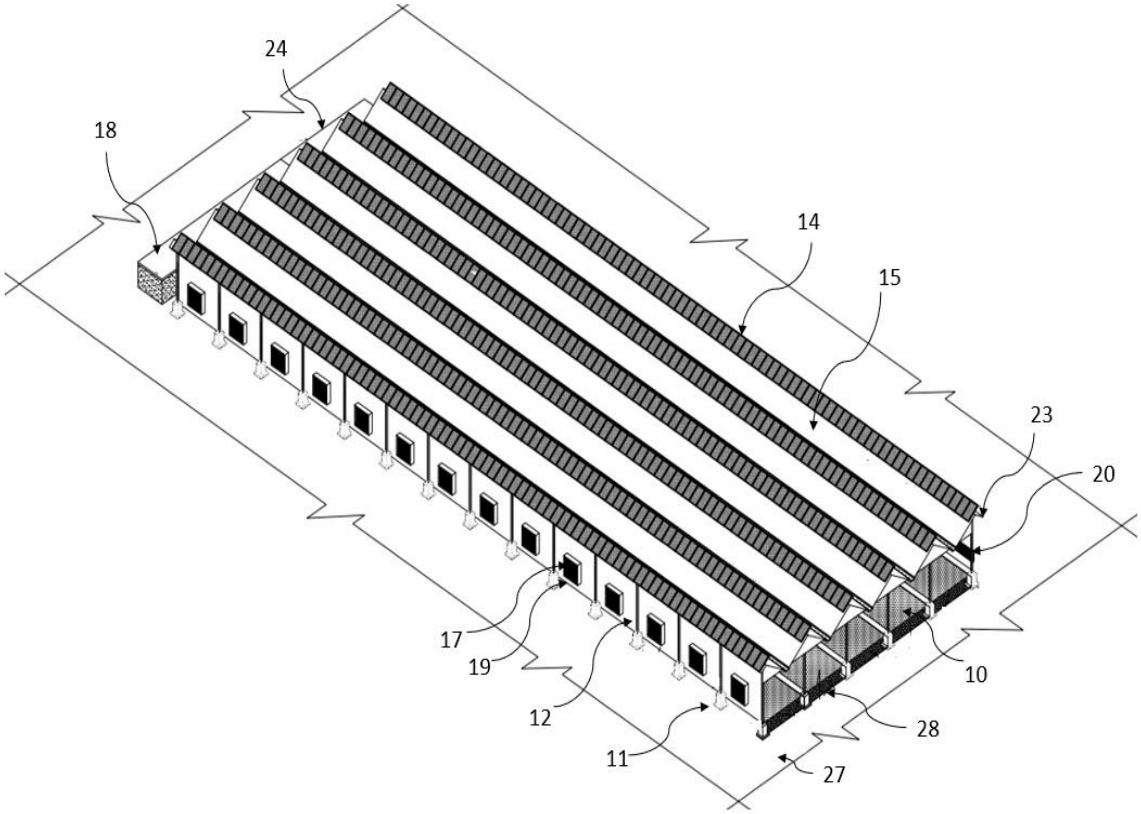

Fig. 1.

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

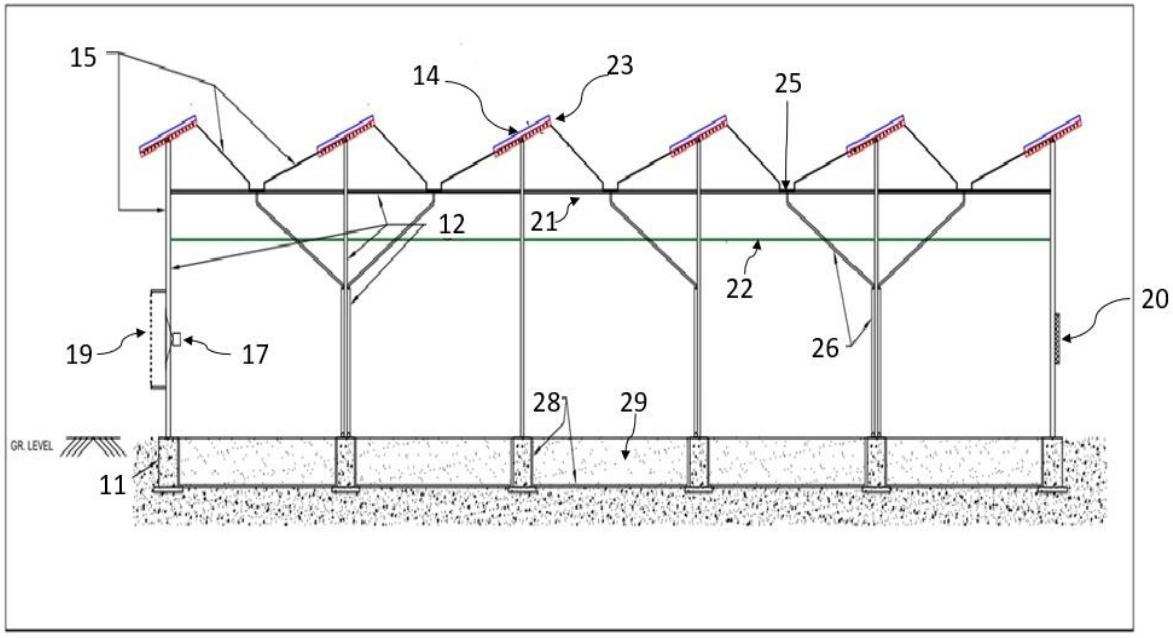

Fig. 2.

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Agent of the applicant -IN/PA-2190

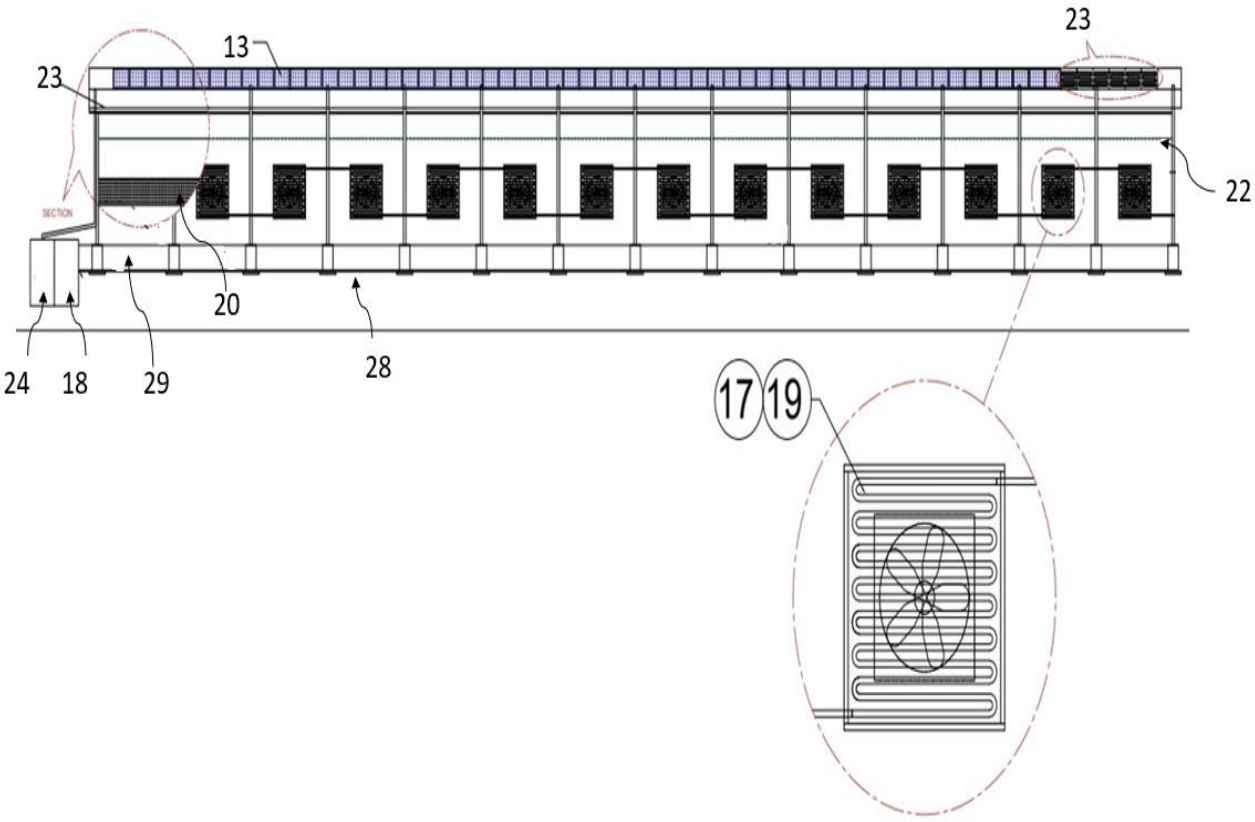

Fig. 3.

