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Renewable Plasma Turbine System

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Abstract

The design of the new principle for creating electricity and increase the efficiency of both solar panels and wind power to be commercial source of energy for cities and manufacture depends on solar cells, gas turbine, compressor, magnets and electric generator to create plasma instead of fossil fuel. This paper presents the design of turbine depend on plasma from solar power to increase the efficiency of solar cells or wind turbines and the fuel considered as Plasma. The computational approach attempts to strike a reasonable balance to handle the needs of manufacture and cities. The principle of the solar reactor is approach to get clean, safe and cheap source of electricity in addition to contribute to solve the global warming problem in order to increase the investment and manufacture. Accordingly, in present study an attempt has been made through new device create hyper energy to generate electricity through the creation of direct electric current of the solar cells then interact electricity and compressed air to transform the gas into plasma to reach the ultimate goal to generate 1500 Megawatt from unlimited source of energy and with high assurance of clean and safety.

Keywords: plasma, solar power, wind energy, power plant, PVs system

1. Introduction

Solar turbine create thermal energy to produce mechanical output power and increase the efficiency of solar power as the new modification is to replace the fossil fuel by plasma created from sun power with using the principle of free energy produced from solar power and creation of plasma with low cost and easy design

The most advanced technique is to make wind turbine as alternative way to produce electricity if it's rainy or windy day or if it's not active site for sun power

The force of the torque is similar to the concept of the rotation of the gas turbines of the current power plants or as the concept of jet engines in the style of acceleration by an or as jet power in the Form of acceleration through a burned gases or air expelled from an engine of its operation to create clean, safe and more cheaper energy while the target of this study is to achieve the below objectives

- solar reactor designed to produce 1500 Mega WATT per unit to cover all the needs for cities and manufacture by using clean and safe energy
- Modify inside the gas turbine to be plasma turbine in order to enhance the actual power plant facilities in order to decrease the cost of construction
- Generate electricity from unlimited source of energy without nuclear waste or pollution.

2. Content

1) Instant challenges of solar power
2) requirement to enhance the efficiency of solar and wind power:
3) total renewable energy contribution
4) The main goal of this design
5) The design of the turbine & its components
6) Main Idea of the new concept of the design
7) Cooling system
8) Storing PVs electricity

3. Abbreviations

- MW= megawatt
- KV=kilo volt
- LIs=Lithium sulfur
- KW/H=Kilo watt per hour
- DC=direct current
- AC=alternative current

3.1 Instant Challenges of Solar Power and Obstacles with Solar Energy

What is the obstacles that prevent solar energy from being the biggest source applied in energy production.

To generate electricity directly from sunlight Solar panels use expensive semiconductor material and factories require' clean' manufacturing environments high cost for both maintenance and construction
After modification and development in solar photovoltaic cells the effectiveness increased and the current capacity ranges from around 20% up to a top range which didn't reach the optimum level around 40%, although there is slight in progress happened and now 60% are wasted as heat of the sunlight that hit the photovoltaic cell. The most efficient photovoltaic now (up to 43% efficient – as we can see there is low impact and contribution of solar energy for the time being - but these cells still remain expensive in both construction process and manufacture
The new idea for Solar farms set up in desert regions and has reduced the set up cost since a larger economy-of-scale is created (equipment. Devices, materials & and man power to setup the construction in the location). But these farms require big area and very expensive plus considering the transmission lines it's too far from cities where the power is needed however some countries don't have these desert regions and the hot climate as many countries in Europe. Expensive transmission lines are required to connect the power from far distance deserts to cities
High cost of maintenance and repairing in addition to time factor as the solar panel should be clean and clear of debris to be Fully operational. Their efficiency drops drastically even when a small portion is obstructed by fallen tiny parts of mud or dust.
The serious issue with solar power that it will be useless and not efficient in some weather conditions as the production of solar energy only takes place when the sun is shining. Huge storage systems need to be improved to supply a stable and reliable source of electricity when the sun isn't shining at night or at cloud days.
The rainy and cloudy day in those days sun power will not be efficient or fit to generate electric power, however there are many countries and sites in the world not active sites for solar power
The solar energy is too expensive for the consumer due to the high quality material required and the systems needed for construction and build as **table1** represent

Table 1.

Cost of Energy	
Source of energy	Average cost (cent per KW/H)
Hydropower energy	2 to 5
Nuclear energy	3 to 4
Coal energy	4 to 5
Natural Gas fuel	4 to 5
Wind energy	4 to10
Geothermal energy	5 to 8
Hydrogen energy	10 to 15
Solar energy	15 to 32

Table 1 showed the comparison of the cost for consumers which is so expensive when it comes to solar power

3.2 Requirment to Enhance the Efficiency of Solar and Wind Power

Alternative methodology should by applied with new applications to improve the methods of energy production commercially as the enhancement will reduce the cost of maintenance and construction for the consumers

It's necessary for new systems with advanced equipment for transmission and storage systems should be designed to enhance clean energy especially when it comes to track the sun rays and at the transform stage from the sun light to electrical power. New ideas are required for the storage system to be efficient in order to work fully operational at the difficult conditions happens by climate and atmospheric.

