

WAVergy

CRO-WAVE-ENERGY (CWE)
(Concept for linear electric power generator)

1. SUBMISSION INFORMATION

1.1 Contact information

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1.2 Submitting category

Student project using Autodesk Fusion 360



2. PRODUCT DESCRIPTION AND IMAGE

2.1 Product description

Wavergy (CWE) is linear generator which represents a power generator that exploits the amplitude of the motion of the waves and generates electric power and sends electricity to the transformer. The buoy follow the wave movement, actually it moves from the lowest bottom dead center to the highest top dead center or inversely.

Ball bearing is connection between the buoy and the plastic (HDPE) "rope" (connection).

Ball bearing has the ability to accept lateral forces. Plastic (HDPE) "rope" is used for transferring translational motion obtained from the buoy to a serie of permanent magnets (neodymium magnets).

Magnets, which now have a straight-line path, follow the raising and lowering of the buoy and these reciprocating motion multiple times undergo multiple coils and thus the magnetic field becomes multiple times intersected (greater number of input-output means higher induction of electricity).

Handle allows easier extraction of the device from the sea because of required regular maintenance.

Absorbing springs reduce the resulting strokes.

The gasket has the role of preventing the entry of sea water into the device. Anchor point represents connection junction of devices with anchor block on the sea bottom for positioning and stability.

The produced electricity is discharged to the nearest transformer plant cell and to further use.



2.2 Image rendered in Autodesk Fusion 360

On image we can see a cross section of the outer casing without a inner casing, and main assembly of Wavergy. Picture on the bottom, show as a complete assembly with inner casing.



2.3 Materials in use

Thermoplastic:

Polyethylene - PE
(PET, PP, PVC)