For applicant,

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Agent of the applicant -IN/PA-2190

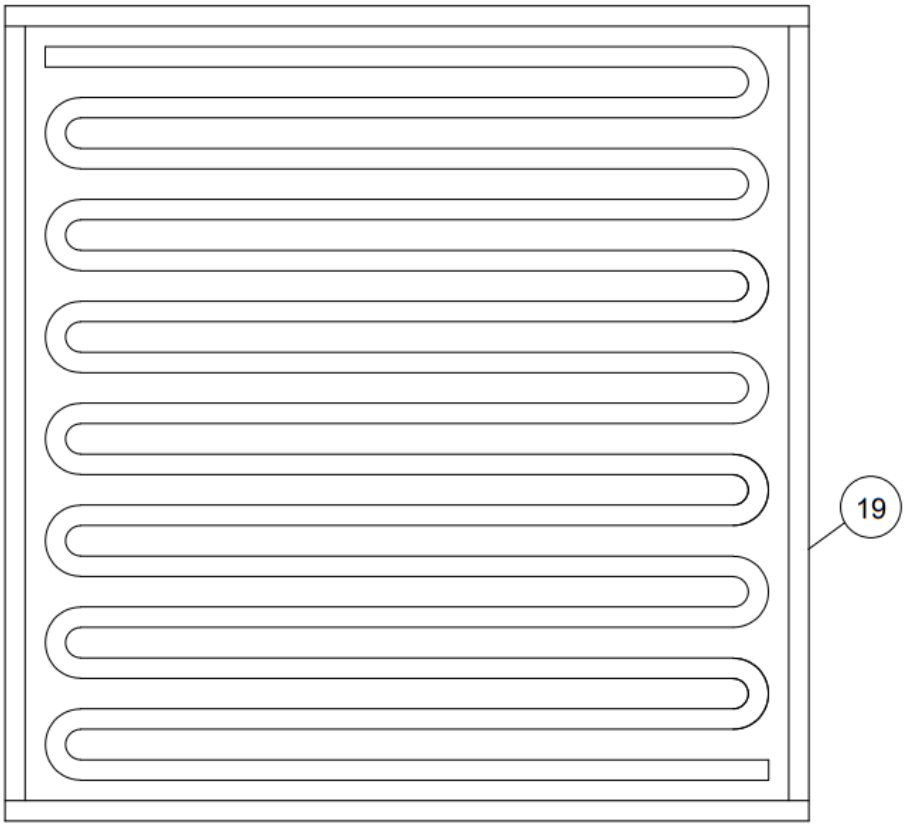

Fig. 4.

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

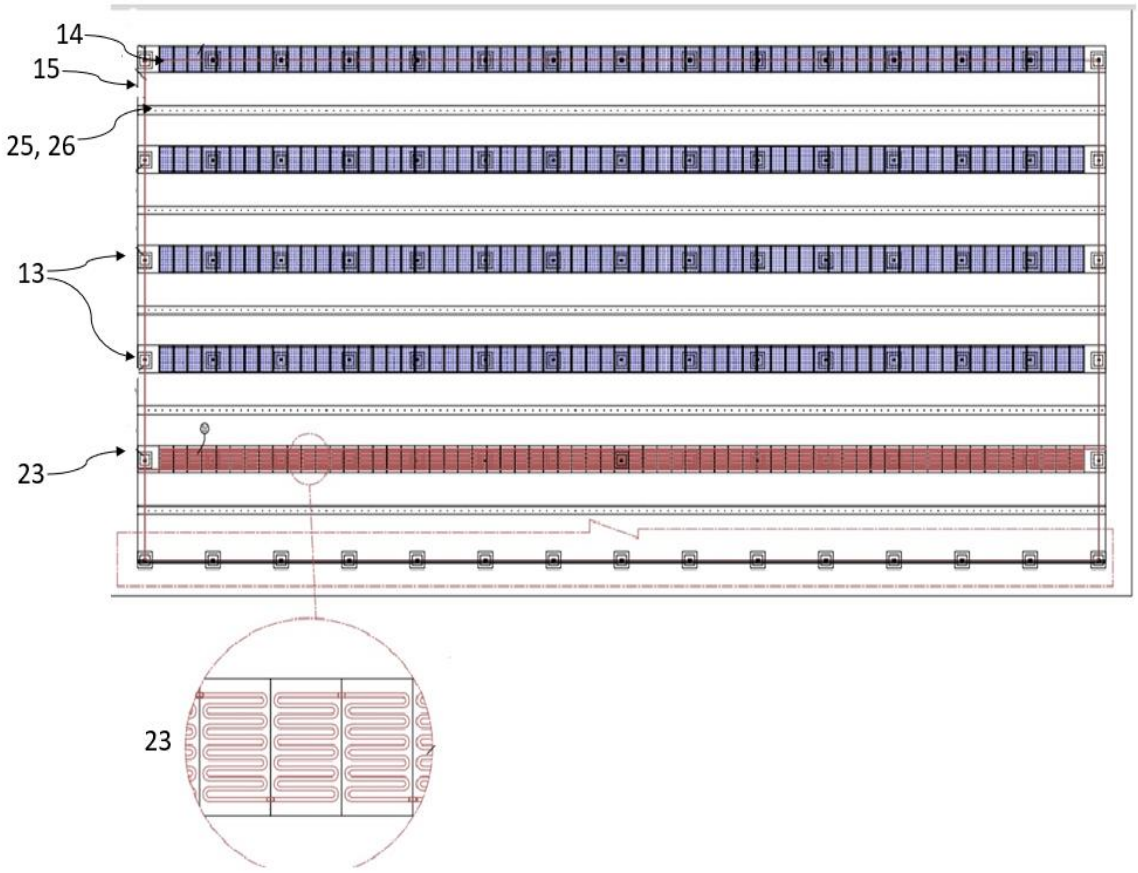

Fig. 5

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

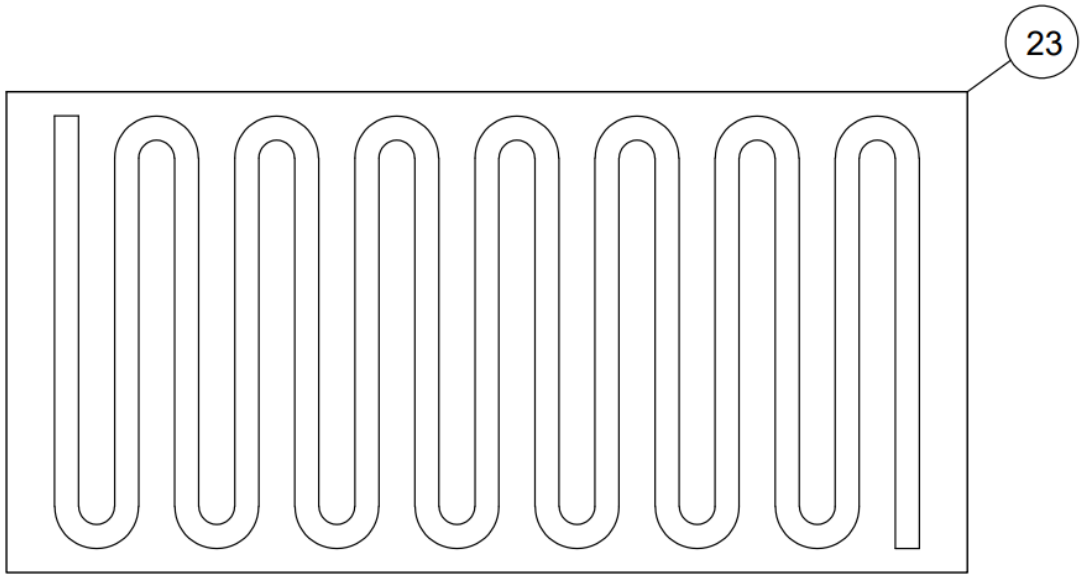

Fig. 6.

