Report

Analysis and Critical Reflection of my Technological Practice

By Kevin Anderson

Contents Page

Client situation, background and Issue

20/10/09 10:46:39 A
Options
An outline of the initial problem to be addressed.

My client, his wife and three children do a lot of camping out in the bush. They drive out to one of their several nearby camping spots, set up a campsite and enjoy the environment, far from busy city life and troubles. They like going camping for at least a three days and so they take with them in their Ute all the food necessary for that amount of time as well as torches, essential electronic devices and lighting systems etc. they are unable to go camping for any longer than this time as their mini battery powered fridge, lighting systems and other small electronic devices will start to run out of battery life after this time period. My client wanted to be able to go camping with out the time restriction of the battery life of essential devices. Some way of charging a small battery bank that he could then in turn charge and run the electronic devices that are necessary when he goes camping is what he wants so that he could have more time to enjoy his camping trips and allowing for more time to relax and go on day tramps, exploring the surrounding area of the base camp.

Project Overview

20/10/09 10:46:39
Options
A clear definition of the issue to be addressed and the problems which required a solution.

The project officially started in early February, beginning with looking for a client who had a problem that I would be able to solve using technological practice. I went into this project both excited and nervous for the many months that lay ahead of me in which I had the daunting task of solving someone's real life issue using my existing technological skills and many more that I would have to pick up and learn along the way. The whole project I would say has been a journey. It has been so educational as I have learned more skills and techniques than anything else that I have ever done.

I started off by looking for a client, asking family and friends. I came up with a range of issues that all had viable solutions but also had definite pros and cons as technological practices, as this is, at the end of the day, is what I am trying to achieve. The issues discovered covered quite a range, from how to heat the pool cheaply to watering the garden to providing campers with power out in the bush. After looking into each extremely carefully, I tried to choose an issue, which took into consideration time, practical ability at start of project, actually wether or not I could solve the issue effectively and efficiently and one which would allow me to explore the widest possible range of technological issues.

20/10/09 3:32:17 P
Options
Student identifies the options available to enable a complex solution where high level of synthesis, integration and critique can occur.

With a fair amount of collaboration, I decided to choose the issue of: " I need a system with will charge a battery bank that I can then run lights off of and charge small electronic devices whilst camping." My client, and the one who had this issue of restricting his camping time to the life of a small battery bank used for running things like a small camping fridge, low power lights and other small electronic devices. I definitely thought that this was going to be a challenging project but I thought that I one year if I could really get on top of it and work hard that I might be able to pull it off. The project was full of technological issues and also had many problems that would need to be over come but still on the whole it was definitely an achievable task. From the start it was clear that the project was going to involve renewable energy,

which was clearly shown when I first consulted and came up with some key factors with my client. At the beginning, my knowledge of renewable energy was fairly poor, I new a fairly minimal amount beyond what the word actually meant and so this project definitely challenged me as I had to learn so many new things and the best way of doing different things in a rather short space of time in order to suit my clients needs as best as I possible could.

Right from the beginning of the project, I followed a well planned out and methodical design process. With the first main thing being the client interaction, establishing a design brief and key factors from and initial client consultation.

Once I had the first set of key factors finalised, I started getting into what was going to be many hours of painstakingly intense research. I would defiantly say that research along with trials and testing dominated this project due to the huge amount that I had to learn and look into to be able to find the best possible solutions to the many issues that I faced. I had abut six main experienced technologist that guided me through this project, not helping me so much with the actual designing of this project but more with keeping me pointing in the right direction as far as the technological process goes or making sure that I look at different issues from all angles. One of my technologists, James, did keep me on the right path for the complex and highly complicated wind turbine blade design. I am told that these blades have aspects to them that are only covered in fourth Year University.

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Options
Evidence of the understandings of other technologists. Student could have improved her portfolio if the technologists and their specialist areas were identified.

The trials and testing were a huge assistance and helped me a lot with finding the best type of the many components that went into this project. The trials and testing also went very far with helping me understand some features a lot better. They also allowed me to explore all my options and pin out the good and bad points and characteristics of different types of components, materials, finishing methods and joining methods. They played a huge role in getting the whole device up to a high and efficient standard.

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Options
Evidence of the understandings which were gained from analysing their technological practice.