3.3 Total Renewable Energy Contribution

The renewable energy totally is less than the fossil fuel used in the world as the Figure A.1 represent

The total contribution of wind and solar energy together represent less than 15% from the total contribution of renewable energy as figure B represent.

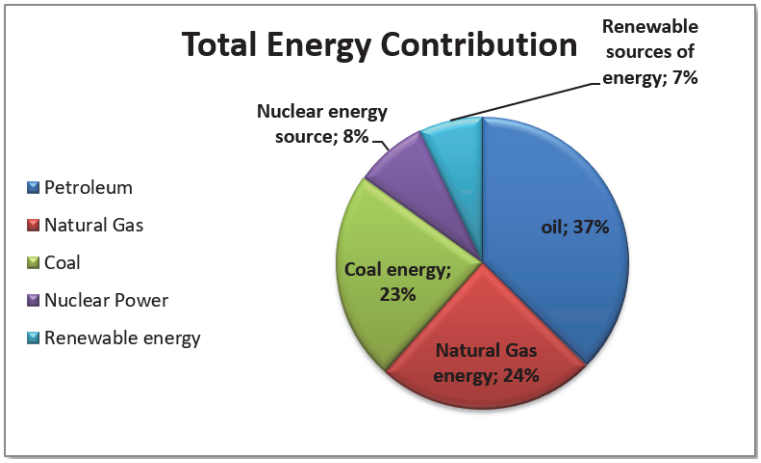


Figure 1. Represent the actual Contribution of the energy in the world, however renewable energy is the lowest contribution

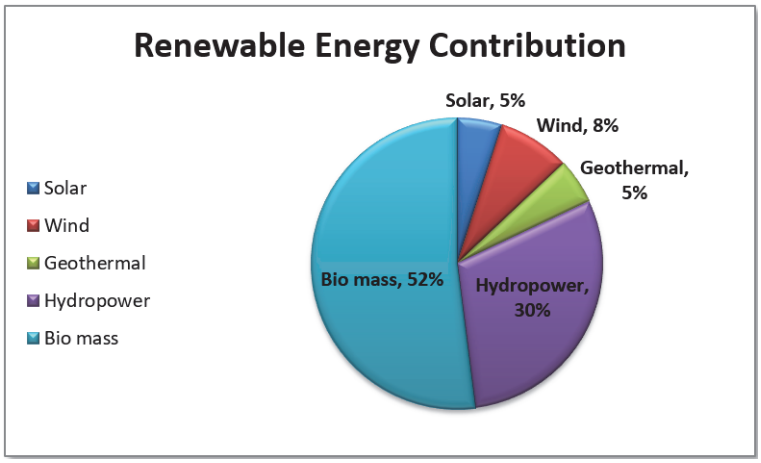


Figure 2. Represent the contribution of the renewable energy while the sunrays strike earth by 1.2x105 TW solar energy is not the leading power in the field of energy even in the renewable energy contribution

3.4 The Main Goal of this Design

A-increase the efficiency of the solar panels as the total conversion didn't reach the optimum level of efficiency or benefits because 600 TW of energy go through the earth as it's represented in table 2 and limited amount of power conversed

Table 2.

Earth solar resources and the conversion efficiency	
Theoretical calculation	1.2x105 TW actual solar energy (1.76 x105 TW hit the earth; 0.30 Global
Energy in 1hr sunlight	↔14 TW for a year
Practical	> On-shore electricity production potential of ≈ 600 TW (10%conversion efficiency).
Photosynthesis	90 TW

Table 2 showed the huge potential energy can be used; however the conversion is 10% only

B-solve the global warming problem

As we can see the acceleration of the ratio of the Carbon dioxide gas even from the green houses or the fossil fuel emission and its Derivatives and it will impact the weather by increasing the temperature at the minimum level 2 C for example in countries in south Europe and north Africa

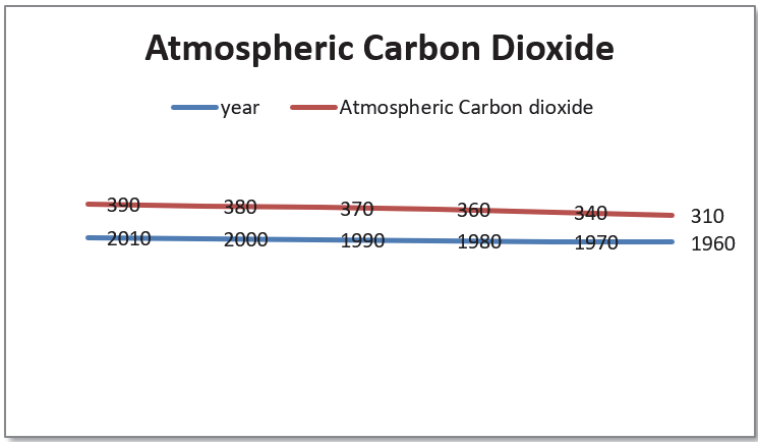


Figure 3. Represents the increasing of the carbon dioxide and the effects on the global warming