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

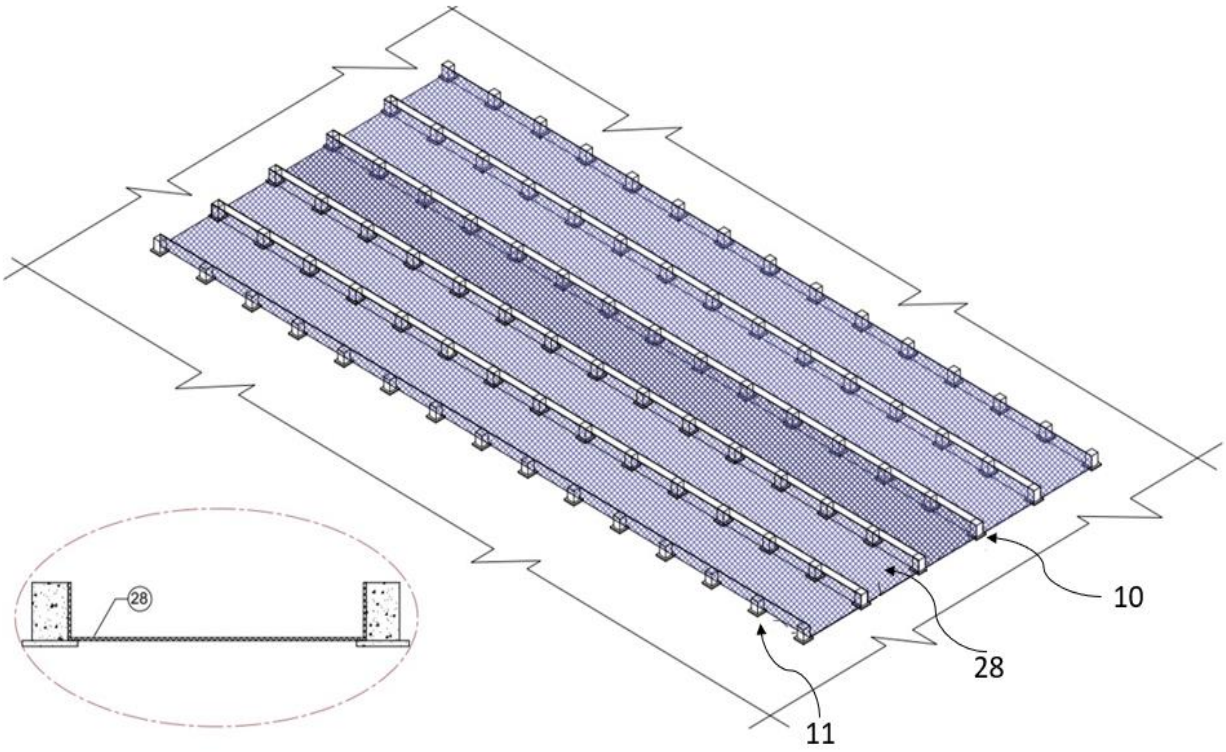

Fig. 7.

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

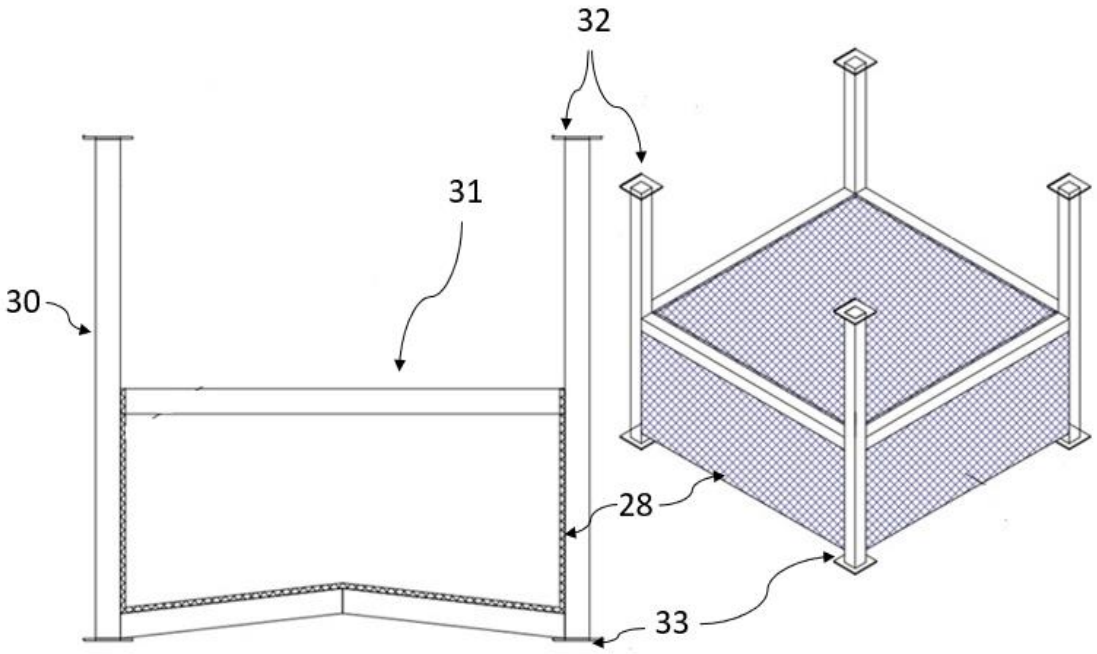

Fig. 8.

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

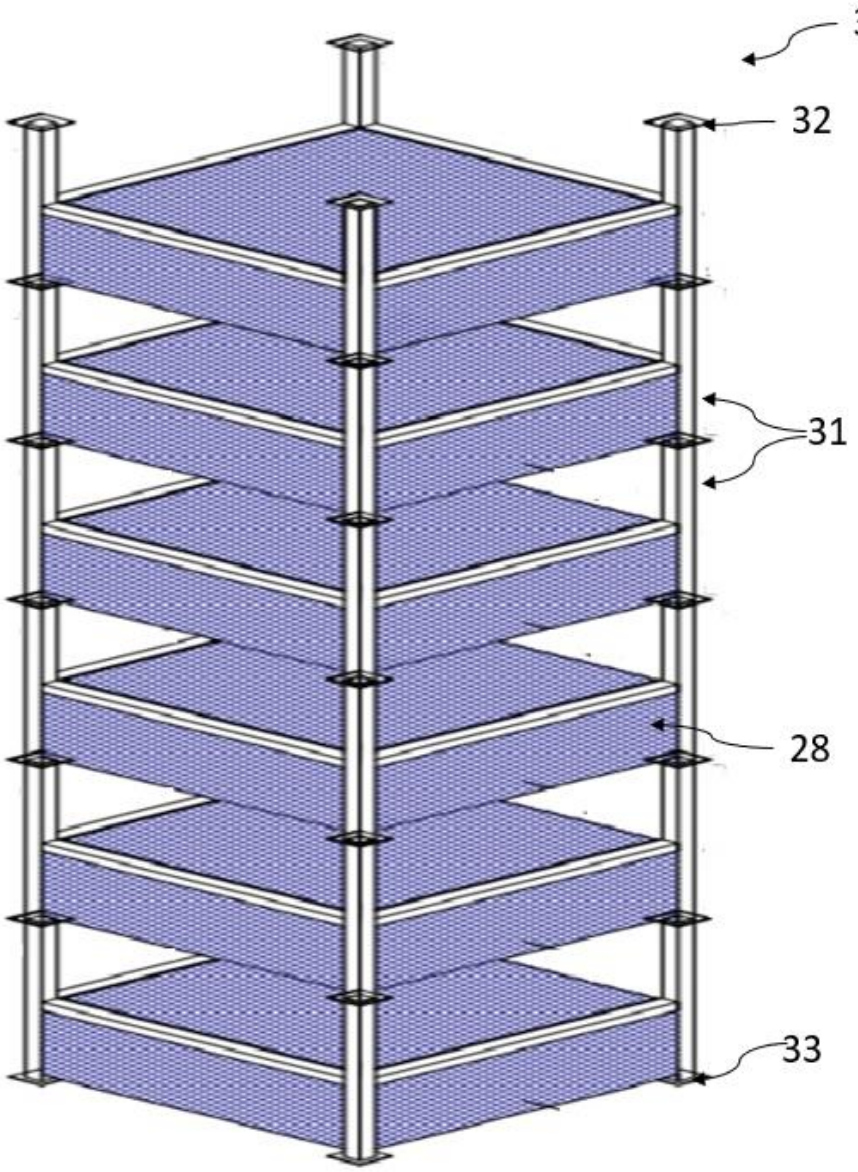

Fig. 9.

For applicant,

Mrs. Allison Katariya

Agent of the applicant -IN/PA-2190

FORM 2

THE PATENT ACT, 1970

(39 OF 1970)

AND

THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(See Section 10; rule 13)

A SOLAR PLANT WITH ENCLOSED SPACE SYSTEM

Mr. Jadhav Uttamrao Hanumantrao

with address at

Village- Sultangade, Taluka-Khanapur, District- Sangli- Maharashtra, India.

The following specification particularly describes the present invention and the manner in which it is to be performed.