High-density polyethylene

Acrylonitrile Butadiene Styrene

Polylactic acid - PLA

Rubber

Copper

Stainless steel

NdFeB - Neodymium magnet
alloy of neodymium, iron and
boron

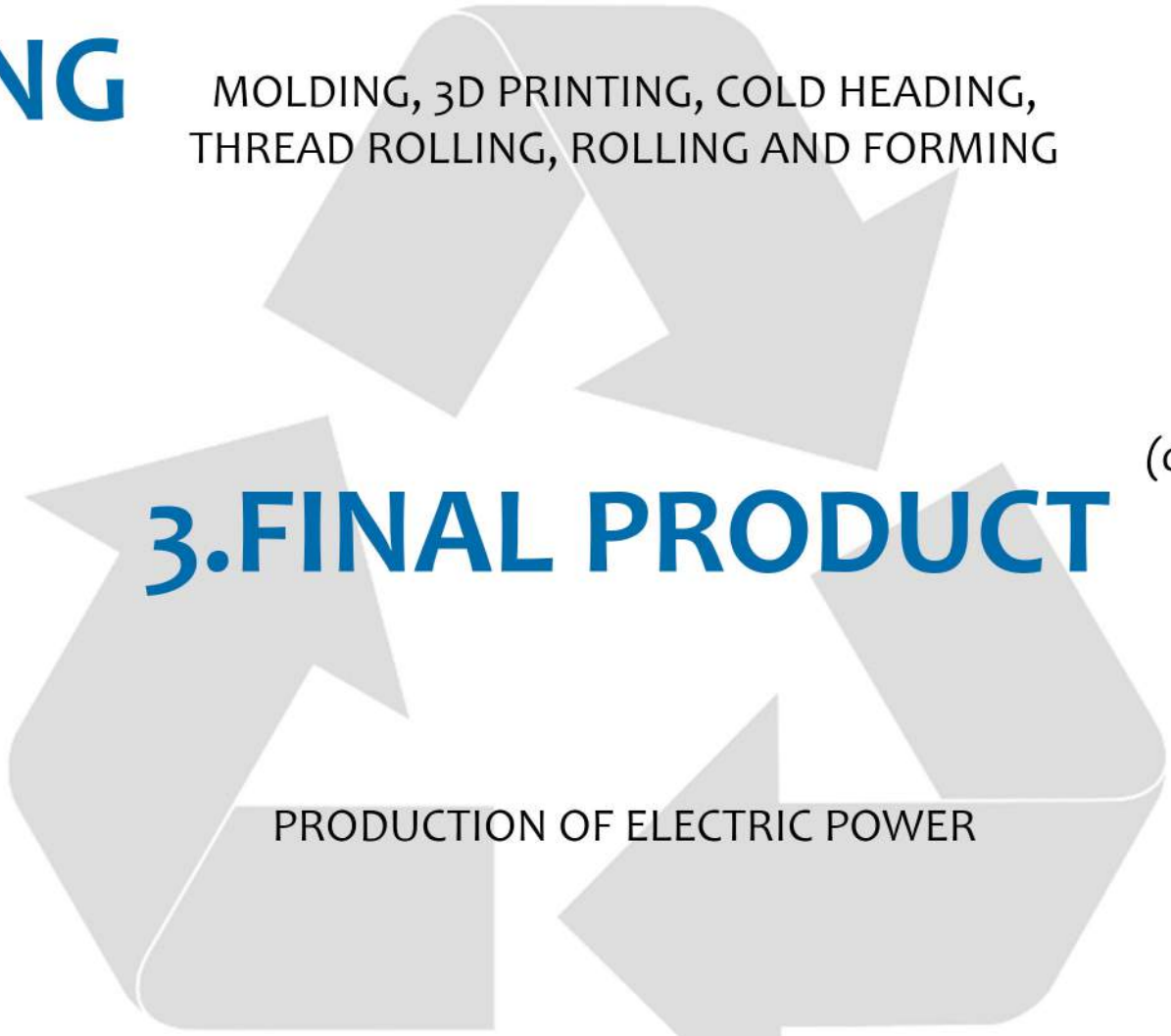
2.4 Illustration of the product system

1. RAW MATERIAL

PE
(PET, PP, PVC)
HDPE
ABS
PLA
Rubber
Copper, steel, neodymium,
iron and boron

2. MANUFACTURING PROCES

MOLDING, 3D PRINTING, COLD HEADING,
THREAD ROLLING, ROLLING AND FORMING



3. FINAL PRODUCT

WAVERGY
PLASTIC PARTS
(casing, buoy, handle, ball bearing, screws caps...)
METAL PARTS
(copper coil, stainless steel screws,
neodymium magnets)
RUBBER PARTS
(seals)

4. PRODUCT USE

PRODUCTION OF ELECTRIC POWER

5. "END OF LIFE"

IT IS NOT A END OF LIFE,
WAVERGY CAN BE UPGRADED, REPAIRED,
AND OLD PARTS CAN BE RECYCLED INTO
BETTER PARTS

6. RECYCLING

RECYCLE THE OLD PARTS, PLASTIC AND
METAL WASTE

3. REUTILIZATION CYCLE AND BUSINESS MODEL

Technical advantages:

Simple design, because the simple design of the concept is a big potential in a mass production.

The possibility of 3D printing of individual parts.

It solved the problem of cooling the transformer. By laying in the sea transformer cools nearly to the temperature of the sea.

The expected longer lifetime, because there are no parts that develop strong attrition or mechanical impacts.

No need for complicated control over the system, just the simple automatization of the entire process via one computer.

The system of random magnets and coils allows much greater production of electricity than standard linear generator because of larger number of inputs and outputs of the magnet coils.

Greater overall efficiency because there is no transfer of energy from a linear movement in hydraulic and then to electrical form.

Fast installation, fast startup.

Economic advantages:

Simple design means easier and less maintenance and service expenses.

The concept is designed so that there are no parts that create a lot of friction, thus there is no wearing those same parts.

Requires less highly qualified workforce for service and installation due to the simplicity of the concept.

There is no need for large and complex structures, or expensive steel elements.

Low production costs. The use of inexpensive materials for the production (**recycled plastic**).

Environmental Benefits:

Do not threaten the integrity of the coast. By this we mean that there is no so-called "industrialization" of the shore, coast ecology remains intact. It does not require an appropriate shore installation, the possibility of using a much larger domain (along the coast, open sea, etc..).

For Wavergy production, most common material is plastic.