Consultation with my client was helpful to me as we discussed different trials that I had done and different thing that I had found out. Consultation with my client meant that I could look at my findings and listen to my clients needs at the same time and find a solution to any given problem that both suited my client the best and suited the efficiency and practicality of the design the best. As there were so many possibilities for the device that I was designing, having my client consultations allowed me to rule out some straight away if they were just simply not what my client wanted.

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Options
Explanation of the interactions that were had with their client.

Having the basic idea that my client wanted a portable wind turbine from previous research and client consultations, to charge a battery bank and also having some specifications; I found it hard to decide where to start with concepts. After some more collaboration, I eventually decided to start with finding a generator. This was almost a whole project in itself but I did eventually find one that suited my client's needs. My client, not knowing much about wind turbines did give me some specifications that were a bit unrealistic. This first became apparent to me when I found the motor/generator that would most likely be able to stand up to my client's power requirements. But with another consultation with my client, we discussed the matter and he was interested in what I had found about the weight of the motor/generator that was going to produce his power requirements. He realised that his original

specifications were unrealistic and gave me a new weight limit and container size limit that were a lot more realistic and achievable and they were still going to work with how he was intending to transport the portable wind turbine. He takes his ute when he goes camping and so the wind turbines does not have to be carried around whilst hiking or anything like that so there is room for a bit of weight. The weight does not want to get up to high or else carrying it, which he tells me would never be for longer that a couple of minutes, and setting it up would become dangerous. So the new weight and size limit took all this into careful consideration and it was critical that I did not exceed it.

As this project was so complicated and there were so many features and components to it that had to be carefully designed with weight and strength being a huge factor in all of them. I felt that for my concepts, I could not do one concept that had all components of the wind turbine in it. So with the idea that I was building a wind turbine and the generator size and weight now set in concrete, I research all the components that there needs to be in a fully functional wind turbine and then I did concepts for each of them. This method worked extremely well for my client and I, as we were able to go into a lot of detail in designing each part of the wind turbine. The development of each part followed on quite well form here.

Planning was done by recording what I hope to achieve going into a task, what I did achieve, what I learned and how/what I was going to do next. Planning kept what I was doing and trying to do clear at all times. It allowed me to focus on the quality of a task that I was doing rather on what task I was supposed to be doing. As a result of planning I was also able to keep focused on satisfying my clients needs and to stay on a path leading to success and completion on time with good results.

I achieved the one off-solution by designing a constructing a device solely on what my client wanted. It is suited to for full every one of his needs and 'wants'. Through so much client consultation and research I definitely feel that I, along with guidance form existing technologist, was able to produce a final product that my client was very satisfied with. I went into this project with determination to succeed in this field that I was very new to. I new that I was going to have to learn so much in order to please and for full my client's expectations. There were many problems during this project, some definitely bigger than others. But I was able to solve them with constant reference to my client needs along with careful planning and lots of research.

Research was probably the biggest aspect of this project. The first few months of this project was just purely research due to the vast amount of knowledge and information that was out there that needed to be learned and understood. This was so I could then best suit the solution to the problem to my client. An overall technique that I used for testing, was to look at all my options or in other words, look at as many possible ways to solve and issue so that when I found one the suited my client, I was sure that there was nothing any better.

20/10/09 10:46:
Options
Student reflects on information, understandings and practices of others that were used to inform the development of their technological outcome.

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Options
Student focuses on the importance of planning and how technological practice was used to inform planning for future practice.

20/10/09 3:21:
Options
Client interactions are evident throughout the project which resulted in reprioritising of resources, key factors and brief development.

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Options
Relevant research was considerable, which gave understandings of how to identify the specific problems that required resolution.

Key milestones

The first key milestone was the final decision on what project I was going to do. I originally had a range of possible issues that I could solve which I had to work through, identifying good and bad points for each. I eventually decided on this project – 'design a portable power generation system to charge a battery bank that runs small electronic devices whilst camping'. From the very start I was sure that this project would allow me to explore the most areas of technology.

My second key milestone was establishing a brief. I had to come up with some general questions for my client, to try narrow what he wanted down to a level where I could start to do some investigation into the final solution. These first questions were crucial for this project as later on in the design I found out that they did contradict each other. This issue did however in the end get resolved. After I had the first real brief with specifications, I was then able to identify, analyse and justify the prioritisation of key factors explaining their implications and interactions and how they were going to affect me developing a solution that addresses my client's issues.

