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# LAGI 2019 – Abu Dhabi

## Land Art Generator

This competition has been challenging in many ways to make renewable energy beautiful. Art can be subjective and can be used to expressing our emotions and feelings.

Art to create a visual, auditory or performing artifacts (artworks), to expressing the author's imaginative, conceptual ideas, or technical skill, intended to be appreciated for their beauty or emotional power.

I personally feel Art can be beautiful in its Simplicity, and nature is the best Art work that can inspire us. The proposed Site itself is split into two there is a road which segregates the two and is surrounded on both sides by buildings. I wanted to create a breathing space which is an open. My proposal is simple, yet beautiful and meaningful, below is how I have split the LAGI Site into different functions

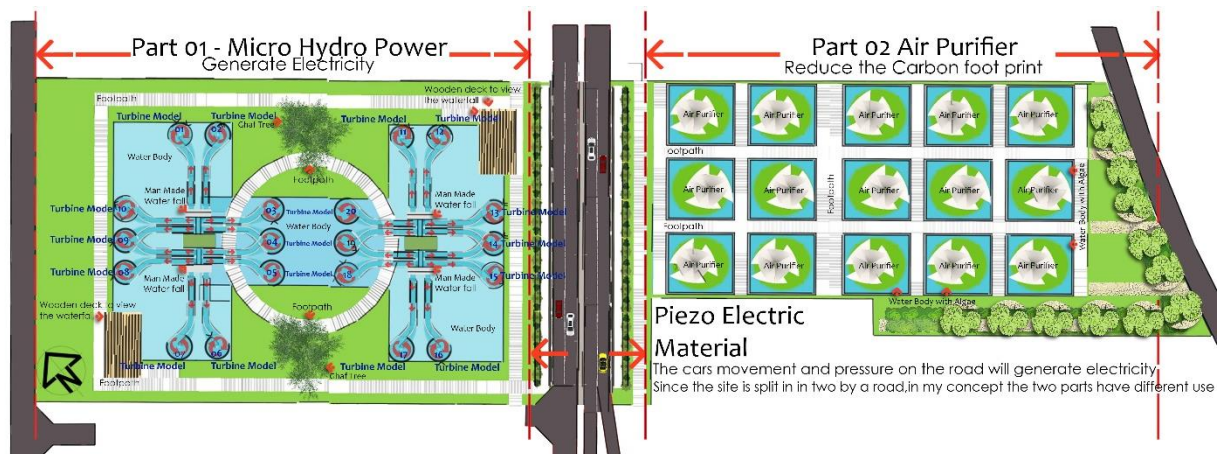
### Part 01 – Hydro Power

### Part 02 – Piezo electric Material

### Part 03 – Air Purifier

It being the year of tolerance one of the factors that inspired me was the Ghaf Tree.

Solar Power is the most practical way of generating Energy in Abu Dhabi. In this proposal I wanted to venture out into new types of technology.



## Part 01 – Micro Hydro Power

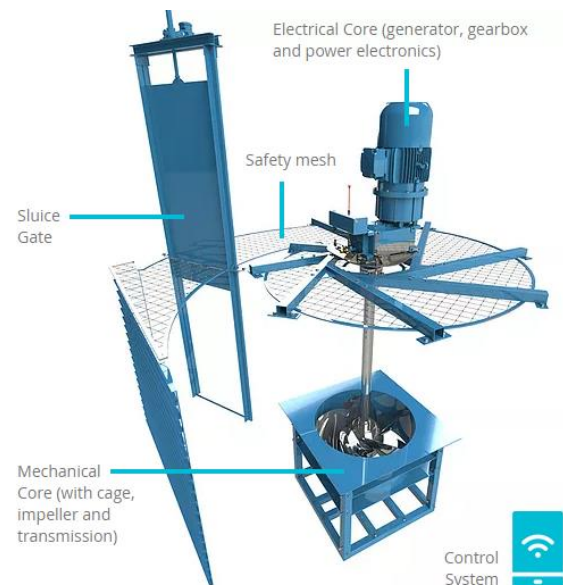
Hydro Power is always reliable and is the most practical way of generating electricity in almost all countries, is impossible to create without a water source.

In UAE most of the developments/ projects have water bodies as a feature. I thought why not use these manmade water bodies as water features which can generate electricity for that development. It would be aesthetically pleasing as well as serve a purpose.

While researching I came across a company called Turbulent, this company has invented a micro hydro power plant. They have developed an efficient hydropower plants for rivers and canals with a low height difference (between 1.5 - 3.5m). It is a new technology based on the vortex principle. To generate electricity using an individual turbine or a network of multiple turbines, all designed for durability and low maintenance. They are using this technology mainly in Rural Areas and has been successful. These are all-natural forms of water, I am proposing a man-made water feature a waterfall.

Since the site is restricted and would not be easy to form rivers or channels. I propose a 20m high water fall in which the rate of flow for the water should be 6m/sec to generate the maximum amount of electricity. The electricity produced depends the rate of flow of water and is the driving force. Multiple turbines can generate up to 2MW which is what I tried to achieve in my design. The water fall at that rate will fall 10m into a concrete channel which is 3.0m wide by 2.5m high. This channel is sloped over a length of 15.0m and 10m in height into the turbines, to generate the electricity. The water then flows back into the water body and is recycled by the water fall. It is a constant cycle.

Below is the isometric view of the Turbine and the table as per the specifications.



	Model A	Model B	Model C
Max Basin Diameter [m]	3.92	5.3	6.91
Min Basin Diameter [m]	3.32	4.51	5.84
Basin Height [m]	up to 4	up to 3.5	up to 3
Weight Core Unit [kg]	940	1330	1880
Max dimension of Core Unit: w x h x l [m]	2.63 x 5.96 x 2.64	3.53 x 5.86 x 3.54	4.70 x 6.38 x 4.71
Head Range [m]	1.55 - 4	1.55 - 3.0	1.8 - 3.3
Flow Range [m <sup>3</sup> /s]	1.2 - 3.0	1.6 - 3.6	2.0 - 5.8
Power Range [kW]	10 - 55	12 - 55	16 - 100

<https://www.turbulent.be/technology>

In my design I have opted for multiple turbines of Model C which a max basin diameter of 6.91m and up to 3m high

The advantage of having a Man-Made Water fall is control. The rate of flow of the water produced on a daily base. It can work 12 hrs or 24 hrs depending on the consumption. It is environmentally friendly and since it not a river it not affecting the natural ecosystem.

This is proposition and this design is based on the parameters and specifications. With further study, research it can be more practical, and variables may change to make it more efficient.

### Installation

This system is flexible with low head design and is viable.

Easy set-up with long-lasting productivity.

### Minimum site requirements.

Drop of 1.5m to 3.5m (2 sequenced turbines are possible if 5m drop and larger flow)

Minimum flow of 1m<sup>3</sup> (1000 l)/second constantly available throughout at least 9 months of the year.

Road nearby (to avoid unnecessary roadworks and environmental damage)

For On-Grid, Feed-in options nearby (ideally under 200m, to avoid lengthy line connections)

Since it is manmade the water fall will be constant and so as the speed. The water fall would be the source for the turbine and would have to be pumped up. The flow rate of the water should be greater than 1m/s so I propose the specification for option C which is 5.8m/s

If achieved, then the power range is 16 – 100 kw.

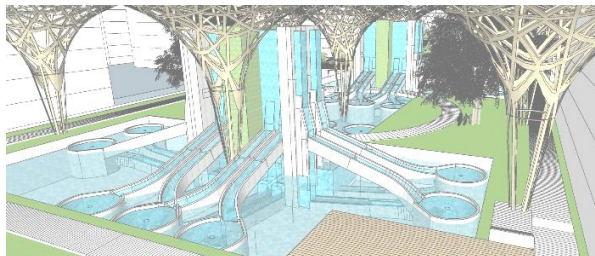
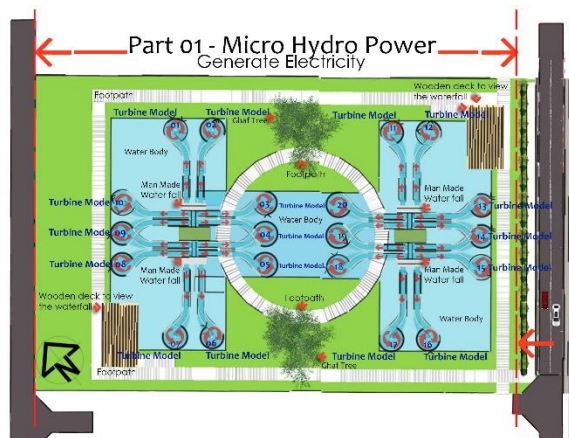
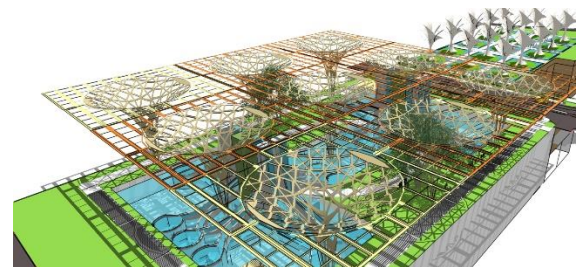
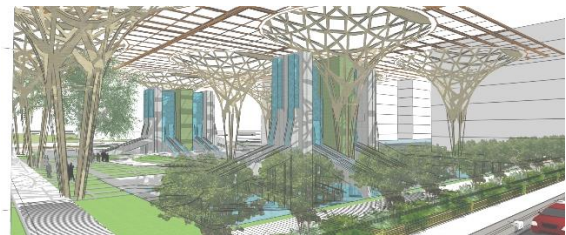
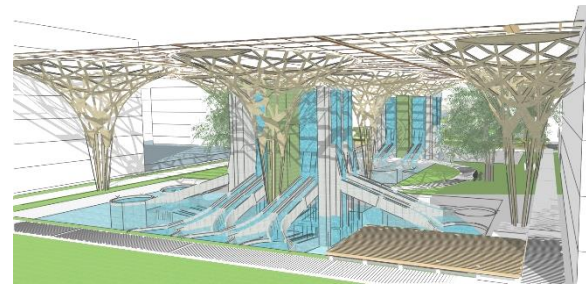
In My design I have opted for 20 Turbine Units

With 20 Turbine units then the minimum power achieved will be 16kw x 20 Vortex units = 320kw

The maximum power achieved will 100kw x 20 Vortex units = 2000 kw/2Mega W

To symbolize the Ghaf Tree and year of tolerance the Shading device which is the artistic element has been inspired by trees.

This area will be landscaped with Ghaf tree as a mark.





## Part 02 – Piezo electric Material

Cars being used to produce electrical energy, this idea if feasible would be beneficial.

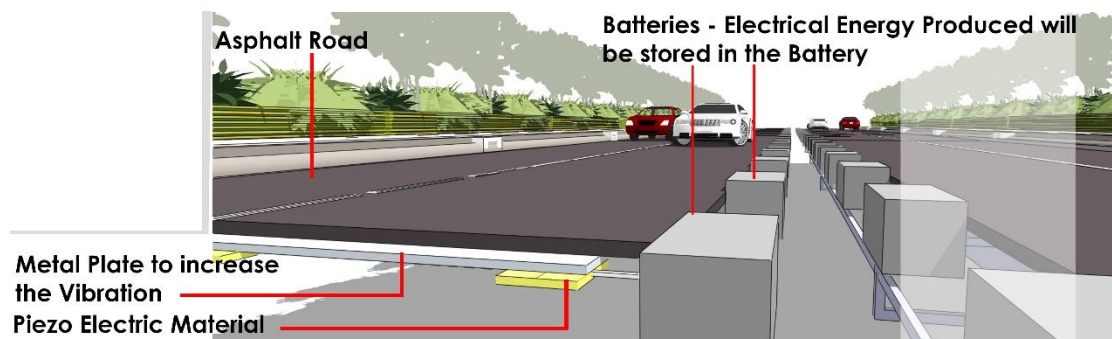
Piezoelectric devices fit into four general categories, depending of what type of physical effect is used: generators, sensors, actuators, and transducers. Generators and sensors make use of the direct piezoelectric effect, meaning that mechanical energy is transformed into electrical energy.

The piezoelectric material is placed between the vibrating structure and a seismic mass introducing the vibration forces into the piezo element. The piezo element itself converts the vibrations into an electric charge proportional to the applied force.

In my proposal, the Piezo electrical Material/ sensors can be placed below the asphalt road at intervals.

Energy cannot be destroyed it is transformed from one form to another. The road section would be the asphalt road below a metal strip to achieve the maximum vibration. Below that the Piezo electric material which can be ceramic or sensors. The force, pressure and constant movement of the cars applied on the on the road causes some deformation this would be transferred to the Piezo material/sensors which will the convert this to electrical energy. This electrical energy will be transferred to a battery and stored there as shown below.

This material is expensive and is still under research which is why I was not able to make a calculation as to how electrical energy could be produced.

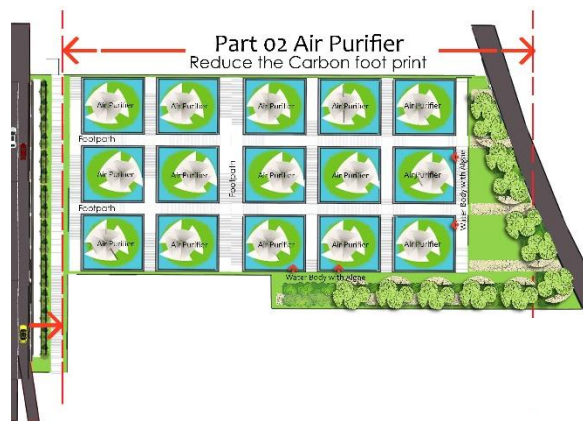


## Part 03 - Air Purifier.

Algae is one of the most primitive life forms found on Earth. It has a lot of potential in the medical field and to produce energy. It is mainly studied as a bio fuel, but I am proposing to use it as an air purifier so as to reduce the carbon footprint.

### Advantages of Algae

Algae is characterized by the fast growth, only needing water, sunlight and carbon dioxide to grow and it consumes huge amounts of carbon dioxide.

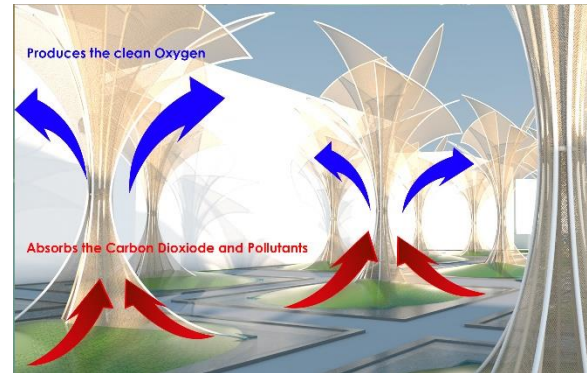


In the Artistic elements seen below, these act as air purifier. The Polluted air is taken in by the surrounding. The air purifier is supported on the mound with water surrounding it the water is for the algae to be harvested as the local algae. The art forms are made of steel tubes and which hold the plastic modules in between as shown below.

The plastic modules will have the local algae in them with water, the steel tubes below will have inlets to let the pollutants in which is mainly carbon dioxide from the surrounding and the cars nearby.



This will then mix with Algae and photosynthesis will occur in turn and produce fresh oxygen which will be dispersed from the outlet in the steel tubes above, thus producing fresh oxygen and reducing the carbon foot print.



Check Website

<https://www.youtube.com/watch?v=nLoFt3vGeBE>

Cultivating Air by Otis Sloan Brittain

Lanzhou, China the most polluted City





**Polluted Air pumped in**



**Clean air out**



**Comparison of the Indoor Air Quality achieved after using the Algae Air Purifier**



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## Environmental Impact Assessment

The Design Proposal and the Environmental Impact on the socio – economic, cultural and human health impacts along with Environmental.

### The Hydropower

- Is fueled by water, so it's a clean fuel source, meaning it won't pollute the air like power plants that burn fossil fuels, such as coal or natural gas.
- Hydroelectric power is a domestic source of energy, allowing each state to produce their own energy without being reliant on international fuel sources.
- The energy generated through hydropower relies on the water cycle, making it a renewable power source, making it a more reliable and affordable source than fossil fuels that are rapidly being depleted.
- Since it won't be in the river it will affect the flora or fauna of the ecosystem
- It creates a social place for leisure a place to gather and view the artistic elements and the waterfall.

Most air pollution comes from energy use and production Burning fossil fuels releases gases and chemicals into the air. This creates a destructive feedback loop; air pollution not only contributes to climate change but is also exacerbated by it. Air pollution in the form of carbon dioxide and methane raises the earth's temperature. Climate change also increases the production of allergenic air pollutants including mold (thanks to damp conditions caused by extreme weather and increased flooding) and pollen (due to a longer pollen season and more pollen production).

- The Air Purifier will have a positive impact since we would be producing clean air and improving the air quality and trying to reduce the carbon footprint
- It creates a social place for leisure a place to gather and view the artistic elements.

My proposal is to use as natural elements and have a positive impact on the environment and create a social place

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