, that ventilators used for summer cooling are shut off before the heating season begins, that draught exclusion tape and pipe lagging is still in good condition. Replace old light bulbs with energy efficient equivalents as standard and clean shades, reflectors and bulbs regularly. Clean windows and daylighters monthly to maximise daylighting.	This action should be implemented immediately and kept up as part of regular maintenance activities. Monthly or even weekly checks are advised.

At a Glance



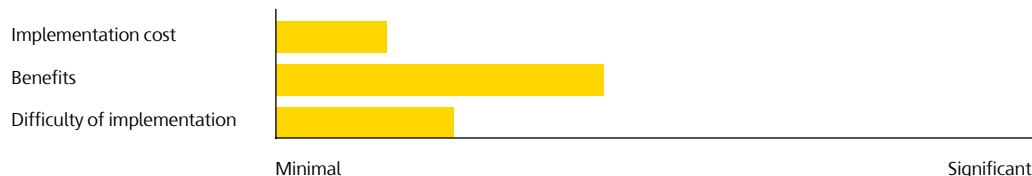
Notes

<p> No professional advice needed unless a problem is spotted with the HVAC system, in which case a professional qualified building services engineer should be consulted immediately.</p> <p> The exact cost and payback are dependant on circumstances i.e. energy bills, climate, amount of lighting.</p> <p> Install no cost measures identified here first, then move onto the low cost measures.</p> <p> Additional maintenance costs are likely to be minimal - an extra two hours per month is typical. This cost is likely to pay for itself within 6 months.</p> <p> Most of the checks recommended can be easily accommodated into existing maintenance schedules, however the frequency of checks may mean that an additional 2 to 5 hours (depending on the size of the building) may be needed.</p> <p> Maintenance staff may need to receive training on how to spot energy wastage and warning signs of faults in HVAC systems.</p> <p> Staff should be encouraged to report concerns about energy wastage and defective plant to maintenance / building management as soon as it is spotted.</p> <p> These activities should be carried out on a monthly, and ideally a weekly basis.</p> <p> Regular spot checks are useful but should not replace the annual servicing of HVAC systems by a fully qualified professional. Other tasks can be carried out by a member of the building management team.</p>	<p> May also apply in the home.</p>
Regions	
Argentina	Recommended
Brazil	Recommended
Czech Republic	Recommended
Finland	Recommended
Norway	Recommended
Poland	Recommended
Sweden	Recommended
UK	Recommended
USA	Recommended
Office Compatibility	
Owned	Compatible
Leased	Compatible
In house FM	Compatible
Outsourced FM	Compatible
Old Properties	Compatible
New Build	Compatible

Low Cost – Exclude Draughts

Top Ten Action	Why?	How?	When?
Ensure that buildings are as airtight as possible to exclude draughts from ill fitting windows and doors.	Poor fitting doors and windows can create draughts and allow heat to escape. Draughts create uncomfortable working conditions for those sitting nearby, and can increase heating demand.	Poor fitting doors and windows can be fitted with adhesive draughtstrip tape or a PVC seal. Keyholes and letterboxes can be draughtproofed too. If draughts are coming in from cracks between floor/ceiling and the walls, PVC sealant can also be used to draughtproof these. Fit closers to doors to ensure they are always closed after use.	This option should be considered as soon as all no cost measures have been implemented. It should be installed before winter/windy season. Tape should be reapplied whenever redecoration occurs, and/or if the tape begins to lose its adhesiveness. This action is best suited to offices where overheating is not a problem.

At a Glance



Notes	Regions
<p> The tape can be fitted easily by anyone with moderate DIY skills. No professional advice is needed, so long as essential ventilation is not affected.</p> <p> The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of windows / doors.</p> <p> This action is a secondary priority that should be instigated after all no cost measures have been tackled.</p> <p> Exterior doors can be fitted with a draughtstrip for around US\$ 7.50 or PVC seal, in addition the keyhole and letterbox can be draughtproofed for between US\$7.50 to US\$15. Door closers are around US\$7.50 each. Payback time is under six months.</p> <p> No additional maintenance costs, but some small disruption is likely during installation of cavity wall insulation. Significant disruption is likely from installing thermal lining paper as this necessitates redecoration. Time it to coincide with refurbish.</p> <p> No training implications for staff.</p> <p> No behavioural issues, once the insulation is installed staff will not have to act any differently.</p> <p> Lifespan of cavity insulation is adhesive draught strips are approximately 2 -5 years depending on the humidity of the climate. PVC sealant can last up to 15 years.</p> <p> For health and safety it is important to maintain background ventilation / trickle vents for 0.5 to 1 air change per hour. Also essential that no vents for heating equipment etc are blocked up. If in doubt get an expert to check.</p> <p> May be applicable in the home.</p>	<p>Argentina Recommended</p> <p>Brazil Recommended to exclude excess heat and improve the efficiency of AC systems</p> <p>Czech Republic Recommended</p> <p>Finland Recommended</p> <p>Norway Recommended</p> <p>Poland Recommended</p> <p>Sweden Recommended</p> <p>UK Recommended</p> <p>USA Recommended</p>
Office Compatibility	
Owned	Compatible
Leased	Likely to be permissible under rental contract. If in doubt contact the landlord
In house FM	Compatible
Outsourced FM	Compatible
Older Properties	Only advisable if the office isn't planning to relocate or else payback benefits might not be seen
New Build	Compatible, but likely that may be fitted already

Low Cost - Increase the efficiency of water heating systems

Top Ten Action	Why?	How?	When?
Fit electric immersion water heaters and hot water circulating pumps with time switches, if boiler systems are used ensure that hot water tanks and pipework are well insulated.	Time switches ensure that hot water is only generated when needed. Circulating pumps run at night waste the heat stored in the cylinder and use energy needlessly. Insulating pipes can reduce heat losses by 70%.	Get a qualified electrician / heating engineer to install time switches on immersion heaters and secondary water pumps, if they don't need to run at night (turn the time switch off in the winter to prevent pipes freezing). Preformed foam pipe lagging can be fitted simply to all hotwater pipes and tank jackets are easily fitted DIY. Find out about installing solar water heating panels on the roof.	This option should be considered as soon as all no cost measures have been implemented, and should only be considered if the system is not due to be replaced in the short term. When refurbishing hot water systems, considering installing plate heat exchangers as they have minimal heat losses, reduce the risk of legionella and are cheap to run. Try to consider heating water close to the point of use to avoid long pipe lengths. Small quantities of water are most efficiently heated by electric on demand heaters, for larger quantities consider a gas system.