The third key milestone that I reached was the completion of research. This was definitely a challenging and demanding area of this project. It required me to look at a huge range of aspects of renewable energy on the whole and then even more on wind turbines. When I started in the general research into power producing methods, it did not take long for me to realise just how much there was for me still to learn and understand. I had to look into many pros and cons for several power producing methods and try to get one that suited the specifications the most satisfactorily. There was so much research that needed to be done and how I was able to control it all was by doing it in distinctive stages. When it came time to research the wind turbine before the actual design of my clients wind turbine, there were so many components in a wind turbine that all required a lot of attention and careful thought. To deal with this I did research into each component separately so I did not miss anything out in making this whole device as efficient and practical as possible.

My fourth key milestone was making a choice on the generator. I looked into many different types and sizes of possible generators and feel that I covered close to all angles in that aspect. Finding the correct generator was the first main thing to do with the design of my clients wind turbine as it determined almost everything to do with the wind turbine and brief, foe example, things like overall weight, power producing capabilities, size of blades and strength of pole. So it was clear that I had to find a suitable generator that would produce the required power as the first thing that I do and then work from there. I collected many types and sizes of motors and tested them as generators, at various speeds and matched these voltage outputs to the range of r.p.m's that a usual wind turbine would deliver in average wind speeds. This I found was a quick and easy way of ruling different motor/generators out straight away. From doing these tests I also quickly learned what type of motor would be most suitable (permanent magnet multiple coil A.C motor) and then from there was able to collect deferent sizes of these same types and do further tests. I continued testing

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Option
Conclusive justification of the technological practice

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Options
Defining techniques for questioning which enabled clear definition of the issue to be addressed.

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Options
Summary of the how the understandings gained from research and wide investigations developed around the issue.

motor/generators until I found one (the Smart Drive), which my client was most happy with and that matched all the specifications. After I found this generator and from testing realised that it produced very high voltage at very low r.p.m (which is what I had been looking for), I also found out that there is a way to rewire it so that you decrees the overall internal resistance of the motor and there for increase the amount of current coming out of generator when charging a battery, at the same r.p.m. This was a huge break through as it meant that when I had rewired and done all necessary modifications to it, at any speed that the generator is turning at, it would be able to move more current through the charging circuit and therefore into the battery. This means that the battery will charge faster at a lower wind speed, which is ideal for my client's needs and purpose. This generator clearly produced the highest power output at the lowest possible wind speed and therefore was ideal for my clients wind turbine. It also by far had the best weight/efficiency ratio, which was very important in this project as the whole device had to be portable. With further client, teacher, Engineer consultation and discussion on the matter, I decided on using this motor, as it was ideal, considering the time limit for project and budget, to solve my client's issue.

My fifth key milestone was design. This key milestone marked the end of most of the main component design. Using the knowledge that I gained from the many hours of research that I completed, I under went design of each individual component. I did this design of each individual component at a time again for the same reason as for research, so that all aspects were covered with confidence and with quality and specifications at mind throughout the entire process. I was really able to focus on each component, which was good as it revealed an ideal final, complete product. I designed each component in an order so that one part could be designed with respect to another to ensure that each part worked well with another and fitted together with as much elegance and strength as possible.

The sixth key milestone was quite unique to this project alone and was almost an entire project on its own, completion of the design and construction of the wind turbine blades. This was huge, the amount of optimisation that can go into these extremely precise items is astronomical and I had to limit myself due to time and budget. People spend many years at tertiary institutes learning how to design even the most basic of blades. I could have gone for flat square planks of material mounted on an angle for blades and the turbine may have turned in strong winds and produced a small amount of power. But I had an extremely high tech generator and I wanted to make as much use as possible of the weight, time and budget that was available to me. So I decided to somehow design, possibly with some help, as efficient wind turbine blades that I could with the time and resources that I had. When I started looking into how you design a blade, I found out that they are so complex with angles, widths and 3d curves having to be exactly precise at every point along the blade. At the time it seemed that I had a very daunting and task ahead of me that would make or break the efficiency of the entire project. So I had to seek some direction from James, an experienced technologist in this field. He helped me understand different terms and definitions that arise when you design you own blades and he also showed me some standard formula that I should be using.

I also then had to research different materials that are suitable for wind turbine blades. Different materials included PVC, plywood, hardwood and fibreglass. I looked into

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Options
Reflective comments on modelling and construction gave clear descriptions of how the complexities of the situation were developed.

