



Educator's Guide

Global Change - Green Audit Toolkit



1. Purpose

This Educator's guide has been developed as support documentation for educators who wish to implement a green audit at school. The Green Audit Toolkit (including the Educator's guide, Learners' Information Booklet, Audit and Activity Sheets) has been developed in partnership by the City of Cape Town and ACCESS (Africa Centre for Climate and Earth System Sciences) with support from Fran Cox and Grace Stead (Steadfast Greening).

It is important that the audit is not a stand alone action within the classroom, but becomes an integral part of the curriculum in a practical way. This Educator's guide aims to make it easier for the educator to achieve this. The Educator's guide includes a set of the audit sheets – an additional set of audit and activity sheets are provided to enable the educator to make copies for the learners to work on.

2. Green Audit

An audit is an evaluation of how well or poorly something is working. By doing a green audit at the school or home, learners can determine how their actions impact on the environment, either in a positive or negative manner. By doing a green audit they determine what they need to do to help our planet, and how they can live a more sustainable lifestyle.

It is essentially a 'snap shot' of the environmental resources being used at a specific venue (i.e. the school) during a specific time. Such a 'snap shot' can be used to motivate for funding and implementation of energy efficiency, water conservation or waste reduction projects at the school.

A green audit is a useful tool for a school to determine where they are using the most energy or water. In doing so, the school can then consider how to implement changes to make savings. Such an audit can be used to determine the type and volume of waste which can be used for a recycling project or waste minimisation plan.

The audit could be used as an awareness tool for both educators and learners when it comes to issues surrounding global change and environmental concerns, greener living and sustainable development (the current thinking in both developed and developing countries). This is particularly relevant when we consider our commitment through national governments decisions to support and implement the outcomes of Agenda 21 and the Millennium Development Goals.

Following on from the awareness phase, it is hoped that by doing the exercises, analysing the results and reflecting on the outcomes, there will be a behavioural change in learners when it comes to environmental issues. It is important for the educator to point out the relevance of the audit in relation to the immediate built-environment of the learner, and the wider context of the planet and its resources.



3. Curriculum Links

Environment and sustainable development are curriculum concerns in primary and high school, which means that learner participation in this audit can help achieve learning outcomes. These outcomes can be assessed as part of the work plan. If educators plan well, then this audit process can fit into their learning programmes and subject frameworks. It need not be extra-curricular or extra work. Here are a few examples of the curriculum links, although there are many more.

Grade: 10 (and Grade 11)

Subject: Life Orientation

Learning: Citizenship Education: Participate in a group project to address a contemporary social and environmental issue.

Grade: 10 (and Grade 11)

Subject: First Additional Language

Learning: Listening and speaking: Planning and research skills for oral presentations: research a topic, referring to a range of supplied, relevant sources; organise material by choosing main ideas & details or examples for support; use appropriate vocabulary, conventions and formats; prepare introductions and conclusions; incorporate appropriate audio-visual aids.

Grade: 10 (and Grade 11)

Subject: Home Language

Learning: Listening and Speaking: Learn about and share ideas and concepts, defend a position, make an unprepared response; participate in group discussions by expressing own ideas and opinions and listening to and respecting those of others, while engaging with issues such as inclusivity and power relations, and environmental, socio-cultural and human rights issues; participate in panel discussions, debate, forums and formal meetings following correct procedures.

Grade: 11 (and Grades 10 and 12)

Subject: Life Sciences

Learning: Plan and conduct an investigation; analyse findings and communicate them. Apply Life Sciences knowledge to everyday life. Investigate human influences on the environment. Manage natural resources. Investigate a local environmental issue; problem solving; decision making.

Grade: 11 (and Grades 10 and 12)

Subject: Mathematical Literacy

Learning: Investigate a problem on issues such as those related to social, environmental and political factors; choose methods to summarise and display data in statistical charts and graphs.



Grade: 11 (and Grades 10 and 12)

Subject: Physical Sciences

Learning: Investigate and report findings. Sustainable use of energy, saving energy in the home. Controversies around the use of nuclear energy. Dependence on fossil fuels, their environmental impact and dwindling supply.

Grade: 11 (and Grades 10 and 12)

Subject: Geography

Learning: Plan and structure a project/enquiry at a more advanced level; use and manipulate data and information. Report findings/take a substantiated position. Propose solutions/strategies to manage local/global problems: Energy use and management. Water as a critical resource. Global warming; poverty, inequalities, conflict, urbanisation; hazards and environmental management of hydrological systems (e.g. rivers). The concepts development and sustainability, strategies to address development problems, application in local context.

Grades: 7, 8 and 9

Subject: Life Orientation

Learning: Health Promotion – Evaluate actions to address an environmental health problem. Human rights. Volunteer organisations (Grade 7). Plan an action in which laws, policies are applied to address an environmental health issue. Democratic processes to address a local problem (Grade 8). Develop and implement an environmental health programme. Participate in a national health or safety programme (Grade 9).

Grade: 9 (and grades 7-8)

Subject: Mathematics

Learning: Data handling – Pose questions relating to human rights, social, economic, environmental and political issues in South Africa. Collect data. Draw graphs. Critically read and interpret data with awareness of sources of error and draw conclusions and make predictions about social, environmental and political issues.

Grade: 9

Subject: Technology

Learning: The impact of technological developments on the quality of people's lives and on the environment; strategies for reducing undesirable effects.

Grade: 9 (and grades 7-8)

Subject: Home Language

Learning: Speaking – communicate ideas, facts and opinions on challenging topics accurately and coherently, demonstrate a range of complex interaction skills by participating actively in group discussions, interviews, surveys, debates, and while doing so: tackle important issues e.g. social and ethical issues related to the environment and human rights; motivate own point of view using evidence, negotiate difference to arrive at a common point of view or compromise.





Grade: 9

Subject: First Additional Language

Learning: Speaking – Give a short formal talk or presentation, using some statistics and visual effects (e.g. a poster); using challenging topics (e.g. human rights and environmental issues).

Grade: 9

LA: Social Sciences

Learning: Development issues, approaches to development, concept of sustainability, use of appropriate technology. Sustainable use of resources, principles of Agenda 21, the need for everybody to be actively involved in addressing environmental problems. Social and environmental conflicts in SA, the role of factors shaping access to resources such as housing, jobs. Relevant case studies. History – Apartheid and how it affected people's lives.



4. Methodology

During the audit process the learners should be encouraged to **consider four distinct requirements**:

1. Identify the direct and indirect environmental aspects of the activities at the home or school. In other words, the learner must understand how their school or home interacts with the environment and what the impact of their action is on the environment.
2. Identify the environmental aspects that can be controlled or over which the school can have influence.
3. Arrive at a list of significant environmental aspects, based upon the relative environmental impact of each environmental aspect.
4. Develop a procedure to keep this information up-to-date.

To provide **guidance to the learners**, the following needs to be considered by the educators:

1. Ensure that learners work in groups – this is essential to gain the relevant information and also encourages team work.
2. The scope of the audit needs to be defined so that it can be compared to other schools (benchmarking) or compared to other audits to be done in the future. There are two common ways to organise an environmental review: by areas or by activities. To prepare for these steps, it will be helpful for the learners to have:
 - a clear overview of the physical layout of the area to be reviewed, including buildings, tanks, storage facilities and other significant installations and facilities up to (and including) the site limits;
 - an overview of the activities of the school, which needs to be considered as part of the audit such as the administration block or student accommodation.

Learners need to find information that is already available which could be useful, for example:

- map of the vicinity (municipal or district level) showing the location of the school and surrounding properties;
- general photos, aerial photos of the school;
- plan of the electricity, water and sewage systems on the school.

One of the questions is to decide how far to go in the various considerations around the audit. For example, a 'cradle to grave' life cycle assessment looks at the environmental impacts of a product or service from the extraction of raw materials, their transport to site, activities at site, the environmental impacts of use and the product's final disposal. It is a very thorough analysis but not easy to do and certainly time-consuming.





This information should then be used to define the scope of the audit:

- Does it include all the facilities, or focus on a few key activities and facilities?
 - Does it include staff accommodation on the property, or other auxiliary functions, if applicable?
 - Does it only look at the actual resource management on the school property, or does it look at the whole life cycle (cradle to grave)?
3. Learners need to understand that there are different methodologies that they can use for the data collection depending on the situation. They can start by doing a **survey**: walking through all the different facilities, and determining the different types of appliances (lights, taps, toilets, fridges, etc.) as well as **measuring** the usage per item (Watts indicated on the appliance or measuring water from a tap); they can identify the relevant consumption **patterns** (such as how often an appliance is used).

Learners will have to **interview** staff or other learners to get details around usage of frequency or general characteristics of certain appliances (such as fridges). Surveys are useful tools for measuring less quantitative activities, such as meeting awareness-raising objectives.

Audit sheets have been developed for use in the schools, but might need to be adapted depending on the local situation.