At a Glance



Notes	Regions
Professional advice should be sought on what controls and insulation are most suitable for the system in your office.	Argentina Recommended
The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of windows / doors.	Brazil Recommended
This action is a secondary priority that should be instigated after all no cost measures have been tackled.	Czech Republic Recommended
Typically these measures will cost under US\$150, and will pay for themselves in under 12 months.	Finland Recommended
Some small disruption is likely during installation of time switches and insulation, but there are no significant maintenance implications. Controls should be checked every six months to see that they are working correctly and to the correct hours of operation. They may need to be modified for Day-light Saving Time and during holidays.	Norway Recommended
The facilities manager / maintenance team will need to know how to alter the time switches, this should be clear from the instruction manuals.	Poland Recommended
No behavioural issues, although staff working late will need to be briefed that there will be limited hot water available out of hours.	Sweden Recommended
A lifespan of 10 years is usual for such measures. The integrity of insulation should be checked annually to make sure it is still in place.	UK Recommended
If you are using a water temperature regime to control Legionella this needs to be taken into account, with water temperature not being allowed to fall below 55 degrees C.	USA Recommended
May apply in the home.	
Office Compatibility	
Owned	Compatible
Leased	This may be permissible under the tenancy agreement, if in doubt check with your landlord
In house FM	Compatible
Outsourced FM	Compatible
Old Properties	Only advisable if the office isn't planning to relocate or else payback benefits might not be seen
New Build	Compatible, but likely that may be fitted already

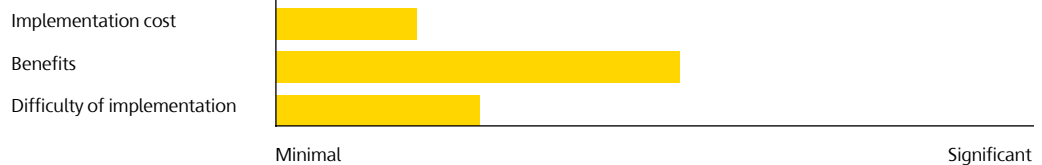
No / Low Cost – Improve efficiency of AC / ventilation systems

Top Ten Action	Why?	How?	
Ensure that AC / ventilation systems are operating in the most energy efficient manner where installed.	As our climate changes, increased use of AC is likely and associated costs will rise. Even in higher latitudes, peak annual energy demand is now to be found in summer months due to increasing use of AC.	Air conditioning systems should not cool rooms to below 24C, heating should not heat rooms to above 19C. It is important to avoid heating and cooling operating simultaneously. Set units in common areas to the same mode of operation (either heating or cooling) to avoid conflicts. Air conditioning systems should have timers fitted to match occupancy patterns. It is also important that there is an override function so that in cooler weather systems can be turned off. Remove sources of unwanted heat from air conditioned areas i.e. uninsulated pipes. Ensure cooling vents are unobstructed. Ensure that server rooms are not kept too cool: 25C should be fine. Check that thermostats are located appropriately i.e. not next to heat sources. Fit a 7 day time switch to extraction fans and	air conditioning systems, or use occupancy sensors in small areas. Options for free cooling should also be considered i.e. solar shading from tree planting, re-using exhaust ventilation from offices to garages etc.

When?

This action should be implemented as soon as all no cost measures are completed. If considering installing a new AC system, make sure that insulation levels are topped up as it may be that a smaller system can be specified. If a new building, try and install a system which use a low-GWP refrigerant.

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Notes

Professional advice may be needed when installing controls onto AC / ventilation systems. Check minimum temperature requirements for specific IT systems before altering server room temperatures.

The exact cost and payback are dependant on circumstances i.e. energy bills, climate, amount of lighting, AC system.

Install no cost measures identified here first before moving onto the low cost measures.

Additional controls typically cost under US\$150, and are likely to pay for themselves in under 6 months. None of the other measures have any capital cost.

No additional maintenance costs are associated. Important to get AC system serviced once per year or sooner if not working well as refrigerant levels may be low.

Building management teams should familiarise themselves with the instruction manuals for new time controls.

Staff should be encouraged to consider how their actions affect the energy efficiency of cooling systems, i.e. reminded not to open windows when cooling systems are on.

The time controls recommended typically have a lifespan of 10 - 15 years.

For best practice, consider installing heat exchangers into ventilation systems to recover waste heat from extracted air. In colder climates, ventilation systems should be modified to incorporate recirculation of extracted air to conserve heat.

Unlikely to apply in the home, except in Brazil / USA.

Regions

Argentina	Recommended
Brazil	Recommended
Czech Republic	Recommended
Finland	Recommended
Norway	Recommended
Poland	Recommended
Sweden	Recommended
UK	Recommended
USA	Recommended

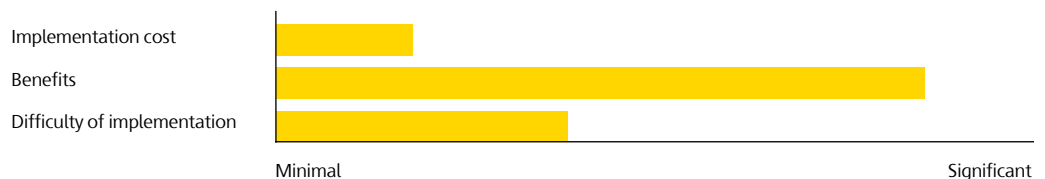
Office Compatibility

Owned	Compatible
Leased	May need landlord's permission, if in doubt check tenancy agreement
In house FM	Compatible
Outsourced FM	Compatible
Old Properties	Compatible
New Build	Compatible

Low Cost – Improve efficiency of lighting systems

Top Ten Action	Why?	How?	
Improve the efficiency of lighting systems.	Lighting can account for up to 50% of the money spent on electricity in an office. Much of this expense is needless and can be saved without compromising on light quality or safety.	Install lighting controls and sensors, label lighting banks so that people know which switch turns off which light. Move any obstructions to natural daylight and ensure windows and rooflights are kept clean. Daylighting can also be increased through the use of sunpipes which can reduce the need for artificial lighting in rooms without windows. Reduce lighting levels in non-critical areas by selectively removing tubes / light bulbs. Clean light fittings annually. Replace all redundant bulbs with energy efficient equivalents. Replace fluorescent fittings with new slimline fittings to accommodate the new energy efficient slimline tubes. Fit photocells to automatically turn off lights when daylight	is adequate. Fit PIR sensors in less-used areas such as bathrooms and cupboards to ensure that lights are only on when needed.
			When? This option should be considered when all no cost measures have been implemented. If lighting systems are scheduled to be replaced ensure that energy efficiency is at the core of the designs. When replacing worn out light bulbs ensure that energy efficient equivalents are installed as standard.