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Options
Reference to technologists and the understandings gained from exploring other technological practice and how these understandings were used to inform own practice.

each with quite some detail trying to find the one that I would be most able to complete with high precision skill and a material that would most suit my clients specifications and environment that the wind turbine would be operating in. With a bit of collaboration and trials and testing, I found that wood is probably the best but to carve three near identical blades would be difficult as my carving skill level is probably not high enough and for the portable factor, wood is not the lightest material available. I then looked into plywood but the technique used to mould plywood would make it hard to get the simultaneous width and length way curve. I then turned to Fiberglas due to its lightweight and strength properties. From some extensive research into fibreglass wind turbine blades, conventionally, they are made out of solid fibreglass. I felt that this was not very suitable as a time consuming and expensive mould would need to be made and the cost of all the fibreglass needed to fill all the mould X amount of times for as many blades as needed would also be quite costly. I then pointed in the direction of hollow blades covered in fibreglass. I could not find any information to support that this could be or has been done for wind turbine blades but I was addiment that I could do it and that it would suit my specifications far better that any other conventional method that I had found. I thought about it for quite a while and then came up with two possible ways that I could do it, the first being by making the blades out of a series of plywood cut out ribs located at certain intervals along the length of the blades and spars embedded in a notch in the top and bottom of each rib and then running the length of the blade (this method is similar to the way that you make some model aeroplane wings). The second method that I came up with was to use a hot wire machine to cut out the exact calculated blade shape with all the necessary twists in it. This way I will get an exact foam replica of the blade and then what I have to do is cover it in fibreglass. This method definitely appealed to my ability, my client and my client's specifications as well as strength and efficiency requirements. I then looked into Fibber-glassing over foam and other aspects to the blade construction and this method seemed to be what me and my client were looking for so I, with engineer, teacher and client consultation, decided to go ahead with this material and technique for building the blades. After this, using the blade materials that I had chosen from my and consultation with stakeholders, I was then able to start designing and drawing up the blades. I made many spread sheets with numbers, lengths, widths and sizes for every point along the blades length that were made from the blade formula. With these I then came up with a CAD model of the blades that simulated what they were going to look like so that I could reinsure my stakeholders that the idea would work. The reason that I did not just go and buy some factory made blades is because I wanted to design some that would most efficiently work well together with the generator that I new from tests would have the ideal power outputs for my clients needs. I wanted blades that would also make the wind turbine meet the specifications with more strength. The advantage of designing my own blades is that they would then be perfectly suited for the generator that I was going to use, especially for things like low wind speed start up and good high wind speed performance. It would also mean that the amazing generator that I had found could be used to its full potential making the weight/efficiency ratio even grater that it already was. The disadvantage of designing my own blades was the complexity and extreme difficulty, which I was able to overcome with some guidance from existing technologists as well as a lot of planning. When I had completed models and drawings of the most efficient possible wind turbine blades that I could design, and I had consulted my client, Engineer and teacher, it was time for construction. And as there was no suitable method, for my specifications, for building wind turbines blades

known by existing technologists at the time, I had to come up with my own. And as previously stated, this method that I came up with was to make a foam replica of each blade and then cover it in fibreglass. I was wondering wether or not this would actually work so I consulted with Impact Fibber Glass and also with my Engineer. Brian, my engineer said that he thought it would work but said that I should make the part that attaches the blades to the axle strong enough. The guy at Impact fibber Glass also thought that it would work as fibber glassing over foam is certainly very strong but he said that to now for sure how many layers of fibber glass I would need, I would first have to do one and then just asses it. Actual construction of the blades was complicated and time consuming and I had to do a fair amount of practices on scrap material before I learned some good techniques and skills to actually build the blades. The way the blades attached to the axle required some further research and design and then more client, teacher and engineer consultation before I decided on a method.

The seventh key milestone, which followed on from blade design and construction, was construction of the rest of the wind turbine. This consisted of ground securing methods, pole, base plate, horizontal swivel, top platform, generator attachment, tail, manual break, circuitry and circuitry box. The construction process took the longest, as there was a lot to complete. If found out all the necessary components from research into existing wind turbines, and one thing that I found is that you don't really get portable wind turbines that produce any decent amount of power like my clients wind turbine will. I learned a lot of techniques and practical skills during this process; I also had to teach myself how to weld. During this I encountered many issues, which I was able to overcome with advice from my teacher, Mr Watson.

My final key milestone was when I finished the whole wind turbine; designed to meet my clients needs as effectively and practically as possible. This key milestone consisted of me testing the wind turbine; I first put all the parts together and made sure that everything fitted together and it when I did it, everything worked perfectly but what was probably always going to happen, when I did set it up this first time, there was hardly any wind. There was enough to see it self-seeking into the wind and the blades did start rotating with minimal wind speed, which was a very satisfying achievement. There was not enough wind to do full on voltage tests and so I set it up again another time when more wind was blowing. This time I was timing how long it took to set up (which should meet the design specification of 10 minutes and as I have designed the whole thing to be fairly easy to assemble this time limit should be easily achievable). The purpose of the second set up was also to do the voltage testing and to make sure that the voltage output was adequate at, or even better, below Tauranga's average wind speed of 16 km. The test were absolutely successful and the wind turbine overall preformed extremely well.

Initial concepts and development

Initially I researched wind turbines of all types, finding out what were the common components in all of them. I then made a list of what components are necessary for a wind turbine to operate efficiently. After that how I did the initial design work was by drawing concepts of each component, showing ways to make it as small and light as possible but still strong enough to operate in fairly rough conditions. This was done

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Options
Student presents a clear definition of the issue to be addressed and the problems which require resolution.

for all the components that I was going to need to make for this wind turbine. I then developed each after that and because of this I had to design the components in an order so that one component was designed relative to another. This meant that I could get them all to work well together and fit together securely. The reason that I did my design work in this way and not just a whole wind turbine as one concept was because each part is so important and a lot of attention was needed for each part. I designed each part separately but with reference and relative to the other parts so that I could make sure that each part was designed specifically and precisely so that it would do what it is supposed to do and also be strong enough for its individual purpose.

During the initial research and concepts, on of the issues that I faced was the first design specification, which was 10 kg for the entire device packed into its container. I realised that this was an unrealistic and impossible weight limit for a device, which is capable of producing the required power output. The specification came from my client and was unrealistic just simply due to the fact that my client had no idea what actually goes into a device that can produce the amount of power that he wanted. When I found this issue out, I discussed it with my engineer and he agreed with me that it was unrealistic, I then went to see my client. We discussed the issue and he was enlightened and interested when I told him that from my research and trials that I had done on generators I told him that I would not have thought that a wind turbine that can produce the necessary power requirements could be made for much under 60 kg. He then told me that I should do some more research into the matter and get a more accurate weight. I then consulted an experienced technologist in this field. He said that he has never seen a fully portable wind turbine like one that I described that I was trying to design and construct. He told me that he has mad quite a few and none were even close to being under 100kg. This was worrying but I did more research into the issue and with some careful weight conscious design, the smart drive motor that I had found and tested and the method for blade construction that I had invented specifically for my clients overall issue, I strongly felt that I could build the entire wind turbine with and overall weight limit of less than 40 kg. With more consultation with my client, we discussed and came up with the new weight limit of 40 kg. My client said that it will be transported in its box in his Ute to the camping destination and the 40 kg limit is a compromisation so that him and his son can carry it (never more that 1.5) km to its final set up destination. So I thought that if I was very careful and employed good building skill and practice, I would be able to design and build the wind turbine so that it did not exceed the 40kg specification. I also did some testing into how much weight two people can lift and carry comfortably for a distance of abut 1.5 km and found that 50 kg was probably quite close to the limit. This just showed my client that he would still easily be able to carry the wind turbine, weighing 40 kg or less, around to were he wants to set it up. This was a good test just to make sure that my client is comfortable with the negotiated change and to make sure that he is sure that he will still get exactly what he wants overall.

For the blades I started with different methods of blade construction and from them and previous knowledge, I came up with my own way to construct the blades that would meet my specifications more accurately than any way that was used at the time. The blade construction method needed a lot of research and perfecting and then it's exact shape was developed into the highly optimised shape that they are now, requiring low speed wind for start up and preform well in high winds as well. The unique blades and portable aspect made the wind turbine something a lot different to

what people in the field have seen before. I feel that I used ingenuity and inventiveness to design and construct a highly efficient, quite, light and easy to use wind turbine which suited my clients needs compared to conventional residential wind turbines which have the draw backs of being extremely heavy, loud and require quite high wind speeds to get a usable amount of power output

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Options
Student comprehensively justifies the technological practice undertaken and why the outcomes address the problem.