FIELD OF INVENTION:

The present invention relates to a solar plant for generation of renewable power. More particularly, it relates to a solar plant with utilisation of space beneath by enclosing it, for various uses like covered farming; supplemented with controlled temperature, humidity and intensity of illumination; with protection from ultra violet bandwidth of sunlight; further supplemented with rain water harvesting, percolation prohibition and water recycling arrangement collectively enabling enhanced food production and enhanced generation of renewable power and providing environment protection by mitigation measures against Global warming with more generation of renewable power and by vast CO2 sequestration from atmosphere and by measures to adapt to and fight the ill effects of Climate change.

BACKGROUND:

Renewable power generation: on one hand, utilization of renewable energy such as solar power against the use of fossil fuel is growing high and is necessary to protect environment. India has potential to generate billions of MWh electricity from solar power, more than current & future requirement. Likewise, entire world has tremendous potential to generate electricity out of solar power, in multiples of the present & future requirement. Various types of Solar panels are available and are capable to generate electricity, the renewable energy. Generating electricity out of solar energy needs to be accelerated rapidly. Erection and installation of solar plant, however, require sizeable land area, approximately 4 to 5 acres, for every MW along with heavy structure & solar panels etc. which involve substantial expenditure, around Rs 50 million (US $ 0.67 million) in addition to cost of 4-5 acres of land, per MW solar plant.

Global electricity generation must increase to meet rising demand in ensuing years. In 2010, electricity production was 21.5 billion MWh globally. This is expected to increase to 51 billion MWh by 2050 so as to cater increasing demand. The future primary energy mix in 2050 shows that growth rates will be highest for renewable energy sources although fossil fuels (coal, oil, gas) will remain dominant. The share of renewable energy sources must increase from around 15% in 2010 to almost 100% earliest in future.

Solar plants generate electricity only under bright sunlight while power is unavailable during night hours and also under clouded sky. Thereby, solar plants generate less electricity also in day hours during rainy season. Wind power plants generate power throughout day & night and they generate more electricity during 4 months of rainy season because of faster wind but they

generate lesser electricity during rest of year. Solar plants & Wind power plants, in a way, complement one another and their operation together causes better consistency in renewable power generation, thus, reducing need for storage of renewable power which is otherwise intermittent. Electricity storage system such as batteries or gravity storage system may still be required to fully overcome intermittent character of the renewable power generation. It is also necessary to reduce cost and/or to increase revenue in respect of renewable power plants so as to make renewable power affordable.

Food security: on the other hand, the techniques which are developed in the field of covered farming by virtue of trapping Carbon-di-oxide and maintaining/controlling temperature for the benefits of plants, have proved to be very high yielding. Covered farming in form of Green House or Poly House, involves covering all sides as well as top surface of land to be cultivated, by transparent materials like plastic, glass, acrylic, textile etc. It involves use of sizeable quantity of materials for coverage & heavy structures for support which entails in enormous expenditure of around Rs 37 million (US $ 0.50 million) for Greenhouses in addition to cost of 4-5 acres land, equivalent to land required for installation of 1 MW solar power plant.

Major part of the world is facing threat from Global Warming, Climate Change and emerging global food shortage. Large number of people worldwide suffer from undernourishment and world's chronically poor persons located in Africa, China, India, Brazil, Philippines & elsewhere need more food.

Availability of arable land for cultivation will have to be increased for more food production which, however, will cause generation of more Green House Gases, particularly more CO2 and will have adverse effect on human attempts to limit CO2 level in the atmosphere. More generation of GHGs increases Global warming, resultant Climate change and ill effects thereof. By 2050 the world's population will reach 9 billion, 34 percent higher than today. Nearly all of this population increase will occur in developing countries. Urbanization will continue at an accelerated pace, and about 70 percent of the world's population will be urban (compared to 49 percent in 2020). Income levels will also be many multiples of what they are now. In order to feed this larger, more urban and richer population, food production must increase by 70 percent. Annual cereal production will need to rise to about 3 billion tons from present production level of 2.1 billion ton.

80 percent of the necessary food production increase must come from increase in yields and cropping intensity while only 20 percent can be expected from expansion of arable land area.

But the fact is that globally the rate of growth in yields of the major cereal crops has been steadily declining & it is dropped to less than half in the year 2000 when compared to year 1960, mainly because of ill effects of the Climate change. The challenge for technology is to reverse this decline, since a continuous linear increase in yields at a global level following the pattern established over past decades will not be sufficient to increase food production to meet future need. Research & Development although is one of the most effective activities, has since not been focused effectively in the field of food production. Therefore, there is a need for increasing agricultural production per hector of land instead of bringing more & more land under agricultural cultivation.

Simultaneous enhancement in food production & in renewable power generation is necessary and it is possible: added agricultural yield & more clean energy will, thus, be necessary to meet demands of the presently needy people as well as fast increasing popullation across the world. It is more necessary in densely popullated regions including India.
In several countries, popullation of under nourished & cronically poor persons as also overall popullation are fast increasing & civic authorities face herculean task in making provisions for food security & for meeting demand for electricity, for the existing as well as increasing popullation.

Now, the Greenhouse is an agricultural shed used to cultivate plants or farm crops by trapping CO2 emitted by plants during night and providing more CO2 for enhanced photosynthesis and by creating suitable environmental conditions conducive for proper growth of the plants, crop. It is also used to protect plants from adverse climatic conditions such as wind, cold, excessive precipitation, excessive radiation, insects and diseases. Greenhouses are framed structures covered with transparent material large enough to grow crops under a covered shed with protection from climatic adversities to get optimum growth and increased productivity. Agricultural yield in Greenhouse farming is reportedly 4 to 5 times more compared to open farming.

While using Greenhouse to cultivate plants or crops, electricity facility such as for cultivation lights, water pumps, water sprinklers and exhaust fans is often required. However, the electricity is not easy to get when the green house is situated in a remote village or in hilly area. Supply of electricity is also not continuous and at times its supply is interrupted, particularly during the hours when climate is extremely hot or chilling cold. In most part of the world, electricity supply for agricultural activities is done at subsidized rates. Agriculture being low

paying client is generally neglected by electricity distribution agencies so far as continuous, uninterrupted power supply is concerned. Further, whether the greenhouse is in the city, remote village, or hilly area, the use of the land and its value wherever the greenhouse is situated, can be increased if a natural electricity generating facility such as solar plant or wind turbine is added to the greenhouse. Therefore, combing the greenhouse and the solar power facility & wind turbine becomes an important issue.

The conventional Polyhouse shelf is not designed for combining with the solar power facility, and the shelf is only strong enough to isolate crop, plants from the rain and wind. The solar power facility cannot be arranged on the conventional Poly house shelf, especially large solar power facility built up with the solar panels. Given the above, the current Greenhouse structures can be improved in order to make it much more efficient. Thus, in the present invention, solar power plant is installed first and then by covering gaps between solar panels, panel rows & sides with the partitioning sheets or with Greenhouse materials, farming can be done or other activities can be conducted in the enclosed space beneath solar plant.

Sunlight Filtration is required; different activities and variety of crops, plants require different level of intensity of illumination and most of them need protection from specific bandwidth of sunlight so as not to get damaged. This requires a setting up of filters which will filter the sunlight reaching the interior of the enclosed space and will allow only the specific bandwidth of sunlight and specific level of illumination which are conducive for the activities desired to be conducted or for proper growth of the crop or plants.

Air conditioning of the enclosed premises to be cost effective; air conditioning is the process of controlling temperature & moisture in the interior of an enclosed space at desired level to improve the comfort of occupants & safety of delicate things.

Cooling in traditional AC systems is accomplished using the vapor-compression cycle, which uses the forced circulation and phase change of a refrigerant between gas and liquid to transfer heat. Refrigerants used in AC machines are unsafe and use of traditional AC machines involves high capital cost & huge energy consumption and is thereby, cost prohibitive. According to the International Energy Agency, cooling is expected to represent up to 37% of the world's total energy use.

Evaporative coolers comprise of electric motor, fan, cooling pad, system to spray & recycle water or coolant on pad and they provide cooling of air achieved by evaporation of water or

coolant. Water being bad conductor of heat, temperature of water during hot hours is few degrees lesser than ambient temperature. Evaporative coolers also increase humidity which is beneficial more in regions with dry climate whereas evaporative coolers do not function effectively, rather they add to humidity in humid climate. While evaporative coolers work cost effectively, they have serious limitation in so far as their cooling effect is limited merely to few degrees Celsius, depending on temperature of water spread on cooling pad & extent of evaporation. Reducing temperature in an enclosed space also reduces humidity by condensation of water vapor.

Greenhouse covering materials such as plastics have direct effect on the higher air temperature inside. In order to keep the inner temperature within a suitable range, a greenhouse is required to be equipped with an apparatus to ventilate excess heat during hot summer days and to raise the temperature by heaters during the harsh, cold winter days since temperatures below 15 degree Celsius and more than 30 degree Celsius are disadvantageous for growth of the plants and crops as also for most of the industrial or commercial activities.