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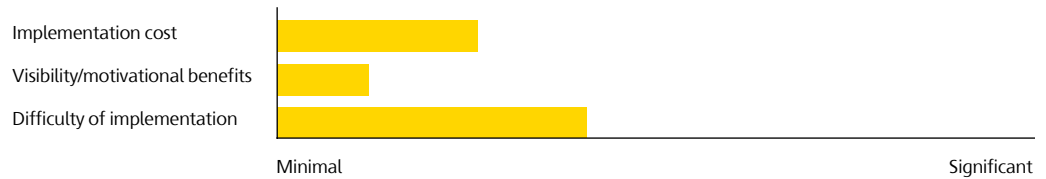


Notes	Regions
Professional advice should be sought on what controls and insulation are most suitable for the system in your office.	Argentina Recommended
The exact cost and payback are dependant on circumstances i.e. energy bills, climate, amount of lighting	Brazil Recommended
Install no cost measures identified here first, then move onto the low cost measures.	Czech Republic Recommended
Adequate controls on lighting systems cost under US\$150 to install and typically pay for themselves in under 12 months. Many of the actions identified here are actually no cost.	Finland Recommended
Energy efficient light bulbs actually save maintenance costs as they last up to ten times as long as conventional lightbulbs and hence need replacing less often.	Norway Recommended
The facilities manager / maintenance team will need to know how to alter the time switches, this should be clear from the instruction manuals. Staff should be briefed on energy efficiency.	Poland Recommended
Any changes to lighting systems need to be backed up with staff awareness training so that people help rather than hinder energy saving efforts.	Sweden Recommended
A lifespan of 15 years is typical for improved controls. Some energy efficient lightbulbs are guaranteed for 10 years.	UK Recommended
Don't forget exterior lighting - is it really needed? Fit photocells to restrict exterior lighting to hours of darkness. If dimmers or automatic security switches are used for either internal or external lighting, CFLS may not be suitable.	USA Recommended
May apply in the home.	
Office Compatibility	
Owned	Compatible
Leased	This may be permissible under the tenancy agreement, if in doubt check with your landlord.
In house FM	Compatible
Outsourced FM	Compatible
Older Properties	Only advisable if the office isn't planning to relocate or else payback benefits might not be seen.
New Build	Compatible, but likely that may be fitted already

Low Cost – Install or top up loft / roofspace insulation

Top Ten Action	Why?	How?	When?
Install or top up loft / roof space insulation.	25% of all heat lost in a building could go through the roof! One of the most cost effective ways to combat this is to ensure sufficient loft insulation. Loft insulation also reduces overheating in offices in the summer by preventing heat from sunlight striking the roof, from entering the office - thus saving on cooling bills.	A loft should be insulated to a depth of at least 250mm (10 inches), it can be done by a professional installer or DIY, and it is essential to maintain good ventilation, and that the insulation remains dry.	This option should be considered as soon as all no cost measures are implemented. It is advisable to implement it before winter. It needs to be implemented before replacing any spaceheating systems as the energy saved may mean that a smaller heating system can be installed.

At a Glance



Notes	Regions
<p> Professional advice is recommended. Rolled insulation can be installed DIY providing that health and safety guidance is adhered to.</p> <p> The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of loft space.</p> <p> This action is a secondary priority that should be instigated after no cost measures have been tackled.</p> <p> Low cost option. Costs are approximately US\$10.50 per m² if professionally installed, US\$7.50 if DIY. Costs will be recovered in under eighteen months if installed DIY, and in under two and a half years if installed professionally.</p> <p> No additional maintenance costs, but some small disruption is likely during installation. It is also recommended that the insulation is checked annually to ensure ventilation is adequate. Ensure that any water tanks and pipes in the loft space are insulated to reduce the risk of freezing.</p> <p> No training implications</p> <p> No behavioural issues, once the insulation is installed staff will not have to act any differently.</p> <p> Lifespan is over 20 years if well installed, do not consider in premises due for relocation</p> <p> To achieve best practice, sustainable insulation materials such as Warmcell (made from recycled newspapers), Hemp or Sheeps Wool insulation could be considered. Going beyond the recommended depth of insulation will bring additional benefits.</p> <p> May apply in the home.</p>	<p>Argentina Recommended</p> <p>Brazil Recommended</p> <p>Czech Republic Recommended</p> <p>Finland Legally required already</p> <p>Norway Legally required already</p> <p>Poland Legally required already</p> <p>Sweden Legally required already</p> <p>UK Legally required already</p> <p>USA Recommended</p>
Office Compatibility	
Owned	Compatible
Leased	May not be permissible under rental contract, however, if UN do not own the asset there is an incentive gap and they should instead present the business case for improved insulation to their landlord
In house FM	Compatible
Outsourced FM	Compatible
Old Properties	Only advisable if the office isn't planning to relocate or else payback benefits might not be seen
New Build	Compatible, but likely that may be fitted already





Medium Cost

– Install cavity wall insulation or thermal lining paper on solid wall buildings

Top Ten Action	Why?	How?	When?
Install cavity wall insulation where possible. If there are no cavities in the building's external walls consider fitting thermal lining paper.	Uninsulated walls could account for 35% of heat lost from your office. Generally, in Europe, buildings built after 1930 have cavities in their walls and these can be insulated to reduce heat loss.	Cavity wall insulation involves injecting insulation from the external side of the walls through small holes into the cavity between the external and internal skin of a building, this can only be done by a professional installer. Thermal lining paper can be fitted on the inside of all external walls by a standard decorator during refurbishment activities in buildings without cavity walls.	This option should be considered as soon as all no cost measures are implemented. It is advisable to implement it before winter, and if using thermal lining paper during a refurbishment as the inside walls will need to be redecorated. It needs to be implemented before replacing any spaceheating systems as the energy saved may mean that a smaller heating system can be specified.

At a Glance

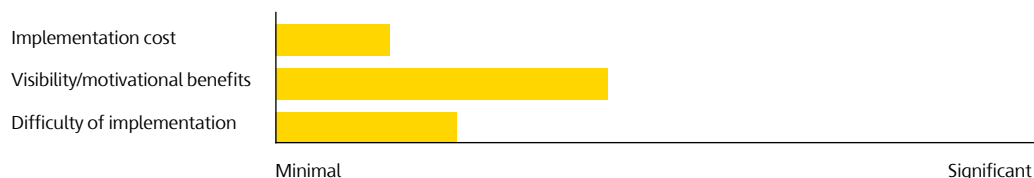


Notes	Regions	
 Professional advice is needed. As is professional installation. Hire a reputable accredited installer, if in doubt ask around and get quotes.	Argentina	Recommended
	Brazil	Recommended
	Czech Republic	Recommended
 The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of external walls.	Finland	Legally required already
	Norway	Legally required already
 This action is a secondary priority that should be instigated after all no and low cost measures have been tackled.	Poland	Recommended
	Sweden	Legally required already
 Medium cost option. Cavity wall insulation costs approximately US\$7.50 per m2 of external wall. Depending on the heating system, payback time is from 6 months to 2 years.	UK	Legally required already
	USA	Recommended
Office Compatibility		
	Owned	Compatible
	Leased	May not be permissible under rental contract, however, if UN do not own the asset there is an incentive gap and they should instead present the business case for improved insulation to their landlord. Lining paper can be installed during any refurbishment
	In house FM	Compatible
	Outsourced FM	Compatible
	Old Properties	Only advisable if the office isn't planning to relocate or else payback benefits might not be seen
	New Build	Compatible, but likely that may be fitted already

Low Cost – Increase the efficiency of space heating systems

Top Ten Action	Why?	How?	
Ensure that heating systems are operating at maximum efficiency by installing timers and temperature controls and that all staff know how they operate. Ensure heating system timings correspond with occupancy.	Space heating can account for up to 50% of the energy used in an office. Changes to improve the efficiency of this system can have massive savings. Rooms should not be heated above 19C. Costs rise 8% for each degree above this.	Controls which could reduce energy consumption include: A programmer - allows you to automatically set when you want your central heating and hot water to come on, thus reducing wastage. Individual Room Thermostats switch off your heating once the room reaches a set temperature, and switches it back on when the temperature drops. Thermostats should be sited away from heat sources or draughts. Thermostatic Radiator Valves(TRV's) - allows control of an individual rooms temperature by reducing the flow of water through the radiator (in a wet heating system) when it reaches set temperature. Ensure that	all heating vents are unobstructed at all times.
			When? This option should be considered as soon as all no cost measures have been implemented, and should only be considered if the system is not due to be replaced in the short term. It is also important to improve insulation before improving heating systems so that energy is not wasted. When refurbishing space heating systems, considering installing the most efficient system available.

