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Hi Teachers!

We have completed this project based learning workbook to help in your planning of one of our projects. This document has been developed using the *Project Based Learning Handbook* from The Buck Institute for Education and in cooperation with the NB Department of Education.

This is not meant to be a prescriptive term plan but rather as a guide to help you in your planning. Included in the Sustainability Plan PBL workbook is a fully planned term calendar based on the District 18 calendar to help you get started.

What we've included in this package:

- PBL workbook
- Planning flowchart and term calendar
- Letter to Parents
- Sample table of contents for proposed reports
- Rubrics
- Team building activities

We want to be a continuing resource for you. We've developed an extensive network of contacts in the energy and environmental sectors in New Brunswick and the Maritimes. Combine that with our own experience and we should be able to find an answer, or find a person or organization with the answer to any questions you have and provide you with any additional resources you might need.

If you ever have any questions or comments, please get in touch with us.

Regards,

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The Big Picture

Title: Sustainable Design	**Duration:** 6 weeks, or 30 class sessions (recommend building in at least 2 flex days for school cancellations or other lost classes)
Course: Environmental Science	**Grade Level:** 11/12

Project Idea: Summary of the issue, challenge, investigation, scenario, or problem	Critically examine consumption and waste in students' everyday lives. • Plan and implement a waste audit (either at school, individually, or at home) • Conduct a life cycle assessment on a product: trace its impact from manufacture to disposal • Propose a redesign of the product • Use waste audit and life cycle assessment to develop school-specific, realistic waste reduction strategies • Implement waste reduction strategies • Assess whether waste reduction was successful
Learning Outcomes: SCOs from Unit 3 of the NB Draft Environmental Science Curriculum	1. Identify the stakeholders and trace the history of the issue – *Stakeholders will be consumers, solid waste commissions, manufacturers and retailers. Trace the history, or life cycle, of a product in the context of examining our own consumption habits.* 2. Explore the economic, social, cultural and environmental impacts, locally, regionally and beyond – *Examine the impacts of waste disposal and overconsumption locally. Compare waste disposal at home to other areas in Canada and around the world – consider places with reputations for doing better and those for doing worse.* 3. Identify the perspective and mandate of local, regional and national environmental organizations – *Identify organizations whose mandate is related to waste diversion and sustainable living.* 4. Demonstrate the effective and critical use of various investigation and research methods – *Use various sources of information to trace the product's life cycle such an the internet, surveys, contacting manufacturers/retailers.* 5. Design and carry out an experiment to test an impact of the issue on the environment – *Conduct a personal (or school-level) waste audit and subsequently trace the impacts of a product of their choosing throughout its life cycle.* 6. Determine how current environmental legislation and policy applies – *Examine environmental policies related to waste management, as well as any legislation that product manufacturers/retailers must meet – local legislation can be compared to national & international.*

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	7. Demonstrate an understanding of alternate values and viewpoints – *Weigh the impacts of each step in a product's life cycle – positive vs negative impacts may be hard to identify because a stage in the product's life cycle may provide jobs but harm the environment.* 8. Synthesize and analyse information from a variety of sources – *Use life cycle assessment and waste audit to suggest ways to reduce personal waste, and waste at the school, as well as redesigning products to be more sustainable.*

21st Century Competencies:
To be explicitly taught and assessed
	• **Critical thinking and creative problem solving**
	  ○ *Teaching strategies*: activities on experimental design and data management, developing a team work plan, developing and implementing realistic recommendations to reduce waste
	  ○ *Assessment strategies*: work plans, daily accountability, effectiveness of marketing findings to school.
	• **Collaboration:**
	  ○ *Teaching strategies:* Subarctic Survival team building activity
	  ○ *Assessment strategies:* self and team progress reporting, self and peer assessments

Culminating Events: • Presentation on waste audit results • Presentation on life cycle assessment results • Implement waste reduction strategies at the school	**Audience:** The Gaia Project staff, school administration, solid waste commission representatives, all students at school

Possible Subject Matter Experts:	• Local engineers from sustainability/environment sector • Representative from local solid/waste commission We have contacts and relationships with many of these organizations, and would be happy to put you in touch with the right person, or help you track down someone. Let us know what you need.