Plants, crops are very much sensitive to temperature and they do photosynthesis well in the temperature range of 15 degree Celsius to 30 degree Celsius, ideally 23 degree Celsius. For cooling interior of Greenhouses, fan & pad system may be used wherein exhaust fans are disposed on one wall and porous pad on opposite wall. While hot air in the Greenhouse is sucked/blown out by the exhaust fans & partial vacuum is created, water is sprinkled on the pad and atmospheric air at ambient temperature on passing through such pad gets relatively cool and such cold air enters in the Greenhouse through the pad to fill in the partial vacuum created in the Greenhouse. It provides cooling effect i.e. temperature in the Greenhouse gets reduced by entry of cold air through the pad, to the extent of few degree Celsius cooler than the ambient air temperature level. Reason being that water is bad conductor of heat and in hot climate water is cooler than ambient air temperature by few degree Celsius while in cold climate water is warmer than ambient temperature level. Such cooling by fan-pad system is, however, insufficient for Greenhouses located in hot regions where ambient temperature is much more than 305 degree even up to 50 degree Celsius. Large area of the world viz. entire area on both sides of equator up till tropic of Cancer in the north and tropic of Capricorn in the south experience hot climate up to around 50 degree Celsius. As a result of the adverse effect of climate change, world's large region beyond tropic of Cancer in the north and tropic of Capricorn in the south otherwise supposed to be cold, is also facing extremely hot climate. Greenhouses & enclosed premises situated in such area require further cooling of temperature

of the air inside so as to bring temperature down and maintain it between 15 degree Celsius and 30 degree Celsius, ideally 23 degree Celsius.

Area in northern side of tropic of Cancer and area in southern side of the tropic of Capricorn experiences very cold climate even less than zero degree Celsius. Greenhouses or enclosed premises situated in such region require heating of the air inside so as to bring temperature level above 15 degree Celsius.

Water sourcing & water conservation; in India, hardly around 40 million hectares of agricultual land is irrigated while remaining 120 million hectares is rain fed land. Water for irrigation is mostly sourced from dams & canals which are cost prohibitive and also involve social challenges such as submerging huge land area under water and relocation of villages & large number of people. Water for irrigation is also sourced from ground water which however, is depleting year by year. Situation across the world is somewhat similar. Providing sufficient water round the year for irrigating crop, plants on such presently rain fed land will enhance food production, substantially. It has been civic authorities' endeavor to increase land area under irrigation facilities; but irrigation dams in India & Maharashtra are over saturated and no enough number of new sites seem to be in view. Not only constructing dams is cost prohibitive but such dams also cause serious disturbance to ecological balance and very large land space gets submerged beneath water and thousands of people & hudreds of villages need to be relocated causing very complex social situation. Therefore, other possible methods to provide water for irrigating rain fed land and enhancing water use efficiency in agriculture are essential for increasing food production.

Worldwide, major quantity of available water, upto around 80%, is consumed in agriculture sector. In farming, plants & crops are irrigated either by flooding the fields or by modern technics using sprinklers or drip irrigation equipment. While these modern techniques do cause saving of water, in both senario, however out of water provided for irrigation, marginal quantity (up to around 1%) gets evaporated in atmosphere due to sun heat, only a small quantity of water (hardly up to around 10%) along with nutrients disolved therein is consumed by plants, crop commensurate to their dry & weight mass while by that time, major quantity of water (over 90%, depending on water holding capacity of soil) along with nutrients disolved therein gets percolated in the ground beyond reach of roots of the plants. Such huge quantity of water & nutrients (over 90 %) go waste since provided but not actually consumed by plants. Water

use efficiency in agriculture is thus too meagre i.e. hardly around 5% to 10% which needs to be improved.

Need for CO2 sequestration; during pre-industrialization era, CO2 level in the atmosphere was 280 ppm i.e. 2,200 billion ton CO2 was in earth's atmosphere which has been increased to 421 ppm as of 2022 which represents 3,300 billion tons of CO2. To limit Global warming i.e. temperature of the atmospheric air, it is necessary to reduce Green House Gases, particularly CO2 in the atmosphere or at least to reduce rapid increase of the CO2 content in the atmospheric air. It is, therefore, desirable to reduce 1,100 billion tons of CO2 from the atmosphere. Getting CO2 level back to pre-industrial levels is considered very difficult and it is said that it would take thousands of years unless technologies that can suck up vast quantities of CO_2 from the atmosphere are deployed. The present concentration of CO_2 is the highest for 14 million years. The increase has been attributed to human activities, particularly deforestation and the burning of fossil fuels. This increase of CO_2 and other long-lived greenhouse gases in Earth's atmosphere has produced the current episode of global warming and resultant climate change and adverse effects thereof.

Increased CO2 level in atmosphere has caused the Global warming and resultant Climate change and thereby rise in sea level, threat of adverse, dangerous effects such as delayed monsoon, extended dry spans, heavy rainfall in short duration, erratic rainfall, hail storms, extreme weather events, heat stress etc. which the entire world is presently facing.

Reforestation has been an endeavor of many countries worldwide. Besides reforestation, inducing existing forests and trees to absorb more CO_2 is one more way to reduce its quantum in atmosphere. In Greenhouses, CO_2 emitted by plants, crops during night is trapped in the enclosed space and is not allowed to get mixed in the atmosphere and the plants, crop in the Greenhouse consume such excess CO_2 (around 1450 ppm i.e. 4 to 5 times more than ambient CO2 level in the atmosphere) in photosynthesis during early day hours in next morning for making more carbohydrates which is food for them as well as energy for all living things. Plants, crop in every acre of Greenhouse consume nearly up to 60 tons of more CO_2 every year for photosynthesis which is made available to them by trapping CO_2 emitted by them during earlier night hours. Therefore, farming in Greenhouses, more particularly of long living plants, trees is helpful in substantially reducing CO_2 in the atmosphere.

It is desirable to cover relatively large area of dense forests with roof comprising of transparent sheets as in Greenhouse, with or without solar panels forming part of roof with help of scaffolding or hot air balloons. Such roofs may also be made of wire mesh to allow natural precipitation on the trees in forests. Side walls of desired height for such roofs may be retractable curtains whereby CO_2 emitted in night hours by huge trees in dense forest will be trapped and such more CO2 will be consumed by trees in the forests during following early day hours. One fully grown tree in ordinary situation is capable of sequestering, thus reducing 12 ton of CO2 from the atmosphere, per year which with aforesaid covers will increase up to 5 fold. Thus, efficiency of existing trees & forests to consume CO_2 will be enhanced substantially, up to 5 times more than current level which will provide an immediate effect similar to reforestation.

Multi-tier farming to boost production of food items; most of the food crops such as cereal crops and pulses crops are dwarf, hardly feet or two in height. It is possible to cultivate them in a multi-tier manner whereby not only crop yield per hectare will be more but land requirement of such food production will also be reduced, substantially.

It is considered that if a combination of solar plants and Greenhouses along with the various mentioned facilities above are installed on over one billion acres of land across the world, they will produce enough food for all and will also generate electricity to meet entire future need of the world. It will not only provide immense mitigation measures against Global Warming but will also provide effective adaptation measures to fight ill effects of the Climate Change. It will also enhance absorption of more than 60 billion tons of CO2 every year.

PRIOR ARTS:

WO/2008/052224 discloses a solar poly farm for solar power generation and agriculture; wherein the said solar poly farm provides both a least two "crops" (functions) including irrigated agriculture and highly concentrated solar photovoltaic (HCS PV) power generation. It further discloses a water source and means for water flow which are shared by both crops so that water is allowed to flow through HCS PV power generation to control heat during the day; whereas the water is allowed to pass into irrigation for agriculture during the night. The water flow subsystem includes a valve(s) to change between these two functions. It further discloses a solar concentrator mirror and solar receiver, including photovoltaic (PV) cell(s), mounted on a means to track the sun, atop support structures and provide support for climbing plants.

EP2230695 discloses a photovoltaic greenhouse structure; including a house structure having upstanding walls and a roof forming an enclosed greenhouse space therein, and at least one thin-film solar cell module mounted on the roof for converting solar energy within a pre-selected light band of sunlight into electricity, wherein light not absorbed by the thin-film solar cell module passes through and enters the greenhouse space, which can be utilized by plants or crops for photosynthesis. The thin-film solar cell module has high transmittance of light in the wavelength intervals, for example, 400-450nm and 640-700nm, required by the cultured plants or crops inside the greenhouse space.