At a Glance



Notes	Regions
Professional advice should be sought on what controls and insulation are most suitable for the system in your office.	Argentina Recommended Brazil Recommended Czech Republic Recommended Finland Recommended Norway Recommended Poland Recommended Sweden Recommended UK Recommended USA Recommended
The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of windows / doors. This action is a secondary priority that should be instigated after all no cost measures have been tackled.	
Adequate controls on space heating systems could save up to a third off heating bills and typically pay for themselves in under 12 months.	
Some small disruption is likely during installation of time switches and insulation, but there are no significant maintenance implications. Controls should be checked every six months to see that they are working correctly and to the correct hours of operation especially at weekends and holidays. The facilities manager / maintenance team will need to know how to alter the time switches, this should be clear from the instruction manuals. No behavioural issues, although staff working late will need to be briefed that they may need to bring a jumper to prevent them getting cold.	Office Compatibility Owned Compatible Leased This may be permissible under the tenancy agreement, if in doubt check with your landlord In house FM Compatible Outsourced FM Compatible Old Properties Only advisable if the office isn't planning to relocate or else payback benefits might not be seen New Build Compatible, but likely that may be fitted already
A lifespan of 10 years is usual for such measures. Reduce heat dependant on the activity ongoing in a room. Offices don't need to be heated above 19C, workshops should be no more than 16C and stores no more than 12C. Set tamperproof covers on temperature controls to prevent staff reducing their efficiency. May apply in the home.	

Medium Cost - Double or triple glaze all single glazed windows

Top Ten Action	Why?	How?	When?
Double, triple (in Scandinavia) or secondary glazing should be considered on all offices.	Fitting double or secondary glazing can halve heat losses through windows. Up to 23% of heat lost from your office could be through your windows if they are single glazed and uninsulated. There are also benefits in terms of a more comfortable working temperature and reduction of external noise for staff members working near windows.	Contact reputable local glaziers for quotes and installation. Windows can be fitted in a matter of hours.	This option should be considered when upgrading a heating system or replacing windows as the extra cost cannot always be justified by energy savings alone. All no and low cost measures should be undertaken before this action is considered.

At a Glance



Notes	Regions	
Professional advice is not necessary, but professional installation is. Secondary glazing can be installed DIY.	Argentina	Recommended
The exact cost and payback are dependant on circumstances i.e. energy bills, climate, area of glazing.	Brazil	Climatically unsuitable
This action is a secondary priority that should be instigated in the medium term or during refurbishment, low and no cost measures should be tackled first.	Czech Republic	Recommended
Medium cost option. A UPVC Double glazed window, at an average cost of US\$300 per window has a payback time of 5 to 6 years. Secondary double glazing, at a cost of under US\$1.50 per m2 has a payback time of less than a year.	Finland	Legally required already
	Norway	Legally required already
	Poland	Legally required already
	Sweden	Legally required already
	UK	Recommended
	USA	Recommended
Office Compatibility		
No additional maintenance costs, but some disruption is likely during installation as windows are removed. Regular cleaning of windows will also maximise daylight and reduce lighting costs.	Owned	Compatible
No training implications	Leased	May not be permissible under rental contract, additionally, if UN do not own the asset there is an incentive gap and they should instead present the business case for improved glazing to their landlord
Some behavioural issues, staff need to be reminded that windows should not be opened when heating or cooling systems are in operation, to minimise energy wastage	In house FM	Compatible
Lifespan is over 20 years if well installed, do not consider in premises due for relocation	Outsourced FM	Compatible
To achieve best practise, specify low-e coated glazing. The heat and sound insulation of glazing may also be improved through the use of a film or coating applied to its surface.	Old Properties	Only advisable if the office isn't planning to relocate or else payback benefits might not be seen
May apply in the home.	New Build	Compatible, but likely that may be fitted already

Next steps toward clean and renewable energy generation

Renewables

It only becomes cost effective to consider renewable sources of energy generation once energy efficiency measures have been installed to reduce demand. Whilst installing a micro wind turbine or solar photovoltaic (PV) panel is a highly visible statement of an organisation's commitment to sustainability and minimising its impact on climate change, it should really be considered as the icing on the cake – i.e. something to be considered only once energy efficiency has been tackled.

Co and Tri-generation

Another option to consider, which may or may not use renewable fuel, is cogeneration technology also known as Combined Heat and Power (CHP). Conventional power plants emit the heat created as a by-product of electricity generation into the environment through cooling towers, as flue gas, or by other means. CHP or a bottoming cycle captures the by-product heat for domestic or industrial heating purposes, either very close to the plant, or —especially in Scandinavia and eastern Europe—for distribution through pipes to heat local buildings. Cogeneration is a thermodynamically efficient use of fuel. In separate production of electricity some energy must be rejected as waste heat, but in cogeneration this thermal energy is put to good use. CHP units exist which run on a range of different fuels from renewable i.e. biomass, to non-renewable sources i.e. gas. In most electricity generating plant, over half of the energy in the primary fuel is wasted as excess heat. By capturing the excess heat, CHP uses heat that would be wasted and can potentially reach an efficiency of up to 89%, compared with 55% for the best conventional plants. With CHP more than 4/5 of a fuels' primary energy is converted in usable energy, resulting in both financial and environmental benefits. This means that less fuel needs to be consumed to produce the same amount of useful energy. Also, less pollution is produced for a given economic benefit.

In areas, with a warm climate and where demand for cooling is greater than the demand for heating, Trigenation or trigen technology may have a role to play in increasing energy efficiency. Trigen is the simultaneous production of mechanical power (often converted to electricity), heat and cooling from a single heat source such as fuel or solar energy. As with cogeneration, the “waste heat” by-product that results from power generation is harnessed, thus increasing the overall efficiency of the system. In conventional CHP space heating and hot water storage tanks serve as a heat sink for waste heat utilization. In summer, the heat demand is much lower and with a trigen plant the waste heat of the electric generation process can be transformed into cooling energy by an absorption chiller. Trigenation is sometimes referred to as CCHP (combined cooling, heating, and power generation). In warmer climates the need for heating is limited to a few winter months. There is, however, significant need for cooling (air conditioning) during the summer months. Heat by a cogeneration plant in this case is used to produce cooling, via absorption cycles for minimal financial and carbon dioxide cost.

Next steps toward clean and renewable energy generation for Managers of Leased Properties

Managers of leased buildings are likely to struggle to persuade the landlord to incorporate renewable energy such as by installing solar panels directly – and as a tenant the cost/benefit payback would not be sufficient unless your lease terms are very long. The issue of building-integrated renewables can be raised with your landlord during lease negotiations, especially if the building is due to undergo a refurbishment or upgrade of services. If onsite renewable generation is not possible or suitable, consider specifying a ‘green’ electricity tariff. Determine whether UN or the landlord / managing agent is responsible for choosing the electricity supply for the premises. It may be appropriate to specify that UN requires buildings with a green tariff electricity supply, where available. This may present an additional cost on the service charge, but energy savings from specifying an efficient building can compensate for this.

