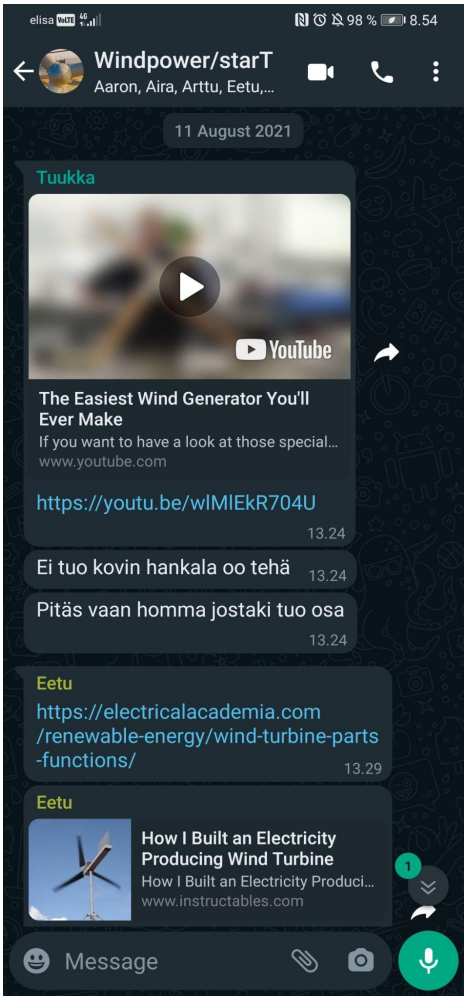
Learning diary

of Wind Power StarT-group from Keminmaa, 2022

Starting Point: WindPower



So, our idea was to make our own wind turbine. It shouldn't be that hard, right?

From the start we knew that we would be needing some help with our ambitious plan. On the 28th of September at our first meeting we searched for help and support for the project through sending emails to experts of the field.

We sent emails to :

- Luma-center
- Finnish Wind Power Association
- Ox2: Eero Länsimäki
- Hannu Kemiläinen, Myrsky Energia Oy

A week later we received supportive answers to our emails and got the help we needed. Then we began organizing an interview with Eero Länsimäki from Ox2. We spent the day's gathering thinking of questions for him on the subject of wind turbines and the wind power industry.

The Questions

At a later date, a part of our group visited the Metsälamminkangas wind farm in Vaala during their class trip, where they met Eero and got to interview him. On the premises they also got a tour of the under construction wind farm. When it's finished it will bring energy to over 80 000 households in a year.

The Next Step

Our next steps of the journey included a lot of research on different subjects concerning our project. We had already gotten a lot of answers from Eero regarding things from his personal experiences working with windmills to technical inquiries, but we still needed more knowledge.
Our subjects of interest included :

- Stepper Motor and how they work
- Different kinds of wind turbines ; some even without any blades
- Ways to make our own little wind turbine without any unnecessary pollution

Together we gathered up the information and what we would need to execute the plan. We ended up with a small list of things.

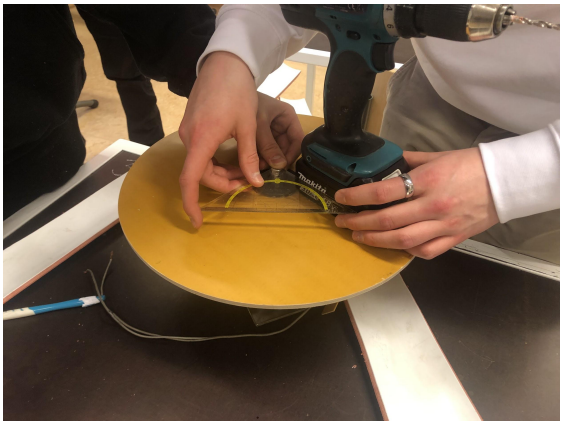
- a pipe
- a plan and material for the base of the turbine
- a place to put the wind turbine
- a memory stick

We contacted company Kilpimaa (LVI Kilpimaa Oy). We wanted to have a recycled material for our blades. We succeeded and got a pipe from their trashpile.

Making the turbine

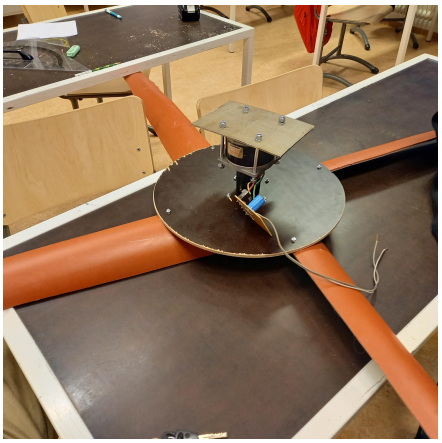
When we had purchased all the materials we were ready to start making the turbine itself.