Consideration of social implications

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Options
Evidence of the understandings gained from analysing the social and physical environment in which their technological practice took place and the location of the outcome.

My whole technological practice was based around renewable energy and so the environment was definitely quite and important factor to take into consideration. A wind turbine sticks out in the environment a lot. The things is that wind turbines when operating, look like they are in harmony as they are very peaceful when operating. I did use a range of other techniques to make it more stick out less and more environmentally friendly whilst still making it safe. The first thing that I considered was noise pollution. This is an important issue especially in the environment and my client did want this wind turbine to affect and disturbing the natural sounds and peacefulness that is experienced when one entrees the environment. So I went to great lengths to achieve a very quite wind turbine. I achieved this firstly in the blade design; they are designed to be as quite as possible whilst affecting the efficiency as little as possible. The blades are very aerodynamic and have a very smooth finish, which does reduce noise quite a bit. Part of the twist in the blade also has noise reducing affects. The tapered blade design is also a noise reducing agent. The blades are balanced as accurately as possible, which significantly reduces vibrations and therefore noise as well. The main horizontal axis bearing used is large and firm also giving nice silent affects when the axle is rotating. All this work that went into making the wind turbine as quite as possible payed off when the first testing was done as you could hardly hear the blades spinning which was a great achievement and I was very successful in giving my client exactly what he wanted. Another way that I made the wind turbine fit into the environment was by using only natural (but certainly visible for safety reasons) colours to paint it. This gave a great result as it definitely fits right into the environment. The wooden locks used for the guy ropes also help add a natural feel to the whole wind turbine.

I had to take into consideration society. This was achieved by making sure that it did not intrude upon and interfere with the environment. This was done by again, a lot of design into making the blades and whole thing operate quietly and by using the correct colours to paint it with, ones that made it fit into the environment by also visible enough for safety. It also has an overall neat and professional look and is aesthetically pleasing to the eye, which again makes it nice to look at.

As this device is so easy to set up, easy to transport, extremely useful and it operates automatically, I can very easily see it going into production for use on a local, national or even international scale. This will be of great benefit to the environment as it will potentially increase the amount of people that go camping and enjoy and appreciate the environment by not stripping them, when they go camping, of some of the basic electronic devices that they have become so adapted to living with. It could also mean that the standard of living when you go camping can be increased with the option of this portable renewable energy power generating system. Which means camping will be made more appealing to a wider audience and environmental awareness will be

increased, as more people would want to go camping with the availability of this environmentally friendly portable power source.

The device that I have designed to meat my clients needs could be further developed with more advanced technology and maybe even adding fold out solar panels so that it would be a small renewable energy portable power station that would meat the needs of even more people and being adapted to operate as affectively in a wider range of climates.

This wind turbine is extremely safe to use and be around. Two grown men can set it up in 10 minutes or less. The turbine is put together and the electronic switch is turned on which locks all the blades so that they do not turn around whilst trying to put the wind turbine up. Once erected, one person holds the tower straight up whilst the other person puts four pegs into the base plate and sets up three guy ropes, puts three pegs in, attaches guy ropes and tightens them using the easy tighten and release locking system. Once the guy ropes are tightened correctly, the whole wind turbine is now secured. Its pole is so secure that (not at all advisable) some one could clime up it. When the turbine is all set up, the tip of the blades are over three meters up (far higher that even the tallest of people) the switch can now be turned off and then the wind turbine will start up (it needs about 5 km/h wind speeds to start turning and abut 8 km/h wind speeds before battery bank starts to charge. this is very acceptable as average wind speeds in Tauranga are 16 km/h and the most common wind speed that you will get is 70% of average which is 11.2 km/h in Tauranga. This means that the wind turbine should be charging the battery bank for a large portion of the time it is up which is good and meets another of my design specifications). You can now just leave the wind turbine alone and the circuitry will control battery charging and when the battery bank is full it will dump power through the dump load. When it comes time to stop the turbine you pull the manual brake situated on the top of the tower using the extendable hook until it stops which is when you turn the main switch to shut the whole turbine down and lock the blades so they do not move, now the tower can be lowered quite easily and packed back into the box. So it is clear from my explanation that the wind turbine is indeed very user friendly and safe to operate and be around whilst it is in motion.

