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GREENHOUSE CHALLENGE PLUS



ENERGY AUDIT TOOL BUILDING INSULATION

09



Australian Government
Department of the
Environment and Heritage
Australian Greenhouse Office



ENERGY AUDIT TOOL BUILDING INSULATION

09



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Effective management of your organisation's energy usage is good business sense. It can produce both environmental and economic benefits – and importantly reduce your greenhouse gas emissions.

The Greenhouse Challenge Plus Energy Audit Tool has been developed to assist non-technical or semi-technical energy managers in small to medium organisations:

- identify actions to improve energy efficiency through the use of a simple but detailed audit checklist; and
- develop plans for implementing energy efficiency actions.

The checklist contains notes supplying the auditor with further explanation or hints on how to complete the tasks. It should be possible to complete the majority of tasks through simple observation.

The energy efficiency action plan – can also be utilised in the preparation of or alternatively form part of your organisation's annual progress report to the Greenhouse Challenge Plus programme—which details abatement actions.

The energy audit tool has been designed as a modular system. This means that you can utilise each of the volumes as stand-alone independent units or in combination with the other units.

This is *Volume 09 — Building insulation* of the Greenhouse Challenge Plus Energy Audit Tool, which includes the following 11 volumes:

- Volume 01** — Lighting (indoor and outdoor)
- Volume 02** — Lighting control
- Volume 03** — Chillers
- Volume 04** — Boilers and steam systems
- Volume 05** — Ventilation systems
- Volume 06** — Airconditioning systems
- Volume 07** — Office equipment
- Volume 08** — Domestic hot water
- Volume 09** — Building insulation
- Volume 10** — Infiltration (air leakage into buildings)
- Volume 11** — Compressed air

Your challenge to reduce energy consumption and greenhouse gas emissions starts now!

Need more information?

If you require additional information about the Greenhouse Challenge Plus Energy Audit Tool, contact your Industry Adviser on 02 6274-1229 or at email greenhouse@greenhouse.gov.au. Additional copies of the Greenhouse Challenge Plus Audit tool can also be downloaded from www.greenhouse.gov.au/challenge

A:

BACKGROUND INFORMATION

Insulation reduces the rate of heat transfer through external surfaces of a building. It reduces heat loss from the building in winter and reduces heat gain during summer, thereby minimising the need for heating and airconditioning in the building. A well-insulated building increases the rate of comfort and can provide considerable energy cost savings.

Insulation is assigned a particular 'R' value depending upon how well it resists heat transfer. The greater the 'R' value, the more effective the insulation is at resisting heat flow into and out of the building. Australian Standard *AS2627:1993 Thermal Insulation of Dwellings — Thermal insulation of roof, ceilings and walls in dwellings*, sets out the recommended 'R' values for insulation depending upon the type of heating and cooling undertaken in the building, the building type, and most importantly, the climatic zone the building is located in. Various Internet sites also provide similar information and can be found on the resources page in section D of this volume.

This volume gives direction as to what areas of the building should be insulated, the different types of insulation available, and where to obtain information regarding the selection and installation of the correct type of insulation.

Each question in the energy audit checklist, which follows, has a space where you can write your energy efficiency improvement ideas. You should refer to the explanatory notes when considering what can be done to improve energy efficiency. You may need to take additional notes and attach them to the checklist, or attach other relevant documentation (such as instruction sheets and site plans) in order to support your improvement ideas and completely document your audit.

Remember these are ideas, not decisions. When you have completed the energy audit checklist, select the energy efficiency improvements that are viable and enter them into the energy efficiency action plan in section C of this volume.

STRUCTURE

QUESTION 1: What type of roof insulation exists in the building? Please tick the appropriate boxes .

- Bulk
- Reflective
- Composite
- Other:
- None

Improvement ideas and notes:.....
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- Bulk insulation contains millions of tiny pockets of still air trapped within the material, which provides the insulating effect. Bulk insulation is available as batts, blankets and boards, or as loose fill, which is pumped, blown or placed by hand into an area.
- Reflective insulation is made of thin sheets of highly reflective aluminium foil laminate, which reflects heat while only absorbing and emitting a small amount. Reflective insulation is commonly used directly under roofs. The four types of reflective insulation products are: reflective foil laminate, multi-cell reflective foil products, expandable concertina-style foil, and foil bonded to bulk insulation.
- Composite insulation combines some features of both types. Examples include foil backed blankets, foil backed batts and foil-faced boards. Composite insulation in the form of blankets (such as foil backed glass fibre, polyester and rockwool) is suitable for use under metal roofs.
- A roof must be isolated as most heat is transferred (either gained or lost) through the ceiling and roof. Roof insulation will reduce the need for the use of heating and cooling equipment, therefore saving energy and money.