The first step was to make the blades. We cut the pipe into four pieces and shaped them into the right shape. Then we heated the pieces so we could easily get them to the shape we wanted. After the shaping we carried them outside and put them in snow, so they'd cool down and harden into the right position. The blades were about 100 cm long at first, but later on we decided to cut them a little shorter.



The next step was to attach the blades to the base and to the generator, which we already had on hold. We didn't need to make the generator by ourselves. It was given to us by one parent.

We drilled holes to the base and to the blades. The holes on the base were calculated to be 90° towards each other. Next we screwed the blades to the base. We also wanted to test the turbine with 3 blades and for that we needed to do more holes to the base. Those were 120° towards each other.



Now our turbine was ready for 2, 3 and 4 blade testing.

Testing

When the blades were attached to the base, it was time to test the turbine. We brought the turbine and a voltmeter outside. Then we connected the voltmeter to the turbine's generator and held the turbine up towards the wind. Turns out, our wind turbine really does work!

At first we tested the turbine with 3 blades and then with 2 and 4. We also tested our turbine in different wind conditions.

First we did the testing during weak wind conditions (3m/s). Wind was pretty similar during both tests. Secondly we did testing during the stronger wind (5m/s) in two places: on the ground and on the top of pile of snow (height 4m) on the school yard.

Results

We had learned from Eero Länsimäki, that according to the laws of physics, the more blades there are in the wind turbine, the more energy it produces.

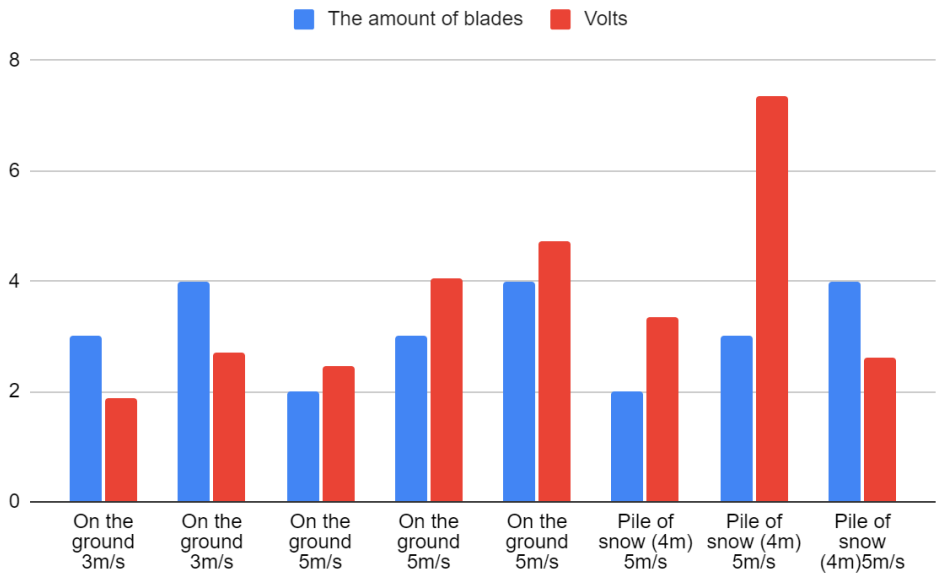
It turned out also in our testing that the produced energy is higher with more blades and more wind.

All results are performed in Chart 1 and Diagram 1.

Chart 1. Results.			
Amount of blades	On the ground		Pile of snow (hight 4m)
	Wind 3 m/s	Wind 5 m/s	5 m/s
2	-	2,46	3,34
3	1,88	4,06	7,36
4	2,71	4,71	2,6

Using 3 blades we got 1,88 volts and with 4 blades we got 2,71 volts . The results were a lot better with 4 blades than 3 blades as we expected. During the testing the wind conditions were pretty unstable. There were sudden blasts of wind at the top of the snowbank which can explain the illogical results while testing our windmill there.

Diagram 1. Results.



What we learned?

The annual worldwide wind power capacity is now about 743 GW. Wind power as an energy producer is growing also in Finland. In 2020 it produced 7,8 TWh energy, which is 10 percent of Finland's energy production.

Wind power is a current question in our area, Meri-Lappi. For instance Simo, a municipality in Finland, in South of Lapland, has 64 efficient wind farms from which the total per is 280 MV. 8,6 percent of Finland's wind power capacity resides in Simo. Actually, the videomaterial of our project film is filmed in Simo by StarT-students. They drove there with their snowmobile.

We learned a lot during our project - clearly a lot more than our schoolbook has to offer about wind energy. We are pleased that we had courage to contact wind power experts and our results matched to the theory.

Even though the project still left us with several questions.

- How can windmills develop bigger and better - more efficient?
- Is it possible to produce all the energy in the world by wind power?
    - If so, how long would it take?
- When would it be possible to store energy produced by windturbines and what does it take?
- How can I transfere the energy from our windmill for example to my cell phone?