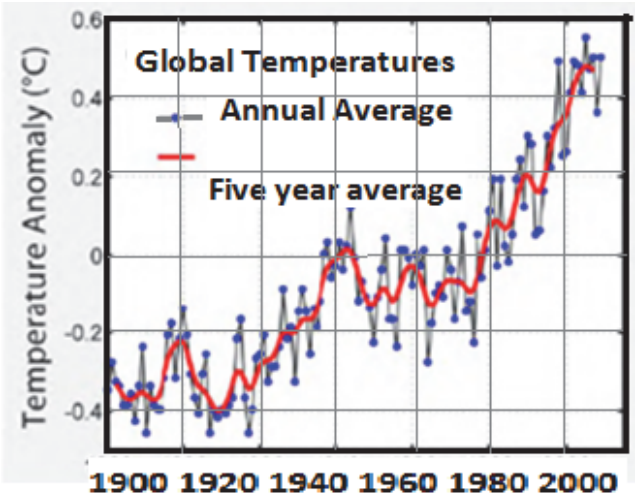


Figure 4. Represents the global warming temperature after increasing the percentage in CO2 as it's showed before in Figure 3

C-provide clean source of energy

Growth

• Increasing in global energy usage estimated value as an average ~1.5-1.6% per year.

• Encompass, for 1%/yr. performance improvement

• 28TW global power usage by 2050

Health

Emission of power plants operates by coal:

• More than 58% of sulfur dioxide released from it

• On yearly basis more than 17% of nitrous emission

• According to last analysis in U.S the most polluter there are the coal power plants as its releasing more than 35% of toxic mercury

3.5 The Design of the Turbine

The turbine designed by mixture of the unique materials in order to bear the high temperature.

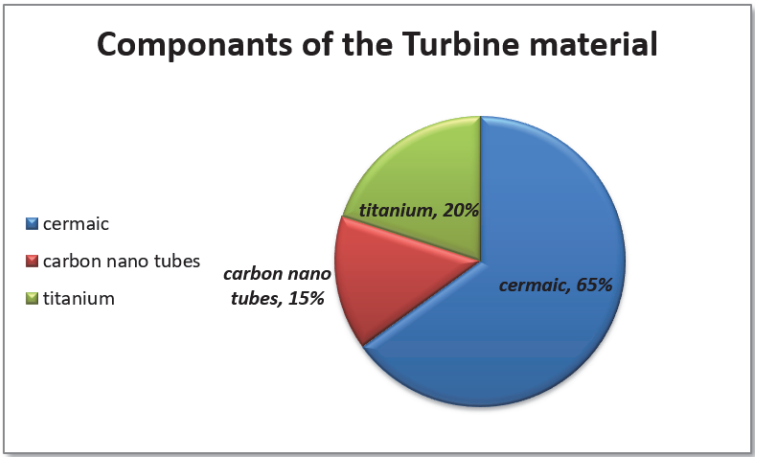


Figure 5. Represents the material percentage to guarantee bearing high temperature reach to more than 2000 C

Ceramic, Carbon and Titanium

The unique crystal structure of ceramic can make the blades bear to 1600 C

In the future there is high chance for Nano tubes as it will be the best thermal conductor's application along the tube, exhibiting a property known as "ballistic conduction", but the most edited insulators beside the tube axis. Studies confirm that single SWNT has a room-temperature thermal conductivity along its axis of about 3500 W·m−1·K−1 compare this to copper, a metal recognized for its good thermal conductivity functions, as it can pass through it the below transition estimated by 385 W·m−1·K−1. Single SWNT has a room separated-temperature thermal conductivity across its axis (in the radial direction guide) about 1.52 W·m−1·K−1, which is about as thermally conductive as soil. Macroscopic installation of nanotubes such as fibers have reached up to 1500 W·m−1·K−1 so far .The temperature consistency of carbon nanotubes is estimated to be up to 6000 °C in vacuum and about 2000 °C in air.

