Tuggerah Lakes Secondary College Tumbi Umbi Campus
Teaching and Learning Program

Course: STEM	
Unit Title: Facing the Future	
Stage: 4	**Year Group:** 8
Length of Unit: 13 weeks	
4MAT Concept: Sustainability **Syllabus/content concepts:** Aspects of Physical World, Earth and Space, Number and algebra, Statistics and Probability, Measurement and Geometry, Technology Mandatory Stage 4	
Outcomes: See attached outcome sheet.	
Unit Essential Questions: Predict the exploitation of a renewable resource What is my favoured learning style? What is a built environment? What is the Design Process? Experiment with a variety of sustainable investigations relating to energy, water and materials What is the scientific method? How do I utilise the design process in the production of my design solution? **Background/Prior Knowledge:** No required background/prior knowledge required. Suitable for any Stage 4 class. Knowledge of the Design Process would be helpful but not necessary.	

Facing the Future

Design Situation

Our environment is under pressure, we need innovation and cooperation to work towards a more sustainable future, especially concerning the conservation of energy, materials and water. We may have to think about the built environment in a whole new way.

Design Brief

Facing the Future is challenging young people to collaborate in the creation of an innovative sustainable built environment.
Design a built environment that utilises sustainable materials and can harvest alternative forms of energy and water. Your built environment could fit any of the architectural, environmental, interior, landscape or structural design categories, but it must be presented as a scaled model with a supporting portfolio.

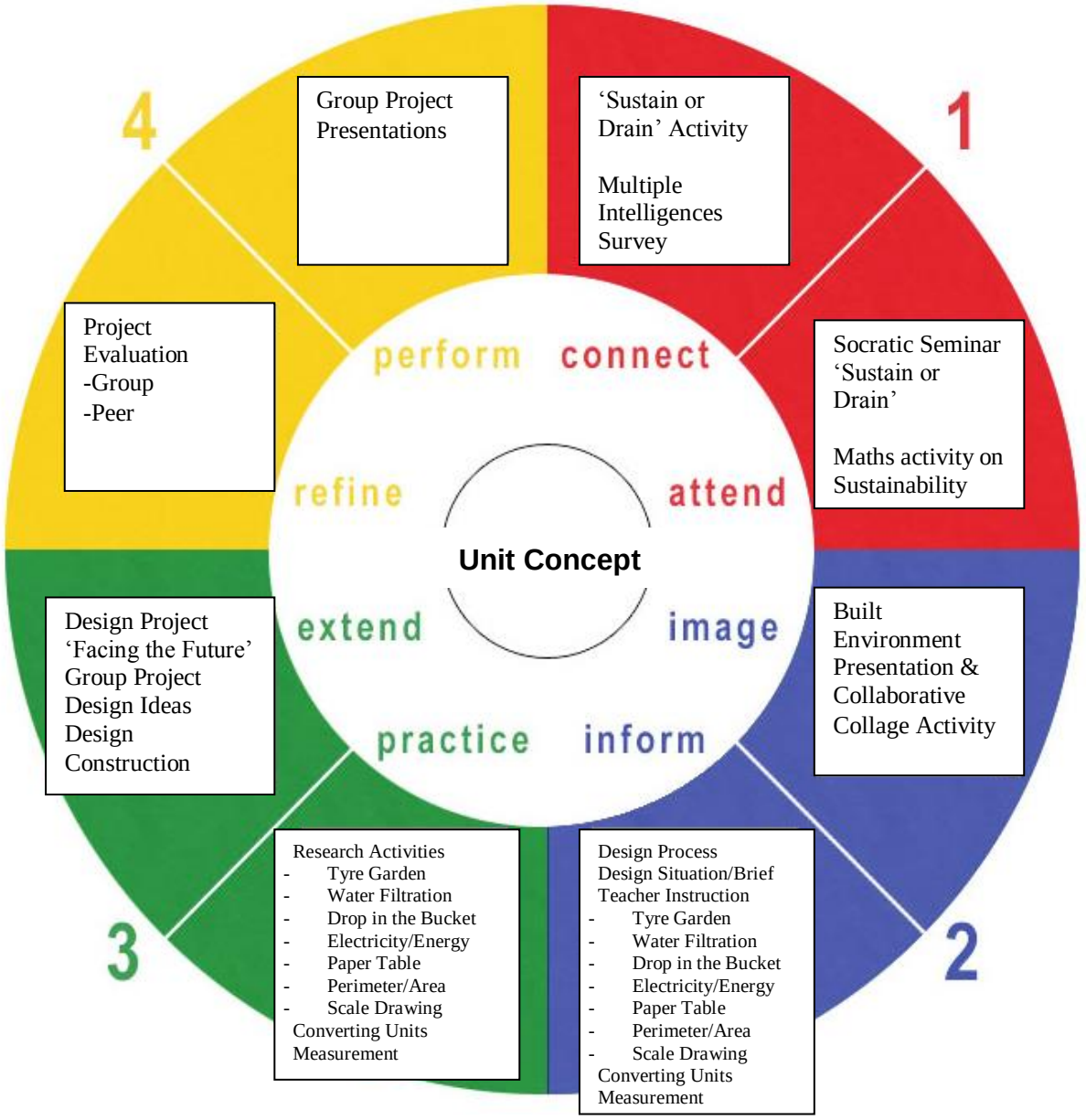
Assessment

1. ePortfolio presented using Google Sites
    - Criteria for success – will be established early in the project and be used as an ongoing evaluation tool to monitor progress and determine success.
    - Research & Experimentation – renewable and non-renewable resources; experiments into sustainability relating to energy, water and materials; energy efficiency; built environments.
    - Design Ideas – sketches, design modification, justification of design decisions, responses to peer feedback.
    - Final Design - scaled drawings supported with notes and/or legend to clarify all details, including environmental and sustainability considerations.
    - Construction – documentation from initial ideas to finished product (video, photographs, diary)
    - Evaluation - project evaluated against the identified design needs, specifications, quality, innovation, environmental and sustainability considerations. Assess the collaborative management processes of the group and identify areas for improvement.
2. Scaled Diorama/Model
3. Group Presentation

Timetable

The Facing the Future STEM unit is designed to run through the TAS faculty with year 8. The project will be run over 6 periods a cycle for 13 weeks. The breakdowns of lessons are:
4 x 1 hour periods with TAS trained teacher
1 x 1 hour period with Science trained teacher
1 x 1 hour period with Mathematics trained teacher
By the end of 2016 TLSC TUC will have taught the unit 3 times refining it along the way. The Math and Science teachers will be the experts that are called upon during the whole unit. TAS teachers will help in the preparation of specific Math/Science lessons that may arise from inquiry lessons. Math and Science lessons are also planned to meet the educational needs of the unit as it progresses.

Unit Outline:



General Capabilities: *(See Teaching and Learning Program to identify links to General Capabilities)*
Learning Across the curriculum used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW
http://syllabus.bostes.nsw.edu.au/mathematics/mathematics-k10/learning-across-the-curriculum/
The cross-curriculum priorities:

- *Aboriginal and Torres Strait Islander histories and cultures*
- *Asia and Australia's engagement with Asia*
- *Sustainability*

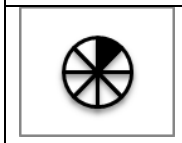
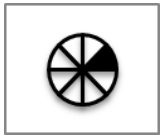
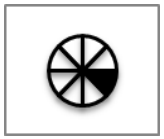
The general capabilities:

- *Critical and creative thinking*
- *Ethical understanding*
- *Information and communication technology capability*
- *Intercultural understanding*
- *Literacy*
- *Numeracy*
- *Personal and social capability*

Other learning across the curriculum areas:
Work and enterprise

The outcomes used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW.
http://www.boardofstudies.nsw.edu.au/syllabus_sc/

Science Outcomes	TAS Outcomes	Mathematics Outcomes
SC4-4WS, SC4-5WS, SC4-6WS, SC4-7WS SC4-11PW SC4-13ES	TAS 4.1.1, TAS 4.1.2 TAS 4.2.1, TAS 4.2.2 TAS 4.3.1, TAS 4.3.2 TAS 4.5.1, TAS 4.5.2 TAS 4.6.1, TAS 4.6.2	MA4-1WM, MA4-2WM, MA4-3WM MA4-4NA, MA4-5NA, MA4-6NA, MA4-7NA MA4-13MG MA4-19SP, MA4-21SP

4MAT	Outcomes	Suggested teaching strategies, learning experiences and necessary adaptations to meet student learning needs:	Student Products	QT/GC	Registration Date: Sign:	
	TAS 4.6.2	**Essential Question: Predict the exploitation of a renewable resource** Sustain or drain activity Students to participate in the sustainability game to introduce the concept of resource sustainability. See link below for full instructions. http://www.esdtoolkit.org/concept_intro/drain1.htm Theme song: I'm a survivor- Destiny's Child		PK EQ M		
		**Socratic Seminar** With the questions from the 'Sustain or Drain' activity Students to participate in a Socratic seminar using the questions in the above activity as a guide.		E HOT SS SC		
	MA4-19SP MA4-3WM	**Math activity in groups** Hands on sustainability activity, mathematical analysis of Sustain or Drain activity. **Essential Question: What is the most efficient way to ensure the supply lasts longer and everyone gets more lollies?** Students model the results of the activity, what were the different outcomes of the activity? In groups have the students represent lollies (L) algebraically and write an equation or expression. What would be the benefit of working out the most sustainable method of sharing resources? Number pattern for most efficiency = $4(2+2^n)$ http://www.esdtoolkit.org/concept_intro/drain1.htm	Expressions that solve the problem or begin to solve the sustainability problem.	PK HE KI C SS		
		Essential Question: What is my favoured learning style? Students to complete Multiple intelligences survey Complete survey, record the results on the worksheet and display them graphically. Give information on different types of surveys. Discuss that this is a		DU HE KI		

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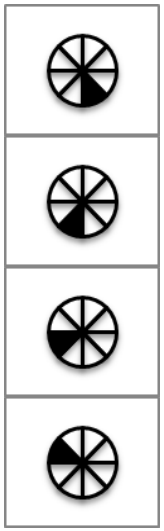	MA4-19SP MA4-3WM TAS 4.2.2 TAS 4.1.2 TAS 4.6.2 TAS 4.2.2	Likert-type scale survey. When students finish, we could discuss what the survey revealed about their learning style. Was this a valid or reliable survey? Where the learning styles in the class varied? What does this say about the group surveyed? How can this be helpful when planning groups for our project? Students will display their learning style graphs as part of a gallery in the room. Z:\8274_Common\STEM Engineering Fundamentals Survey **Essential Question: What is a built environment?** What is a built environment presentation? Jigsaw activity. • Architectural Design – design projects may result in plans, drawings, models and construction for buildings, set designs, facility design, exhibit design • Environmental Design – design projects may result in plans, drawings, models and construction that enhance or support natural environments such as public access routes, habitats, aquariums, land management systems, water management strategies, responses to environmental issues, plant production systems • Interior Design – design projects may result in plans, drawings, models and construction for layout and styling of spaces, finishes and furnishings • Landscape Design – design projects may result in plans, drawings, models and construction of residential, commercial and recreational spaces both internal and external • Structural Design – design projects may result in plans, drawings, models and structures such as bridges, shelters, enclosures for animals, play equipment.		DU PK BK HOT SC		

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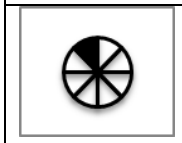	MA4-21SP	**Collage activity** Students are to form groups of 5. Each group member will be given a chosen built environment to research and to create a collage. The group will then come back to together to present their findings. Collages are to be displayed in the STEM room. Students are encouraged to give constructive criticism on collages. Critique is supported by scaffolded model such as PMI. **Venn Diagram** Similarities in relation to sustainable and unsustainable for environments illustrated in collages. In groups students learn about Venn diagrams and use these to show relationships among sets. The Venn diagrams will help the students classify environments as sustainable or unsustainable. The activity is designed to have students explore the different types of environments. following the script: To draw a Venn diagram, you first draw a rectangle which is called your "universe". In the context of Venn diagrams, the universe is not "everything", but "everything you're dealing with right now". Let's deal with the following list of things: houses, tents, caves, picnic areas, etc……whatever they can think of. Students complete a quick write, share this with a partner and then as a class create a mind map of things to put in the Venn Diagram. We'll call our universe "Environments": Let's say we want to classify things according to built and natural. We draw circles to display our classifications: Students then fill in the circles according to classifications and discuss what happens when you have overlaps. The overlap section maybe sustainable built and natural..... **<u>Essential Question: What is the Design Process?</u>** Students are to complete a jigsaw activity on the stages of the design process using the A3 laminated posters and cut up pieces on information.	Built Environment Collages Design Process	SC SS DU EQ SD I C DU HOT PK SR KI SC PK		

4MAT	Outcomes	Suggested teaching strategies, learning experiences and necessary adaptations to meet student learning needs:	Student Products	QT/GC	Registration Date: Sign:	
			Posters	M E HE SD DU HOT SC		
	TAS 4.1.1	**Design Situation** Our environment is under pressure, we need innovation and cooperation to work towards a more sustainable future, especially concerning the conservation of energy, materials and water. We may have to think about the built environment in a whole new way. **Design Brief** "Facing the Future" is challenging young people to collaborate in the creation of an innovative sustainable built environment. Design a built environment that utilises sustainable materials and can harvest alternative forms of energy and water. Your built environment could fit any of the architectural, environmental, interior, landscape or structural design categories, but it must be presented as a scaled model with a supporting portfolio.ng portfolio				
		Portfolio- Google Sites Introduce the use of Google Sites to document the design process digitally. Set up group site so everyone can contribute. Give students time to personalise the site.	Digital Portfolio	SD		
		<u>Essential Question: Experiment with a variety of sustainable investigations relating to energy, water and materials</u> **Building a tyre garden** Students to investigate fast growing, seasonally appropriate plants to grow in a tyre garden. Use the following website for appropriate options. http://www.abc.net.au/gardening/vegieguide/ They will plant seeds in recycled materials (e.g. plastic bottles, newspaper pots etc.)	Tyre Garden	DU PK M SD		
	TAS 4.2.1	**Water filtration activity** www.iteea.org/ Publications/TandC/Mar11.pdf		DU PK		

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	TAS 4.2.2	**Drop in a bucket activity** Benefits of renewable energy math lesson Differentiate between renewable and non-renewable energy sources. Describe the effects human actions have had on the environment over time and explain the need for alternative energy sources.		KI HOT		
	TAS 4.2.2					
	TAS 4.2.2 MA4-5NA MA4-7NA MA4-4NA MA4-6NA TAS 4.2.2 MA4-7NA MA4-2WM	**Electricity/Energy** **The Economics of Solar power** View the slide show Sustained by the Sun, describing how a community in Costa Rica constructed solar panels to power their biological reserve. Consider the costs and financial benefits associated with renewable energy. Find out how many kilowatt hours (kWh) of electricity your home or school uses each month. Research how many solar panels you would need to produce this much energy, the costs of installing, and when you could expect to see financial benefits. Students will compare the cost of installing a solar powered device and if this will be of a financial benefit. Research: cost of solar power, solar production from your school, students calculate the savings and do a cost/benefit analysis of installing such a device. Our school currently has solar energy and the students can log in and check the production. http://www.peacecorps.gov/wws/videos/sustained-sun/		KI DU HOT SD C EQ PK		
		Paper table Design squad nation paper table activity. Trial and error designing. Learning from errors and re-engineering to overcome failures. Brainstorm, design, build, test, evaluate, redesign.	Paper Table	PK HOT		

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	TAS 4.1.1 TAS 4.6.1 TAS 4.5.2	**<u>Essential Question:</u> What is the scientific method?**				
		Discuss the importance of following the scientific method and complete an ordering activity to understand the sequence and flow.		DU M HOT		
		Students plan an investigation using the scientific method to test				
		Energy efficiency Students investigate how energy is transformed from one form to another (e.g. electrical energy to light/heat/movement etc.), and how this relates to the energy efficiency of lights and other appliances in a built environment.		KI HE		
	SC4-11PW	**Investigating energy efficiency of different materials** Students design and perform an investigation to test the insulation properties of a variety of materials. The materials they will test could include polystyrene, metal roofing, tiles, foil, bubble wrap and any other readily available material that could be used to insulate a built environment. Specific equipment will be supplied (e.g. thermometers, stopwatches) that students will use to perform their investigation. Site to look at solar production at school login:8271 password: Tumbi150 https://www.webgraphs.com.au/Reporting/Pages/Dashboard.aspx		DU M HOT KI HE		
	SC4-4WS SC4-5WS SC4-6WS SC4-7WS	**Electricity - how does it work?** Students investigate the production of electricity by setting up a simple circuit connecting a copper coil and ammeter in series and moving a magnet within the coil to generate an electric current. They will then investigate the difference between series and parallel circuits and apply this understanding to their built environment.		KI HOT		

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	TAS 4.2.2 TAS 4.2.2 SC4-13ES SC4-4WS SC4-5WS SC4-6WS SC4-7WS MA4-13MG	**Renewable and non renewable resources and energy** Students investigate energy such as solar, wind, geothermal and nuclear as viable alternatives to non renewable alternatives to non renewable options. **Wind Power - Design a turbine blade** Students will design and test 2 blades that could be used on a wind turbine. They will then use the STELLR equipment to test the effectiveness of their blade. They will also research wind energy and its efficiency and decide whether it's a viable option to power a built environment. **Shapes and areas** Students will learn or use prior knowledge to calculate the areas of two-dimensional shapes. Students will use areas to solve related problems is of fundamental importance in many everyday situations, such as carpeting a floor, painting a room, planting a garden, establishing and maintaining a lawn, installing concrete and paving, and measuring land for farming or building construction. They will be calculating areas and the most efficient area shape with available resources. Students will move from area to volume. Discussing problems like why are most water tanks cylindrical? **<u>Essential Question: How do I utilise the design process in the production of my design solution?</u>** **Design Ideas** Utilising the research activities, their own creative and critical thinking, the student-design-groups are to sketch and annotate at least 3 initial designs to answer the design brief. The groups will then present their 3 initial designs to the class for feedback and recommendations from peers.	Design Sketches and idea presentation	  KI EQ DK HOT  BK DU KI E DK EQ		

