



Project Guide: Sustainability Plan

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Sustainability Plan

A guide to producing a sustainability plan in your classroom, at your school or in your community.

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The Gaia Project is a charitable organization dedicated to providing project based learning opportunities in the areas of energy, environment and sustainable engineering.

We develop projects, provide professional development, technical support and ongoing project support for teachers and students. Our projects aim to incorporate three key principles, which symbolise our focus on realistic environmentalism.

1. **Data Informed Decisions** – We want students to be able to explain why, and quantify the effect of each decision they made along the way to their final solution.
2. **Economic Assessments** – We expect students to be able to assess the cost effectiveness of their solutions, and be able to optimize their projects with limited budgets.
3. **Environmental Impact and Lifecycle Assessments** – We need students to take a holistic view to their projects. This means looking at their projects from cradle to grave, as opposed to just examining the use phase, and acknowledging that greenhouse gas reduction is not the only environmental issue at stake.

For more information, please visit www.thegaiaproject.ca

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Sustainability Plan

Sustainability Plans are becoming an increasingly common thing for corporations and organizations to develop as we focus more and more on our environmental impact. So what exactly is a Sustainability Plan?

Sustainable development is often defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The word environment does not appear in that definition and that is important. In order to be truly sustainable we need to consider our actions from a number of viewpoints – their environmental, economic and social impacts.

So a Sustainability Plan is a roadmap for an organization or an individual to follow on their way to meeting their own needs without compromising the ability of future generations.

Since our environmental impact is generally the problem area, this usually means finding ways to reduce our environmental impact without imposing undue economic or social burdens. In fact we can often make economic and social gains by addressing our environmental impact.

Discussing with your class

Discuss with your class what the term Sustainability Plan means to them. Different people will often have different areas of interest and different areas of focus.

What would you study while developing a Sustainability Plan of your school or other building in your community?

This guide is going to focus on four main areas. These are not the only components of a Sustainability Plan, but are some of the areas

where you and your students could have the most direct impact.

The areas we will be looking at are:

- Energy
- Water
- Waste
- Food
- Transportation

A sustainability plan can be a huge task, especially when dealing with a large building, or organization. People, and even entire companies, and paid to do this for a living, so accomplishing it on a part-time basis in one semester or a few weeks is probably too much to ask. The great thing about it is that we can break it up into smaller parts.

Each of the above five areas can be looked at independently. There may be some overlap, like the energy used to pump and heat water, but generally you are not going to run into any significant problems. The list above is ranked in order of complexity, with the energy component being the most time intensive.

You can also divide each of the five areas into smaller categories to make them more manageable by a small group of students.

It is essential that you include your custodial staff and administration in the planning for any sustainability plan for a number of reasons.

Firstly, while collecting data and implementing some improvements, you are likely to be measuring or adjusting some of the school's facilities. It may not be safe to do so, or there may be a very specific reason of which you are unaware for its current setup.

Secondly, if you want your recommendations to stick or be implemented, you are going to need the support of your administration and of your custodial staff (who are responsible for a lot of the processes you may want to change).

Energy

Energy is used in our buildings for a variety of tasks and it can come in a variety of forms.

Virtually all buildings will use electricity, whether it comes from the local utility or is produced locally from renewable resources (solar, wind, hydro).

Natural gas and oil are two other likely sources of energy used in buildings, typically for heating.

Some newer buildings may even use solar, or geothermal for building heat (and even cooling).

It's important to remember that **all** sources of energy have an environmental impact. It's easy to think of that impact when we are talking about a coal fired power plant producing electricity with all the mining and emissions, but it also applies to renewable technologies such as wind and solar.

Even though no emissions are produced during operation, they probably were during construction - where did the raw materials come from? How much land is required to be cleared?

We can divide the way we use energy in buildings into three main categories:

- Heating
- Lighting
- Plug-in loads

We could also divide a large building into several smaller geographic areas, either by wing or by room type, such as:

- Gymnasium
- Cafeteria
- Standard Classroom
- Lab

- Workshop

Essential Resources

Energy Audit: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/energy>

This guide serves as a brief introduction to the energy portion of the sustainability plan. It refers heavily to the four project guides listed below which break the area down into smaller, discrete (and more manageable) chunks.

Heating: The Gaia Project

<http://www.thegaiaproject.ca/sites/default/files/teacher-resources/project-guides/heating-audit.pdf>

Degree Days: The Gaia Project

<http://www.thegaiaproject.ca/sites/default/files/teacher-resources/project-guides/degree-days.pdf>

Lighting: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/energy-audit/lighting>

Plug-in Loads: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/energy-audit/plug-in>

Additional Resources

Mount Allison University Environmental Audits

<http://www.mta.ca/environment/audit.html>

The university hires student environmental auditors to update their ongoing sustainability plan.