Construction of the Wind Turbine

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Options

Explanation of how reflections on their prior technological practice were used to inform the planning for future practice.

Like mentioned before, construction was definitely the most time consuming part of this project as there was a lot of carefully design components that I had to construct with a lot of care. I learned a lot of techniques and technological skills and processes. The largest process and most skill needed was fibber glassing. This was a very complex but rewarding process and you can't afford to make a mistake as fiver glass when dry is extremely hard and correcting errors is very time consuming. I learned how to fibber glass from a bit of previous knowledge, advice from my teacher and just by doing some trials.

The second thing that I built was the plate that goes on top of the tower which was fairly straight forward and required some hack soaring, welding and grinding which are all skills that I am now quite good at the plat has 8 holes in which I was careful

about the size of so not to weaken the square box section that this plate is made out of four of the hols are where the tail attaches to and the other four are were the generator attachment clips bolt to. Under the plate is a larger pipe that the galvanised tower pipe, this larger pipe has a plastic bush which fits smoothly over a piece of hydraulic pipe welded to the top of the tower, this is the horizontal bearing. The parts for the horizontal bearing, plastic bush large outer tube and hydraulic pipe were salvaged from an old wheelie chair. I then made the clips that attached the plastic bearing housing on the smart drive to this plate. These clips were an issue, as I did not know how to make them so that they would not bend when the bolts were tightened. So I went and sore my Engineer and he suggested some possible ways, which I developed to get to the method that I actually used. These turned out extremely strong and hold the tough plastic bearing housing (which is attached to the stator of the smart drive) very firmly which is good.

I then constructed the tail boom. This was an odd looking component as it had two feet that bolted the plate on the top of the tower and then it went up and over the large smart drive, it turned out very nicely issues that I had with it were just making it strong enough but with out over engineering it. This was done using a few some round steel webs on all corners, which produce a very strong and quit light structure. I did consult with my teacher on this small strengthening issue and he advised me that it was not too hard to fix giving me some general suggestions and agreed that it would be easy to over engineer this part. I then had to make the actual tail. Material selections were out of thin plywood, aluminium and per specs. I wanted the non-corroding properties of the per specs with the stiffness of plywood and did not choose aluminium as I needed quite a large area and aluminium is expensive. But what I ended up doing was using per specs and making small angle steel supports out of thin, light and strong sheet metal. These run the entire length of the tail on both sides and there is a slot cut in the end of the tail boom which the tail slides into and then two bolts hold it all together. I did have and issue with how to actually connect the tail to the tail boom as it thought that cutting a 5mm slot in the 11 mm box section tail boom would create huge possible stress fracture points where the slot stops ends one fifth of the way down the tail boom. I consulted my Engineer and teacher on the mater and we agreed that I just put a small curve on the corners, it should be strong enough which is what I did and it did turn out to be very strong.

Brian, my Engineer helped me decide on a pole, for the tower, thickness based on the fact that I need it to be as thin as possible to reduce weight but also strong enough. He gave me that there would be not much force needed by the poles on a side to side motion as the guy ropes will keep it secure that way and steel pip is not easy to bend either. The only other force is down, from the weight of the generator, blades and tail but poles are extremely strong when pushed length ways so we agreed that 3 cm diameter with 3mm wall thickness would be a good compromise between strength and weight. There was a lot of collaboration between how to join the sections of pole and after some consultations with the teacher and Engineer and some development I decided to go with the poles being joined by threaded sockets as this is how water pipes are joined and I now from passed experience they join very firmly together which is what I need. The guy ropes were developed from the method that that is used to tighten tent stays. The base plate once developed and a final design was established, was quite straightforward to build. It had another socket secured to it in

the middle that the bottom of the tower screwed into and four holes on the outside edge of it, which the pegs go through and then into the ground.

Quite a big issue that was resolved was how to attaché the blades the axle. Through some design work and consultation with my Engineer and teacher, I came up with a way, which seemed very suitable and firm and work perfectly in the first test of the wind turbine. This was to; when I had the foam replicas of the blades, counter sink a 40 cm length of box section steel into the end of the blade (flat pieces of sheet metal were welded to one side of the piece of box steel that went into the blade. This serves as opposition against any twisting force on the steal box section that stuck out the end of the blade). There was fibber glass laid underneath the steal and then the piece of fibber glass that went over the entire blade also covered the box steel section from the top so that effectively the steel box section is completely surrounded by fibber glass making it very secure and strong, (refer to design sketches for more information on this as it is quite hard to explain).

Once fully constructed, painted and fully assembled the whole wind turbine was successful, firm, and strong and looked very neat and professional.

20/10/09 3:37:
Options
Student explains how the complexities of the situation were identified and explored.

Skill and knowledge development

Throughout this project I have learned many new skills, codes of ethics, common practices and techniques. I had a range of technologists that were involved in purely guidance and making sure that I have completed all parts to the technological practice. My stakeholders also helped make sure that I looked into all possibilities before deciding on a solution to any given issue. I learned new skills such as welding fibber glassing, correct grinding methods, how to use the metal lathe, how to fabricate steel neatly and elegantly, pop riveting, drilling, cutting with large machinery, pressing techniques, foam cutting, soldering, rewiring a motor and many more. I learned all these new skills, which allowed me to build my clients, wind turbine safely, with good quality, good technology practice and with elegance. I also learned a lot of new knowledge to do with blade aerodynamics, optimisation and efficiency, I learned all about the electronics and components behind a charge controller, how it works and why. I also learned a lot about smart drives, the affects of doing different things to one, how to rewire it in many ways giving many different outcomes for different purposes. I learned so much behind how a generator works, the actual physics behind them.

20/10/09 3:38:
Options
Explanation of the understanding of wide investigation that occurred around the issue and the development of skills required.

20/10/09 3:38:
Options
Student demonstrated elegance in terms of ingenuity, simplicity, optimisation and polish in their technological practice and its resulting outcome.

This was almost a research assignment ass well as a technology assignment. This is because of the large amount of information out there that I had to learn, comprehend and apply to my project. The amount of trials and testing that I did was phenomenal. My research was a huge assistance and I would not have gotten far with out it. It is absolutely essential for finding something that suits you client the best as there is always more than one way to do something and you can always make something better by development. So research allowed be to find the possible ways that I could solve an issue which I could then develop from and make it suit my client as much as possible could, catering for his every need and want.

20/10/09 3:39:
Options
Evidence of understanding gained in consultation with client and research undertaken.

Consultation and Feedback

Consultation and feedback was another crucial element in the proper design and development of a clients issue. Consultation with my client was very helpful as it constantly kept my client in the picture and he was constantly giving me suggestions of what he wanted instead of something else. Consultation made sure that the end product would be as close as you could possible get to what yo client wants. As the project develops it can change a lot and so with consultation with my client I was able to make sure that the project was always changing in a direction that suited him the most and that also suite the actual projects quality and practicality the most

I also had frequent consultation with my technologist. These consultations played a major role in making sure that the project itself was heading in the correct direction physically so that it was not over or under engineered and also so nothing was looked over or forgotten.

Implications for future practice

What I would do next time to improve this process is to better my time management, although it was pretty good this time, I could save some time on all areas of the process, research, design and construction. I probably took a bit longer this time as I did not no much about the renewable energy field and so research took quit long as I had to learn so much which then put everything else a little bit behind. My practical skills were also probably not that high meaning that some time was used for learning how do different processes and so there was less time for actual construction. This means that next time I carry out this process, my practical skills will be of a higher standard and so I can get straight into the construction which will save me a lot of time. The amount of client consultation was definitely at an adequate level, which was clearly showed when my client was completely satisfied with the device that I designed and built. On the whole, it was a long and amazing learning journey and used some good technology practice to produce a device that my client was100% satisfied with and the main thing that I can improve on is planning and speed that I carry out construction could also be increased.

20/10/09 3:39:51 PM
Options
Student explains that the complexities of the situation have been identified and explored.

20/10/09 3:40:34 PM
Options
A critical reflection on their technological experiences that justified the technogical practice undertaken to develop a technoloigcal outcome.

20/10/09 3:43:06 PM
Options
Student demonstrates originality in terms of inventiveness, innovation and elements of unconventionality in the technological practice they undertake and its resulting outcome.

20/10/09 3:42:56 PM
Options
Student explains that the complexities of the situation have been identified and explored.

20/10/09 3:43:20 PM
Options
Student comprehensively justifies the technological practice undertaken and why the outcome addresses the problem.