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Driving Question:	By critically examining consumption and waste, can we implement strategies to reduce waste and become more sustainable consumers, both at home and at school? Students should refine driving question in their own words depending on their subject area of focus

Assessment Plan		
	Form of Assessment	**Method of Assessment/Rubrics**
Formative Assessments:	• Waste Audit Work Plan	See sample work plan table of contents
	• Student observation	Team Observation Checklist
	• Daily accountability sheets, or journaling • Regular self and peer progress reporting	- Self and Team Progress Report
	• Debriefing	Self-Reflection on Learning
Summative Assessments:	• Waste Audit Presentation	- Presentation Rubric - Audience Feedback Form (give out to 3 or 4 students in audience for each presentation)
	• Self- and Peer-Assessment	Teamwork Rubric
	• Life Cycle Assessment Presentation	- Presentation Rubric - Audience Feedback Form (give out to 3 or 4 students in audience for each presentation)
	• Effectiveness of marketing findings to school/peers	Presentation Rubric
Sample Assessment Strategy:	• 20% - Peer assessments • 20% - Work Plans and Progress Reporting • 10% - Life Cycle Assessment Paper • 20% - Waste Audit Presentation • 20% - Life Cycle Assessment Presentation • 30% - Effectiveness of Marketing Findings to School	

Knowledge and Skills Gap Analysis

Knowledge (K) and Skills (S) Needed by Students *to successfully complete culminating products and performances, and do well on summative assessments*		**Scaffolding/Materials/Lessons/Activities** *provided by you, other teachers, experts, mentors, community members*
Waste and consumption		Guest speaker from local solid waste commission
Life Cycle Assessment		Activity tracing the life cycle of a common product like a coffee cup
Experimental design		Activity on how to successfully design an experiment: • Begin with the end in mind, and collect data that will enable you to meet your goal. • Make sure you know how you are going to use the data **before** you start collecting. • Learning the value of assumptions, and determining when and how they can be of use.
Using Excel		Activity on manipulating data in Microsoft Excel, input formulas and produce meaningful, annotated graphs
Presentation skills		Mini-lesson on presentation skills, followed by midterm presentations with immediate feedback

Content and Resources	
Sustainable Design	Project Guide: http://www.thegaiaproject.ca/programs/pbl/sustainable-design/
Buy, Use, Toss unit	A unit developed by the Facing the Future institute called *Buy, Use, Toss* available for download at: http://www.facingthefuture.org/Curriculum/BuyUseToss/tabid/469/Default.aspx This unit follows a similar structure to the Sustainable Design project, but is much less project based. A useful resource for background information and case studies.

Management by Design

Resources Needed:	**Onsite people and facilities**	Collaboration with custodial staff and administration at school to ensure they know that students are conducting a waste audit. Their collaboration may also be required when students campaign a waste reduction strategy.
	Equipment	• Waste Audit: Sorting area, tarps, gloves, bags • Life Cycle Assessment: basic tools may be required for product disassembly
The "Grabber": Launch activity	Start by emptying the contents of the classroom waste bin. Ask students to classify the waste (they do not have to touch the waste, but rather survey it). Then have students compare their classification to that of their peers. Did people come up with similar strategies? If yes, why? If not, what were the major differences? Were waste classification strategies similar to that of your local solid waste commission? Ask students to resurvey the waste. Is there anything in there that could have been recycled? If yes, why do you think it ended up in the waste bin? Challenge students to think about the difference between needs and wants. What type of items were in the waste bin that represented things someone would like need (like an apple) vs an item of convenience like a disposable cup?	
Team Building Strategies:	• Subarctic Survival Consensus Building Activity • Team contracts assigning duties and responsibilities, and discussing methods of resolving any conflicts or disagreements.	
Team Management Strategies:	• Regular self- and peer-assessments • Daily monitoring of team work (team work checklist) • Daily accountability sheets • Progress report sheets.	
Debriefing: Exit activity	• Self-reflection on learning (see attached for sample) – we have built two into the project calendar. • Class Discussion • Preparation of report for next term's/year's class	