US20130200017 discloses a greenhouse shelf structure with modularized solar power facility; that includes a greenhouse shelf set between two neighboring standing pillars wherein the greenhouse shelf is of a wave form shelf or a ridge form shelf connected by the standing pillar through a connector associated with the shelf. The top of the connector is connected to a solar panel support. Accordingly, the solar panel support and the greenhouse shelf are integrated into a whole assembly by the modularized combination. Solar panel to receive solar power can also be established near the greenhouse to fulfill the electricity requirement of the greenhouse or other devices.

MUM/431/2014 discloses a covered greenhouse structure with solar power facility comprising plurality of solar panels arranged across the length and breadth at a height of around four meters; where the solar energy is converted to electric energy by the solar plant and is used by supplying the solar power to the grid or by any other known conversion method; and the solar panel covered top of the greenhouse/polyhouse facility having filtration units for selective bandwidth to maximize plant growth so that farming under solar plant helps to maintain the temperature beneath panels which will support and enhance functioning of solar panels by keeping the lower surface cool.

All the above patents possess one or more shortcomings such as: absence of mechanism to control temperature while it is essential but difficult to keep the temperature beneath solar panels and temperature inside the Greenhouse within a precise suitable range; separate land requirement independently both for solar plant and for Greenhouse/Poly house which results in use of more land which is valuable and which also adds to costing both for solar power plants and for greenhouse; quantity of materials independently required both for solar facility and for greenhouse also adds to the cost; absence of mechanism to clean solar panels or roof of Greenhouse to make them dust free; absence of mechanism for weeding out ground beneath

solar panels; absence of precise & elaborate method to filter sunlight entering in to Greenhouse and protection of plants, crop from UV bandwidth of sunlight; absence of precise & elaborate mechanism to control, maintain temperature at the connection points beneath solar panels which is necessary for efficient functioning of solar panels; absence of mechanism for sourcing, conservation & recycling of water required for cleaning solar panels and Greenhouse covering materials as also for irrigating plants, crop in Greenhouse and for other activities beneath solar plant; absence of mechanism to increase agricultural yield of main food crops such as cereal crops and pulses crops which are mostly dwarf i.e. of short length; absence of system and method to reduce CO2 from atmosphere using long living plants in Greenhouse and by existing trees and forests.

Therefore, there is a need for cost effective method both for solar power plant and for Greenhouse or shed for any other activities such as to eliminate need of separate land, materials & efforts requirement both for solar plant and for Greenhouse/Poly house.

To overcome the evident drawbacks as stated above, the present system provides a uniquely designed, versatile, cost-effective solar plant with enclosed space beneath for growing plants in a precisely controlled climate enabling enhanced food production and enhanced renewable power generation and conservational methodologies to protect environment.

OBJECTIVES OF THE INVENTION:

An object of the present invention is to provide a combination of solar plant and enclosed space/ greenhouse system.

Another object of the invention is to provide a greenhouse arrangement powered by the energy from solar plant arrangement.

Another object of the present invention is to remove all the associated drawbacks of the prior arts and to provide a technique whereby farming & other activities are conducted beneath solar power plants in a cost effective and efficient manner.

Yet another object of this invention is to generate more electricity, the clean energy, with the enhanced efficiency of solar plants complemented by farming in Greenhouse beneath.

Yet another object of this invention is to combine benefits of both these techniques viz. solar plant and Greenhouse together; minus their respective shortcomings and at the same time, increasing their benefits.

Yet another object of this invention is to save the land area, materials & efforts by facilitating common use thereof and sharing them for these two different purposes.

Yet another object of this invention is to reduce capital expenditure involved in erection & installation of solar power plant & of Greenhouse for covered farming or building for other activities, by common use of land surface and common use of materials & efforts required for both.

Yet another object of the present invention is to reduce levellised cost of renewable power and also to reduce cost of production of food items by reducing capital cost as well as enhancing efficiency both of solar plant and Greenhouse and by providing strong economic support to one another.

Yet another object is to provide a UV protection and controlled intensity of illumination in enclosed greenhouse for cultivation.

Yet another object of the invention is to provide a cost-effective heating and cooling arrangement to maintain the temperature in the Greenhouse and at area at connection points beneath solar panels, at precise beneficial level.

Yet another object is to provide a fan-and-pad arrangement re-enforced with cooling coils placed in front of exhaust fans for forced evaporation deriving benefit out of fast air from exhaust fans and hence for enhanced and efficient cooling of enclosed greenhouse during hot climate.

Yet another object of the present invention is to utilize heat energy generated by solar panels with help of heating coils placed below solar panels for heating air in the Greenhouse and at the area at connection points beneath solar panels during chilled climate.

Yet another object of the invention is to provide a rainwater harvesting and percolation prohibition of water beyond roots of plants, crop and conservation & recycling of water achieving, thus, 99% water use efficiency in agriculture.

Another object is to provide a greenhouse arrangement with carbon sequestration (trapping) mechanism for enhanced CO2 sequestration by existing trees & forests.

Yet another object of the present invention to provide water reticulation arrangement so that

a. every land including all rain fed land, will have assured supply of water throughout year;
b. Available water will be clean (rain water) as against contaminated ground water & canal water importance whereof is significant;
c. Every land including presently rain fed land with assured water supply will provide 2 or 3 crops a year which would multiply agricultural yield per hectare of land;
d. Quantity & cost of nutrients, manure required for crop, plants will be reduced by elimination of their leaching & recycling;
e. Flood irrigation is feasible, thereby eliminating high cost of Sprinkler or Drip irrigation which will also cause good saving;
f. Assured multifold agricultural yield, cost effectiveness, conservation of every drop of water and several other benefits would be achieved with application of the envisaged arrangement.

Yet another object of the present invention to provide a cost-effective arrangement for air conditioning the enclosed spaces;

a. Enhancing extent & rate of evaporation of water deriving advantage of fast air flowing from fans and thereby chilling water, air or coolant in cooling coils and in turn, cooling atmosphere in enclosed spaces.
b. Air conditioning enclosed spaces without use of refrigerant and eliminating high capital as well as huge operation cost of traditional Air Conditioning systems & machines;
c. Enhancing efficiency & cooling effect of Fan-n-Pad systems being used in controlling temperature in Greenhouses, Poly houses & other enclosed spaces;

Yet another object of the present invention is to provide Sunlight filtration arrangement;

a. to control intensity of illumination of sunlight as per varied requirement of different plants, crop cultivated or desired activities conducted in enclosed space, Greenhouse beneath solar plant;
b. To restrict entry of ultra violet bandwidth of sunlight providing protection to plants, crop from getting damaged or to other desired activities beneath solar plant.

c. To provide light with help of LED bulbs etc. in the enclosed space, Greenhouse after day hours or if available sunlight is lesser than requirement.

Yet another object of the present invention is to provide an arrangement that facilitates CO2 sequestration;

a. To enhance Photosynthesis by existing trees and forests to suck-up vast quantities of CO2 from the atmosphere
b. To reduce vast quantities of CO2 in the atmosphere by more sequestration by existing trees and forests up to 5 times more than current level of sequestration.
c. To provide great mitigation measures against Global warming and resultant Climate change.
d. To provide way to get back to CO2 level during pre-industrialization era within few decades.

Yet another object of the present invention is to provide two-pronged mitigation measures against global warming firstly by enhanced generation of renewable energy by solar power plants; and secondly, by more photosynthesis by the plants, crop in the Greenhouse as also by existing trees & forests and thereby consuming more CO2 and thus, reducing substantial quantity of CO2 from atmosphere.

Yet another object of the present invention is to help undertaking adaptation measures to fight and overcome adverse effects of the climate change.

Yet another object of the present invention is to cause sustainable development of farmers, farm workers including females by enhancing agricultural production and by providing safe, decent & pleasant atmosphere at their work place viz. farms.

Yet another object of the invention is to provide a multi-tier container stacked arrangement for dwarf plants, crop to facilitate enhancement in food production.

A further object of the invention is to facilitate and encourage renewable power generation.

SUMMARY OF THE INVENTION:

The present invention relates to a solar plant with enclosed space **100** beneath solar plant including a solar plant arrangement **(A)**; an enclosed space arrangement **(B)**; greenhouse arrangement **(C);** a sunlight filtration arrangement **(D)**; a heating and cooling arrangement **(E);**

a humidity control arrangement **(F)**, a rainwater harvesting, percolation prohibition and water recycling arrangement **(G);** a CO2 sequestering mechanism **(H);** and containers stacking arrangement **(I)** comprising of a greenhouse **10**, foundation **11**, fabricated structure **12**, solar plant **13,** solar panels **14**, glass or UV coated film or Polycarbonate sheets **15**, vents or exhaust fans **17**, a tank **18**, cooling coils **19,** porous pads **20**, Filters **21** and **22**, Heating coils **23**, hot water tank **24**, gutters **25**, pipelines **26,** farm pond **27**, insulating layer **28** and multi-tier stackable containers **30** and recycled water storage tank **34;** and wherein few or all the arrangements A, B, C, D, E, F, G, H and I, function in co-ordination enabling enhanced food production, enhanced generation of renewable power, environment protection by mitigation measures and effective measures to adapt fighting the ill effects of climate change.