Water

Water is so often ignored in Canada because of its abundance, but globally it's one of the biggest environmental problems we face.

Water used in buildings is typically used in:

- Bathrooms
- Landscaping
- Cooking
- Cleaning
- Drinking

Essential Resources

Water Audit: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/water>

Waste

Looking at waste in a Sustainability Plan presents an interesting challenge. Not only can we consider what we throw out, and if it can be diverted elsewhere (recycling, compost), but also if it needed to be thrown out in the first place (reuse), or even if it needed to be purchased or used (reduce).

In the waste hierarchy, we often focus on the recycling part of the 3Rs: Reduce, Reuse, Recycle, but this is just treatments of an existing problem – overconsumption – as opposed to addressing the problem directly. Examining reducing and reusing are much more effective waste reduction strategies.

Essential Resources

Waste Audit: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/waste>

Additional Resources

Waste Hierarchy

http://en.wikipedia.org/wiki/Waste_hierarchy

The classification of waste reduction strategies according to their usefulness: 1. reduce, 2. reuse, 3. recycle. It is most effective to first reduce the waste we produce by asking ourselves if we need the product. If we do need it, is there a way we can reuse it? When we can no longer reuse it, can we recycle it so that it becomes another product?

Food

Examining food can be an important part of a sustainability plan because the growing, manufacturing, transporting and disposal of food have many hidden environmental and social impacts.

The food audit is based on a lifecycle assessment—looking at food from its manufacture to disposal and everything in between, with the goal of redesigning it to be more sustainable. This can also be combined with a waste audit—examining the food that people throw out can give important information about packaging and portion size.

Essential Resources

Food Audit: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/food>

Transportation

The first three areas (energy, water and waste) look at the direct environmental impact of our buildings, but this one looks at how we get there.

You could have the most environmentally sensitive building in the world, but if people have to drive 2 hours to get there, they aren't going to be happy, it'll cost them a lot of money, and the impact on the environment could nullify every gain made in the building itself.

In this section, you can examine travel to and from the building and what could be done to improve the situation.

Essential Resources

Transportation Audit: The Gaia Project

<http://www.thegaiaproject.ca/projects/sustainability-planning/transportation>

Auditing

The purpose of an audit is to help your people and organizations find areas where improvements could be most effectively targeted. It's all very well to talk about reducing your environmental impact, but in order to do it effectively, you need to know where your impact is in the first place.

That's why the first step of any sustainability plan is the audit – and this means taking inventory. You need to identify who, what, where, when, and why something or someone is having an impact on the environment in your building.

A completed inventory will allow anyone to quickly identify the biggest contributors towards the buildings environmental impact, which is usually where the biggest gains can be made. We want to be able to target our resources (time and money) to the area where we are going to have the greatest impact.

The inventory also serves as a useful tool for continuous improvement. As changes are made we can keep the inventory up-to-date and track changes in a buildings performance over time.

Establishing the inventory may require some equipment (especially for the energy audit), and will require extensive data collection and experimental design.

Remember, **you can't manage what you don't measure**. This audit step is all about measuring.

Making Assumptions

It won't be possible to measure everything, nor is it really necessary. There are often assumptions that we can make to make our job a lot easier as long as we've thought them through.

For example, if we were conducting a water audit on student washrooms in the school we could firstly monitor frequency of usage at each bathroom in the school. If each bathroom is used by a similar number of students during each period of the day, we could do a comprehensive water audit of one bathroom and use this to generalize to all bathrooms in the school. It will be important to define what you will consider a homogeneous number of students **before** monitor usage frequency of each bathroom.

Learning how and when to make reasonable assumptions will be an important, but probably foreign, skill for most students.

Data Management

Another important skill for students to master will be data management. Taking the time to plan out data collection, as well as organizing and labeling this data will likely not come easy to most students.

While we recommend letting students spend a couple of days play around with data collection, the volume of data students collect can quickly become overwhelming.

Data management is an important part of experimental design because we should consider why we have chosen to collect certain data. In the end, it might be best to have less data and have made some sound assumptions than to have an overwhelming amount of data that can't be analyzed because we didn't think about what we wanted to compare beforehand.

Emphasize that a couple of minutes spent organizing and labeling data today will save hours later on.

It is essential that students have a clear idea of why they are collecting data, and have expected results before they actually begin collecting data.

