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SPEEDIER

SME PROGRAM FOR ENERGY EFFICIENCY THROUGH DELIVERY AND IMPLEMENTATION OF ENERGY AUDITS

D3.3 - METHODOLOGY, CRITERIA EVALUATION SYSTEM TO FIND OPPORTUNITIES FOR ENERGY AND COST SAVINGS

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This document is a report associated with Deliverable D3.3 - Methodology, criteria evaluation system to find opportunities for energy and cost savings. The document outlines the SPEEDIER standardised methodology that will be used to carry out energy audits for SMEs. It also describes the categorization of the energy conservation measures into no-cost measures, low cost measures, medium cost measures and high cost measures.

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02/03/2020	0.2	Jo Southernwood	Edits and revisions.
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12/03/2020	2.0	Diana Romeu	Add average energy savings potential in Section 3 to address feedback from PO

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Abbreviations

ECM	Energy Conservation Measure
ISO 50002	Energy audits – Requirement with guidance for use (2014)
HVAC	Heating, Ventilation and Air Conditioning
SME	Small or Medium sized Enterprise
DHW	Domestic Hot Water
VFD	Variable Frequency Drive
VSD	Variable Speed Drive

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1 Introduction

1.1 Background

SPEEDIER is a highly innovative *one-stop-shop solution* that applies an integrated approach to energy management, providing information, advice, capacity building, energy auditing, financing, as well as implementation of energy efficiency solutions and monitoring of impacts. As part of the project, the SPEEDIER team, (led by partner, ITEC), will develop a SPEEDIER Tool for SPEEDIER Experts that will assist them to quickly carry out an assessment of the energy saving opportunities available to SMEs, who avail of the SPEEDIER Service.

In order to develop this tool, a standardised methodology to carry out energy audits of SMEs will be developed, which will be followed by SPEEDIER Experts. This methodology will help to define a number of important aspects to the undertaking, including the structure of the tool, the necessary functionalities that the tool must have in order to be of use to the SPEEDIER Expert as well as the most suitable layout and flow of the tool to allow for easy data entry. Additionally, the SPEEDIER Service requires that the SPEEDIER Experts present the SMEs with a range of ECMs, classified into no-cost, low-cost, medium-cost and high-cost categories to assist them in deciding, which package of measures to implement.

1.2 Purpose of the document

By reviewing the ISO 50002, 2014 – Energy audits – Requirement with guidance for use and drawing from their own experience and our SPEEDIER partners, ITEC developed a standardised methodology for carrying out energy audits for SMEs. This document describes the standardised methodology in detail. Furthermore, a list of common ECMs has been developed by the SPEEDIER partners and these have been categorised into no-cost, low-cost and medium-cost and high-cost measures and are explained within this Deliverable. The list was compiled based on the results of previously conducted energy audits as well as the experience of the SPEEDIER project team members. Their classification of ECMs is based on the likely economic cost of implementation and is described within in detail.

1.3 Links to other work packages

In Work Package 2, it was discovered that SMEs have a negative association with the term ‘energy audit’. As a result, one of the recommendations made in D2.5 Recommendations for the SPEEDIER Service is that SPEEDIER Experts should use the term ‘energy assessment’ instead. Although SPEEDIER Experts will be encouraged to avoid the use of the word audit as far as possible when speaking to SMEs directly, the SPEEDIER Service does nevertheless intend to deliver a form of energy audit to SMEs and therefore, the term ‘audit’ will continue to be used throughout this document.

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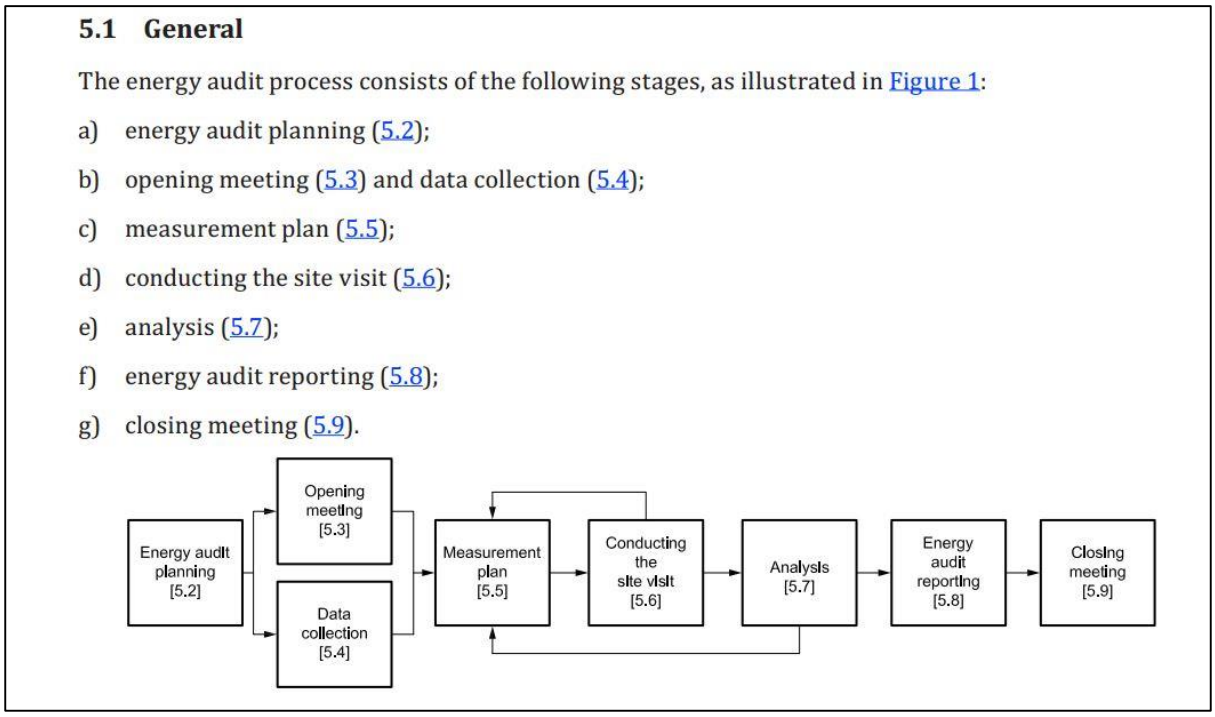
2 Methodology for energy audits

This chapter will describe the steps that an energy expert would normally carry out in order to perform an energy audit as efficiently as possible. According to the ISO 50002 (Energy auditing standard), the methodology for an energy audit follows the route described in Figure 2-1. It should be noted that each energy audit will include these steps in some form, but the level of detail that will be required in each stage can be customised according to the requirements of the SME as well as according to whether the SPEEDIER Expert wishes to carry out a **simple opportunities assessment** (i.e. quickly identifying a range of appropriate ECMs with rough estimates of the likely cost of implementation and level of savings that can be achieved), a **full investment grade audit** (i.e. a detailed and accurate calculation of cost of implementation and accurate prediction of the potential savings from the proposed ECMs) or an **energy survey** (more detailed than an opportunities assessment but less detailed than an investment grade audit).