In accordance with one aspect of the present disclosure, The solar plant arrangement **(A)** forms a part of roof to an enclosed place arrangement **(B)** or the greenhouse arrangement **(C)** associated with a sunlight filtration arrangement **(D),** heating and cooling arrangement **(E),** humidity control arrangement **(F),** a rainwater harvesting on the roof, water percolation prohibition beyond root zones and water conservation & recycling arrangement **(G),** CO2 sequestration mechanism **(H)** and multi-tier container arrangement **(I);** in the greenhouse **10;** wherein the solar panels **14** are installed at a desired elevated height forming part of the roof of the enclosed space or the greenhouse **10** supported by a foundation **11** and a fabricated structure **12**; covered by roofing, partitioning sheets or glass or UV coated film or the polycarbonate sheets **15** and the enclosed space arrangement **(B)** and the greenhouse arrangement **(C)** is provided with a fan-and-pad unit with cooling coils **19** in front of exhaust fans **17** placed on one wall of the enclosed space or of the Greenhouse **10** and porous pads **20** are placed on other wall for cooling air in the enclosed space or in the Greenhouse **10** during hot climate; whereas heating coils **23** are disposed beneath solar panels **14** for heating air in the enclosed space or the greenhouse **10** during cold climate; for temperature regulation.

In accordance with another aspect, the said cooling arrangement includes the cooling coil **19** which has pipes wrapped in textile fabric enabled with a mechanism to sprinkle water thereon and to circulate water, air or coolant from a small tank **18** in the pipes of each cooling coil **19** installed in front of a respective exhaust fan **17** of desired size and speed, disposed on one wall of the enclosed space or the greenhouse, thus allowing forced evaporation of water on outer surface of pipes of the cooling coils at a faster rate and extent thereby lowering the temperature of water, air or coolant in the cooling coils. Additionally, a continuous sprinkling of chilled

water on the porous pads **20** enforces chilling of air surrounding the porous pads **20** and the chilled air is forced into the enclosed space or in the greenhouse **10** as the operation of fans **17** creates a partial vacuum in the enclosed space arrangement **(B)** or the greenhouse arrangement **(C)** allowing enhanced cooling effect substantially, providing temperature ranging between 15°C to 30°C ideally 23 degree Celsius. Air is used in the tank **18** and cooling coils **19** and chilled air is spread in the enclosed space or greenhouse when ambient relative humidity is higher than 60%. When ambient relative humidity is less than 40%, chilled water is spread directly in the enclosed space or greenhouse through foggers.

In accordance with yet another aspect, the heating arrangement includes heating coils **23** disposed at the lower face of the solar panels **14,** through which the water, heat-transfer-fluid or air from a small tank **24** is circulated which gets heated due to the heat of solar panels and the hot water, heat transfer fluid or air is circulated with help of a pump; also provided with mechanism for continuous sprinkling of the hot water or heat-transfer-fluid on the porous pad **20** thereby increasing temperature of air around the pad **20** such that the hot air is forced into the enclosed greenhouse **10** as the operation of fans **17** blows or sucks out cold air and creates a partial vacuum in the enclosed space arrangement **(B)** or the greenhouse arrangement **(C)** allowing enhanced warming effect amounting to temperature rise of air in the enclosed space or, the Greenhouse to around 15°C - 25°C within the Greenhouse **10**. Air is circulated in the heating coils & hot tank which on getting heated with heat from solar panels, is alternatively, spread in the enclosed space or the Greenhouse through nozzles.

In accordance with another aspect, the system **100** includes filters **21** and **22** that restricts entry of UV bandwidth of sunlight and reduce intensity of illumination respectively. The system **100** is further provided with gutters **25** connected to pipelines **26** for collection, harvesting of rain water and for use as pathways for cleaning of solar panels **14** and frames of roofing, partitioning sheets or glass or UV coated film or of Polycarbonate sheets **15** and then stored in a farm pond **27.** The system **100** is further equipped with insulating layer **28** placed beneath root zone of plants, crops enabling accumulation of water provided for irrigating cultivation but not consumed by plants, crop and prohibited from percolation beyond the insulating layer **28** which water is flushed out and carried through pipeline and stored in a recycle water tank **34** for utilization during subsequent irrigation cycle. The arrangement, thus, forming a unique rainwater harvesting, percolation prohibition and water conservation and recycling arrangement **(G).**

In accordance with yet another aspect, multi-tier stackable containers **30** made up of multiple sections **31** provided with top supports **32** and bottom supports **33** enabling stacking the containers **30** one above another and equipped with pipes for watering the cultivated crops and also equipped with insulating layer **28** and pipes to carry water provided for irrigation but not consumed by the cultivation and accumulated on the insulating layer **28** towards tank **34**.

In the enclosed Greenhouse arrangement **(C),** the plants consume the same CO_2 during early hours on the subsequent day, that was emitted by them during earlier night hours which is trapped within the enclosed space providing a carbon sequestration mechanism **(H)** thereby substantially reducing CO_2 in the atmosphere by consuming excess CO_2 around 4 to 5 times more than the ambient CO2 consumption for photosynthesis.

In accordance with yet another aspect, the solar plant with enclosed space beneath **100** enables conducting various activities including covered farming supplemented with sunlight filtration arrangement **(D)** with controlled intensity of illumination and with protection from ultra violet rays from sunlight; controlled temperature with cooling & heating arrangement **(E)**; humidity control arrangement **(F);** also supplemented with rain water harvesting, percolation, prohibition and water conservation and recycling arrangement **(G);** CO2 sequestration mechanism **(H)** and containers stacking arrangement **(I)** collectively enabling enhanced food production and enhanced generation of renewable power and environment protection by mitigation measures against Global warming such as by generation of renewable power and by carbon sequestration in atmosphere and by adaptation measures for fighting the ill effects of Climate change.

BRIEF DESCRIPTION OF THE DRAWINGS:

The disclosure will now be explained in relation to the accompanying drawings, in which:

Fig.1. is the isometric view of solar power plant with enclosed space beneath **100** with solar panels (14) installed at a desired height with enclosed space, the Greenhouse **10** created beneath solar power plant.

Fig.2 is a sectional side view of the solar power plant with enclosed space, the Greenhouse **100**.

Fig.3 is side view of the solar power plant and enclosed space, the Greenhouse **100** with exhaust fans **17** and cooling coils **19** disposed on one wall and porous pad **20** on another wall of the Greenhouse **10**.

Fig.4 shows a cooling coil **19** and its sectional view.

Fig. 5. is a top view of solar power plant showing heating coils **23** placed beneath solar panels (14).

Fig.6. is heating coil **23** and its sectional view.

Fig.7. shows insulating layer **28** disposed at the bottom of the Greenhouse **10** below root zone **29** of the plants, crop to be cultivated in the Greenhouse **10**.

Fig.8. is isometric drawing of a fabricated container **30** with insulating layer **28** up to certain height to be used for multi-tier farming of dwarf crop, plants.

Fig.9. shows containers **30** stacked on above another for multi-tier farming of dwarf plants or crops.

DETAILED DESCRIPTION OF THE INVENTION:

Before the present invention is described, it is to be understood that this invention is not limited to methodologies described, as these may vary as per the person skilled in the art. It is also to be understood that the terminology used in the description is for the purpose of describing the particular embodiments only and is not intended to limit the scope of the present invention. Throughout this specification, the word “comprise”, or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps. The use of the expression “at least” or “at least one” suggests the use of one or more elements or ingredients or quantities, as the use may be in the embodiment of the invention to achieve one or more of the desired objects or results. Various embodiments of the present invention are described below. It is, however to be noted that the present invention is not limited to these embodiments, but rather the intention is that modifications those are apparent are also included.

The present invention spells out system & method to combine both of these two different techniques and to bring in a novel technique viz. solar plant for enhanced generation of electricity with utilisation of space beneath by enclosing it for various uses including for covered Greenhouse for increasing yield in agriculture, added with system to filter sunlight particularly, to restrict entry of ultra violet bandwidth of sunlight as also to control intensity of illumination at appropriate level; also equipped with system to control, maintain temperature & humidity at level conducive for desired activities in the enclosed space or for proper growth of plants, crop; further equipped with sourcing of water by rain water harvesting, conserving water by prohibiting percolation in the ground, collecting back & recycling the water for reuse in irrigation and thus, achieving 99% water use efficiency in agriculture and also equipped with multi-tier stackable containers to grow dwarf crops. In accordance with the present invention, the enclosed space so created beneath solar plant can also be used for conducting several other activities including rearing of cattle, goats, poultry farm, storage godown, workshop, residence, office etc.