Renewable Energy Options

What	Issues to consider	Costs	Benefits
Solar PV (photovoltaics) can be installed on roofs to supply electricity directly to a building or to the grid, during daylight.	Generation depends on roof space availability and over shading issues. Lead times are decreasing and are typically <12 months. Most planning systems now are reducing their barriers to PV panels.	Operating costs are very low, with only periodic maintenance / cleaning required. The cost of generation varies considerably due to the setting. For a high performance system with a load factor of 10%, costs of US\$650-US\$875 per MWh can be assumed. Installation costs vary and economies of scale are very pronounced typical costs are US\$4,375 - US\$7,300 per kWh installed. Smaller systems can cost up to US\$14,500 per kWh.	Can be maximised, where possible by integrating systems into the design of new buildings. Offers energy security and vastly reduced electricity bills for the summer months in high latitude regions, and all year round in sunnier climates. Also a high visible demonstration of 'green credentials'
On-site wind power. Micro turbines (< 10 kW) can be mounted to the building directly to provide electricity to the building or into the grid.	Ability to generate electricity is related to wind yield availability and urban sites often have poor availability and buildings create air turbulence. If in close proximity to other buildings, planning issues can be problematic. Lead times are typically under 12 months dependant on planning issues and grid connection.	Installation costs range from US\$3,600 - US\$7,200 per kWh installed. Operating costs are low, typically in the range of US\$21 to US\$30 per kW installed to cover periodic maintenance. Assuming a typical urban load factor of 20% generation costs will be in the region of US\$150 – US\$300 per MWh.	Offers energy security and vastly reduced electricity bills. Also a highly visible demonstration of 'green credentials'.
Biomass can be used as a fuel to provide electricity to the grid or combined heat and power plant (CHP) providing space, water and process heating and electricity.	Large units are often problematic because of the storage space required for fuel, and the need to constantly transport fuel into urban areas. There are significant issues with biomass technology outside of continental Europe and Scandinavia, including technology risks and immature fuel supply chains.	Cost estimates are highly case specific and usually undisclosed. However, major existing biomass developments indicate generation costs of US\$100 per MWh. Operating costs are higher than for other renewables reflecting the need for regular inspection and intervention for fuel loading.	These systems do not eliminate fuel supply costs but are likely to be a cheaper fuel option in the medium term as fossil fuel prices rise. They offer energy security, and can generate both heat and power.

What	Issues to consider	Costs	Benefits
Ground, air and water source heat pumps take the latent heat using a heating coil, from the soil, standing water or the air and compress and concentrate it to provide useable heat. Systems use a small amount of electricity and a device similar to the compressor on a refrigerator.	They can be adapted to fit with conventional heating systems but are most suited to under floor heating. Systems are of a similar size to air conditioning plant. Ground source heat pumps, if using a horizontally laid collector pipe require substantial outdoor space around the building, the alternative is to drill a bore hole and lay the collector vertically but this option is more expensive. Air source systems are the cheapest to install but are unsuitable in regions of the world which experience significant periods of extreme heat or cold.	Cost estimates are highly case specific. The initial cost of installing a ground, air or water source heat pump is usually quite high and can range from US\$3,600 to US\$8,750 for a 2,000 sq. ft. office. However the average cost of most systems is around US\$14,500 including groundworks if needed. The cost of installation is impacted by the geology of the area, size and location of the property. The system can save the reducing the average heating/cooling costs by 35-70% depending on the system installed.	For every unit of electricity into the system, typically you get 3 or 4 of heat out. There are no visibility benefits but this could be an advantage in areas with strict planning guidelines.

³ The load factor is actual electricity output from a renewable device divided by the maximum rated output of the device if it were operating in optimum conditions over the year, for a solar panel this is typically 30%.
(⁴) Existing PV installations in London such as the Vauxhall station indicate load factors of around 8-10%

Next Steps

If you are able to install onsite renewables on your premises, before doing so you should contact your national trade association for a list of accredited installers, and have a detailed survey undertaken to find the most appropriate system / technology mix for your needs. Trade associations for renewable technologies in the different countries that Skanska investigated in the preparation of this document are included in the table below:

Information sources and support services by country

This section provides a summary of available support services and contact details, by country. It is tabular in format and is designed to act as a signposting section to help you make the next steps in reducing energy use and managing UN's carbon dioxide liabilities.

Argentina

Government department responsible for energy efficiency

Energy Department and its Energy Efficiency Coordination unit. <http://energia3.mecon.gov.ar/home/>

The Energy Department belongs to the Ministry of Federal Planning, Public Investment and Services. Energy Efficiency Programs at the National Level are at a preliminary stage at present, but rising energy costs and the recent problems with gas supplies in Argentina are pushing energy efficiency up the government and corporate agenda.

Government department responsible for building standards

Building codes are designed by provinces and applied by city councils. To search for local codes for your building go to: <http://www.mininterior.gov.ar/municipales/busqueda/>

Support programmes, Trade Associations and Professional Bodies

None. Argentina's energy efficiency support programmes are primarily focused on production processes and heavy industry. Energy Efficiency is only regulated for production processes, by the Green Credits 5 for Small and Medium Enterprise Program which has the objectives of attaining better environmental performance in businesses, resource optimization (raw materials, water, energy) and waste minimization. For more information see: <http://www.ambiente.gov.ar/> Generally the Argentinean state focuses on end user behaviour. The key programmes here are: Energy Rational Use Program. Decision 415/2004 (Published in the Official Bulletin N° 30.390 29/04/2004). <http://www.boletinoficial.gov.ar/> The Gas Rational Use Program, and Electric Energy Rational Use Program, are based on the creation of price categories depending on energy demand and the application of a reward system for users who save energy and additional charges for those who exceed their target consumption. It establishes goals for gas and electricity consumption. More information can be found at: <http://www.enre.gov.ar/> Residential, commercial and industrial users are affected by this program.

Brazil

Government department responsible for energy efficiency

The government department responsible for energy policy generally is the Ministry of Mines and Energy – Ministério das Minas e Energia. <http://www.mme.gov.br>

In December, 2001 The Energy Efficiency Levels and Indicators Management Committee was established by. Federal Decree n°4059.