This links to the findings of WP2 which identified that SMEs would prefer for energy audits to be undertaken as a 2 stage process. In stage 1, a simple opportunities assessment is undertaken, while in stage 2, a more detailed energy survey or full investment grade audit can be undertaken. In the next sections, the technical steps of an energy audit are described in more detail.



5.1 General

The energy audit process consists of the following stages, as illustrated in Figure 1:

a) energy audit planning (5.2);

b) opening meeting (5.3) and data collection (5.4);

c) measurement plan (5.5);

d) conducting the site visit (5.6);

e) analysis (5.7);

f) energy audit reporting (5.8);

g) closing meeting (5.9).

Figure 2-1: Energy audits flow diagram

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2.1 Scope of the energy Audit

An energy audit consists of an inspection, study and analysis of the energy flow of the entire building, paying particular attention to the uses and origins of the energy consumed. The main analysis focuses on thermal energy consuming systems (domestic hot water and space heating), electricity consuming systems (lighting, air conditioning and other equipment) and their location, with the aim of reducing the amount of input energy in the system without negatively affecting the conditions within the building, through carrying out a structured energy saving plan. Energy audits can be carried out on buildings, processes, or transportation systems. For the purposes of SPEEDIER, it is assumed that the energy audits undertaken by SPEEDIER Experts will be limited to buildings, and in the case of SMEs for the manufacturing sector and processes.

2.1.1 Preparatory work

Before making a first visit to the building, it is important to speak with the client in order to:

- **Explain the general objectives and expected results** of the energy auditing process in order to set the expectations of the client at an early stage. During this discussion, the client and auditor can agree on the level of detail that is required in order to establish whether the output will be a simple opportunities assessment, energy survey or full investment grade audit.

- **Request basic information about the site and the company** to allow some analysis and preparatory work to be undertaken before the site visit. The information gathered can also provide useful insights to the auditor around where the main opportunities for energy saving might be, so that the focus can be in these areas and clarify any points of uncertainty during the site visit.

The basic information about the site and the company should include (if it is available), the following details.

- **Basic information about the SME** including the normal building operating hours, number of employees and type of ownership of the building.

- The **address of the building**; this will allow the SPEEDIER Expert to identify the climatic zone in which the building is located.

- The **type of building construction**, including any previous refurbishments or building extensions that have been undertaken. This information can be provided in written or graphic form (i.e. through the provision of floor plans or building drawings).

- If available, the **building construction and installation plans** would give a large amount of information on the composition of the building fabric, and the specifications of any integral equipment such as HVAC and lighting systems.

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- **Schematic drawings** of the HVAC systems, domestic hot water systems and lighting systems installed in the building. This can then be verified by inspection during the site visit.

- An **asset list** of all the energy consuming equipment installed at the site, including their technical specifications.

- **Past invoices relating to the consumption of energy** (electricity and gas bills, invoices for purchases of oil or other fuels etc.) to allow the auditor to study the historical energy consumption of the building (in kWh and €) and how this consumption has evolved over time. This enables the auditor to establish the baseline energy consumption for the building before any further ECMs are implemented.

- **Operation and maintenance manuals** for any energy consuming equipment on site. This will provide details of the age and efficiency of the system and normal operating parameters.

- Details of any **ECMs already implemented** at the site.

The above is a complete list of all the possible information that could be requested from an SME. However, it is expected that the SPEEDIER Expert will use their professional judgement to determine the exact data requirements. For most SMEs, it is also unlikely that they would have all this information to hand. Where data is not available, the SPEEDIER Expert will need to gather the required information through observation during the site visit or use their professional judgement to make reasonable assumptions or extrapolations from known data.

2.1.2 Current state of the building

By examining the data gathered during the preparatory work, the SPEEDIER Expert will have a more accurate idea of the current state of the building and its facilities, which will allow them to prepare the field work more effectively. It will also enable the SPEEDIER Expert to pre-populate the SPEEDIER tool for Experts with some building details, which will be used by the tool for future calculations for example: the location (which defines the climatic zone); the use type of the building (which can help to select appropriate ECMs); the size and shape of the building (which allows heat losses/gains to be calculated); the year of construction (which can help to determine the thermal properties of the building fabric) and other parameters as described in Table 2.1. This description will be accompanied by a photo of the building and its location where possible.

Table 2.1: Initial building parameters

Use of the building		**Constructed area**	
Location		**Useful surface**	
Address		**Number of floors**	
Climate zone		**Floor height**	
Year of construction		**Heated surface area**	
Current regulations		**Unheated surface area**	

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2.2 Site visit

2.2.1 Data collection or verification

During the site visit, the SPEEDIER Expert will gather as much information as possible relating to the building, the energy consuming equipment on site, the behaviour and responsibilities of staff members in relation to energy consumption. It will also collect an inventory of the building fabric characteristics, lighting, HVAC equipment and other appliances. If this data was provided by the SME before the site visit, then the SPEEDIER Expert need only verify that the information provided is correct as they walk through the facility.

2.2.2 Activity and time schedules

During the site visit, the SPEEDIER Expert should record the typical building occupancy levels in terms of the typical number of building users during the normal operation. For some business sectors, e.g. office based work, the hours of operation and therefore occupancy rates will be standardised and predictable throughout the year. In other sectors, e.g. the hospitality sector, the level of occupancy may seasonally vary by day of the week and by time of day and therefore could be more flexible. These kind of variations should be noted by the auditor as they will affect the energy consumption of the building.

Furthermore, the SPEEDIER Expert should record the operating hours of any equipment that does not match the normal working hours of the business. For example, an office may typically be occupied between 8am and 6pm, but the HVAC system may run from 6am to 8pm; refrigeration equipment and data servers may run at all times despite the building only being occupied for certain hours of the day. This will impact on the overall energy consumption and energy saving potential of particular items of equipment so it is important that this is recorded.