4. The school audit team needs to define a strategy for collecting and analysing data - ensure that data collection methods are simple and systematic and fully understood by all the people collecting the data. Details should be included on to a spreadsheet, and any **assumptions** that are made need to be indicated so that they can be referred to during the analysis. Encourage the learners to ensure that specific people in the audit team are responsible for collecting data and that it is well managed.

Learners should set **time frames** for specific actions so that the audit team can provide feedback and any problems can be addressed early in the process.

The project needs to be **communicated** within the school. Ensure that the relevant staff members at the school (including key people such as the care taker) are informed about the process; they should provide learners with the appropriate information as required.

All the data will need to be interpreted at the end of the project so that a **retrofit plan** can be proposed for implementation at the school. This will then result in savings over the long term. This initial exercise whereby the audit team is required to collect, collate and assimilate data clearly covers the salient points of Learner Out-





come 1 in the National curriculum, which states that learners must be able to:

“use process skills, critical thinking, scientific reasoning and strategies to investigate and solve problems in a variety of scientific, technological, environmental and everyday contexts...”

5. It is important that the learners identify environmental aspects and impacts¹. All the activities at the school have some impact on the environment, but it is important to ensure that the approach to identify the impacts and aspects is rigorous and consistent throughout the school.

The following process can be followed by the learners for implementation of the actual audit:

4.1 Venue description

This part of the activity clearly allows the educator to assess the learners' abilities to organise themselves and assess their immediate school environment while working as part of a team. Language skills are required to clearly describe the venue and key activity areas. Life orientation skills are developed as learners participate in a group project to address a contemporary social and environmental issue.

The learners need to provide a brief description about the **use of the venue** (school), **number and type of rooms** (for example 10 class rooms and one office) and an **indication of occupancy** (e.g. one room used as a store room, others used 220 days per year on average). This description should be short and to the point, including all the main aspects that could influence the usage of resources and possible assumptions that might have to be made. The educator may request more details to ensure that the learners can provide a comprehensive overall summary.

Within the venue (school) the learners will be required to identify the **key activity areas**, which could be the kitchen, office, library or class rooms. This will assist to compare different key activity areas that are in different venues. As an example, most of the classrooms could be lumped together during the audit, where as the kitchen and office should be kept separately.

4.2 Data collection

Mathematical literacy is developed as learners investigate issues and choose methods to summarise and display data in statistical charts and graphs. Learners need to plan and conduct an investigation, analyse findings and communicate them in the Life Sciences Learning Area. Life science knowledge needs to be applied to everyday life; human influences on the environment need to be investigated through problem solving and decision making. The ability to interpret the data and display it visually in graphs is a valuable skill.

¹ To understand the definitions of aspect and impact, 'cause and effect' provides a useful simplification. The **aspect** is the **cause** of the **impact**, which is the change to the environment, or the **effect**.



To ensure an accurate audit with reliable results, it is essential to obtain accurate data. The overall usage of the venue (school) can be determined through the utility bills, but more detailed information is needed to determine what resources are used in different areas, so that more effective systems can be implemented. Detailed information can be **calculated** through determining the number and type of the different appliances and how they are used. Learners are required to do simple calculations as outlined below and in the audit sheets:

Appliance	Power use (Watt)	Hours/day in use	Number of appliances	Ave kWh per day (Watts x hours x no/1000)	Average kWh per month
Light bulb - Incandescent	60W	4 hours	7 lights	$60 \times 4 \times 7 = 1680 / 1000 = 1,68$ kWh per day	$\times 30 = 5,04$ kWh/month

Note: 1000W = 1kW

Utility bills (municipal accounts) usually include energy and water consumption with associated costs and can be very helpful. It is essential that this type of data is collected over a period of time (preferably about 36 months). This information is generally only given to the owners or managers of property, so the educator would have to request this from the school on behalf of the learners. The learners can then interpret the information and provide a summary about the amount of water (kilolitres) and energy (kilowatts) used, which will need to be compared to the audit calculations.

Note that a school could have more than one metering point or more than one invoice (utility bill). Refer to the activity sheets for an example of collection of data. By scrutinising the utility bills of the school, the learners should be able to critically assess and understand current methods used to calculate energy and water consumption. This exercise will develop scientific reasoning and highlight how actions can be translated in monetary value i.e. if you leave a light on, you use more energy; hence a higher school electricity bill. This is vital in terms of developing and strengthening social responsibility.

4.3 Policies

Where there are policies (e.g. waste separation or landscaping policy) they need to be **listed** and if possible **copies** need to be obtained (if a formal written policy) or **described** in short (if verbal or informal). Also make note of any **awareness raising or training** programs that might be in place. This can reflect anything that the school is already implementing that could have a positive impact on the audit.

4.4 Assumptions

It is imperative that any assumptions that are made during the audit are recorded and transparent to give credibility to the process. Assumptions need to be constant throughout the process of the audit; the audit team needs to work together to ensure this—due



to this reason it is best to have a small audit team. Team work and acting responsibly are key elements in this audit.

4.5 Analyse and collate data - make recommendations

Once the data has been collected it needs to be collated and analysed to ensure that the right conclusions are reached. These conclusions will then be used to make recommendations for implementation through a retrofit plan.

Here learners will need to either demonstrate or be directed by educators on how to scientifically evaluate and interpret data. This will allow for informed decisions to be made which is critical for scientific thought-development and problem-solving.

4.6 Retrofit plan and implementation


Retrofitting refers to the addition of new technology or features to older systems, such as replacing an electric geyser with a solar water heater. A retrofit plan can be compiled for the school based on the findings of the audit.

A retrofit plan will outline all the areas within the school that need to be addressed over the short, medium and long-term, attached to an associated budget and indicating pay back times. As an example all the light bulbs in the school could be changed from incandescent lights to CFL lights– if there are 100 lights and the lights cost R5 each, then it would cost R500 to do the replacement of all the lights. This could then be compared to the cost of incandescent lights and the running cost taking the difference of the wattage into account.

Example of replacing 100 incandescent lights (80W) with CFLs (18W) with a rate of R0,35 per kWh of electricity used if the lights burn 5 hours a day:

Type	Unit cost	Installation cost	Watts	Energy consumed	Operational cost (per day)
Incandescent	R2	R200	80	100 x 80 x 5= 40 kW	R14.00
CFLs	R5	R500	18	100 x 18 x 5= 9 kW	R 3.15
Difference	R3	R300	62	31 kW	R10.85





To determine the pay back time you need to calculate how many days you will need to cover the installation cost based on the operational cost:

$$\text{Pay back time: } 300 / 10,85 = 27.6 \text{ days}$$

So, although the installation will cost R300 more, this cost should be recovered over a period of less than a month and from then onwards there will be additional savings.

Though determining the installation cost and possible savings on the operational cost a motivation can be made for funding of projects that will actually save the school money over the longer term. This retrofit plan should be compiled in such a way that it could be presented to possible funders to obtain financial support for the implementation thereof.



School Green Audit : Waste					
Auditor name		Team			
Venue		Date			
Type of waste	Amount of waste	Measuring unit	Recycling potential	Current recycling	Cost for recyclables
<i>Give a short description of the type of waste</i>	<i>Measure the amount of waste</i>	<i>Measuring unit (bag / kg)</i>	<i>Can this be recycled?</i>	<i>Is this currently being recycled?</i>	<i>How much can you make if it is sold?</i>
<i>e.g. cardboard</i>	2	kg	yes	no	R0,25 per kg
Cardboard (K4)					
Electronic/IT					
Furniture					
Glass					
Metal: general					
Metal: tin cans					
Organic: food					
Organic: garden					
Other packaging					
Paper: other					
Paper: white					
Plastic: PET #1					
Plastic: HD #2					
Plastic: PVC #3					
Plastic: LD #4					
Plastic: PS #6					
Other:					

Determine if any of the following **hazardous waste** is being disposed and the frequency

Type	Possible usage	Yes	No	How often
Batteries	Torches, remote controls			
CFLs	This contains mercury			
Chemicals	Maintenance			
Medical waste	First aid, sanitary waste			
Oils	Mechanical oil			
Paint	Maintenance			
Other:				

Determine if any of the following **cleaning material or chemicals** is being disposed and the frequency, and indicate the product name:

Type	Name of product	Yes	No	How often
Bleach				
Carpet cleaner				
Dish wash liquid				
Disinfectant				
Floor shine				
General surface cleaner				
Oven cleaner				
Softener				
Toilet cleaner				
Washing powder				
Other:				

Provide an outline of the different types of **waste containers** available (number and size):

Type	Describe & indicate placement if fixed	Number	Size
Compost heap			
Dustbin			
Skip			
Wheelie bin			
Worm farm			
Other:			

School Green Audit : Energy

School Green Audit : Energy					
Auditor name			Team		
Venue			Date		
Appliance	Power use (Watt)	Hours per day in use	Number of appliances	Average kWh per day (Watt x hours x no/1000)	Comment
<i>Give a short description of the appliance or fixture</i>	<i>What is the rating for this item?</i>	<i>How many hours is it used per day?</i>	<i>How many of these items are there?</i>	<i>Calculate the kWh (60x4x7)/1000</i>	<i>Make any comments relating to the item.</i>
<i>e.g. light bulb Incandescent</i>	60W	4 hours	7 lights	=1,68 kWh / day	
Lights - CFLs					
Lights - incandescent					
Lights - down light					
Lights - fluorescent					
Lights - fluorescent					
HVAC - heating					
HVAC - ventilation					
HVAC – air condition					
Fridge - stand alone					
Fridge - walk in					
Deep freezer					
Hot Water Geyser					
Kettle/Urn					
Stove					
Microwave					
Toaster					
Extractor fan					
Dishwasher					
Laundry - washing machine					
Laundry - tumble dryer					
Laundry - iron					
Water pump					
Television					
Laptop					



School Green Audit : Energy					
Auditor name			Team		
Venue			Date		
Appliance	Power use (Watt)	Hours per day in use	Number of appliances	Average kWh per day (Watt x hours x no/1000)	Comment
<i>Give a short description of the appliance or fixture</i>	<i>What is the rating for this item?</i>	<i>How many hours is it used per day?</i>	<i>How many of these items are there?</i>	<i>Calculate the kWh (60x4x7)/1000</i>	<i>Make any comments relating to the item.</i>
<i>e.g. light bulb Incandescent</i>	60W	4 hours	7 lights	=1,68 kWh / day	
Data projector					
Computer					
VCR/DVD player					
Security					
Office/management					
Other:					
Other:					
Other:					
Other:					
TOTAL ELECTRICITY USAGE					kWh per day

Determine if any of the following energy sources are used (please tick):

Type	Possible usage	Yes	No
Liquid petroleum gas (LPG)	Cooking in kitchen, laboratories		
Petrol	Generator, vehicles		
Diesel	Generator, vehicles		
Renewable energy	Solar panels, wind energy		
Other:			

If yes, then please describe:

--

Please note any assumptions made during the audit for future reference

--

School Green Audit : Water					
Auditor name			Team		
Venue			Date		
Appliance	Water use (litres)	Frequency	Number of appliances	Average usage per day (litres)	Comment
<i>Give a short description of the appliance or fixture</i>	<i>What is the rating for this item?</i>	<i>How often is it used per day?</i>	<i>How many of these items are there?</i>	<i>Calculate the usage 9 x 5 x 4 = 45 litres</i>	<i>Make any comments relating to the item.</i>
e.g. toilet	9 litres	5 times	4 toilets	45 litres per day	Duel flush
Hot Water					
Shower					
Hand wash basin					
Cleaning – dishes					
Cooking					
Other - sinks					
Other:					
Other:					
Cold Water					
Toilets					
Urinals					
Cleaning – clothes					
Cleaning – floors					
Gardening					
Other:					
Other:					
TOTAL WATER USAGE					Litres per day

Determine if any of the following water sources are used (please tick):

Type	Possible usage	Yes	No
Borehole	Garden/toilets		
Rainwater harvesting	Garden/toilets		
Effluent water	Garden		
Other:			

If yes, then please describe:

Please note any assumptions made during the audit for future reference

School Green Audit : Biodiversity

Auditor name		Team	
Venue		Date	
Answer the question	Yes	No	Comment/solutions
Do you have an eco club at your school?			
Does the car park at the school have permeable paving so that water can soak into the ground?			
Are most of the plants indigenous (naturally occurring) to the area?			
Do you often see birds and insects at your school?			
Do you have any facilities to encourage bird life?			
Is there a lawn area that needs mowing and watering?			
Is there a vegetable garden?			
Are organic pesticides or herbicides used at the school?			
Is there a nature reserve close to the school?			
Does your school have an irrigation system with automatic timers? When are they triggered to go off?			
Does your school have potted plants and or planters in communal areas? Are these indigenous plants?			
Are there any school pets/mascots?			
Does your school have large trees in the parking lot or fields?			
How are the tree clippings and grass cuttings disposed of?			





Notes





**A collaborative project developed by the
Africa Centre for climate and Earth Systems Science
(ACCESS) and the City of Cape Town**



CITY OF CAPE TOWN | ISIXEKO SASEKAPA | STAD KAAPSTAD

THIS CITY WORKS FOR YOU