Distribution System

After merging the compressed air with the plasma the heat created will rotate the turbine and will be distributed through tunnels to the boilers in the tower to create more steam for another turbine

Components of Solar Turbine:

1-neudimium magnets

2-negative electrodes

3-solar panels or wind unit

4-high and low compressor

5-positive terminals

6-gas turbine

7-electric generator

3.6 Main Idea of the New Concept of the Design

First Stage

It called preparation stage because in this stage Full-tracking system track **(array with 10 photovoltaic units)** along two axes. A turntable device authorizes and adds the ability to keep tracking the sun rays from east to west. The sun shine on daily basis from east to west and climbs down from the southern northern in the southern hemisphere of the horizon with the progression sequence of seasons the tracking system at **Figure 6** of the sun that give the possibility for the array to cover the sky in both directions in order to track the sun rays and deliver better opportunity to get more energy from the array, however some designs are installed to track only the sun rays from east to west and the systems are in fixed positions when it comes to relation to the sun's height (angular distance from the horizon) at adjustment angle that is constant or manually adjusted every three or six

weeks. Failure in array output energy production due to the absence of the efficient tracking must be added against the cost of adding new advanced tracking devices

On the other side gear equipment control motion designed to keep tracking the sun rays from north to south progression sequence or 20 wind turbines then Create direct current or estimated value by 500KW with full system such as (inverter, batteries, and connector and tacking system array) then the electric current will be distributed to the compressor and the microwave igniter.

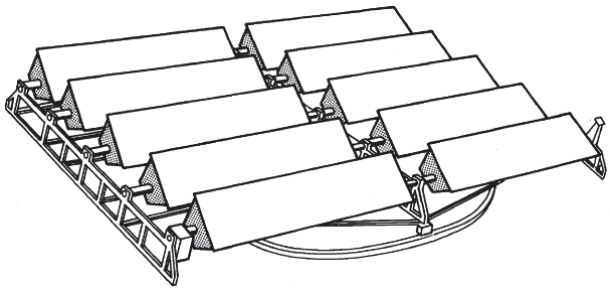


Figure 6. Full-tracking system is keep tracking sun rays along two axes.

A turntable device authorizes tracking the sun from east to west

At the same time gear equipment control motion to follow the sun rays from north to south

There are advanced methods for an array to keep tracking the sun light. The array can be shifted, or alternatively, as the sun rays can be reflected from mirrors that track the light according to the location of the sun in the sky (daily and/ seasonally) in addition to considering the angle deviation. Sometimes both are shifted. The privilege of shifting mirrors instead of arrays is various:

1. Adding new feature to increase the efficiency and the functionality for the mirrors in the array it should have to be alternate or rotate only half as much as the rotation of the arrays like arc rotation, because reflection twice the impact of the mirror's motions. (According to the example of the penlight. the mirror, and the face of a clock with a mirror straddling the 3 and g, light guided from the 11 o'clock position reflects past the 1 o'clock position. Were the mirror rotated to straddle the 10 and 4 positions-a displacement of one hour-the same penlight's ray from 11 o'clock would reflect back past 3 on the clock face-a displacement of two hours **Figure 7**

2. When the pressure of movement decreased from the array rotation and transfer to the mirror functions, so it will be probability less for fewer electrical and mechanical damage or deactivation or failure as the structural stress will be on the mirrors not the array and the second benefit is to increase the efficiency of the array to be operational even if some electrical failure in the movement of some mirrors.

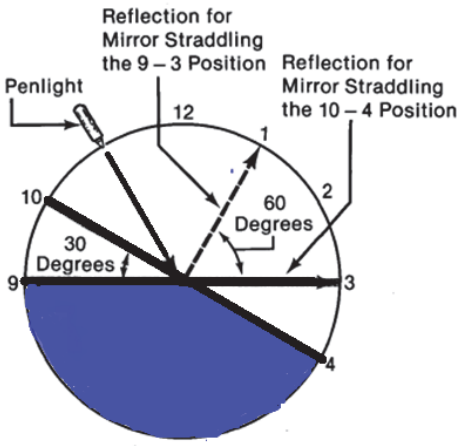


Figure 7. the privilege of rotating the mirror instead of the array to track sun rays. An array requires only alternating or shifting through the arc described by the motion of the sun. The mirror (as the figure show) needs only to rotate through half the angle. This can be known better by observing the horizon oppositely. If the suns were just at the "horizon" (3 o'clock) and the mirrors were oblique along the 10-4 axis, the sun's reflection would return to the 11 o'clock position. As the sun was at the 1 o'clock position (600 arc progression) the mirror requires only turning 300 (to the 9-3 position) for the sun's reflection to be able to crossover the 11 o'clock

position. A fixed array at 11 o'clock, by observing the core of the mirror, as the figure show the result will be facing the sun in the same location for both locations of the mirror and sun rays.

Second Stage

Creation of plasma stage as a small amount of Direct Current estimated value by 12K Volt will pass to the microwave unit to create Microwave with frequency 10 GHZ and compressed air from compressor in the combustion chamber which covered by magnets to be merged together in order to create plasma

As it will be sufficient voltage was set between two conducting electrodes separated by an insulating material current can travel anyway this phenomena being called breakdown electrons are stripped away from the atoms of the initially neutral matter, which becomes plasma

(Below1 Ampere) it is rather called a discharge.in our set-up the electric field is set so the insolent separating electrodes allows only a low current discharge. The plasma is created using a high voltage (using Pulsed 12KV DC)

With adjustable frequency 10 GHZ under atmospheric pressure this voltage is sufficient to create a discharge when the electrodes are about less than two meters apart, the distance increasing when pressure is reduced.