Government department responsible for building standards

Building codes are designed by municipalities and applied by city councils. ABNT – (Brazilian Association for Technical Standards); developed common standards for the Mercosur region. For more information: <http://www.abnt.org.br>

Support programmes, Trade Associations and Professional Bodies

National Program on Electric Energy Conservation – Procel <http://www.elektrobras.com.elb/procel/main.asp>
Procel - Energy Efficiency Program aims to promote conservation of electricity by means of implementation of projects, avoiding waste and reducing the need for new investments in generating capacity. Procel was created in 1985 and pioneered the introduction of Labeling Programs in Brazil. CONPET is a Program developed by the Ministry of Mines and Energy, coordinated by various Federal Government agencies and the private sector. Petrobras is responsible for providing the technical, administrative and financial resources for the Program. CONPET was established in 1991, as the National Program for the Rational Use of Oil Derivatives. Its main objective is to promote the efficient use of these sources of unrenovable energy in transportation, households, commerce, industry and in agriculture. Conpet funds a range of different projects across Brazil, examples can be found at: <http://www.conpet.gov.br/eng/projects.php> Aneel Energy Efficiency Program The concession contracts signed between electric power distribution companies and the regulator ANEEL require distribution companies to annually invest an amount not less than 0.5 % of their net operational revenue in activities aimed at reducing electrical energy waste. ANEEL also produce publications providing guidance on improving energy efficiency. For more information see: www.aneel.gov.br The Brazilian Labeling Program (PBE) is a power conservation program that uses labels to inform consumers about the power efficiency of some gas and electric powered products. Besides the product power efficiency classification, the PBE Label contains information on power consumption cost (electricity or gas) and/or power yield (%). For more information: http://www.conpet.gov.br/eng/proj_pbe.php

Czech Republic

Government department responsible for energy efficiency

Ministry of the Environment of the Czech Republic

Ministry of Industry and Trade of the Czech Republic

<http://www.mpo.cz/en/energy-and-raw-materials/energy-efficiency/>

The latest national energy policy is detailed in this government decree, it focuses heavily on energy management: <http://download.mpo.cz/get/26676/28754/313830/priloha002.pdf>

Government department responsible for building standards

Jirina Srbkova Technicky a Zkusebni Ustav Stavebni Czech Republic

Support programmes, Trade Associations and Professional Bodies

EFEKT 2007 is a programme run by the Ministry of Industry and Trade of the Czech Republic to support energy savings and renewable energy sources. The programme is financed from national sources. The programme is suitable for regions, municipalities, entrepreneurs, etc. The form of request for support can be found in Czech on the web page of the Czech Energy Agency, which guarantees the programme. You can also contact the Czech Energy Agency for technical support. Subsidies are available from the government, as part of the national energy policy, to subsidise the following: CHP, generation and distribution plant, energy conservation technologies, renewable energy, training in energy management and energy efficiency research and development. For further information see: <http://www.mpo.cz/dokument27471.html> State programme in support of energy savings and the use of renewable sources of energy This grant programme is intended for enterprises (legal entities and natural persons), non-profit organizations, universities, towns, municipalities and regions and organizations established by them. According to the structure of the State Programme support for selected programmes of up to CZK 3 million may be provided. Implementation of savings measures in the area of generation, transmission, distribution and consumption of energy. Higher use of renewable and secondary sources of energy and the development of cogeneration of heat, cold and electricity. For further information see: <http://www.mpo.cz/dokument12408.html> Some activities previously supported by this fund include: Action plans for reconstruction or refurbishment of building resources, Plans for energy savings in industrial enterprises, Certificates of energy intensiveness of buildings, Comprehensive measures aimed at decreasing the energy intensiveness of the energy management and buildings, Comprehensive measures aimed at decreasing the energy intensiveness of lighting.

Finland

Government department responsible for energy efficiency

Ministry of the Environment <http://www.environment.fi/default.asp?node=4779&lan=en>

Ministry of Trade and Industry <http://www.ktm.fi/index.phtml?lan=en&s=2092>

The basis for promoting ecological sustainability in building and on properties is the Land Use and Building Act of the year 2000.

The objective of this Act is “to ensure that the use of land and water areas and building activities on them create preconditions for a favourable living environment and promote ecologically, economically, socially and culturally sustainable development”.

The Act also provides the basis for the more detailed regulations on building laid down in the National Building Code of Finland.

Government department responsible for building standards

Finnish Building Inspection Association

The association is involved in both building control and the skills of those involved in building control function and aims to standardise the interpretation of regulations.

Ympäristöministerio, Finnish Government (Building Division - Ministry of the Environment PO Box 35 FIN-00023 GOVERNMENT Finland)

Support programmes, Trade Associations and Professional Bodies

Finland is one of the first countries in the world to draft a major national programme addressing sustainable consumption and production. This programme, drawn up by a committee consisting of many different stakeholders, aims to make Finland one of the most eco-efficient and competitive societies in the world by 2025, through long-term yet flexible policy-making. The programme includes an impressive array of 73 wide-ranging policy measures. For more information see <http://www.environment.fi/default.asp?contentid=204720&lan=en>

The main tool is the Promise environmental classification of buildings, which is applied in the assessment of the environmental characteristics of new-building projects and existing properties. <http://www.environment.fi/default.asp?node=4779&lan=en>

According to the National Climate Strategy, the use of renewable energy should be increased by the year 2010 by around 30 per cent compared to the year 2001. The vision is that by the year 2025 renewable forms of energy would be used approximately 60 per cent more than at the beginning of the present decade. The programme is expected to reduce carbon dioxide emissions by 4.5–5.5 million tonnes compared to the basic scenario of 2010. The reduction depends on the fuels to be replaced. Development and commercialisation of new technology and economic means of steering, such as energy taxation, investment subsidies and aid for the production chain of forest-converted chips, are key measures. Various statutes, regulations and agreements, as well as communications and training are other important methods. A steering group managed by the Ministry of Trade and Industry has been set up for the implementation and monitoring of the programme.

Surtax is collected on oil products, other fossil fuels and electricity. The surtax on fuels is determined according to their carbon content. From 2003 onwards the surtax on fuels has been EUR 18.05 per carbon dioxide tonne. Natural gas is an exception to this with its 50% reduction in the surtax. Surtax on peat was suspended since 1.7.2005. Electricity is taxed at its consumption stage. The fuels used for power production are tax-free. The tax on electricity is divided into two classes, of which the lower, class II, tax is paid by industry and professional greenhouse cultivation. Other consumers pay the higher class I tax. The energy taxation scheme also includes various subsidies. Of these, the most important ones in terms of energy policy are tax subsidies paid for power production based on renewable energy sources.

Motiva is the government programme that promotes energy-saving activities. Its main forms of activity are information dissemination, development of energy auditing and promotion of the take-up of energy-saving technology. Motiva's operations are focused on energy conservation. Its primary objects of activity are housing, transport, private services, small and medium-sized industry and public services. Motiva can support, for example, information dissemination projects with its own inputs in the projects. Motiva is a state-owned company and its principal financier is the Ministry of Trade and Industry. <http://www.motiva.fi/en>

Norway

Government department responsible for energy efficiency

The Ministry of Petroleum and Energy, the Energy Commission (NOU), The Norwegian Commission on Low Emissions and the Ministry of the Environment play a role in driving energy efficiency. Efforts are coordinated and actively managed by Enova SF. Enova is a public enterprise for promoting energy savings, renewables and environmentally-friendly natural gas solutions. Enova is owned by the Government of Norway, represented by the Ministry of Petroleum and Energy. Enova's mission is to contribute to environmentally sound and rational use and production of energy, relying on financial instruments and incentives to stimulate the market to achieve national energy policy goals.

Government department responsible for building standards

National Office of Building Technology and Administration Responsible for: administering and revising national building regulations the surveillance of local authority building control the market control of building products the approval of undertakings performing design, execution and control work and the provision of guidance and information related to these tasks.

Support programmes, Trade Associations and Professional Bodies

A trading system for greenhouse gas emissions entered into force 1 January 2005 and the concept is in line with the EU emission trading system. Revenues raised from this scheme and from a distribution tariff form an energy fund. ENOVA SF administers the Energy Fund. ENOVA chooses the measures and administers the fund in order to achieve the national energy saving goals in the best way. The energy fund is used to fund measures as purchasing services, payment of grants and other financing of measures in the field of consumption, environmentally friendly heat, wind and natural gas. The fund supports projects in industry, the tertiary sector, the household sector as well as production of new, renewable energy. ENOVA organizes the activities in different programmes: Reduced energy use – industry, Energy management in commercial sector, Grants for energy savings in homes, buildings and outdoor equipment areas, Energy plans in municipalities, Grants to heat plants using bio energy, heat pumps, waste fuels or waste heat, Processing of bio fuel, New technology, Wind power, Information and communication, Education and training. The energy management program for companies in Networks aims at small and medium sized companies with an annual energy consumption of at least 0.5 GWh. Companies or concerns working in project networks can apply for support to energy audits and energy management systems. The grant is individually evaluated and will not exceed 50 % of total approved project costs. The projects have to result in an energy saving of at least 10 % of the total energy consumption or conversion to new renewable energy sources.

Enova SF weblinks:

<http://www.regjeringen.no/nb/dep/md.html?id=668>

<http://www.regjeringen.no/en/dep/md/Documents-and-publications/Government-propositions-and-reports-/Reports-to-the-Storting-white-papers-2/19961997/Report-to-the-Storting-Nr-29-1996-1997.html?id=191107>

Poland

Government department responsible for energy efficiency

The government departments responsible for energy efficiency in Poland are: the Ministry of Environment <http://www.mos.gov.pl/>

Ministry of Buildings, Ministry of State Treasury www.msp.gov.pl and the Energy Regulation Office (URE): <http://www.ure.gov.pl/portal/en>

Government department responsible for building standards

General Office of Building Control (Krucza Str. 38/42, 00-926 WARSAW 63) Responsible for: architectural building administration, building control. The General Inspector carries out tasks defined by the Building law act and in relation to the scope of architectural building administration, provincial inspectors of building control, within the scope of building control, controls activities and keeps registers of licensed persons, building experts and occupational liability. The latest standards can be found at: http://www.worldenergy.org/wecgeis/publications/reports/eepi/a1_newbuildings/polanddata.asp

Support programmes, Trade Associations and Professional Bodies

Support is offered by a number of different governmental and not for profit organisations including the Polish Foundation for Energy Efficiency <http://www.fewe.pl/a-start.htm>, Polish National Energy Conservation Agency (KAPE), Polish CHP Association, support available includes: - training decision-makers and social activists, advising energy producers, suppliers and consumers, promoting energy saving technologies and devices, providing training, workshops and supporting pilot projects.

The most significant piece of energy-related legislation is the 1997 Energy Act which, although primarily concerned with supply-side issues, contained a number of Articles relevant to energy efficiency. Article 45 explicitly creates the framework for DSM activities, by stating that energy tariffs "... may include costs of co-financing by energy enterprises of projects and services the purpose of which is to reduce energy and fuel consumption by customers...". The Energy Act also provides the basis for energy efficiency labelling of equipment. Article 52 requires that manufacturers and importers of equipment specify energy efficiency in technical documentation, and that energy efficiency be displayed on a label. The detailed requirements regarding energy efficiency labelling will be determined through future secondary legislation, but given Poland's imminent accession to the European Union, labelling laws will certainly be based closely on European Directive 92/75/EEC and its subsidiaries. These Directives apply to refrigerators, freezers, clothes washers, electric tumble dryers, dishwashers and lamps.

The thermo-modernisation programme has been introduced in order to protect households against the worst impacts of freeing heat prices. State funds have been made available to provide credits to owners of housing who wish to improve the thermal properties of dwellings, or to owners of local heating networks of up to 5.8 MW wishing to modernise their systems. The fund will cover the final 25% of loan repayments on qualifying investments. The programme also provides guarantees of up to 50% for loans taken out to finance energy efficiency investments.

The National Fund for Environmental Protection is made up of fines and fees paid by firms exceeding various pollution emission limits. It offers grants and soft loans for environmental investments, including energy efficiency.

The ECOFund was created by converting 10% of Poland's debt, and is designed to fund projects with positive international environmental impacts. Certain energy efficiency projects are eligible for support, with grants of up to 30% of the investment cost available.

The heating season in Poland averages 210 ± 10 days, from mid-October to mid-May. The number of heating degree-days ranges from 3,450 on the Baltic coast to 4,000 in the mountainous regions. The number of cooling degree-days is not sufficient for air-conditioning to be a major market – about 1.5% of Poland's buildings currently have air conditioning, although it is becoming more popular in hotels, restaurants and larger shops. Improvements in the thermal properties of new and existing buildings will help to minimise the need for space-cooling, as well as for space-heating, and are likely to prove more cost-effective than air conditioning in most cases. Although the minimum insulation standards specified in Poland's building regulations have been tightened significantly in recent years, they still fall short of the levels required in many Western European countries. Considerable attention has been paid to stimulating the market for efficient lighting products in Poland, with the result that Poland probably ranks among the most efficiently lit countries in Central and Eastern Europe. The Poland Efficient Lighting Project (PELP) has undoubtedly been among the most influential programmes. PELP was financed by Global Environment Facility (GEF), and commenced in 1995. It used a combination of producer subsidies and targeted marketing to stimulate the market for compact fluorescent lamps (CFLs). Between 1994 and 1997, annual sales of CFLs increased from 0.6 million to 1.6 million units, and new manufacturers had entered the Polish market.

Sweden

Government department responsible for energy efficiency

Ministry of Enterprise, Energy and Communications: <http://www.sweden.gov.se/sb/d/2067;jsessionid=a1ejwZcs19Dh>

The objective of the Swedish Government's energy policy is to secure a reliable supply of energy at internationally competitive prices. Sweden has decided that an energy policy should create conditions for efficient and sustainable energy use, with minimum negative impact on health, the environment and the climate. It should also facilitate the transition to an ecologically sustainable society.

Government department responsible for building standards

Föreningen Sveriges Byggnadsinspektörer (FSB) Comprised of persons employed by local authorities and engaged in building inspections and building permits. The principal aims of the FSB are to promote the education of and give support to its members and pursue the uniform application of regulations.

Support programmes, Trade Associations and Professional Bodies

The two main bodies responsible for implementing energy policy measures are the Swedish Energy Agency http://www.energimyndigheten.se/WEB/stemex01Eng.nsf/F_PreGen01?ReadForm and Affärsverket svenska kraftnät <http://www.svk.se/start.aspx?id=5208> However, the National Board of Housing, Building and Planning <http://www.boverket.se/templates/Page.aspx?id=1697&epslanguage=SV> the Swedish Consumer Agency <http://www.english.konsumentverket.se/mallar/en/startsidan.asp?lngCategoryId=646> the Swedish National Electrical Safety Board <http://www.elsak.se/> the Swedish Agency for Innovation Systems <http://www.vinnova.se/> the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning http://www.formas.se/default_529.aspx the Swedish Research Council <http://www.vr.se/2.69f66a93108e85f68d480000.html> and the county administrative boards also help implement measures in the sphere of energy policy. A summary of the support available and current policy targets can be found here: <http://www.sweden.gov.se/content/1/c6/06/36/35/8cc80743.pdf>

UK

Government department responsible for energy efficiency

BERR (DTI) and Defra share this responsibility, although it has been recently mooted that Defra will soon have sole charge of energy policy. <http://www.dti.gov.uk/energy/index.html>

<http://www.defra.gov.uk/environment/energy/index.htm>

The semi autonomous Carbon Trust and EST (both funded by DTI and Defra) are in charge of energy efficiency initiatives in the UK.

There are also a number of NGOs and trade associations active in this area such as ACE.

Government department responsible for building standards

Communities and Local Government – CLG The Department is the Government Ministry responsible for making the Building Regulations in England and Wales. provides guidance on compliance with the Regulations, and commissions relevant research.

It is responsible for the implementation of the Construction Products and Energy Performance Directive in the UK and for the development of appropriate standards. LABC is the representative and marketing body for local authority building control in England and Wales and is dedicated to maintaining the highest standards in building design and construction.

Support programmes, Trade Associations and Professional Bodies

The Carbon Trust is the primary source of support for businesses seeking to improve their energy efficiency. The Carbon Trust helps business cut carbon emissions, and supports the development of low carbon technologies. <http://www.carbontrust.co.uk/energy/takingaction/> The Carbon Trust provides interest free loans to invest in energy saving projects such as improved lighting, boilers or insulation. <http://www.carbontrust.co.uk/energy/takingaction/loans.htm>. The Carbon Trust also provides energy surveys to identify energy saving opportunities and provide practical advice on how to achieve them. http://www.carbontrust.co.uk/energy/assessyourorganisation/energy_survey.htm. The Carbon Trust also offers a design advice service which promotes the construction of more energy efficient non-domestic buildings. Support ranges from self-help guidance to free or subsidised consultancy. http://www.carbontrust.co.uk/energy/assessyourorganisation/design_advice.htm Enhanced Capital Allowances permit 100% of the capital cost of approved energy saving equipment to be offset against corporate tax. <http://www.carbontrust.co.uk/energy/takingaction/eca.htm>

The Energy Saving Trust or EST works with local authorities, householders and businesses to improve energy efficiency in the building and transport sectors. http://www.energysavingtrust.org.uk/what_can_i_do_today/energy_saving_grants_and_offers

The Low Carbon Building Programme offers grants for microgeneration technologies such as micro wind turbines and solar panels. But potential applicants should note that this fund has been heavily criticised for running out of funds very early into each grant award month (i.e. within hours of the money being released) <http://www.lowcarbonbuildings.org.uk/home/> The Royal Institution of Chartered Surveyors – RICS The RICS Building Control Faculty is the foremost body in building control guidance in the UK. Responsible for:-science and law of building control. A member of the Construction Industry Council and the Foundation of the Built Environment.

USA

Government department responsible for energy efficiency

The Department of Energy, through the Office of Energy Efficiency and Renewable Energy's (EERE) Building Technologies Program works closely with the building industry and manufacturers to conduct research and development on technologies and practices for energy efficiency. The Department also promotes energy and money-saving opportunities to builders and consumers and works with state and local regulatory groups to improve building codes and appliance standards.

In addition, the Office of Hearings and Appeals plays a regulatory role in the area of Energy Efficiency as it relates to the Energy Policy and Conservation Act.

Government department responsible for building standards

Building Control is a devolved function within the US and handled at a state and county level.

Support programmes, Trade Associations and Professional Bodies

The Building Technologies Program advances the research and development of energy-efficient building technologies and practices for both new and existing residential and commercial buildings, works with state and local regulatory groups and others to improve building codes, appliance and equipment standards, and guidelines for efficient energy use and promotes market transformation by educating homeowners, builders, and developers about the significant returns they can achieve by adopting energy-efficient technologies and practices (part of EERE) <http://www.eere.energy.gov/buildings/> State Energy Program provides grants to states and directs funding to state energy offices from technology programs in DOE's Office of Energy Efficiency and Renewable Energy. States use grants to address their energy priorities and program funding to adopt emerging renewable energy and energy efficiency technologies. http://www.eere.energy.gov/state_energy_program/ The US Green Building Council is a non-profit organisation composed of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work.: <http://www.usgbc.org/DisplayPage.aspx?CategoryID=1> The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council, provides a suite of standards for environmentally sustainable construction. Since its inception in 1998, LEED has grown to encompass over 14,000 projects in 50 US States and 30 countries covering 1.062 billion square feet (99 km²) of development area. <http://www.usgbc.org/DisplayPage.aspx?CategoryID=19> Institute of Architects Committee on the Environment (COTE) <http://www.eere.energy.gov/buildings/info/office/index.html>

Best Practice from Facilities Managers around the World

As a facilities manager, you are in a position to influence many of the procurement choices within your building. If you are looking for further inspiration, here are some of the great ideas that facilities managers around the world are already implementing – maybe they could work in your building?

- 1 If you are in a position to make major changes, for example in a UN owned building, commissioning a new building, or looking for new leased premises – approach energy in a hierarchical manner and think big. Concentrate on reducing primary energy use: consider ‘big hitters’ such as district heating systems and combined heat and power (CHP) if feasible. This could reduce your carbon emissions and energy spend by 20%!
- 2 There are quick ‘techno-fixes’ that pay for themselves rapidly and don’t involve major infrastructure change. For example, is energy efficient office equipment specified as standard? When light-bulbs fail substitute them with low energy bulbs / tubes – as they last longer, less maintenance time is spent changing them.
- 3 Look at reducing the carbon impact of smaller procurement choices you can influence. For example, consider specifying recycled paper, introducing a printing reduction policy, and selecting local seasonal food for meetings.
- 4 As a central point of information for your premises, you could use your influence to ensure that UN’s indirect carbon emissions are reduced by promoting sustainable transport to and from your premises.

About the UNEP Division of Technology, Industry and Economics

The UNEP Division of Technology, Industry and Economics (DTIE) helps governments, local authorities and decision-makers in business and industry to develop and implement policies and practices focusing on sustainable development.

The Division works to promote:

- > sustainable consumption and production,
- > the efficient use of renewable energy,
- > adequate management of chemicals,
- > the integration of environmental costs in development policies.

The Office of the Director, located in Paris, coordinates activities through:

- > **The International Environmental Technology Centre** - IETC (Osaka, Shiga), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
- > **Sustainable Consumption and Production** (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
- > **Chemicals** (Geneva), which catalyzes global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
- > **Energy** (Paris), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
- > **OzonAction** (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
- > **Economics and Trade** (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies.

*UNEP DTIE activities focus on raising awareness,
improving the transfer of knowledge and information,
fostering technological cooperation and partnerships, and
implementing international conventions and agreements.*



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