MAKE SURE YOU: Consult maintenance or engineering personnel, insulation supplier, building plans, or building owner.

QUESTION 2: Does the insulation in the roof have an R-value suitable to the climatic region you are in?

- Yes No

Improvement ideas and notes:.....
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- The R-value indicates the thermal resistance or resistivity of insulating material (the ability of the insulation to restrict heat transfer). Buildings in different areas of Australia require different R rated insulation depending on the climatic zone they are in, as set out by Australian Standard AS2627.1-1993: *Thermal Insulation of roof, ceilings and walls in dwellings*. Insulation should have the correct R value or higher for the climatic region the building is located in, otherwise heating and cooling equipment will need to compensate for this, resulting in excessive energy consumption and a decrease of comfort levels.

B:

ENERGY AUDIT CHECKLIST



→ To determine the correct R value for your region of Australia, you can consult your state's Sustainable Energy Department website or other relevant websites, which are listed in section D — resources in this volume. Alternatively, you can consult the Australian Standard mentioned above. Insulation suppliers may also be able to inform you of the correct R values. It must be noted that the higher the R value, the greater the resistance to heat transfer. Different types of insulation with the same R value have the same insulation performance, however one type may be more suitable for a particular application than another.

MAKE SURE YOU: Consult maintenance or engineering personnel, building plans, builder, or insulation supplier to determine the R value of your existing roof insulation. To determine the applicable R value, consult the resource page (section D), your insulation supplier, or Standards Australia.

QUESTION 3: What type of ceiling insulation exists in the building? Please tick the appropriate box below.

- Bulk
- Reflective
- Composite
- Other:
- None

Improvement ideas and notes:.....
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→ Ceiling insulation should be installed, where possible, to work in conjunction with roof insulation and therefore further reduce heating and cooling costs. Bulk or composite insulation in the form of batts (such as glass fibre), boards (expanded polystyrene for use in cathedral or raked ceilings for instance), and loose fill (cellulose fibre for example) is suitable for use in ceilings, along with reflective insulation (such as reflective foil). Refer to explanatory notes in question 1 for further information regarding insulation.

MAKE SURE YOU: Consult maintenance or engineering personnel, insulation supplier, building plans, or building owner.

QUESTION 4: Does the insulation in the ceiling have an R value suitable to the climatic region you are in?

- Yes No

Improvement ideas and notes:.....
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→ Insulation with the correct R value must be installed in the ceiling. The R value for ceilings not only depends on the climatic region the building is in, but also on the natural and artificial heating and cooling systems present in the building. Refer to explanatory notes in question 2 for information on R values and how to determine them.

MAKE SURE YOU: Refer to question 2 on how to determine the required and existing R values.

QUESTION 5: Are any external walls in the building insulated?

Yes No

If no, go to question 7.

If yes, what percentage?:.....

Improvement ideas and notes:.....

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→ External walls should be insulated to reduce heat transfer. Wall insulation can be installed within cavities, within stud frames, on the outside of stud frames and on the inside or outside of solid walls. If possible, insulation should be installed on the outside of a wall rather than on the inside, as inside insulation may cause problems resulting from humidity accumulating in the wall. Refer to insulation supplier if unsure.

MAKE SURE YOU: Consult maintenance or engineering personnel, insulation supplier, building plans, or building owner.

QUESTION 6: What type of insulation exists in the external walls in the building? Please tick the appropriate box below.

- Bulk
- Reflective
- Composite
- Other:
- None

Improvement ideas and notes:.....

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→ Bulk and composite insulation can be used to insulate external walls. Batts (e.g. glass fibre) can be used in framed walls, boards that may have foil attached (for instance expanded polystyrene) can be used within framed and full masonry walls, and reflective insulation (such as reflective foil) can also be used in framed walls. Refer to question 1 regarding information on insulation.

MAKE SURE YOU: Consult maintenance or engineering personnel, insulation supplier, building plans, or building owner.

B: ENERGY AUDIT CHECKLIST



QUESTION 7: Does the insulation in the external walls have an R value suitable to the climatic region you are in?

Yes No

Improvement ideas and notes:.....
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→ Insulation with the correct R value must be installed in external walls as mentioned in question 2. The R value for external walls mainly depends on the climatic region the building is in, but may also depend on the natural and artificial heating and cooling systems present in the building. Please refer to question 2 on how to determine the correct R value for your external wall insulation.