Comparison of actual results to expected results can lead to identification of errors in data collection, or in making the hypothesis—both of which are useful lessons.

Data Collection Methods

We have several methods of data collection available to us, all of which have their pros and cons. Some of these are discussed below.

It is very likely that a combination of all of these methods will be required.

Continuous Observation

Physically observing the subject over an extended period of data. This obviously results in very accurate data, but is incredibly resources intensive

Datalogging

Where a sensor is available to observe the subject, a datalogger can be incredibly useful. It removes the time commitment, enabling you to monitor a subject for an extended period of time and receive virtually complete data.

Certain activities could be missed due to the sampling time—once a minute sampling will miss activity within that one minute period.

Large amounts of data can be collected very quickly which can become overwhelming.

Sensors may not be available for every situation.

Sampling

The only way to get perfect data for a one year period is to measure for a one year period. This however, may not be practical. Instead, we can sample appropriate times and assume these are representative.

For example, we could study a one week period and assume that is the average for every week. Or we could study several weeks and average them. Questions we would need to ask include whether or not there are seasonal variations, and if so, can we allow for them.

During a school day, we may only be able to

sample data during one period. Would it be appropriate to assume that this is representative of all periods? That's a question that will have to be answered on a case by case basis.

Surveys

Asking users of the device how often they use the device can be a quick method of obtaining an estimate of its use.

Surveys need to be used with caution, as they aren't always the most reliable source of information. Why is this?

Firstly, these are things people don't usually keep track of, and so don't have an accurate idea.

Secondly, surveys are subject to bias. People like to try and give the answer that the surveyor is looking for. In the case of a sustainability plan, people are likely to indicate that they are much more environmentally friendly than they actually are as soon as they realize the purpose of the survey.

Setting Targets

Setting targets is an important part of any Sustainability Plan. These give you and others an idea of just exactly what you are trying to accomplish.

For example, reducing energy use by 1% a year will require a completely different approach than reducing it by 20% a year.

It is important to have both short term and long term goals. These could be:

- Achievements for this year;
- Three year target; and,

- Ten year target.

Having multi-year targets is essential in a school environment where students involved are unlikely to be the same from one year to the next. This gives a departing class a chance to leave a roadmap going forward and subsequent years a chance to see what is expected of them.

Setting your targets appropriately is always difficult, but you should keep these pointers in mind.

- Targets should always be achievable, but challenging to reach.
- There should be times when you don't meet your targets (hopefully you are close).
- Targets can be adjusted as you go through the process and begin to realize what is appropriate.

Identifying Improvements

After completing the inventory, we need to take steps towards making improvements. These changes come in two forms – physical and behavioural.

Physical improvements relate to making actual changes to a building / facility. This could be installing additional insulation to reduce heat loss, installing a composter, reducing the number of parking spaces in a parking lot, or reducing the amount of water used per flush in a toilet.

Behavioural changes on the other hand relate to people making changes to the way they act and make decisions. This could be turning lights off when you leave a room, using a reusable travel mug for drinks, shortening the length of

your shower, or carpooling.

Physical and behavioural changes are not mutually exclusive. We can make physical changes that are designed to encourage behavioural changes. Reducing the number of parking spots for example is a physical change designed to cause a behavioural change – where people find an alternate way to travel to and from the building. Installing a composter is designed to encourage people to compost waste.

Physical changes often involve a financial expense and are therefore often harder to implement. People will want to see the potential return on investment for the expense, and we will talk about how to do that later. That said, many of the physical changes also don't rely on people changing their behaviour, which can make it much more reliable. Installing additional insulation for example will reduce heat loss regardless of whether the building occupants take any action or not.

Behavioural changes on the other hand are usually much cheaper (and often free) to implement. It doesn't cost anyone anything to turn lights off when they leave a room. However, people need to be convinced to make that choice repeatedly for it to have an effect. In order to do that, we need to make the task:

- as easy as possible;
- as enjoyable as possible; and,
- seem important to people.

Additional Resources

The Fun Theory

<http://www.thefuntheory.com/>

This project is a great way to demonstrate how you can change behaviour for the better by making the task fun. Obviously, the expense involved in some of these projects is probably

too great, but the idea is sound (particularly the stair case piano).

Calculating Savings, Costs and Benefits

Calculating savings made from any of the proposed changes is an essential step. Before we actually implement any changes, people are going to want to see that the change is one worth making.

As mentioned earlier, we want to direct our resources to where they are going to be most useful.

Savings don't always have to be financial (although those will usually get the most attention). We can also calculate any environmental benefits (such as tonnes of CO2 avoided, or tonnes of material diverted from landfill) as well as any social benefits (perhaps better working conditions).