Finally, if the building is made up of different areas where different activities take place, it is important to record which activities happen in each area of the building and the occupancy hours in each area. For example, a manufacturing site may have a production line that operates for 16 hours per day and a back office area that is occupied only between 8am and 6pm.

2.2.3 Inventory

During the preparation for the site visit, the SME may have provided the SPEEDIER Expert with details of the building and its systems. If this is the case, then during the first site visit, the SPEEDIER Expert need only verify that the information with which they were provided is correct. However, if at the time of the site visit, documentation has not been received from the SME, the SPEEDIER Expert will need to take an inventory of onsite equipment themselves as the walk around the site. The inventory of site equipment will enable the SPEEDIER Expert to determine the likely energy consumption of each of the building systems.

2.2.4 Floor plans

If the SPEEDIER Expert received floor plans of the building being audited before the site visit, they can simply verify that there has been no significant changes to the building as they walk around. However, if floor plans were not provided, the SEEDIER Expert may need to estimate the floor are of the building by recording the approximate size and layout of each room or area that is visited. A template of the type of information that will need to be collected is given in Table 2.2.

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Knowing the floor area of each of the rooms or spaces within a building will allow the SPEEDIER Expert to check that the level of energy consumption per unit floor area calculated by the tool during the analysis phase is approximately what is expected. Floor area data will also allow the SPEEDIER Expert to compare energy consumption per unit floor area, to known benchmark data for comparable buildings of similar size and similar use type. This will enable the auditor to see at a glance whether the building is consuming more or less than a typical building of its type.

Table 2.2: Template for gathering information on useful building floor area

ID Space	Typology of space	Floor	Useful surface

2.2.5 Lighting

If an inventory of all lighting assets was provided to the SPEEDIER Expert before the site visit, then they need only carry out spot-checks on lighting types as they walk through the building to verify that the asset list is correct. Where a lighting inventory was not provided, the SPEEDIER Expert can take their own inventory of lighting as they walk around the site if necessary.

Buildings can make use of many different lighting types and lighting levels can vary between areas of the same building so it is important to take a detailed inventory of lighting if accurate energy saving calculations are required to support recommendations relating to lighting. The SPEEDIER Expert should gather information on the types of luminaires, their respective power consumption, the location, number of units and estimated run hours. An example of the type of data that should be collected in a lighting inventory is given in.

Table 2.3: Template for taking a lighting inventory

ID Space	Type of luminaires	Lux level (lux)	Number of lamps	Power (kW)	Run hours	Consumption (kWh)

2.2.6 Appliances

The SPEEDIER Expert will be able to add details of any type of electrical or thermal appliance to the SPEEDIER tool for Experts. If an asset list was provided before the site visit, it may be possible to simply verify that it is correct. Otherwise the SPEEDIER Expert may wish to take their own inventory of equipment as they walk through the building during the audit. Table 2.4 shows an example of the type of data that the SPEEDIER Expert may need to collect about the various appliances found in the building. Many appliances do not operate at their nominal power consumption for the entire time that they are turned on e.g. a computer operates at maximum power while it is booting up and then draws less power while it is in normal use depending on the activity it is performing. The load factor is a percentage value between 0-100% that accounts for this variability in loading during normal run hours.

Table 2.4: Template for gathering information on appliances

ID Space	Equipment name	Power (kW)	Number	Run hours	Estimated Load factor	Consumption (kWh)

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2.2.7 Building fabric

The thermal envelope of the building is the skin that protects the indoor environment from outside conditions to improve the thermal comfort for occupants. To understand how much heat is lost or gained through the building envelope, and therefore calculate the amount of heat energy that needs to be delivered to or extracted from a building in order to maintain comfortable conditions, it is important to know the details about the building fabric. Where possible, this will include taking into account the thickness, thermal conductivity, thermal resistance and the transmittance at each of its layers. Table 2.5 shows an example of the type of data that the SPEEDIER Expert may need to collect regarding the building fabric. Many energy experts will be able to estimate these values by observation during the walk around survey. If detailed information on building fabric is not available, assumptions can be made for each of the relevant values based on the age of the building.

Table 2.5: Template for gathering information on building fabric

Type	Material	Thickness/Length (m)	Thermal conductivity, λ (W/mK)	R value (m2K/W)	Thermal transmittance (μ)

2.3 Analysis

Once all the necessary data has been gathered, the SPEEDIER Expert should analyse the data to look for patterns and trends and potential areas for energy saving. This can include the following activities:

- **Calculation of total annual energy consumption**, broken down by type of energy. Using data gathered from energy invoices, the SPEEDIER Expert can calculate the total amount of energy consumed on site broken down by electricity, natural gas, oil and other fuels.

- **Breakdown of energy consumption by time period**. Depending on the granularity of the energy consumption date that is available, graphs can be created showing monthly, weekly, daily, hourly or half hourly energy consumption for the site. This can be very useful for identifying anomalies such as equipment running when the building is unoccupied or unusual spikes in energy consumption

- **Breakdown of energy consumption by area**. If the site has sub-meters it is possible to look at the distribution of actual energy consumption across different areas of the site (e.g. consumption per floor of the building) to identify any unexpected anomalies.

- **Calculation of expected energy consumption using the equipment inventories** gathered during the site visit. This gives an indication of the likely breakdown of energy consumption by use type (lighting, HVAC, appliances, process etc.). This is important for determining the significant energy users and therefore the ECMs that will have the biggest impact on energy consumption. It is also important to compare this expected consumption with actual consumption as large differences between the two values can indicate that there is a problem, such as poorly maintained equipment or equipment running hours that do not match occupancy.

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- **Calculation of energy benchmarks**, e.g. energy consumption per unit floor area. This allows the auditor to compare the building to other similar buildings in terms of age, size, or business sector and determine if the building energy performance could be improved. Common benchmarks include analysis of energy consumption in terms of floor area, occupancy, operating hours, or number of units manufactured.

These calculations can be carried out using specialised software packages, such as energy monitoring programmes or using a simple spreadsheet. Where possible, the SPEEDIER Tool for Experts will include some of this functionality or allow the SPEEDIER Expert to enter data that they have calculated in another programme.

2.4 Proposal for improvement and economic analysis

After the analysis has been completed, the SPEEDIER Expert will consider all the information gathered and seek to identify the most appropriate ECMs that will result in the largest energy and cost savings for the SME. This can only be done after first analysing the baseline energy performance of the building based on actual energy consumption data.