MAKE SURE YOU: Refer to question 2 on how to determine the existing and required R values.

QUESTION 8: Are there any suspended floors in the building?

Yes No

If no, go to question 11.

Improvement ideas and notes:.....
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→ Suspended floors are supported on building walls and can be formed from concrete block infills, concrete beams, cast in-situ concrete and pre-cast concrete units, timber boarding and timber joists. Intermediate floors are defined as being suspended.

MAKE SURE YOU: Consult maintenance or engineering personnel or building plans.

QUESTION 9: Have any suspended floors been insulated?

Yes No

If yes, what percentage?:.....

Improvement ideas and notes:.....
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- If the underside of a suspended floor is exposed to the elements, it should be insulated, particularly in cooler climates. Significant heat transfer can occur through the floors, increasing the need for heating and cooling equipment and associated energy use, and reducing the comfort level. Suspended floors exposed to the elements should be insulated in:
- cool temperate and alpine climates
 - temperate climates if
 - slab heating is used
 - the underfloor space is ventilated
 - there is no covering to timber floors or
 - airconditioning is used
 - hot humid and hot dry climates where airconditioning is used.

MAKE SURE YOU: Consult maintenance or engineering personnel, builder, building plans, or building owner to find out whether insulation around suspended floors exists. To determine viability of retrofitting insulation, contact insulation supplier.

QUESTION 10: What type of insulation exists under the suspended floors in the building? Please tick the appropriate box below.

- Bulk
- Reflective
- Composite
- Other:
- None

Improvement ideas and notes:.....
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- Batts (such as glass fibre) and reflective insulation (such as reflective foil) can be used under timber floors, and boards, which may have foil attached (expanded polystyrene for example) can be used under timber and concrete floors. Refer to question 1 for further information regarding insulation.

MAKE SURE YOU: Consult maintenance or engineering personnel, building plans, builder, or building owner.

B: ENERGY AUDIT CHECKLIST



QUESTION 11: Is the building built on a ground slab?

Yes No

Improvement ideas and notes:.....
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- A ground slab refers to a slab of concrete resting on the ground with the building built on it. It can be a source of heat transfer, which increases the need to use heating and cooling equipment and therefore energy. The underside of the ground slab should only be insulated in alpine climates and where groundwater is present.
- The edges of the ground slab should be insulated in cool temperate climates (that is where overnight-temperatures frequently drop below +5°C in winter), alpine climates, and in temperate climates when slab heating is used. Composite insulation in the form of boards (such as expanded polystyrene with foil attached) is suitable for use around concrete slab edges.

MAKE SURE YOU: Consult maintenance or engineering personnel, building plans, or building owner.

QUESTION 12: Is there any insulation under or around the ground slab or building floor, or should there be insulation if there isn't?

- Insulation present
- Insulation not present and not needed
- Insulation not present but needed

If there is insulation, what type?:..... Go to question 13.

If none exists and none is needed, go to question 14.

Improvement ideas and notes:.....
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- Refer to questions 9 and 11 to determine whether suspended floors or the ground slab should be insulated. If they should be insulated but are not, discuss with your insulation supplier if retrofitting is viable in your case.

MAKE SURE YOU: Consult maintenance or engineering personnel, building plans, builder, or building owner.

QUESTION 13: Does the insulation under or around the floor have an R value suitable to the climatic region you are in?

Yes No

Improvement ideas and notes:.....
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→ The R rating of floor insulation should be correct for the type of floor you have and the climatic region you are in. Please refer to question 2 for information on R values and how to determine the value needed for your region.

MAKE SURE YOU: Refer to question 2 on how to determine the existing and required R values.

QUESTION 14: Are there any gaps in the existing insulation in the building?

Yes No

Improvement ideas and notes:.....
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→ Gaps in the insulation should be minimised and repaired where possible, as they create greater need for heating and cooling. Checking inaccessible insulation for gaps may require the services of a professional, which could be costly. Therefore, if renovation or construction of a new building is taking place, ensure insulation in the ceiling, external walls and floors is being checked and improved or repaired if necessary.

MAKE SURE YOU: Check insulation for gaps where accessible (often in the roof) or get maintenance personnel to check for you. Particular attention should be given to the corners of ceilings, walls and floors. Air drafts are a good indication of gaps in insulation.

B: ENERGY AUDIT CHECKLIST



PURCHASING

QUESTION 15: Will all the insulation purchased be certified to applicable Australian Standards?

Yes No

Improvement ideas and notes:.....
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→ Insulation should only be purchased if it is certified to applicable Australian Standards. A label on the insulation packaging will indicate its certification and therefore ensure its quality. Purchasing certified insulation will ensure maximum energy efficiency and safety is achieved.

MAKE SURE YOU: Consult purchasing procedures, guidelines, or policies.

QUESTION 16: Will all the insulation purchased have the correct R value for its purpose?

Yes No

Improvement ideas and notes:.....
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→ The recommended insulation R value should be determined before purchasing insulation. Often the supplier will know the correct R value for the intended purpose of the insulation, but consider double-checking. Refer to question 2 for information about R values.

MAKE SURE YOU: Consult purchasing procedures, guidelines, or policies.

QUESTION 17: Will all the insulation purchased be of the correct type for its intended use?

Yes No

Improvement ideas and notes:.....
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→ Not all types and forms of insulation are suitable for all applications, therefore ensure only the correct type of insulation for the intended use is being purchased. Discuss your requirements with your supplier or refer to section D — resources. A type of insulation may have the correct R value but still not be suitable for the particular application. For instance insulation, which is suitable under a ground slab, may not be suitable for ceilings.

MAKE SURE YOU: Consult purchasing procedures, guidelines, or policies.

Note: As an alternative to using this action plan, you can also enter your energy efficiency actions as objectives and targets in an environmental management system, as a work order in your maintenance management system, or in another process that ensures nominated personnel complete the actions.

GOALS AND METHODS FOR ENERGY EFFICIENCY

Your energy efficiency goals

Example: "Reduce the energy use for lighting by 10% compared to last year's consumption." Be specific where possible taking into account technical, financial and operational inputs. Goals should be measurable where practicable.

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Your preferred energy efficiency options

Chosen from 'Improvement ideas and notes' in section B.

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Target completion date

Person responsible

C: ENERGY EFFICIENCY ACTION PLAN

Goal(s):.....

ACTION STEPS TO BE TAKEN Specific steps needed to implement the preferred energy efficiency actions stated under 'goals and methods'.

No.	Action	Person responsible	Due date	Date completed	Initials

COMPLETION To be signed by person nominated under 'goals and methods'.

Signature.....

Print Name.....

Title..... Completion Date.....

Please photocopy this form if additional action steps are required. Complete the page numbering and action numbering on all forms.

Page..... of.....

National Energy Efficiency

A comprehensive guide to the latest Commonwealth, State and Territory regulations, standards and guides on energy efficient appliances
www.energyrating.gov.au

A SELECTION OF OTHER USEFUL LINKS**1. Your Home Technical Manual: Insulation.**

Department of the Environment and Heritage, Australian Greenhouse Office.

Technical information regarding different types of insulation, the R value necessary for different climatic zones in Australia, and where to install insulation in the building.

<http://www.greenhouse.gov.au/yourhome/technical/fs16a.htm>

2. Home Greenhouse Audit Manual: Appendix 6 — Insulation Guide for Regions of Australia.

Department of the Environment and Heritage, Australian Greenhouse Office.

<http://www.greenhouse.gov.au/coolcommunities/audit/appendix6.html>

3. Information Fact Sheets: Insulation.

Sustainable Energy Authority of Victoria (SEAV).

Provides detailed information about the benefits of insulation, relevant Australian Standards, different types of insulation and the R values for different localities in Victoria.

<http://www.sustainable-energy.vic.gov.au/seinfo/downloads/index.asp#Building>

4. Energy Smart Brochure: Insulating Your Home.

Sustainable Energy Development Authority of NSW (SEDA).

Gives information about the different types of insulation and the installation application for each type. It also provides the recommended R values for some areas of NSW.

http://www.energysmart.com.au/brochures/insulating_your_home.pdf

5. Sustainable and Renewable Energy Publications: Insulation.

Energy South Australia.

Describes the different types of insulation, the recommended R values for different localities in South Australia, and the meaning of the R value.

<http://www.sustainable.energy.sa.gov.au/pages/general/pdf/insulation.pdf>

6. Energy Smart Allies Directory.

Directory of suppliers of energy services and products including information regarding insulation.

www.energysmartallies.com/esa/middlesub.asp

7. Energy Smart Information Sheet: Home Insulation.

Sustainable Energy Development Office of WA (SEDO).

Describes the different types of insulation and the recommended R values for different localities in Western Australia.

http://www1.sedo.energy.wa.gov.au/uploads/Insulation_4pg_50.pdf

8. Standards Australia Customer Service Centre

www.standards.com.au

Phone from within Australia: 1300 65 46 46

From overseas: +61 2 8206 6010

Need more information?

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NOTES



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