One of the key elements here is going to be the cost benefit / analysis. This allows any decision maker to see the costs and benefits of any proposed change. Where the benefit can be seen in financial terms, we can also calculate how long it will take to pay back the initial investment.

Say for example we invest \$50 to save \$10 a year in energy. A very simple cost benefit analysis tells us that it will take 5 years to pay back the initial investment.

It may seem like many of the benefits can't be viewed from a financial perspective, but very often they can. Improved working conditions could lead to increased employee productivity

and lower numbers of sick days, both of which have a financial impact.

Reduced CO₂ emissions, means lower mitigation costs for climate change (maybe our flood defences won't have to be quite as high). We can usually assign a cost to society for each tonne of CO₂ emitted (although finding the right price is usually difficult).

Essential Resources

Calculating Savings: The Gaia Project

<http://www.thegaiaproject.ca/sites/default/files/teacher-resources/additional-resources/calculating-savings.pdf>

Presenting Recommendations

Chances are that you don't have the authority to make all of the changes that are being considered. It is very likely that you will have to try and convince someone else in your school, or district, or province that the change is a worthwhile one – and that means presenting them with the findings. These presentations should be clear and concise, covering the following topics:

- **Current situation:** *where are we today?*
- **Recommendations:** *what can we do?*
- **Cost:** *how much will it cost us?*
- **Impact:** *what will the benefit be?*
- **Payback:** *is there a return on investment*
- **Further Work:** *is there anything else we need to study before we proceed?*

Implementing Improvements

Implementing the recommended improvements is the next step. You are likely to be limited as to what you can achieve here without significant buy-in from your school district. Some of the physical changes may require a substantial investment, significant studies, and professional installation staff and are obviously outside the range of a school project.

Smaller physical improvements may be possible, such as adjustment of temperatures or lighting in a classroom; and behavioural changes are particularly appropriate to make.

Again, make sure you liaise with your custodial staff and administration to ensure any changes do not hinder anything else that may be happening. Computers may need to be left on at times for scheduled remote updates for example.

Implementing behavioural changes are usually a case of effective marketing. How do you convince people to make a change to their life?

There are a variety of ways to do this.

Making people aware of the impact of their decision might be enough. For certain behaviours, people aren't even aware that they are causing a negative impact, and just pointing it out can cause a change.

This isn't enough for most situations though. Everyone knows that cars pollute, but that doesn't stop many people from driving around in their cars by themselves. You will probably have to take additional measures.

Quantifying the impact is often useful. Instead of just pointing out that they are having an

impact with their decision, actually inform people of the size of their impact – and not just from one perspective. Driving a car for example has an environmental impact, but also costs people money.

Social marketing can be effective. People behave in certain ways simply because everyone else does it. Peer pressure can result in a positive change; you are less likely to drive to work by yourself if all of your friends are on the bus, or walk/bike to school together.

Incentives can be another useful tool to cause people to make a change; however, it is unlikely that the incentive can stay in place forever, so people need to see a reason to continue once they have made a change.

All of the changes need to be as easy and as enjoyable as possible for people to respond positively. No matter how often you tell someone what the effect of their choice is, they are unlikely to recycle a bottle if they have to walk twice as far to do it versus throwing it in the garbage. They are unlikely to use a reusable travel mug if it is awkward and inconvenient.

It's hard to imagine recycling as an enjoyable thing to do, but just making it as easy as or easier than throwing something in the garbage, coupled with the right information can make all the difference. Or consider putting a basketball net over the recycling container!

Measuring Success

As we have said before, you can't manage what you don't measure. And that is still important. Even though you may have already implemented your changes, it is still important to track their performance and see if they are falling below, meeting or exceeding expectations.

This is usually as simple as following the initial measurement process conducted in the audit, and updating the inventory. You'll be able to track improvements over the years very easily this way and see if your estimates match up with the actual realized improvement.

If they do match – great. You can pat yourself on the back for a job well done and look for more improvements.

If they don't, then it is time to look at why. It is likely due to an assumption you had to make. *Was the equipment installed correctly? Are people behaving as expected? Are as many people taking part as anticipated?*

Looking at how things actually happened compared to your assumptions can assist you in determining whether you could improve the way you estimate, measure and make assumptions in the future.

Glossary

Sustainability Plan

An action plan that establishes a baseline, sets targets and allocates responsibility in order to make a building/organization more sustainable. This usually refers to environmentally sustainable, but should also include economic and social sustainability

Sustainable Development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs