

2019

Eco-Charge, An Eco-Friendly Substitute for Wall Sockets



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Big Ideas 2019

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Introduction

Who We Are and About Us:

We are a group of schoolboys from Bishops Diocesan College in Cape Town, South Africa. Bishops is an Anglican all-boys school founded in 1849 by Bishop Robert Gray to provide boys with a well-rounded education and produce respectable men who can add value to society. We are very privileged to attend such a prestigious school. Our group is comprised of four members. Our members consist of Thomas Maurel, Joshua Smith, Chris Welby-Solomon and Ronaq Sayed. We are a diverse group with many interests, strengths and weaknesses.



Name:	Interests:	Strengths:	Weaknesses:
Chris	Medicine, working with my hands, and global conflicts.	Strong leader, Innovative, and creative.	Often lazy or won't work if I don't see the benefit of it.
Thomas	Rowing, Science, Maths, Art	Creative, Determined, Motivated.	Procrastinator, Forgetful, doesn't always listen.
Ronaq	Golf, sport, formula 1, Mechatronic engineering, Gaming	Creative, innovative, generous, helpful, trustworthy	Procrastinator, lazy, zone out sometimes and focus on other things
Josh	Art, Rugby, Gym, Science, Engineering	Determined, creative, hardworking when needed	Lazy, weak work ethic, Distractible

Figure 1: In Order from Left to Right. Chris, Thomas, Ronaq and Josh.

About the Big Ideas Course:

As an alternative to the standard education system, we as grade nines were offered the opportunity to take the Big Ideas Course. This would replace the social science subjects of Geography, History, EMS, Biology and Life Orientation. To be a part of the course, we as individuals were required to send in an “audition” or persuasive narrative in any medium we desired (video, essay, song, etc.). We were then selected based on these and then sorted into our classes.

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Figure 2: Big Ideas Logo, As seen on The Bishops [Intranet](#). (Anon., 2018)

For the next eight weeks we were taught about and looked at all the United Nations Sustainable Development Goals in all its complexity, so that we could eventually choose an SDG, that we were interested about, to base our final project and presentation around. We were put in groups of 4 or 5 based on which of the 17 goals we want to try and find a solution to or contribute to solving. After the August holidays, in time building up to the December exams we were left to our own accords to design and implement our very own Big Idea. This document is a complete synopsis of our journey on the Big Ideas program, including our failures, successes, mistakes and reflections along the way.

The SDG's:

The Big Ideas Course is offered to us as an opportunity to learn about the Sustainable Development Goals in a more in-depth manner. The Sustainable Development Goals (SDG's) or Global Goals, were designed and adopted in 2015 by all participating nations of the United Nations (United Nations Development Program, 2019), excluding North Korea, who did not attend. (Sustainable Development Knowledge Platform, 2019)

The Sustainable Development Goals were designed to take action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. There is a total of seventeen unique Sustainable Development Goals, each with their own ten sub-goals. These goals have been designed to be integrated and inter-connected. In other words, an action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability. (United Nations Development Program, 2019)



Figure 3: The Sustainable Development Goal's poster as shown on the United Nations website



Figure 4: The Millennium Goals as Proposed by the UN. (2000)

These goals were put into place to succeed the Millennium Development Goals (MDG's), which ended in 2015. Unlike the Sustainable Development Goals, the Millennium Development Goals were less in number, only having eight Unique Goals, that were much more direct and specific than The SDG's. Although the legacy and achievements of the MDGs provide a good foundation for the Sustainable Development Goals, these goals were mostly left unfinished, resulting in millions of people's problems not addressed. The SDGs aim to build on what the MDGs stood for and aimed to achieve. (World Health Organisation, 2019)

The SDGs are unique in that they cover issues that affect us all. They reaffirm our international commitment to end poverty, permanently, everywhere. They are ambitious in making sure no one is left behind. More importantly, they involve us all to build a more sustainable, safer, more prosperous planet for all humanity (United Nations Development Program, 2019)

The Goals We Have Chosen:

SDG-9: Industry, Innovation and Infrastructure



The planet we live on is experiencing something never seen before. The rapid population and economic growth, coupled with the invention of numerous cheap, man-made substances such as polystyrene over the last 150 years have unveiled new threats to the world such as overpopulation, global warming, and pollution. We are spewing toxic waste and chemicals into the environment around us, the environment we depend upon for our survival, at unimaginable rates. SDG 9 is aimed to create sustainable economic and population growth, build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation and eradicate harmful or toxic chemicals entirely by 2030 in order to ensure the survival of our planet. (Sustainable Development Knowledge Center, 2019)

SDG-11: Sustainable Cities and Communities



SDG 11 is one of the harder and more ambitious SDG's to tackle through the Big Ideas program, as we only have three months to create our final project. It is also however, one of the most important. It aims to make cities and communities that generate their energy through renewable means, are safe for all citizens and have minimal impacts on the environment, while at the same time providing room for uninhibited economic and population growth. (Sustainable Development Knowledge Platform, 2019)

Why We Choose These Goals:

Originally, we were in different groups. Chris and Thomas had selected do SDG 9: Industry, Innovation and Infrastructure, the two of them chose to do this goal as each of them has an interest in and is fascinated by technology and the direction it is going and could go in the future. The two of them both have a technical and mathematical style of thinking and greatly influenced them to choose these goals. Before they had chosen which goal to do, the two of them did not intend to choose this Sustainable Development Goal. Chris had his eyes on doing SDG 3: Health and Well-being, whilst Thomas was thinking about either doing SDG 6: Clean Water and Sanitation or SDG 14: Life Below water.

Ronaq had selected to do SDG 11: Sustainable Cities and Communities. He had chosen this goal as he has an interest in the concept of creating self-sufficient and sustainable cities and how they work and could work. Ronaq also wants to go into the field of engineering and wishes to work on creating and developing sustainable cities in the future.

The final member of our group is Josh who originally did not choose to be in either SDG: 9 or 11. Instead Josh had chosen to do SDG 14: Life Below Water because he wanted to gain more knowledge and eventually do something to combat climate change. When the group had too many members, he nominated to go to his second choice which was SDG 9. He chose this due to his interest in design and civil engineering and the aspect of sustainable living.

Problems We Planned to Address:

As previously stated, the SDG's we have chosen were SDG-9: Industry, Innovation and Infrastructure and SDG-11: Sustainable Cities and Communities. As such our underlining problem that we plan to address is 'To create a sustainable and safe environment/Community using technology'. Since the solution we aim for is quite vague, we can adopt any of the other SDG's to achieve our goal if it reaches our requirements of machining a safe/sustainable community and utilizes technology.

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Narrative

The Beginning

At the start of the third term when we had first split into our groups, we were quite lost and stuck in the cloud. During our journey through the big ideas course we spent many hours in this period between ideas. The cloud is a part of the creative process relating to how we brainstorm and come up with ideas with a complexity where everything is interconnected approach rather than a linear pattern where everything has a fixed outcome. (Talks, 2014)

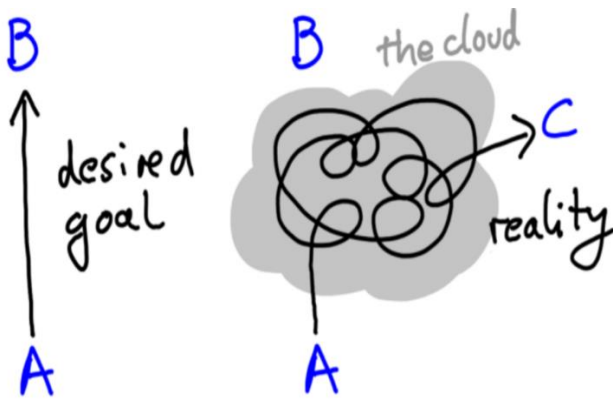


Figure 3: A Linear process vs a Complexity approach.

A complexity approach looks at all aspects of a situation or idea and anticipates possible problems before we encounter them, whereas a linear approach focuses merely on getting from A to B as soon as possible.

Our First Idea:

When we first sat down as a group our first idea was to make a completely sustainable building that would be able to generate its own energy, recycle its own water wastage and produce food. The first thing we looked at, was the design of this building. The first design we looked at was a tower. The idea behind this design was that as a tower it would take up less area while maintaining a high population density. In the 3 months and we had, we all did research for each of our multiple ideas. For the sustainable building, we researched what makes a skyscraper sustainable and how city design could lead the way to a better future (Calthorpe, 2017).

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Figure 4: First Design of Our First Idea.

The first thing we looked was how we would produce power for this building. We had to incorporate this into the design as our idea was to create this self-sustainable building. We thought of two ways we could produce this power. The first thing we thought about was installing a giant turbine in the center of the tower. This led us to some problems, the first of these was structural integrity. We began to think putting a turbine in the center of a tower would lead to it having weak spots making it susceptible to natural disasters, we did not look more into this as we were not sure where to look. The second problem with the turbine is that the idea of a turbine is very situational, as it would only work if the location it is located high winds. Since we want our design to be a universal template, it defeats its purposes if it can't be used by anyone.

With the Idea of using a giant turbine to generate power terminated, we decided to default on using solar panels. We decided that these would wrap around the sides of building. There was one problem with this design. Since it was a tower many of the solar panel would fall in a shadow. As we were about to address this issue, we took a moment to think about the future of this idea. We decided that this idea was far too ambitious to flesh out in three months, so we had to switch direction a little and went back to the drawing board and decided to start from a new canvas.

The Second Idea

With the building idea too advanced, we had to switch it up. Instead of making a whole new sustainable skyscraper, we thought of making Bishops more sustainable. We are already off the water grid, using purified greywater for showering and cleaning, but are very far behind in terms of renewable energy and social sustainability.

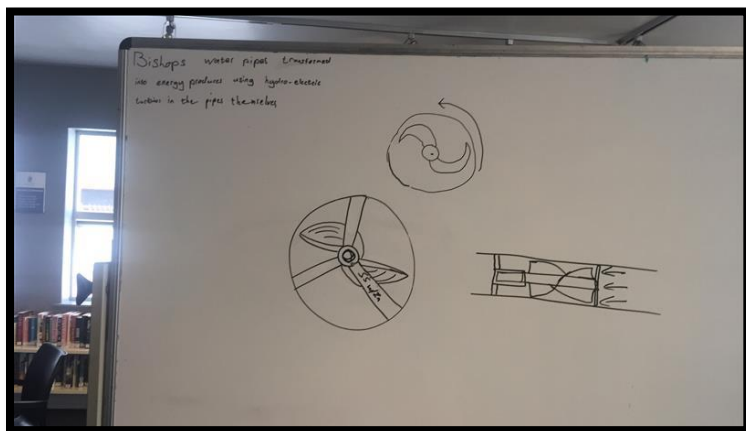


Figure 5: Planning for our Second Idea.

Hence the birth of a revolutionary idea spawned from the downward spiral of boredom and anxiety: Hydro-electric energy using the already flowing water in pipes around Bishops (See Figure: 7). We were inspired by an alternate design for hydropower plants by Turbulent Hydro. (Turbulent, 2018) We originally found out about them when we found a YouTube Video called, “5 Amazing RENEWABLE ENERGY Ideas & Solutions For The Future” by the channel ‘Cool Gadget & Stuff’ (5 Amazing RENEWABLE ENERGY Ideas & Solutions For The Future, 2018) . This led us to the Idea of hydroelectric and brought light to our idea of installing modules in the pipes of the school to generate electricity.

We sat down and highlighted issues that could arise. These problems were how one could install these modules, in installing the modules would we have to turn off the water and how would installing the modules effect people and when we would install them. But we also created solutions to these problems and refined the idea. After we came up with an implemental design, we would have to install the modules during a school holiday, where water would not be used for a long period of time so that a minimal amount of people

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would be affected by us turning of the water. As for locations, we thought one of the boarding house's bath rooms, as their taps would be flowing the most or by the school's purification plant, where the pumps are constantly working. The idea of the pipe turbine came about from watching a YouTube video on 5 Amazing Renewable Energy Ideas. After this, we researched articles about hydroelectric efficiency, electricity generation and pressure in liquids from Science.



Figure 6: LucidEnergy's Home Page

Then we went on holiday and that's where everything began to fall apart. Two days before term 4 started, Thomas sent a WhatsApp saying the basis of the idea has already been patented and used by the American energy company, Lucid Energy (Anon., 2017). This was something we could not work around due to legal issues so scrapped the whole idea in favor of something we could do in the 8 weeks until exams.

Josh's Reflection

I feel we hit obstacle after obstacle ever since starting the final project. The idea of the hydroelectric pipe was a bust due to an unfortunate patent of a specific US energy company and I personally feel lost and don't know which way is up at this point. Library sessions inspire ideas from all of us, but we still don't feel completely in the loop with them yet. Thomas has had an idea that could recover for the lost time, but we first need to see how the next few weeks goes. I think it could be a better alternative to pipe power. In the mean-time we are currently researching for the Plan B project and getting a lot done. I can see this project working out in the end.

Our Final Idea

After being stuck in the cloud for roughly two weeks we eventually came up with an idea! It was to create a safe and environmentally friendly place for people to charge their cellphones in public spaces. The fundamental idea behind this box is to provide people with as safe space where they can leave and charge their phone without fear of it being stolen or broken. This module relies on charging the phones inside using solar panels that will be attached into the roof. The reason we came up with this to firstly save electricity and nudge peoples ideology to use sustainably gained energy for the simple and little thing rather than take electricity straight of the grid. The box part of the design is to incorporate an aspect of safety into the design of the module if it is to be put in a public space.

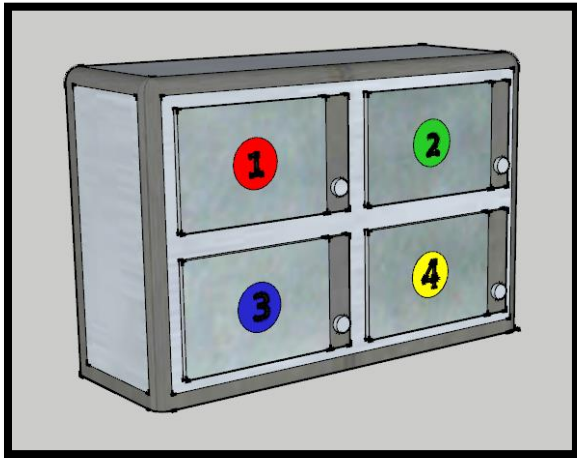


Figure 7: First Design of Our Third Idea Done on SketchUp By Thomas

We then went on to our design this module. We spent a long time thinking in this stage. We wanted to make this thing cheap and affordable as similar thing we saw went for thousands of Rands (Washington, Unknown). We first thought of making this module completely out of metal. This would be comprised of an aluminum frame with stainless steel. As we looked more into this, we realized that having it completely out of metal would be too expensive and would take too long to get made. There was a down side to this. Not making the box out of metal would make it less secure and deduce the safety aspect of the design.

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Metal is a very strong material that cannot be easily broken or broken into, without the use of tools. Therefore, making it not out of metal makes it less secure as it can be easily broken into with little effort. We thought of other materials to make out of. We looked at making it out of wood, although we quickly disbanded this idea as making it out of wood would make it fragile, prone to vandalism and to top it off, a hazard. We say a hazard as we planned to do all the electronics and wiring ourselves and since we are not professional engineers we didn't want to make it out of a flammable material.

The final thing material we looked was something plastic based. Thomas was keen on it being a solid thick plastic sheet. However, the rest of us wanted it to be made of clear Perspex. Although making the box out of an opaque material would make it safer as people wouldn't be able to see the phone inside, reduce the chances of it being a possible target. In the end we decided to go on with Perspex.

Thomas's Reflection

The current consensus of the group is to make the box from Perspex. I on the other hand do not agree with this decision. I feel making it out of Perspex's will take out the safety aspect of the design I would rather at this point make it out of steel sheeting or make a wooden frame and use board wood, purely as we are pressured for time.

We plan on implementing them in one of the day boy houses to get an idea of how effective it'll be and what challenges we will face. We have emailed the respective housemasters for permission to use the space in their houses to build our project.

Ronaq's Reflection:

Throughout this week we have been working very hard the practical part of this project, we have started the practical part, but it's been delayed by some parts missing which we should be getting by the end of this week.

What We Did:

After coming up with a design we then began to source materials. The total cost of the materials would be split at the end of the project. Chris would be sourcing and assembling the electrical components for the module. Ronaq would source the Perspex sheet, which would serve as the covering for our module. For the frame we would make out of aluminum tubing. Josh was to get this, but since he is a boarder this led to some complications. The role of getting the tubes was then handed over to Thomas, who as hard as he tried could not find a place that sold aluminum tubing that matched the needed dimensions.

The Evidence of How It Went And how well it worked:

As we Approach the end of our big Ideas experience, we were not near ready to get this module made, Installed and up and running by the end of the term as we had hoped. A large part of our project was to get feedback from boys to see if this would be a good thing to implement more of into our school. And at the current rate it seems like we will only get this installed at the end of the year, thus defeating the purpose of getting feedback. As for how it has went there have been many lessons where we have not much to do except the last finishing touches on the narrative.

So, in terms of getting this project of the ground it has been very slow. So, it feels the project has not gone as well as we hoped. However, we feel that this project has still much potential to offer. We feel that I would be more beneficial for the project if we work on it during the holidays, so that we can produce something that we know we have put lots of effort into, that we are proud of, rather than a rushed half assed project that we know can be improved on. So, we plan to carry on with this, working on it as we move forwards into the school holidays. During this time, we will probably try to improve on our design, building and installing it, so that by the time the new year starts we can get a good response and see where we move on with this project.

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Reflections On this Year

Ronaq's Reflection

I wanted to do this Big Ideas course to learn to think differently and to see the world from a more environmentally friendly perspective. After being accepted into the course, we were exposed to the reality we face as a planet and a society and as a race. That the very things we use in everyday life and take for granted will soon run dry and will be our demise unless we change ourselves and change things to make ourselves more sustainable. We learned about complexity thinking and how all things are interconnected much more than you think. We learned how to think more lateral instead of linear thinking the way schools normally make you think, which I think is the whole goal of Big Ideas, to think differently, look at something from the outside view, from a different perspective. The course took over Geography, Life Orientation, Biology, EMS and History, but kept those subjects connected to the course in its own way.

The course is built around the UN Sustainable Development Goals. The teachers took up their own goals some took up a few more than others. So, as we were still in the learning phase of the course we learned about the goals as well and did activities. Learning about the goals we were slowly introduced into what the final project will be like and what is expected of us. By the end of the 3rd term we had chosen our goals, me choosing SDG 11(Sustainable cities). I was by myself which was a bit disheartening, but I merged SDG 11 with SDG 9(Industry, Infrastructure and Innovation) I joined up with Thomas, Chis and Josh. From there we worked on an in-between project incorporating the 2 SDGs and we came up with our first idea, but in the end, it was too costly and more of a long-term project and we scrapped the idea.

Our second idea was going well, I particularly was very excited at the idea but like all good things it came to an end after we did some research and found out it was patented so we had to back in the cloud. By this time, we are 2 weeks into the final term, so we were cutting it close for an idea to build off. We were back in the cloud for the next few days until we had a really good idea which turned into our final project and we've been working on it ever since. The problems we've faced is mostly the materials that are needed to build the actual project but other than that we have done very well, I think. I have really enjoyed the Big Ideas course and its really opened my eyes and I've learnt things that are very useful. I have absolute confidence in our project even if we don't end up with a working example. I am nervous so to say for the final presentation, but I've thoroughly enjoyed the course and look forward to what more I can learn in the last few weeks.

Joshua's Reflection

The reason I chose to do Big Ideas was so I could get out of doing Biology and Geography exams. I never thought that I would take in everything we learnt in the last 6 months.

The way I understood Big Ideas and how it operates, is that it gives all the students participating the necessary skills to work efficiently in an ever-changing world. We get to choose how we use the knowledge they gave us. They gave us the choice. No other subject at Bishops can give the same level of insight and awareness like Big Ideas.

Since the entire course is focused around the Sustainable Development Goals, for the first few weeks we were exposed to how the world faces many challenges. Whether it be from inequalities between different groups of people to the acidification of oceans due to global warming, the human population needs a different take on the way we go about living. We learnt about complexity thinking and how to imagine the planet as one large ecosystem where changing one factor can cause a series of events that leads back to us. We were made to understand why the skills they teach us will be beneficial in the future.

The entire course for the past 2 terms was refreshing. We stopped traditional learning where we repeat information back on paper, we instead wrote reflections like this to our coaches so they could see how we were doing and if we took in and understood the topics we spoke about in our sessions. When term 3 ended we chose our final groups. I originally chose to be in SDG 14(Life Below Water) but thought I could more if I went with SDG 9 instead. From then to now we worked hard on creating an idea that was sustainable and benefitted someone other than ourselves. Being a week from exams I can safely say we achieved this goal. I'm confident in our narrative and ready to present our journey through the Big Ideas course.

Thomas's Reflection

As the end of the year fast approaches so does the end my Big Ideas Experience. Over the past two terms we have been working on our own curriculum. This curriculum unlike the standard education system is centered around research learning what we want to learn, on the terms that it relates back to The UN Sustainable Development Goals. Unlike traditional education the Big Ideas Course requires and encourages learners to do research on the topic they are doing, rather than learn from a text book like a parrot.

During the first term we learn about the Sustainable development Goal and how they are incorporate into our everyday life, so that when the time came, we could select an SDG we would do our final project for the term on. Once we chose our SDG, we divided into groups so we could work on a project that would be our term mark for the Big Ideas Course.

I was put into a group which was focused on the two SDG's, which were SDG's 9 and 11. When we first got into our groups we immediately jumped onto an unrealistic idea and tried to go on from there. However, we were soon told that it was unrealistic. We were then thrown into a phase of uncertainty. We finally came up with a second idea which soon was ditched due to copyright issues. It was only halfway the forth term that we finally came up with our final design. This was a break though for us as we had no luck up until this point and a very special moment for me during my big ideas experience.

Originally when I heard about the big Ideas program I was not interested. I had just received my half colours for academics was worried that my marks would drop as a result of taking it. A few days before the application was due, I thought may I'd give it a try, Maybe I had nothing to lose. Now as I look back, I see that I had made the right decision by taking the Big Ideas Course, I've learnt more than I thought I would ranging from things like writing papers, summarizing, referencing, collaboration and team work, leadership and even learning more about my fellow peers. It has truly been a blast and would do it all again.

Chris's Reflection

At the start of the second term, when we were first introduced to the Big Ideas course, I wasn't interested because of the conservation or the whole idea of "changing the world" but simply because I got to miss all the subjects I didn't necessarily enjoy or find useful.

At the start of term 3, when we actually started with the program, my mindset changed entirely. After learning about how dire the situation really is and how much we need to change our behavior in order to survive, I started becoming more interested and engaged in the program.

Towards the end of the third term, just before we split into our groups, I was starting get quite frustrated and bored and started losing interest. But after we split into our groups and started brainstorming, I really started enjoying it and getting more involved. Our first few ideas started off well but soon all turned out to be dead ends.

After the first three ideas, we started getting quite discouraged and wondered if we were ever going to come up with a viable idea that could set us above the rest. After going through three ideas, we finally came to a final decision: to build a solar powered phone charger.

We started working on it but took the amount of time we had for granted and did not complete the build and installation of the charger so we are going to carry the project through to next year in order to get qualitative results and see how we can improve or change the design to make it more effective.

In conclusion, I have found the course informative and different and it has certainly sparked my interest and passion for sustainability and looking for alternative solutions off the beaten track. I am looking forward to our presentation and continuing our project through exams and into next year.

Conclusion

As the end of the year approaches, so does the end of our Big Ideas Experience. Over the course of the last six months we have learned many skills to help go on forwards with our lives. Even though we had a rough start we have made progress over these last few weeks. Our first ideas were originally either too ambitious or too complex for the time that we had allocated. However, despite how it seemed at the time we finally came up with an idea. This would mark the birth of our final project, a box that would provide people with a safe place to charge their phones in public. These phones would be charged using renewable solar energy.

As exams come fast approaching, we have been able to plan an in-depth design for our project. This includes circuit diagrams, material lists, sketches and 3D renders. However, even though we've done all of this we are far from installing the final project. Due to lack of remaining time we are left in a situation where we won't get the project installed by the end of the school year. This was not our desired outcome as we wanted this thing up and running with enough time for us to get feedback on it and reflect and see how we could improve on it or whether we should install more modules. However, since we have left this so late, we were unable to achieve this.

Even though we couldn't make the deadline, this is not the end of our Big Idea. We sat down and talked and decided that it was good that we didn't get the project done by the dead line. This previous sentence may seem controversial; however, this was the reasoning behind our thinking. Throughout the term Thomas has been constantly traveling, as he has had many rowing regattas. Due to this he often left on Fridays and only was back on school on Tuesdays. This led to often have a man down and slowed the progress of our project. With this constantly happening along with people in our group getting sick, if we did produce te project at the end of the year it would have turned out rushed in order to meat the deadline.

This is not what we wanted to do. We would rather have a project we are proud of rather than that which is rushed and uncomplete in our eyes. As such we have decided we shall leave the project in the state that it is now, just a plan and design. We shall carry on with this project going into the December school holidays. During this time, we shall work to develop this Idea further, improving on the idea and building the project. So that when we come back to school next year in 2020, install the project and get the response we originally wanted by the end of this term.

Bibliography

5 Amazing RENEWABLE ENERGY Ideas & Solutions For The Future. 2018. [Film] s.l.: Cool Gadgets & Stuff.

Anon., 1999. *Alibaba.com*. [Online]

Available at: https://www.alibaba.com/product-detail/Solar-Powered-Mobile-Charging-Station-Secure_60840650476.html?spm=a2700.7724857.normalList.30.47a4464dipoPYr

[Accessed 1 October 2019].

Anon., 2017. *LucidEnergy.com*. [Online]

Available at: <http://lucidenergy.com/>

[Accessed 28 August 2019].

Anon., 2018. *Bishops Intranet*. [Online]

Available at: <https://learning.bishops.org.za/bigideas/>

[Accessed 23 August 2019].

Calthorpe, P., 2017. *YouTube*. [Online]

Available at: <https://www.youtube.com/watch?v=IFjD3NMv6Kw>

[Accessed 03 September 2019].

Day, D., 2016. *Converting Water Pressure into Power*. [Online]

Available at: https://www.mswmag.com/editorial/2016/07/converting_water_pressure_into_power

[Accessed 12 October 2019].

Day, D., 2016. *Converting Water Pressure into Power*. [Online]

Available at: https://www.mswmag.com/editorial/2016/07/converting_water_pressure_into_power

[Accessed 18 September 2019].

Sustainable Development Knowledge Center, 2019. *SUSTAINABLE DEVELOPMENT GOAL 9*. [Online]

Available at: <https://sustainabledevelopment.un.org/sdg9>

[Accessed 23 september 2019].

Sustainable Development Knowledge Platform, 2019. *Participating State: Sustainable Development Knowledge Platform*. [Online]

Available at: <https://sustainabledevelopment.un.org/memberstates.html>

[Accessed 28 October 2019].

Joshua Smith, Chris Welby-Solomon, Thomas Maurel, and Ronaq Sayed

Sustainable Development Knowledge Platform, 2019. *SUSTAINABLE DEVELOPMENT GOAL 11*. [Online]

Available at: <https://sustainabledevelopment.un.org/sdg11>

[Accessed 25 September 2019].

Talks, T., 2014. *Youtube*. [Online]

Available at: <https://www.youtube.com/watch?v=F1U26PLiXjM>

[Accessed 17 July 2019].

Turbulent, 2018. *Turbulent*. [Online]

Available at: <https://www.turbulent.be/>

[Accessed 30 October 2019].

United Nations Development Program, 2019. *Sustainable Development Goals UNDP*. [Online]

Available at: <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

[Accessed 25 September 2019].

Washington, U. o., Unknown. *Engineers Without Borders Sol Stations*. [Online]

Available at: <https://csf.uw.edu/application/engineers-without-borders-sol-stations>

[Accessed 15 October 2019].

World Health Organisation, 2019. *Millennium Development Goals (MDGs)*. [Online]

Available at: https://www.who.int/topics/millennium_development_goals/about/en/

[Accessed 22 October 2019].