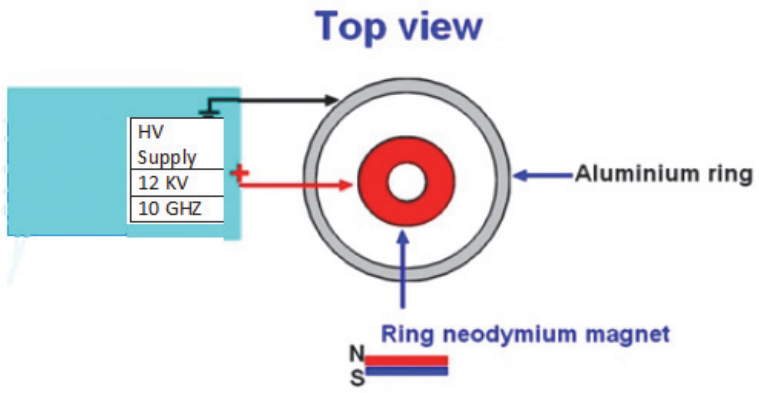


Figure 8.

As the current is low (less than 1 MA) low electrical power will use few watt as showed in **Figure *8***

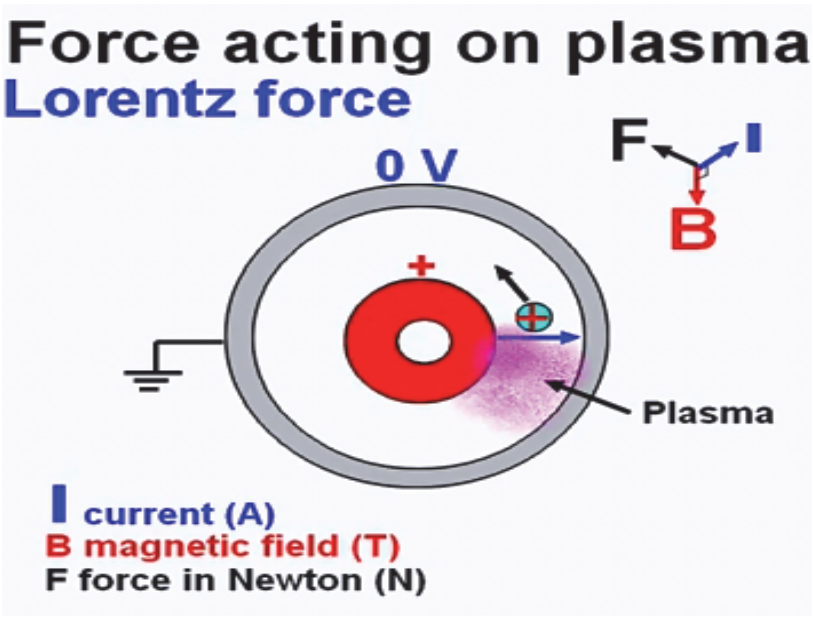


Figure 9.

And no force acts on the plasma so it will form a steam of ionized gas between two electrodes as showed in **Figure 9.**

The plasma motion is created using the Lorentz force when current J Flows through conducting element (a solid in the case of copper wires or a conducting fluid like air plasma) placed inside a magnetic field B a force **F =J*B** is applied on the conducting element

If the current flows along X axis and the magnetic field is applied the Z axis, the force F will be applied along Y axis. In a circular set-up, this causes the conducting element rotation.

Note: the process can be in Vacuum combustion chamber or normal combustion chamber.

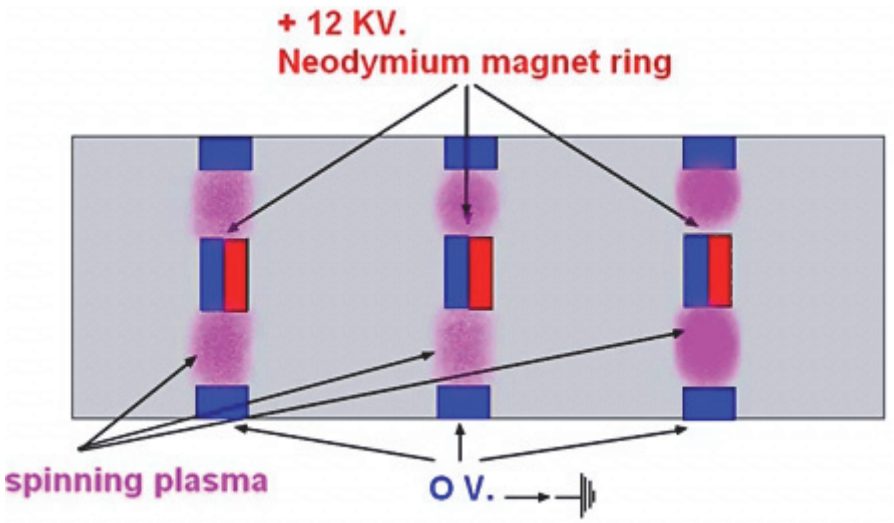
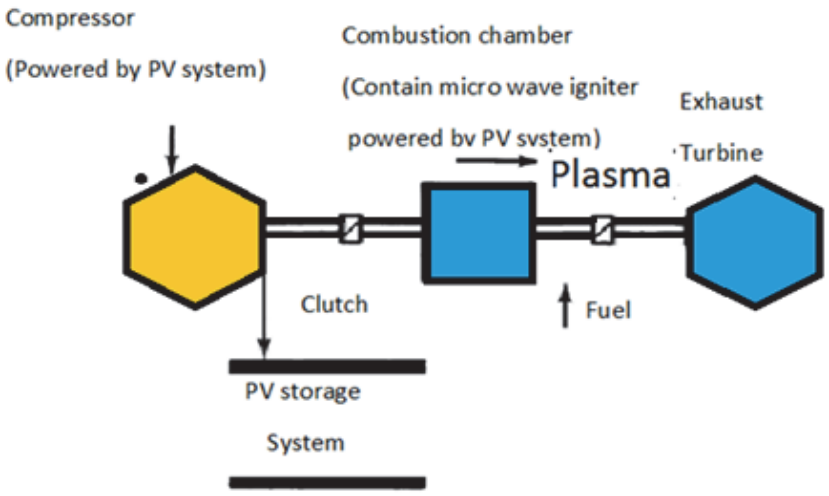


Figure 10. Showed the spinning process of plasma around the magnets by DC 12kv

Inside the combustion chamber there are two tunnels the first to create plasma and the second to allow the compressed air to interact with plasma Vortex as the plasma will be created and surrounded by magnetic field and the air will pass through the hyper vortex to gain extra heat from plasma as it will be igniter to the compressed air instead of coal or normal fossil fuel and the temperature of the air will increased from 600 C to 1600 C , however we put on consideration that the plasma itself reach 10000 C but according to low distribution of amount of plasma to the compressed air we will keep the ratio of F/A (fuel/ Air) in normal gas turbines to be 16:1and allow the air to gain heat from plasma to keep the material of turbine safe from melt and control the plasma by magnetic field

The thing here is to replace plasma instead of natural gases or coal or any fossil fuel to increase the steam temperature with clean and unlimited source of energy, and then the turbine will achieve a high efficient rotation by **4200 RPM.**



Third stage:

Creation of electric current stage as the heat will be distributed through tunnels surrounded by magnets to direct

it to the steam boilers on the other side the heat will be used to rotate the turbine

The remaining heat will be distributed to steam boiler to generate more turbines if it needed the same as normal gas turbine but using the plasma instead of fossil fuel as **figure 11** represent to create **1500 MW** from one unit, when we put on consideration if we put on power plant more than one unit we can increase the production of electricity

3.6 Cooling System

Recirculating or Indirect Wet Cooling

The methodology of recirculating water one of the functions that widely used in the power plants, as the idea is simple to pass hot water vapor plumes through condenser by Appling cool condition then setup pond from which hot water evaporates. The modern power plants today are using the same technique and nuclear reactors also. The plasma power plant will use the same principle by recirculating hot water with condenser network then pass it to the cooling tower therefore mechanical draft using large fans to be able to proceed the cool process in the tower in order to transferring the water's heat to the air, both directly and through evaporation of some of the water and it will be able to keep the efficiency of the air flow and achieve minimum water temperature by using wide axial flow fans ,although there is some issues of requiring more energy from power supply, usually about 1% of the plant's output, and up to 1.1% but it can keep the efficiency work fully operational over a wide range of conditions, ranging from freezing to hot and dry and achieving high performance .in addition to its height less than 50 m high. It required increasing the usage of the water, in range 3.0 liters being evaporated for each kilowatt-hour produced according to the surrounded circumstance. This evaporative water loss by phase change of a few percent of it from liquid to vapor is responsible for removing most of the heat from the coolant water at the cost of only a small part of the volume of the circulating liquid although large volume of the water actually retrieve from lake or vapor). And here our goal to achieve the maximum efficiency in cooling with low cost and high performance

As **Figure 12** represent the process of recirculating the water for cooling to the turbine

