# PROJECT OVERVIEW

**Project Name:** **AES Project**
**Project Duration:** **2 years**
**Total Funding Requested:** **20 Million**

**Location: To be selected by sponsor**

I am writing to propose a project that I believe aligns with your organization's mission and goals. We seek funding for Clean Energy Project , a groundbreaking initiative designed to Electricity Generating System that do not pollute the environment and cause global warming. Depending on the system architecture and site needs (village, airport, military base; for examples), the electricity generated can vary from 1 to 100 MW.

## Introduction

It is self-evident that the current worldwide energy landscape is not sustainable due to expensive and polluting processes used in generating electric power. Existing electricity generating methods; such as coal-fired, nuclear, and hydrocarbon-releasing power plants; are expensive, require fuel with harmful products released into the environment, and/or unsafe.

Even recent alternative efforts to generate electricity, such as utilizing hydrogen or fuel cells, are expensive and harmful to the environment because, to obtain pure hydrogen, processes are required for separating hydrogen from hydrocarbons.

The current worldwide average cost of electricity delivered into the end user is also very high; ranging from 40-to-300 dollars per Megawatt-hours ($/MWh) depending on the production method, country, state, whether, and government taxes and subsidies; with hydro and solar having the lowest prices and coal-fired power plants having the highest prices.

The energy landscape is, however, shifting rapidly into more environment friendly means; this is why governments are implementing ambitious decarbonizing targets, and pursuing and subsidizing alternative clean energy products. But because the worldwide demand for electricity remains high; relatively low-cost environmentally-friendly products such as hydro, solar, and wind are not sufficient to deliver the quantities required.

Another major energy shift underway is the transition from fuel burning to electric-powered cars, trucks, ships, and planes; therefore, the need for electricity shall significantly increase, and thus the need for cultivating novel means of generating electricity continuously. Continuous supply of electricity is important because energy storage (via batteries) limits the vehicle travel distance before a recharge is needed.

The world; therefore, is in need of electric generation products which (1) pollute do not the environment and cause global warming, (2) can be deployed onsite at the end user location, (3) operate continuously 24 hours per day without maintenance, (4) produce power at much lower cost, and (5) can operate in stationary and mobile modes. A mobile product can be utilized in the transportation sector, examples include truck and ship engines.

To that end; Air to Electricity System ( AES, company to be renamed later) is forging ahead, pending funding, with development (Phase 1) and production (Phase 2) of electric generating stations which produce clean electricity at no cost, except for the procurement price and installation cost of the product. Very much similar to solar and wind products where the initial price-and-installation is the only cost.

# 1- System Purpose

Relative to existing methods for producing electricity, AES project with ( Dr. Yousef & Mr. Wassim Ismail) Co offer the world exactly what it needs; a clean source of energy which does not depend on weather, location, utility companies, and supply of hydrocarbon fuels.

The product captures onsite ambient air (Oxygen and Nitrogen) and releases Oxygen and Nitrogen into the environment; along the process, Oxygen is heated and pressurized and then cooled and rejected into the environment. A turbo-generator converts Oxygen heat and pressure into power. System differentiating characteristics are:

1- Utilizes air to produce clean electricity.
2- Pure Oxygen gas is the fuel.
3- Procurement cost is the only cost.
4- Operates continuously with zero maintenance cost.
5- Operates in stationary and mobile modes.
6- Covers wide-power-spectrum.
7- Utilizes proprietary (to be patented) concepts.

In order to protect novelties and to guarantee legal protection; at the start of Phase 1, associated patents shall be submitted in the USA, Europe, and Japan. The integrated system design (or architecture) as well as aspects of the workings of its three subsystems are patentable.

At the most fundamental level, the product promises zero-emission technology and an efficient way to produce electricity in commercial quantities for both stationary and mobile applications. A true carbon footprint eliminator.

# 2- System Basic Definition

The integrated system architecture consists of three products, functioning in unison and in thermally controlled communication with each other, as shown below.