Why plastic?

Because, if you take a look around, we are surrounded with plastic waste, and it is really big problem today.

But we can use that waste and recycled into plastic filament for 3D printers, and we can start production.

The same thing is with rubber, we can collect every year a big quantity of rubber ready for recycling.

At second place we have two types of metals, copper and stainless steel. The copper is important for coil production, and stainless steel for screws.

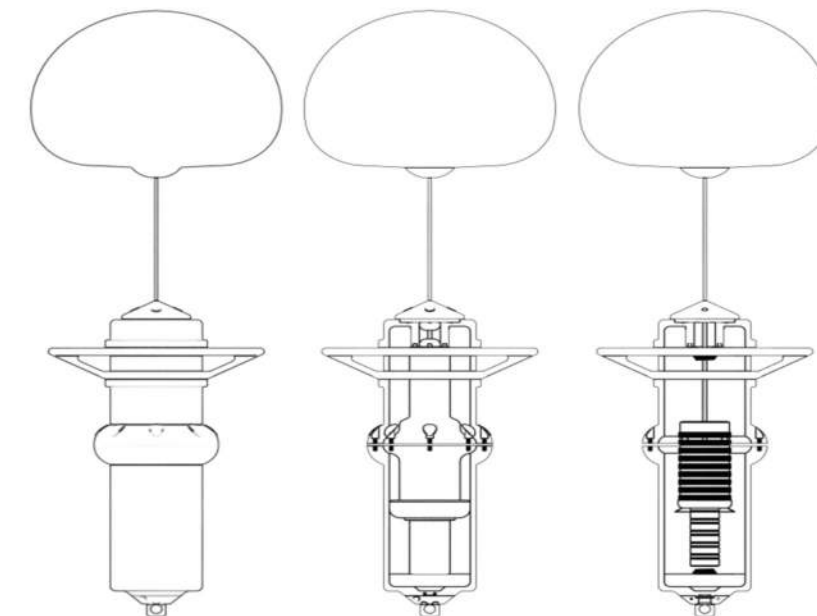
Both of materials is simply to found on the market, and both can be recycled.

The most complicated part of Wavergy are neodymium magnets. This type of permanent magnet is strongest type of permanent magnet commercially available and it is most widely used type of rare-earth magnet.

The recycling is a little bit complicated, but we already have several methods.

At the end, I can only say that we can make social and environmental change.

We can produce free electricity, and remove a lot of waste.



4. MATERIAL SELECTION

4.1 Overview

Wavergy is made entirely of recycled materials, save the magnets. Actually, magnets can be also recycled, but existing methods are not 100% effective.

Copper is the best option for this concept, and plastic was chosen for its recyclability, durability, 3D printing and molding.

4.2 Material reutilization

This concept for linear generator consist of:

Thermoplastic (96%)

Rubber (2%)

Copper (0,5%)

Stainless steel (0,1%)

Neodymium magnets (1,4%)

If we take into consideration this 1,4% of magnets, we conclude that Wavergy recyclable 98,6%.

4.3 Material health

Thermoplastic NFPA rating: 0

PET: SPI RESIN CODE 1

HDPE: SPI RESIN CODE 2

PVC: SPI RESIN CODE 3

PP: SPI RESIN CODE 5

ABS and PLA: SPI RESIN CODE 7

Rubber: natural rubber NFPA rating: 0

Copper NFPA rating: 0

Stainless steel NFPA rating: 0

Neodymium magnets NFPA rating: 0

After more than 5 years of using of various CAD programs, I can only say: Fusion 360 is the best. And question is why?

So, I prepared two pictures produced in Fusion 360. The first one is 2D drawing which can be produced with Fusion 360 so quick and easy with few clicks of mouse. The second one show as main assembly of Wavergy, assembly of coils, magnets and coils stand. Everything is done with direct modeling and it is so quick. Best part of modeling is how easy you can remodel some part (change dimensions and shape). Rendering with Fusion 360 gives you a lot of options and really good results. I can only say few more thing about this software, it is great for team-work, because of cloud option and it save a lot of time, and we know that is time really important today.