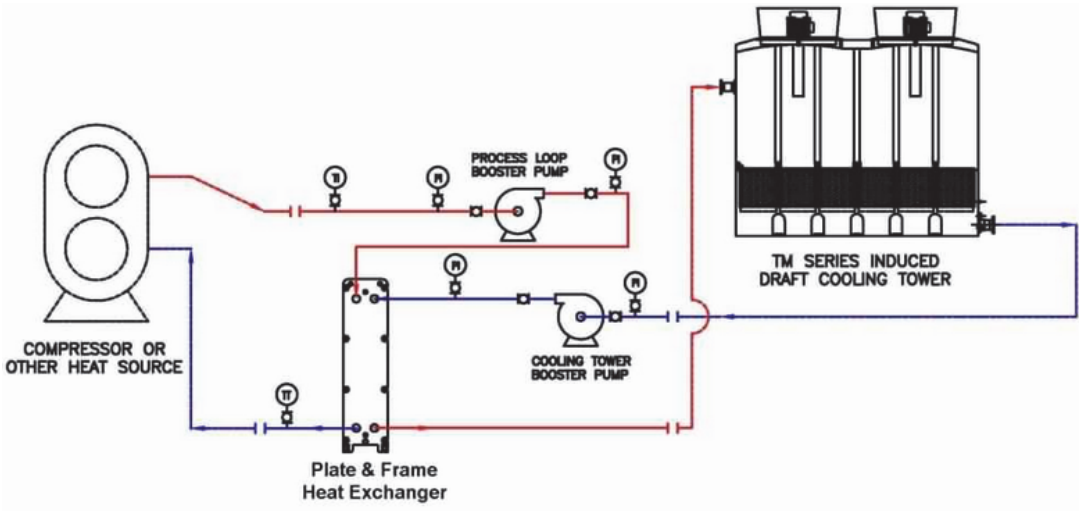


Figure 12. Showed the cooling system process with recirculating water

3.7 Storing Pv's Electricity

The main issue of PV system that it can only be fully operational when the sun is shining or in the active sites but it will be useless in rainy or cloudy days in addition to the inactive sites

By saving 20 MW per day for the Lithium sulfur batteries in order to complete the system working in night without sun power or by using the wind turbine if the place is suitable to generate current from it by wind power

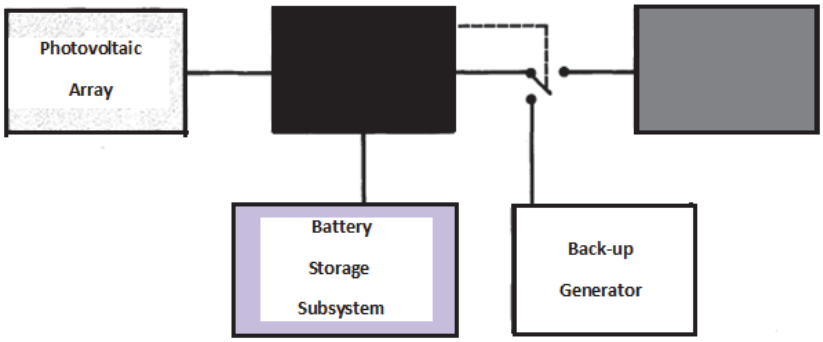
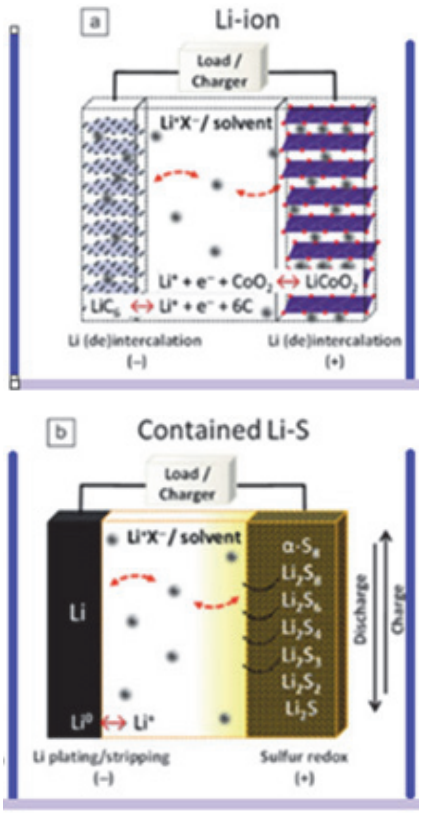


Figure 13. A PV systems with conditioner and storage system. The storage system can be as ordinary as an automatic lithium sulfur battery or with another advanced material such as superconductors. The most important function for the power conditioner should be corresponding to electric storage and other electrical loads. If storage is completed with a flywheel, power conditioners can be utilized in other functions like transform electric energy to mechanical energy. As many achievement done by this concept in many applications, a power conditioner will at lowest statues contain an inverter with a convenient AC waveform generator to run electrical loads. Other potential types of power conditioning are more advanced includes the equipment of voltage limiters and safety switches.