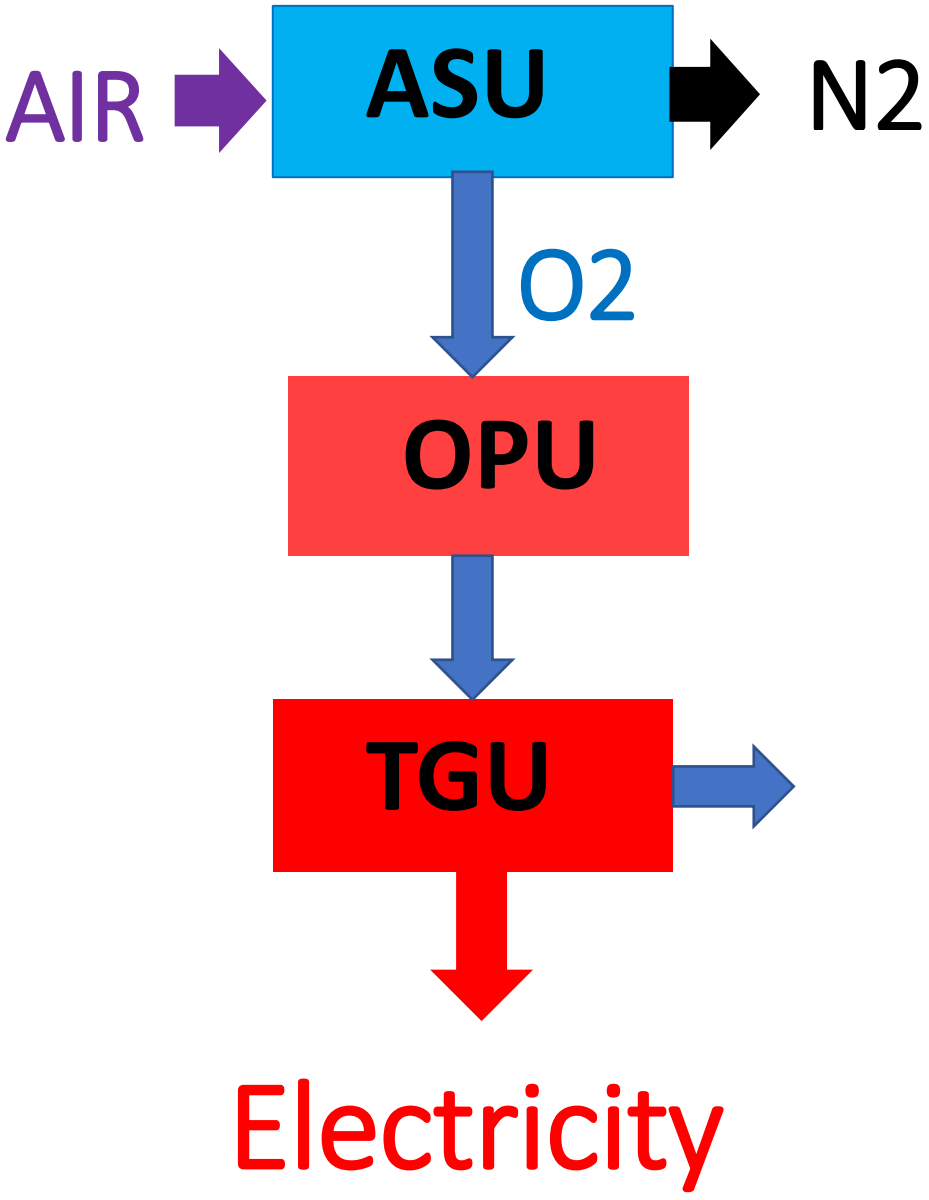
The Air Separation Unit (ASU) accepts ambient air, separates air into Oxygen and Nitrogen, delivers Nitrogen into the environment, and delivers pressurized Oxygen into the Oxygen Processing Unit (OPU).

The Oxygen Processing Unit accepts pressurized Oxygen, and automatically controls its release rate and frequency such that the desired quantity, temperature, and pressure are delivered into the Turbo-Generator Unit (TGU). Excess Oxygen, if any, is released into the environment, recycled back into the ASU, or stored in separate tanks.