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	TAS 4.1.1 TAS 4.1.2 TAS 4.2.1 TAS 4.2.2 TAS 4.6.1 TAS 4.6.2 MA4-13MG	**Converting units** Students will explore the golden ratio; first give them some patterns to solve. Include the Fibonacci sequence as the last pattern and discuss then watch the following link. Golden Ratio: https://www.youtube.com/watch?v=GmZlAVRKx8I Students will be working with various units of measurement. Lesson on converting lengths, volumes and energy units. When planning the blue print of their plan students will be required to convert between units of measurement to enable them to draw a scale diagram. **Creating blue prints lesson** This lesson is intended to further students' knowledge about the process of design, focusing on the mathematics and procedures of creating floor plan blueprints for their environment. Students will use grid paper to create a draft scale plan of their environment. **Geometry** • Use visualization, spatial reasoning, and geometric modelling to solve problems **Measurement** • Apply appropriate techniques, tools, and formulas to determine measurements **Working Mathematically** • Solve problems that arise in mathematics and in other contexts • Apply and adapt a variety of appropriate strategies to solve problems **Communication** • Communicate their mathematical thinking coherently and clearly to peers, teachers, and others • Use the language of mathematics to express mathematical ideas precisely	Annotated scaled design Drawings. converting units worksheet Scaled diorama/model	HE BK EQ SC BK DU EQ KI HOT		

4MAT	Outcomes	Suggested teaching strategies, learning experiences and necessary adaptations to meet student learning needs:	Student Products	QT/GC	Registration Date: Sign:	
	MA4-7NA	**Connections** • Recognise and apply mathematics in contexts outside of mathematics				
	TAS 4.1.1 TAS 4.1.2 TAS 4.2.1 TAS 4.2.2 TAS 4.6.1 TAS 4.6.2	**Final Design** Student-design-groups create scaled drawings of their chosen design. Drawings are supported with notes and/or legend to clarify all details, including environmental and sustainability considerations.		SC KI EQ		
		Design Construction Student-design-groups construct their scaled diorama/model of their sustainable environment using a variety of materials.		SC EQ SS		
	TAS 4.3.1 TAS 4.3.2 TAS 4.5.1 TAS 4.5.2	**Peer Evaluation** Students do a peer evaluation on each of the projects. The student-design-groups can use the feedback from these constructive critiques to make adjustments and improvements to their projects where needed. **Evaluation** The student-design-groups evaluate their project against the identified design needs, specifications, quality, innovation, environmental and sustainability considerations. The students will also assess the collaborative management processes of the group and identify areas for improvement.		SS SC E HE SS SC E HE		
	TAS 4.2.1 TAS 4.2.2					

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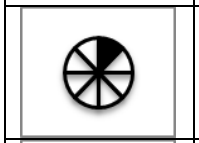
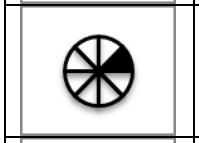
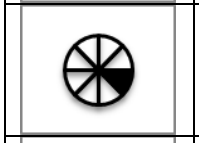
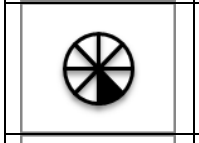
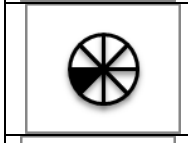
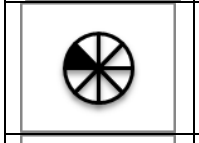
	TAS 4.6.1 TAS 4.6.2 TAS 4.6.1 TAS 4.1.2 TAS 4.2.1 TAS 4.5.2 TAS 4.6.2 MA4-1WM MA4-3WM	**Group Project Presentation** Students present their projects- dioramas/models and portfolio (Google Site) to the class. Guest architect/landscape architect invited to view presentations and give feedback. Most successful Facing the Future project as assessed by students, teachers and guest professional selected for whole year challenge. **LINOIT WITH LINKS TO SITES FOR ACTIVITIES** http://linoit.com/users/missgibbins/canvases/STEM		SS SC E HE		

Unit Evaluation

4MAT	Score 0-2	What works well?	What needs modifying?
			
			
			
			
			
			
			
			

Other comments:

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Teacher: _____ Date: _____Head Teacher: _____ Date: _____

Metalanguage	Definitions