Once appropriate ECMs have been identified, the auditor should give a detailed description of each of the measures. This includes the technical limitations that need to be considered such as available space, characteristics of the building and its facilities, presence of building users, and any necessary interruption of business operation during the implementation of the ECMs. For each ECM, a budget or breakdown of the cost implementing is required that covers the cost of replacing or upgrading equipment, labour costs, cost to dispose of old equipment and any additional materials necessary.

To justify the cost, the SME will need to be presented with the value of any energy savings that will be achieved as a result of the investment. Therefore, the SPEEDIER Expert must also calculate the likely energy and cost savings that will be achieved taking into account any additional savings such as reductions to the annual cost of maintenance and any grants, subsidies or tax incentives that are available as a result of the installation.

Finally, the SPEEDIER Expert can also calculate the predicted new value of any appropriate energy performance indicators assuming that the recommended ECMs are correctly implemented. This will demonstrate to the SME, the potential improvement that can be made as a result of the ECMs and allows them to compare their performance to other organisations of the same type and size.

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3 Categorisation of ECMs

In this chapter, the possible Energy Conservation Measures that could be suggested by the SPEEDIER Tool for Experts are listed below and categorised according to the cost of implementation. These lists have been compiled based on the most commonly applied ECMs from previous audits and the experience of the SPEEDIER project team.

3.1 No-cost measures

No-cost ECMs are measures that cost nothing to implement, yet result in energy and/or cost savings. A non-exhaustive list of no-cost measures that will be included in the tool is given in Table 3.1 and a checklist of items that the SPEEDIER Expert should check in order to determine whether or not the ECM should be included is given in Table 3.2.

Table 3.1: No-cost measures

HVAC	Adjust thermostat set points to a suitable range.
	Change damper position.
	Heat load reduction due to energy efficient lighting during summer.
	Adjust pressure in compressed air systems.
	Keep exterior doors closed while running HVAC.
	Provide adequate ventilation around the compressor to improve its efficiency.
	Relocate thermostats to areas that aren't affected by local heating or cooling from radiators or direct sunlight.
	Automate the control system to run motors only when other equipment is switched on.
	Adjust thermostats for seasonal changes.
	Regularly clean air filters during peak cooling or heating season.
	Modify the control system so that the timer/thermostat switch shuts off both the circulating pump and the boiler itself.
	Keep the motors clean – a dirty motor will consume more energy and get much hotter than a clean one and is more likely to fail.
	Clear any clutter that is blocking vents or air intakes.
	Reduce the motor and fan speed.
Lighting	Labelling light switches so that it is clear which switch relates to which lights.
	Maximise use of daylight. Hold off switching on lights in the evening until necessary and clean the windows in order to make maximum utilisation of sun light.
	Regularly cleaning of light fittings, windows and doors.
	Use task lighting where feasible.
	Switch off the alternate rows of lights, if not affecting the HSE standards.
	Lighting in non-working areas can be minimised by removing tubes from multi-tube fittings or disconnecting surplus bulbs, if not affecting the HSE standards.

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	Ensure light switches are correctly located for easy use and cover individual work areas to avoid lighting areas that are not in use.
Transformer	Transformer load reduction/change (in case of more than one transformer).
	Change to a cheaper electricity tariff.
	Surrender unused maximum demand capacity (KVA).
	Make use of Time-of-Day (TOD) benefits by carrying out non-time dependent activities during off peak times.
Office	Enable the power management function on office computers, which automatically puts IT equipment into a low power state when not in use.
	Reduce the brightness of monitors.
	Turn off all communal equipment at the end of the day, including printers, copiers, vending machines and kitchen equipment like coffee machine, microwave and kettles.
	Activate sleep settings on all printers, copiers, fax machines, scanners, and multifunction devices so that they automatically enter a low-powered sleep mode when inactive.
Domestic Hot Water	Decrease DHW temperature.

Table 3.2: Checklist for no-cost ECMs

HVAC	Check the thermostat set point is appropriate for the activity levels in the area.
	Check the position of dampers to ensure heating/cooling is being adequately delivered.
	Check the location of thermostats, whether they are set correctly and are in the right location.
	Check the frequency of air filter cleaning is appropriate.
	Check the frequency of motor cleaning is appropriate.
	Check for motor and fan speed with respect to desired output.
	Check BMS for automation and data collection.
	Check that the pressure of compressed air systems is appropriate.
	Check if exterior doors are closed while HVAC is in operation.
	Check if there is any clutter that is blocking vents or air intakes.
	Check the location of compressor for adequate ventilation.
Lighting	Check the lux level at different points of workstation/floor.
	Check the location and control distribution of light switches is suitable.
	Check if light switches are labelled correctly.
	Check if windows are blocked of natural light.

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	Check number of tubes in each light fitting is appropriate.
	Are the task lights being used, if required.
	Are light fittings, windows and skylights are cleaned regularly.
Transformer	Check for suitable transformer loading.
	Check actual maximum demand capacity reached during last 12 months and check it is in line with the contracted capacity on electricity bills.
	Check for energy supplier contract end date and check if a cheaper rate is available.
	Check if Time-of-Day tariff is available and being correctly used.
Office	Check for power management function on office computers, which automatically puts monitors to sleep when not in use.
	Check if all communal equipment (Printers, copiers, vending machines, coffee machine, microwave and kettles) are being turned off or not at the end of the day.
	Check if sleep settings on all printers, copiers, fax machines, scanners, and multifunction devises are activated.
Domestic Hot Water	Check DHW temperature is no higher than minimum requirements for safety.

3.2 Low cost measures

Low-cost ECMs are measures that have a small cost associated with their implementation that are comparable to the cost of regular maintenance of the energy consuming equipment. A non-exhaustive list of low cost measures that will be included in the tool is given in Table 3.3 and a checklist of items that the SPEEDIER Expert should check in order to determine whether or not the ECM should be included is given in Table 3.4.

Table 3.3: Low-cost measures

HVAC	Upgrade the controls of HVAC system.
	Calibrate thermostats to ensure that their ambient temperature readings are correct.
	Upgrade to modern electronic thermostats which are much more accurate. These thermostats can be wireless, making fitting easy.
	Change air-filters.
	Fit spring-loaded door closures to minimise the amount of time doors are open.
	Install variable frequency drives on air-handling unit (AHU) fans.
	Repair leaks in compressed air pipes.
	Adjust pressure in compressed air systems.
	Install task fans.

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Lighting	Install occupancy sensors.
	Install photocell control/daylight sensors.
	Install timers for lights.
	Install task lights.
	Install energy efficient fire exit signs.
	Paint walls in bright colours as they reflect 80% of light while dark colours reflect less than 10%.
Domestic Hot Water	Install low-flow shower and tap heads.
Communication and Education	Ensure that team members from every department are trained in the importance of energy management and basic energy-saving practices.

Table 3.4: Checklist for low-cost ECMs

HVAC	Check the controls of HVAC system are appropriate.
	Check the calibration schedule of thermostats.
	Check for the presence of modern electronic thermostats.
	Check if are air filters are blocked or damaged.
	Check for the presence of spring-loaded door closures to minimise the amount of time doors are open.
	Check for the presence of variable frequency drives on air-handling unit (AHU) fans.
	Check for leakages in the compressed air system.
	Check for suitable pressure in compressed air systems.
	Check for the presence of task fans.
Lighting	Check the suitability for occupancy sensors.
	Check the suitability for photocell control/day light sensor.
	Check the suitability for timers for lights.
	Check the availability of task lights.
	Check the availability of energy efficient exit signs.
	Check the paint colours of walls for bright/dark colours.
Domestic Hot Water	Check for the presence of low-flow shower and tap heads.
Communication and Education	Check if the team members from every department are trained in the importance of energy management and basic energy-saving practices.

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3.3 Medium cost measures

Medium-cost ECMs are measures that involve some investment from the SME to implement while delivering a reasonable return on investment. ***A non-exhaustive list of medium-cost measures that will be included in the tool is provided in*** *Table 3.5* ***as well as a checklist of items that the SPEEDIER Expert should check in order to determine whether or not the ECM should be included is given in***

Table 3.6.

Table 3.5: Medium-cost ECMs

HVAC	Install VSD on electric motors.
	Insulate chiller condensate tank.
	Replace boiler jacket.
	Get boiler serviced once a year to ensure it is running at optimal efficiency.
	Repair damaged insulation and replace missing insulation.
	Insulate hot water and chilled water pipework.
	Replace or repair steam traps.
	Install booster pumps.
	Consider replacing smaller motors after several repairs, as each repair will reduce efficiency.
	Install pressure gauges at different points of compressed air pipes and keep the compressed air pipes clean and foul-free by periodically cleaning filters.
	Install VFDs for fan and pump motors.
Lighting	Install light fittings with reflectors so that light is directed to specified areas.
Transformer	Install sub-metering.
	Install power factors correction equipment.
	Install voltage optimisation equipment.
Domestic Hot Water	Insulate DHW tank and piping.
	Install DHW controls.
Envelope	Exterior door replacement.
	Use thermal insulated curtains for windows and/or front door to avoid heat loss from draughts.

Table 3.6: Checklist for medium cost ECMs

HVAC	Check for the availability and suitability of VSD on electric motors.
	Check for condition of the insulation of condensate tank.
	Check the condition of the boiler jacket.
	Check the annual maintenance schedule of the boiler.
	Check for damaged and missing insulation of pipework.

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	Check if hot and chilled water pipes are well insulated.
	Check if steam traps need to be repaired or replaced.
	Check the availability and suitability of booster pumps.
	Check the efficiency of smaller motors.
	Check pressure drop across the different points in the compressed air pipe line to check for leaks.
	Check the availability of VFDs for fan and pump motors.
Lighting	Check for the presence of reflectors in the light fittings.
Transformer	Check for the presence of sub-meters.
	Check power factor from electricity bills.
	Check if site is suitable for voltage optimisation.
Domestic Hot Water	Check for the presence and quality of insulation of DHW tank and piping.
	Check the presence of suitable DHW controls.
Envelope	Check if exterior door is well sealed or draughty.
	Check the windows and/or exterior doors for draughts.

3.4 High cost measures

High-cost ECMs require a large investment in order to implement, but can result in greater energy savings and therefore greater returns on investment. ***A non-exhaustive list of high-cost measures that will be included in the tool is provided in*** *Table 3.5* ***as well as a checklist of items that the SPEEDIER Expert should check in order to determine whether or not the ECM should be included is given in***

Table 3.6.

Table 3.7: High-cost measures

HVAC	Add or upgrade cooling tower.
	Switch to Variable Refrigerant Flow (VRF) chiller.
	Install suspended ceilings to reduce the volume of air that needs to be conditioned.
	Upgrade to high efficiency motors.
Transformer	Consider solar PV panels to generate free and clean electricity from the sun.
	Install energy-efficient transformers.
Lighting	Upgrade to dimmable LEDs.
	Install a skylight to take advantage of natural daylight.

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Domestic Hot Water	Install solar thermal DHW system.
	Upgrade DHW boiler to a higher efficiency unit.
	Install point of use DHW heaters.
Envelope	Increase envelope insulation.
	Install 'Cool' or 'Green' roof.
	Replace windows with more energy efficient options (double/triple glazing).
Office	Identify the most frequently used items and upgrade them to a more energy efficient model.
Process Heating	Boiler water treatment.
	Replace Boiler.
	Preheat combustion air or fuel supply.

Table 3.8: Checklist for high-cost ECMs

HVAC	Check cooling tower efficiency.
	Check type of chiller (constant/variable refrigerant flow).
	Check if suspended ceiling is required.
	Check motor efficiency.
Transformer	Check if the organisation have solar panel already installed.
	Check the age of the transformer.
Lighting	Check if the organisation have incandescent or LED lights installed.
	Check for the availability of sky lights.
Domestic Hot Water	Check for the suitability of solar thermal DHW system.
	Check for the DHW boiler efficiency.
	Check volume of DHW used annually.
Envelope	Check for level and quality of envelope insulation.
	Check the suitability of building for cool or green roof.
	Check for more energy efficient window upgrade option.

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Office	Check the energy rating of frequently used office equipment.
Process Heating	Check the quality of water being heated.
	Check for the boiler efficiency.
	Check if fuel and combustion air is being preheated or not.

3.5 Average energy savings potential

The measures specified in the previous sections will be used in the Speedier Tool to carry out an evaluation of the energy savings that could be produced when applying them. Taking this into account, the potential savings have been estimated according to the category of each measure.

Table 3.9 shows the all the measures listed above categorized by cost, and grouped by the family to which they belong (HVAC, lighting, hot water etc.). The table lists the values that are used by the tool to calculate energy savings and includes conditional data, constants and/or percentages. The conditional data and constants are used in cases where the formula for the calculation of energy savings is dependent on factors related to the type of elements selected in the building or climate data according to the country. The “percentage” is a direct estimate of the level of energy savings that can be achieved by the measure. In addition, the circuit in which the energy savings occur is also specified since in most cases the calculation does not apply to the total site energy consumption (for example, lighting controls only make savings in the lighting circuit). The formula used by the tool to estimate the impact of the measure on energy consumption is specified in the last column of the table.

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Table 3.9: Average energy savings potential

Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
2	**HVAC**	Change damper position.	No	0			5,00%	Total consumption of initial climate equipment	Total consumption of initial climate equipment*Percentage
3	**HVAC**	Heat Load Reduction due to energy efficient lighting during summer.	No	0			75,00%	Cold circuit	Cold circuit consumption-((sum of luminous powers * percentage reduction * Building speedier hours) / Number of cold cooling circuits)
4	**HVAC**	Adjust pressure in compressed air systems.	No	0			0,25%	Total consumption	Total consumption*Percentage
5	**HVAC**	Keep exterior doors closed while running your HVAC.	No	0	ESPANYA RUMANIA ITALIA IRLANDA	0,3 1,23 0,4194 0,8094		Heat circuit	Heat circuit consumption - (((Constant (country function) * Building heat exchanger) / Number of heat circuits and simulation) / Heat machine performance)
6	**HVAC**	Provide adequate ventilation around the compressor to improve its efficiency.	No	0			2,50%	Total consumption	Total consumption*Percentage
7	**HVAC**	Relocate thermostats to areas that aren't affected by local heating or cooling from radiators or direct sunlight.	No	0			5,00%	Total consumption	Total consumption*Percentage
8	**HVAC**	Automate the control system to run motors only when other	No	0			5,00%	Total consumption	Total consumption*Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
		equipment is switched on.							
9	**HVAC**	Adjust thermostats for seasonal changes.	No	0			5,00%	Total consumption	Total consumption*Percentage
10	**HVAC**	Regularly clean air filters during peak cooling or heating season.	Si (18)	0			2,50%	Total consumption	Total consumption*Percentage
11	**HVAC**	Modify the control system so that the timer/thermostat switch shuts off both the circulating pump and the boiler itself.	No	0			2,50%	Total consumption	Total consumption*Percentage
12	**HVAC**	Keep the Motors clean – a dirty motor will consume more energy and get much hotter than a clean one and is more likely to fail.	No	0			2,50%	Total consumption	Total consumption*Percentage
13	**HVAC**	Clear any clutter that is blocking vents or air intakes.	No	0			2,50%	Total consumption	Total consumption*Percentage
14	**HVAC**	Reduce the motor and fan speed.	No	0			2,50%	Total consumption	Total consumption*Percentage
15	**HVAC**	Upgrade the controls of HVAC system.	No	1			2,50%	Total consumption	Total consumption*Percentage
16	**HVAC**	Calibrate thermostats to ensure that their ambient temperature readings are correct.	No	1			2,50%	Total consumption	Total consumption*Percentage
17	**HVAC**	Upgrade to modern electronic	No	1			5,00%	Total consumption	Total consumption*Percentage

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
		thermostats which are much more accurate. These thermostats can be wireless, making fitting easy.							
18	**HVAC**	Change Air-filters.	Si(10)	1			5,00%	Total consumption	Total consumption*Percentage
19	**HVAC**	Fit spring-loaded door closures to minimise the amount of time doors are open.	No	1	ESPANYA	0,005		Heat circuit	Heat consumption circuit - (((Constant (country function) * Building surface * Window coefficient * Building floor) / Number of heat circuits and brassimulation) / Heat machine performance)
					RUMANIA	0,0205			
					ITALIA	0,00699			
					IRLANDA	0,01349			
20	**HVAC**	Install variable frequency drives on air-handling unit (AHU) fans.	No	1			2,50%	Total consumption	Total consumption*Percentage
21	**HVAC**	Repair Leaks in the pipes of the steam pressure system.	No	1		10,84475753		Heat circuit	Heat consumption circuit- ((Constant * Building heat hours) / Number of heat simulation circuits)
22	**HVAC**	Repair leaks and adjust pressure in compressed air systems.	No	1			0,25%	Total consumption	Total consumption*Percentage
23	**HVAC**	Install task fans.	No	1			5,00%	Total consumption of initial climate equipment	Total consumption of initial climate equipment*Percentage
24	**HVAC**	Install VSD on Electric Centrifugal Chillers.	No	2			5,00%	Total consumption	Total consumption*Percentage
25	**HVAC**	Insulate Condensate Tank.	No	2		0,690088476		Heat circuit	Heat consumption circuit- ((Constant * Building heat

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
									hours) / Number of heat simulation circuits)
26	**HVAC**	Replace Boiler Jacket.	No	2		0,034157506		Heat circuit	Heat consumption circuit-((Constant * Building heat hours) / Number of heat simulation circuits)
27	**HVAC**	Get boiler serviced once a year to ensure it is running on optimal efficiency.	No	2		0,025		Heat circuit	Heat consumption*Percentage
28	**HVAC**	Repair damaged insulation and replace missing insulation. Value per linear meter.	Si (29)	2		0,932372597		Heat circuit	Heat consumption circuit-((Constant * Building heat hours) / Number of heat simulation circuits)
29	**HVAC**	Insulate tubes. Value per linear meter.	Si (28)	2		0,932372597		Heat circuit	Heat consumption circuit-((Constant * Building heat hours) / Number of heat simulation circuits)
30	**HVAC**	Replace or repair Steam Trap.	No	2			0,05%	Total consumption	Total consumption*Percentage
31	**HVAC**	Install booster pumps.	No	2			0,05%	Total consumption	Total consumption*Percentage
32	**HVAC**	Consider replacing smaller motors after several repairs, as each repair will reduce efficiency.	Si (38)	2			30,00%	Use circuit	Engine performance*Percentage
33	**HVAC**	Install pressure guages at different points of compressed air pipes and keep the compressed air	No	2			0,25%	Total consumption	Total consumption*Percentage

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
		pipes clean and foul-free by periodically cleaning filters.							
34	**HVAC**	Install VFDs for motors.	No	2			30,00%	Use circuit	Engine performance*Percentage
35	**HVAC**	Upgrade cooling tower.	No	3			10,00%	Cold circuit	Cold consumption circuit*Percentage
36	**HVAC**	Switch to Variable Refrigerant Flow(VRF) Chiller.	No	3			5,00%	Clima circuit	Clima consumption circuit- ((Percentage * Building clima hours) / Number of clima simulation circuits)
37	**HVAC**	Install Suspended ceilings, as it makes the volume of space you need to heat smaller.	No	3			25,00%	Total consumption	Total consumption*Percentage
38	**HVAC**	Upgrade Motors.	Si (32)	3			30,00%	Use circuit	Engine performance*Percentage
39	**Lighting**	Labelling of light switches is important so that it becomes clear which switch relates to which lights –you can only control what you know.	No	0			5,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
40	**Lighting**	Maximise use of daylight. Hold off switching on lights in the evening until necessary and clean the windows in order to make maximum utilisation of sun light.	No	0			20,00%	Lighting consumption	Number_of luminaires * Power_luminaries *Hours_Speedier_Building * Percentage reduction

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
41	**Lighting**	Regular cleaning of Light fittings, Windows and skylights.	No	0			5,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
42	**Lighting**	Use task lighting where feasible.	Si (49)	0			40,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
43	**Lighting**	Switch off the alternate rows of lights, if not affecting the HSE standards.	No	0			10,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
44	**Lighting**	Lighting in non-working areas can be minimised by removing tubes from multitube fittings or disconnecting surplus bulbs, if not affecting the HSE standards.	No	0			30,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
45	**Lighting**	Make lighting switches more distributed - Split the lighting switches to have more control over individual areas of your workspace.	No	0			5,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
46	**Lighting**	Install Occupancy Sesnsors.	No	1			5,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
47	**Lighting**	Install Photocell Control/Day Light Sensor.	No	1			20,00%	Lighting consumption	Number_of luminaires * Power_luminaries *Hours_Speedier_Building * Percentage reduction

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
48	**Lighting**	Install timers for lights.	No	1			15,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
49	**Lighting**	Install Task Lights.	Si (42)	1			40,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
50	**Lighting**	Install EE exist signs.	No	1			2,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
51	**Lighting**	Paint walls in bright colours as they reflect 80% of light while dark colours reflect less than 10%.	No	1	* It does not produce energy savings, what it does is improve light quality.				
52	**Lighting**	Install light fittings with reflectors so that light is directed to specified areas.	No	2	* It does not produce energy savings, what it does is improve light quality.				
53	**Lighting**	Upgrade to dimmable LED.	No	3			60,00%	Lighting consumption	(Number_Luminaries * Power_Luminaries * Hours_Speedier_Building) *Percentage
54	**Lighting**	Install a skylight to take advantage of natural daylight and Ensure to keep them clean.	No	3			50,00%	Lighting consumption	Number_of luminaires * Power_luminaries *Hours_Speedier_Building * Percentage reduction
55	**Transformer**	Transformer Load Reduction/Change (in case of more than one transformer).	No	0			5,00%	Use circuit	Consumer elements (not clima circuit) * Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
56	**Transformer**	Check for another electricity supplier for cheaper electricity price.	No	0			15,00%	Total consumption	Total consumption*Percentage
57	**Transformer**	Surrender the unused contract demand(KVA).	No	0			2,00%	Use circuit	Consumer elements (not clima circuit) * Percentage
58	**Transformer**	Time Of Day (TOD) benefits for any storage task requirement.	No	0			5,00%	Use circuit	Consumer elements (not clima circuit) * Percentage
60	**Transformer**	Correct Power Factors.	No	2			5,00%	Use circuit	Consumer elements (not clima circuit) * Percentage
61	**Transformer**	Consider solar PV panels for your home to generate free and clean electricity from the sun.	No	3			Percentage establish by the user in Energy Contributions Menu	Total combustible consumption	Total combustible consumption*Percentage
63	**Office**	Enable the power management function on office computers, which automatically puts monitors to sleep when not in use.	No	0			1,00%	Total consumption	Total consumption*Percentage
64	**Office**	Optimize the brightness of monitors, as too bright screen uses more nergy.	No	0			0,50%	Total consumption	Total consumption*Percentage
65	**Office**	Turn off All communal equipment at the end of the day, including printers,	Si (66)	0			1,00%	Total consumption	Total consumption*Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
		copiers, vending machines and kitchen euipments like coffee machine, microwave and kettles.							
66	**Office**	Activate sleep settings on all printers, copiers, fax machines, scanners, and multifunction devises so that they automatically enter a low-powered sleep mode when inactive.	Si (65)	0			1,00%	Total consumption	Total consumption*Percentage
68	**Domestic Hot Water**	Decrease DHW Temperature.	Si (72)	0			-2 ºC	DHW circuit	DHW (there are 3 types of DHW circuits) with -2 Degrees of water temperature
69	**Domestic Hot Water**	Separate DHW from Heating.	No	0			20,00%	DHW circuit	Consumption DHW*Percentage
70	**Domestic Hot Water**	Install Low-Flow Shower-heads.	No	1			15,00%	DHW circuit	Consumption DHW*Percentage
71	**Domestic Hot Water**	Insulate DHW Tank and Piping. Value for a tank and for 50 linear meters of pipe.	No	2		47,30871831		Heat circuit	Heat consumption circuit-((Constant * Building heat hours) / Number of heat simulation circuits)
72	**Domestic Hot Water**	Install DHW Controls.	Si (68)	2			-2 ºC	DHW circuit	DHW (there are 3 types of DHW circuits) with -2 Degrees of water temperature
73	**Domestic Hot Water**	Install Solar Thermal DHW system.	No	3			Percentage establish by the user in Energy	Total combustible consumption	Total combustible consumption*Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
							Contributions Menu		
74	**Domestic Hot Water**	Upgrade DHW Boiler.	Si (84)	3			20 % more efficiency	DHW circuit	DHW efficiency*Percentage
75	**Communication and Education**	Ensure that team members from every department are trained in the importance of energy management and basic energy-saving practices.	No	1			2,50%	Total consumption	Total consumption*Percentage
76	**Envelope**	Exterior Door Replacement.	No	2			2,00%	Total consumption	Total consumption*Percentage
77	**Envelope**	Use thermal insulated curtains for windows and/or front door to avoid draught and heat loss.	No	2			10,00%	Total consumption	Total consumption*Percentage
78	**Envelope**	Add envelope insulation (5cm)	No	3	PAR_SINGLE_CERAMIC_1/2_SENSE-E612B51L	0,02494		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1_SENSE-E612BD1K	0,01171		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CONCRETE_SENSE-E61BG511	0,00327		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_STONE_SENSE-E4G211GA	0,04064		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_DOUBLE_CERAMIC_1/2_NV-XDL0NV01	0,00957		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1/2_LLV-XDL0LLV1	0,01076		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1_NV-XDL1NV01	0,00411		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1_LLV-XDL1LLV1	0,00442		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CONCRETE_NV-XDLCNV01	0,00101		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CONCRETE_LLV-XDLCLLV1	0,00104		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_STONE_NV-XDLSNV01	0,01652		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_STONE_LLV-XDLSLLV1	0,01948		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_HEAVY_SENSE-E612BR1L	0,02060		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_LIGHT-PAR_LIGHT_NV-XPWLNV01	0,01981		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					SOLPAR_LIGHT_LLV-XPWLLLV1	0,02386		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_UNIDIRECTIONAL_CERAMIC-K4F64PGE	0,00108		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_UNIDIRECTIONAL_CONCRETE-145A16HB	0,00354		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_RETICULATE_CERAMIC-K4F64PGE	0,00108		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_RETICULATE_CONCRETE-145B3AA7	0,00354		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_CONTACT_TERRAIN-E93628C1	0,00093		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
79	**Envelope**	Increase envelope insulation (5cm)	No	3	PAR_SINGLE_CERAMIC_1/2_EPS-XSL0EPS1	0,02494	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1/2_XPS-XLS0XPS1	0,02494	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_SINGLE_CERAMIC_1/2_MW-XSL0MW01	0,02494	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1/2_PUR-XSL0PUR1	0,02494	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1_EPS-XSL1EPS1	0,01171	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1_XPS-XSL1XPS1	0,01171	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1_MW-XSL1MW01	0,01171	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CERAMIC_1_PUR-XSL1PUR1	0,01171	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CONCRETE_EPS-XSCREPS1	0,00327	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CONCRETE_XPS-XSCRXPS1	0,00327	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_CONCRETE_MW-XSCRMW01	0,00327	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_SINGLE_CONCRETE_PUR-XSCRPUR1	0,00327	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_STONE_EPS-XSLSEPS1	0,04064	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_STONE_XPS-XSLSXPS1	0,04064	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_STONE_MW-XSLSMW01	0,04064	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_SINGLE_STONE_PUR-XSLSPUR1	0,04064	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1/2_EPS-XDL0EPS1	0,00342		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1/2_XPS-XDL0XPS1	0,00317		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1/2_MW-XDL0MW01	0,00354		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1/2_PUR-XDL0PUR1	0,00246		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_DOUBLE_CERAMIC_1_EPS-XDL1EPS1	0,00201		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1_XPS-XDL1XPS1	0,00190		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1_MW-XDL1MW01	0,00206		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CERAMIC_1_PUR-XDL1PUR1	0,00156		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CONCRETE_EPS-XDLCEPS1	0,00069		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CONCRETE_XPS-XDLCXPS1	0,00067		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CONCRETE_MW-XDLCMW01	0,00070		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_CONCRETE_PUR-XDLCPUR1	0,00059		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_STONE_EPS-XDLSEPS1	0,00456		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_DOUBLE_STONE_XPS-XDLSXPS1	0,00418		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_STONE_MW-XDLSMW01	0,00474		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_DOUBLE_STONE_PUR-XDLSPUR1	0,00312		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_HEAVY_EPS-XPWHEPS1	0,02060	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_HEAVY_XPS-XPWHXPS1	0,02060	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_HEAVY_MW-XPWHMW01	0,02060	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_HEAVY_PUR-XPWHPUR1	0,02060	50,00%	Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_LIGHT_EPS-XPWLEPS1	0,00496		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_LIGHT_XPS-XPWLXPS1	0,00452		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage

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Code	Family	Name/Description	Does it contradict another ECM?	Cost level	Conditional data	Constants	Percentage reduction	On which element the percentage is applied	Formula
1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
					PAR_LIGHT_MW-XPWLMW01	0,00517		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
					PAR_LIGHT_PUR-XPWLPUR1	0,00334		Clima circuit	Constant*Facade_Surface * Hours_Speedier_Building *Percentage
80	**Envelope**	Install Cool or Green Roof.	No	3	PAR_FLAT_CONCRETE-15114R1H	0,00354		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_FLAT_GRANULATED-15128R0H	0,00378		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_FLAT_CERAMICTILE-151159K2	0,00108		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_FLAT_LANDSCAPE-15131590	0,00303		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_FLAT_PREFABRICATED-15113ACF	0,00093		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_SLOPED_CEMENT-1523FE0U	0,00499		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_SLOPED_CERAMICTILE-15213G53	0,00123		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
					PAR_SLOPED_PREFABRICATED-15221315	0,00263		Clima circuit	Constant*Deck_Surface * Hours_Speedier_Building
81	**Envelope**	Replace windows with more energy efficient options (double/triple glazing).	Si (82)	3			10,00%	Total consumption	Total consumption*Percentage
82	**Envelope**	Refilling or resealing your existing windows.	Si (81)	2			5,00%	Total consumption	Total consumption*Percentage
83	**Process Heating**	Boiler WaterTreatment.	No	3	* It does not produce energy savings, what it does is improve water quality.				

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1	**HVAC**	Change Set Points of thermostat.	No	0			2,00%	Total consumption	Total consumption*Percentage
84	**Process Heating**	Replace Boiler.	Si (74)	3			20 % more efficiency	DHW circuit	DHW efficiency*Percentage
85	**Process Heating**	Preheat combustion air or fuel supply.	No	3			5,00%	Total consumption	Total consumption*Percentage

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4 Conclusions

The methodology described in this Deliverable will be used as the basis of the design of the future tool for SPEEDIER Experts. A flow chart will be established based on the defined methodological approach to ensure that the tool is as useful as possible and makes the steps described in the Deliverable easier for the SPEEDIER Expert to implement. In addition, the list of ECMs that will be suggested by the tool will be related to the characterization of SMEs undertaken in Task 3.1, so that the process of making recommendations and designing which ones are most appropriate is streamlined as far as possible.

Once the methodology, auditing scheme and background data that feeds into the energy audits are established, the database of the tool will be prepared. This will allow the relationship between the SME characteristics defined in D3.1 and the recommended ECMs to be established. The tool will also include the functionality to select one or more measures and to evaluate which ones should initially be applied. Simulations will be created in order to evaluate a range of different scenarios for the SME. This will help to establish which package of options are more in line with the ambitions of the SME, which will give the best return on investment, or which will have the shortest payback time.

Finally, after applying the first package of measures, it will be necessary to measure the impact of the implemented ECMs in order to determine how energy consumption, energy cost and carbon emissions have been reduced. The tool will be programmed so that the package of measures that the client wishes to implement can be applied progressively and successively over a number of investment cycles; thus, creating a circular flow of reinvestment of the savings achieved by the initially chosen set of measures.

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