The Turbo-Generator Unit (TGU) accepts precise quantity of hot pressurized Oxygen, cools and depressurizes Oxygen before releasing it into the ambient environment, and thus converts heat and pressure into electric power. Depending on the output power need; the TGU, which consist of single or multi turbines integrated into a generator, may itself consist of multi parallel units, each delivering partial power.

Each system accepts only ambient air, consisting mostly of Oxygen and Nitrogen, and discharges only Oxygen and Nitrogen back into the ambient environment.

Each application is designed and constructed to achieve specified power output (MW) and that, in turn, determines the exact quantities of Oxygen flowrate, and exact temperature-and-pressure differences across the turbine(s). Because there are technical design limits; such as the maximum operating turbine inlet temperature and turbine material and rotational speed, multi turbine and/or TGU configurations may be deployed in order to remain below allowable thresholds, thus guaranteeing product quality and reliability.


AIR
ASU
N2
O2
OPU
TGU
Electricity

# 3- System Novelties

The first patentable aspect is the overall system design architecture. The three subsystems (ASU, OPU, TGU), functioning together and in controlled thermodynamic communication with each other, are essential to overall performance.

The second essential attribute is the electronic management of the OPU such that Oxygen flow, frequency of release, and burning rate are performed in a precisely controlled process; with exact deliverables such as turbine flow and inlet temperature and pressure.

The third invention is the structure or configuration of the TGU. The number, turbine type (radial, axial, or mixed-flow), and configuration of turbine wheels are selected for optimal performance and structural responses. And because more than one TGU may be required to deliver the desired power, unique parallel arrangement is utilized; this configuration is essential because there is a temperature upper limit at the turbine inlet.

Fundamentally; the product utilizes two essential-and-controlled frequencies, the first is the Oxygen release frequency of OPU, and the second is the rotational frequency (RPM) of the TGU.

# 4- Process Technical Pathway

Once the ASU-generated quantity of Oxygen is delivered into the OPU, the goal of the experimental process within the OPU is to optimally determine the achievable Oxygen energy level (E1) in terms of temperature (T1) and pressure (P1). E1 is not known at this time; however, T1 is high (varies with flame color, ranging from 600 to 1600 degrees C), and P1 is also high (ranging from 10 to 200 bar).

The high energy E1 is delivered into the TGU, causing it to rotate. Accepting E1, the TGU expands and cools the flow into a lower energy level E2 (or T2 and P2, ideally near standard). The magnitude of generated power (KW) is the product of:

Oxygen Mass Flowrate, kg/s.
E1 minus E2, KJ/Kg.
TGU efficiency, 85% to 90%.

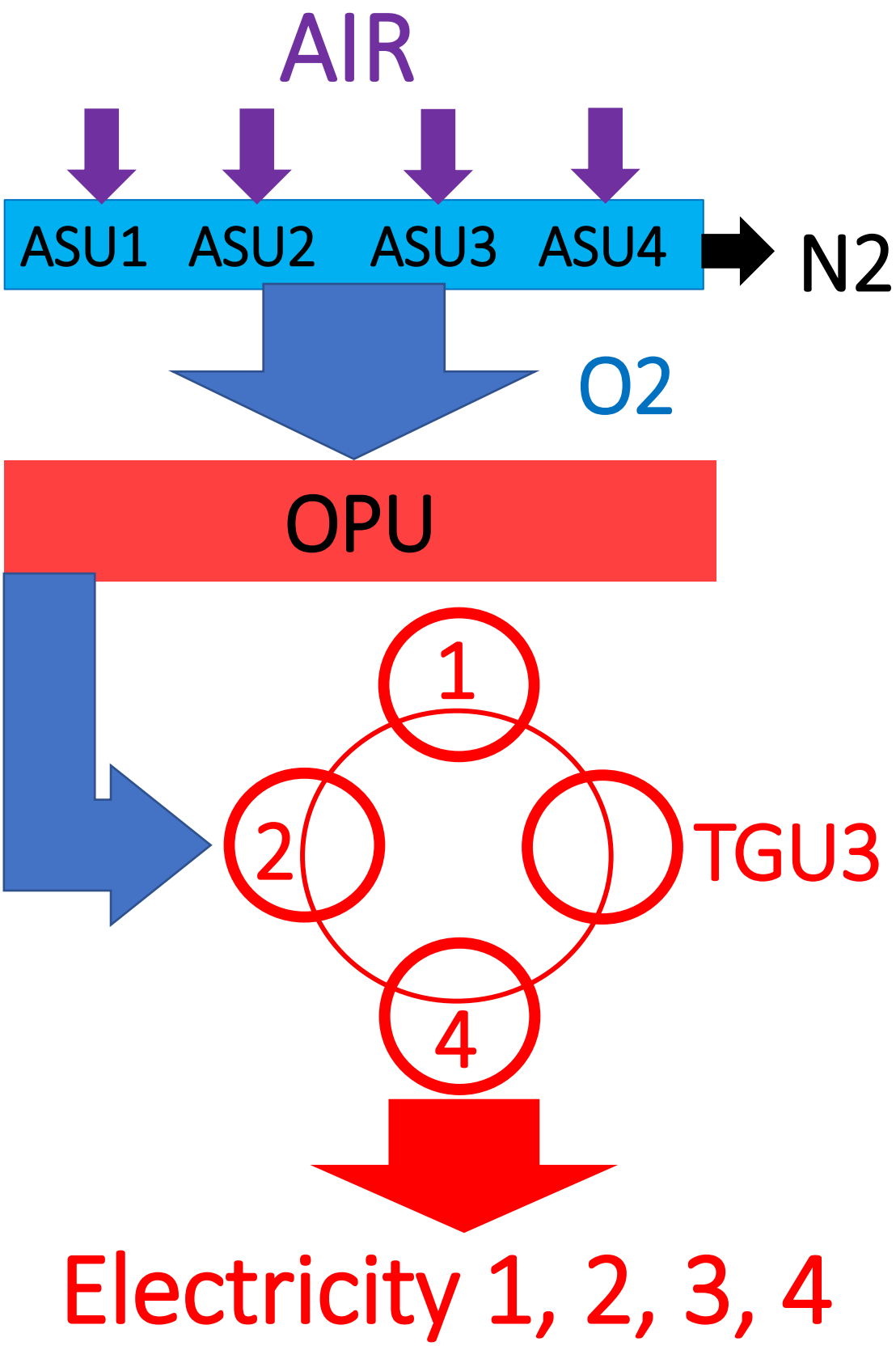
Depending on the required power, TGU mechanical design constraints, and process segmentation; the energy transfer process from E1 to E2 will require single (low KW), parallel (moderate KW), or multi-stage TGU configuration (huge KW).

# 5- Power Spectrum

The system power spectrum range is from 100 KW to 100 MW. Depending on the achievable operating Oxygen temperature, pressure, and mass flowrate; the system may consist of single or multiple ASU's and TGU's. The number of ASU's need not be equal to the number of TGU's.

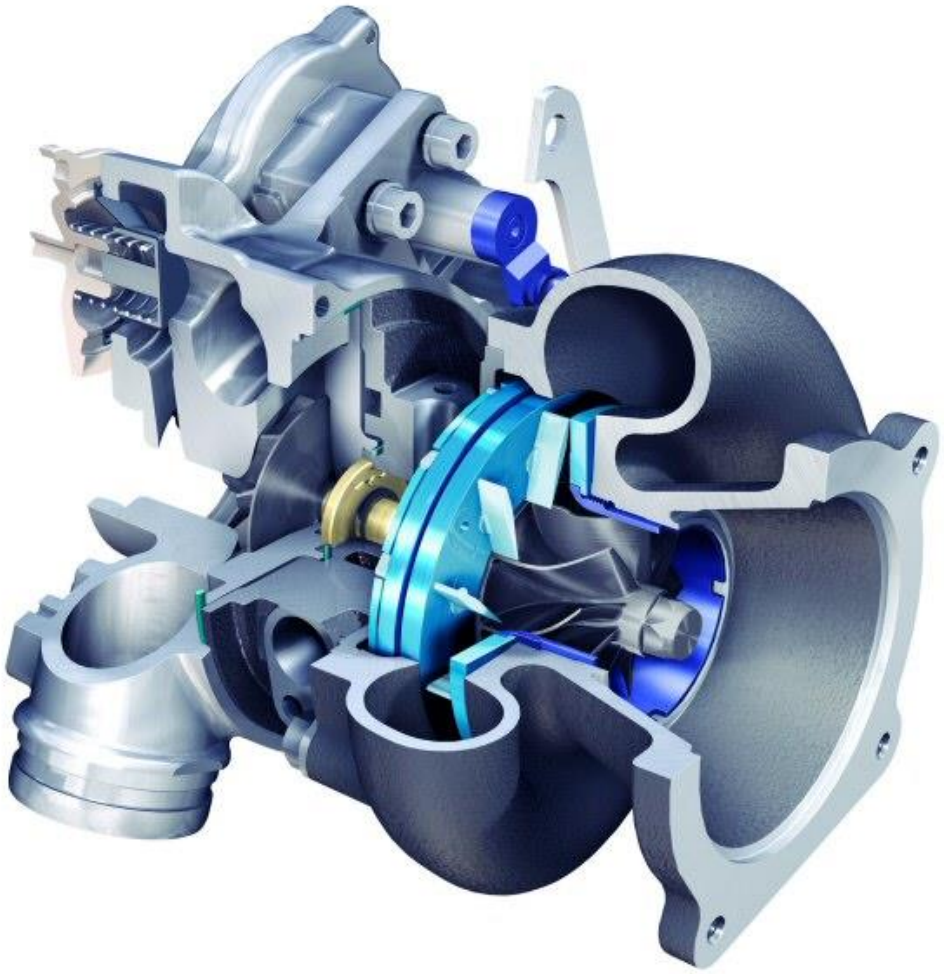
Usually one of each of the three products is sufficient to produce small output power; however, parallel units are required for increased power output. This is because output power is proportional to the Oxygen mass flowrate, so more ASU's are required for increased power. Shown below is a possible parallel configuration, which is also another unique and patentable aspect of the product. A major investigative issue shall be the determination of the Oxygen energy level within the OPU; namely, the ideal temperature and pressure.

During the verification phase, off-the-shelf ASU and TGU will be utilized to determine functionality and proper operating Oxygen temperature and pressure. During the development phase; parallel ASU-plus-TGU arrangements will be utilized to determine whether or not off the-shelf TGU's are sufficient; if not, mutli-stage turbine structure, such as those used on gas turbines or steam turbines, will be need.


AIR
ASU1
ASU2
ASU3
ASU4
N2
O2
OPU
1
2
TGU3
4
Electricity 1, 2, 3, 4

# 6- Similar Hot Turbine Equipment

Examples of equipment which run at very high turbine inlet temperature include gas turbines and automotive turbochargers. For gas turbines, the turbine inlet temperature may be as high as 1500 degrees C. For turbochargers, where the turbine extracts exhaust gas to drive a compressor (thus increase engine efficiency), the turbine inlet temperature may be as high as 1000 degrees C; a turbocharger cross-section is shown below.



# 7- Conclusions

At the most basic level, the novel electricity generator is a true carbon footprint eliminator because it uses Oxygen only as fuel. The TGU accepts hot high-pressure Oxygen, expands and cools the flow, then releases it back into the outside environment.

Like existing systems such as gas and steam turbines, fuel heat and pressure are transformed into power; however, unlike existing systems, the proposed system releases no carbon.

Depending on power requirements; the system architecture deploys three elemental products in continuous thermal communication with each other, and with all three having thermal and structural maximum operating thresholds. Off-the-shelf ASU in single or parallel modes; single OPU; and TGU in single, parallel, or multi-stage turbine structure modes.

To render the system safely functional, much experimental work will be carried out during the verification-and-development phases to determine optimum Oxygen rates, release-and-burn frequency, and ideal temperatures-and-pressures; once determined, the process of simplifying-and-improving the overall system function-and-architecture can begin.