A-Lithium Sulfur Batteries Introduction

New concepts of Li-S cells improved from more than 60 years ago with alternative easy configurations done after progress at the last few years in the structure of materials and nanotechnology. A new problem rise up with the aspects including both room and temperature because the is high temperature cells used the molten salt electrolytes then the researches directed for Li-S batteries working mechanism and control the reaction at room temperature depend on organic electrolyte liquid or gel that contains ions and can be decomposed by electrolysis as presented in the batteries, which have override the field. On the other side most of the studies hide the contributions of both the insulators and host materials. As figure 14 represent



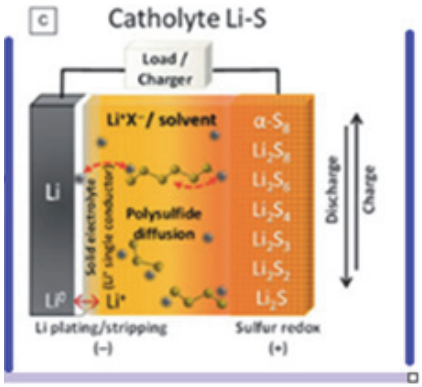


Figure 14. Shows that Li-S and catholyte -type Li-S cells, in a comparison to Li-ion. The (a) Li-ion battery contained two intercalation materials, as shown in the figure lithium cobalt oxide and lithium graphite, isolated by a non-aqueous electrolyte based on lithium salt (X– = PF 6–, ClO4–, TFSI –...). In contraindication (b–c), Li-S batteries preferred to be operated by metallic lithium as the negative electrode. The Li-S figure (b), the function of a pores conductive host mainly used to keep the sulfur species within the positive electrode volume, while the catholyte in figure (c) task as both the electrolyte and positive electrode. The isolation from the negative electrode was understood by a Li +-selective thin film referred by the white layer).

B-Energy Storage System

Figure 15 shows electrical voltage model of a Li-S cell acquire at stable current. In the first discharge zone at 2.35 V, S 8 is decreased to soluble Li 2S n these sulfides are classified as weakly design structure and get along with speedy balance in a solution. The second plateau at 2.1 V represent the decrease of these poly sulfides to insoluble Li 2S.both of the two zones are demarcated by a "knee" (marked in red), which clarify the over potential require to nucleate solid materials from the super saturated polysulfide solution. The over-potential (i.e., energy obstacle, marked in blue) on the charge profile reflects the activation energy required to oxidize the insoluble and isolation Li2S to LiPSs (mostly S 42–and S 62–). On the other side they transformed to S 8 at the last stage at 2.4V. Owing to weak cathode structural design in early Li-S cells, uncontrolled deposition of solid materials in the large pores of the cathode resulted in low capacities due to their redox inaccessibility. The evolution of catholyte cells, while Li 2S n (n= 5–8) is dissolved in an organic electrolyte, in order to solve this problem. The high mobility of LiPS s lead to produce another issue, however they change it easily to the negative electrode, whereupon they are minimized and then diffuse back to the positive electrode and are oxidized on the next cycle. Inside this process "shuttle" gives rise to self-discharge and Columbic inefficiency, while supplying beneficial overcharge capability

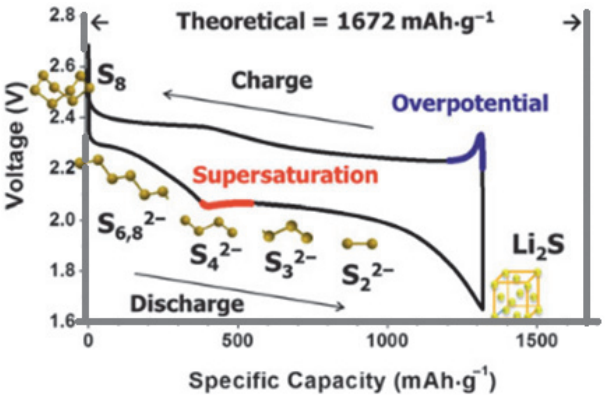


Figure 15. Electrical voltage model for a Li-S battery showing the super saturation point of lithium poly sulfides in the electrolyte (red) and the over potential (blue) encountered for the oxidation of Li 2S on charge. The development in the frame and design of the sulfur species upon discharge is represented, from elemental sulfur S 8rings to chain poly sulfides to solid anti fluorite-type Li 2S

4. Result

New integrated solar system can produce huge amount of energy 24/7and estimated value by 1500MW per unit depending on unlimited source of energy called plasma from sun or wind power especially solar power with zero pollution and smart saving system to save power even if there is atmospheric interruptions by climate and weather

5. Conclusion

The new modification in the new turbine will enhance solar and wind power economically, it can develop the normal power plant which use coal or gas wit new modification on the facility by adding the array and the plasma turbine with its new modification to reduce the cost of creating new power plants and provide the market with all needs of energy requirement to develop the human civilization and technically the benefits will be as the follow:

- High amount of energy reach to 1500 MW
- Replace fossil fuel by using plasma from renewable source of energy
- Develop new technique to defeat the obstacles of the wind and solar power
- Low cost creation
- Safe system to produce power
- Clean and unlimited energy to use

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