The details of the present invention can be understood from various embodiments emphasizing the various components using the figures 1 to 9 as described in the present description. It is to be noted that all the drawings mentioned herein refers to various features of embodiments.

In an embodiment, a solar plant with enclosed space system **100** provides an enclosed space for multipurpose utilization such as covered, protected greenhouse farming, rearing of cattle, goats or sheep, poultry farm, packaging of goods, storage of goods, residence, office or workshop as per the user requirement. The enclosed space is used as greenhouse in one embodiment. However, in general, the enclosed space may be alternatively used for any other purposes like rearing cattle, poultry farm, packaging of goods, storage of goods, residence, office, workshop and so on based on the proposed use and such alterations made by the person skilled in the art.

In an embodiment the solar plant with enclosed space system **100** comprises of;

A. A solar plant arrangement;
B. An enclosed space arrangement;
C. A greenhouse arrangement;
D. Sunlight filtration arrangement;
E. Heating and Cooling arrangement;

F. Humidity control arrangement;
G. Rainwater Harvesting, percolation prohibition and water recycling arrangement;
H. Carbon-di-Oxide sequestering mechanism; and/or
I. Multi-tier containers arrangement;

where all or few of the A, B, C, D, E, F, G, H and I function in co-ordination enabling enhanced food production, enhanced generation of renewable power, environment protection by mitigation measures and effective measures to adapt fighting the ill effects of Climate change.

A solar plant arrangement **(A)** is formed by installation solar panels **14** at an elevated height commensurate to height of plants to be cultivated beneath or height required for carrying out desired activities. An enclosed space arrangement **(B)** is created by filling the gaps between solar panels, panel rows and side walls by roofing, partitioning materials. A Greenhouse arrangement **(C)** is created by filling the gaps between solar panels, panel rows and side walls with glass or UV coated plastic film or Polycarbonate sheets **15**. The sunlight filtration arrangement **(D)** is put in place by disposing filter **22** such as shed net fabric of desired transmittance capacity, above the plants and below the roof which controls intensity of illumination of sunlight while glass or UV Coated plastic film or Polycarbonate sheets **15** restricts entry of UV bandwidth of sunlight forming filters **21**. Illuminators such as LED bulbs are disposed in the enclosed space for providing light after day hours or in excess of available sunlight. The heating & cooling arrangement **(E)** is disposed with exhaust fans **17**, cooling coils **19** installed on one wall and porous pad **20** on the other wall for cooling while installing heating coils **23** on lower phase of solar panels **14** with mechanism to spread, sprinkle air, water or coolant/heat-transfer-fluid from cold water tank **18** or hot water tank **24** in the enclosed space directly or through porous pad **20** on the wall. Humidity control arrangement **(F)** is put in place by using water in the cooling coils **19** and cold water tank **18** or in heating coils **23** and hot water tank **24** when humidity level is lower than 40% while using air therein when humidity level in higher than 60%. Rainwater Harvesting, percolation prohibition and water recycling arrangement **(G)** is made by creating gutters **25** on the roof, laying pipelines **26** and creating a farm pond **27** for harvesting entire quantity of rain water falling on roof and storage for use over a period; putting insulating layer **28** below root zone **29** of plants to prohibit water percolation, flushing out water accumulated on insulating layer **28**, carrying water through pipelines and its storage in recycled water tank **34** for reuse during subsequent irrigation cycles. CO2 sequestration mechanism **(H)** takes place in the enclosed space as CO2 emitted by plants

during night hours gets trapped in the enclosed space and not allowed to get mixed in the atmosphere and plants in the enclosed space get such excess CO2 for consumption during next morning hours for enhanced photosynthesis and at the same time sequestering CO2 from atmosphere. Wire mesh roofs with retractable side curtains are placed on a tree or on number of trees or on trees in dense forest such that they suck up vast quantities, billions tons of CO2 from atmosphere. A multi-tier container arrangement **(I)** is formed by making stackable containers **30** for cultivation of dwarf crops, plants in a multi-tier manner thereby boosting production of all dwarf crops including pulses, cereals.

An embodiment of the present invention is shown in an isometric view of the present system as illustrated in **Fig. 1.;** where the said solar plant with enclosed space system **100** includes:

a solar plant 13 arrangement **(A)** forming a roof to an enclosed space arrangement **(B)** or greenhouse arrangement **(C)** associated with a sunlight filtration arrangement **(D);** a heating and cooling arrangement **(E),** a humidity control arrangement **(F),** a rainwater harvesting and water conservation and recycling arrangement **(G),** CO2 sequestration mechanism **(H)** and multi-tier container arrangement **(I)**; comprising of greenhouse **10**, foundation **11**, fabricated structure **12**, solar panels **14**, glass or UV coated film or Polycarbonate sheets **15**, Vents or Exhaust fans **17**, Tank **18** and cooling coils **19,** porous pad **20**, Filters **21** and **22**, Heating coils **23**, Hot water tank **24**, Gutters **25**, pipelines **26,** farm pond **27** and insulating layer **28**; wherein the solar panels **14** of the solar plant arrangement **(A)** is installed at a desired height such that it forms the roof of the enclosed space or the Greenhouse **10** supported by a foundation **11** and a fabricated structure **12** ; roofing, partitioning sheets or glass or UV coated film or Polycarbonate sheets **15** to cover the gaps between solar panels **14** or panel rows and the sides of the enclosed space, the Greenhouse **10**; Vents or Exhaust fans **17** on one wall of the enclosed space, the Greenhouse **10** for venting out air; Tank **18** and cooling coils **19** placed in front of Exhaust fans **17**, Porous pad **20** on other wall of the enclosed space, the Greenhouse **10** for cooling, maintaining temperature in the enclosed Greenhouse **10** during hot climate; Filters **21** forming part of roof & sides for restricting entry of UV bandwidth of sunlight, Filters **22** above plants, crop for reducing intensity of illumination; Heating coils **23** disposed beneath solar panels **14** and hot water tank **24** for heating air in the enclosed space, the Greenhouse **10** during cold climate; Gutters **25** for collection, harvesting of rain water and for use as pathways for cleaning of solar panels **14** and frames of glass or UV coated film or of Polycarbonate sheets **15** on the roof of the enclosed space, the Greenhouse **10**; Farm pond **27** for storage of harvested

rain water and insulating layer **28** that enables accumulation of excess water not used by the cultivation, for reuse. It is to be noted that Filters **21, 22,** Gutters **25** and pipelines **26** are not depicted in Fig. 1, but form a part of the subsequent figures present in this description.

The embodiment is further disclosed as a sectional side view of the solar power plant with enclosed space **100** as illustrated in **Fig. 2**.; where the foundation **11** forms the base for holding the fabricated structure **12** including the columns and beams that provides support to the rows of the solar panels **14** of the solar power plant **13;** the roofing, partitioning sheets or glass or UV coated films or polycarbonate sheet **15** covers the gaps between the solar panels **14** and the sides of the greenhouse **10** such that it restricts the entry of UV bandwidth of sunlight; Gutters **25** for collection, harvesting of rain water & also for use as walkways for cleaning roof; Pipelines **26** for carrying harvested rain water for storage in a farm pond **27**; Filters **22** to control intensity of illumination of sunlight; cooling coils **19** placed before the exhaust fans **17** as illustrated in **Fig. 3.** are disposed on one wall; whereas the porous pad **20** is disposed on other wall of the enclosed space, the Greenhouse **10** for cooling and maintaining temperature in the enclosed space as well as in the area beneath solar panels **14** during hot season; the heating coils **23** as shown in **Fig. 6.** are placed below solar panels **14** for heating air in the enclosed space, the Greenhouse **10** and in the area beneath solar panels **14** during cold climate. Further, an insulating layer **28** is disposed by excavating the ground at a depth commensurate to the depth of active roots of plants or crop to be cultivated i.e. their root zone **29** enabling the accumulation of water not used by the cultivation to be collected and stored in a tank **34** such that the same water is reusable in subsequent irrigation cycles.

The embodiment of the said solar plant with enclosed space **100** is also illustrated in **Fig. 3** showing the heating and cooling arrangement **(E)** where the exhaust fans **17** are disposed on one wall of the enclosed space, the Greenhouse **10** for venting out air and the cooling coils **19** are placed in front of the said exhaust fans **17** whereas the porous pad **20** is placed on opposite wall of the enclosed space, the Greenhouse **10** enabling cooling and maintaining temperature in the enclosed space as well as in the area beneath solar panels **14** during hot climate. Further, **Fig.3.** and **Fig. 5.** illustrates the arrangement of the heating coils **23** placed below solar panels **14**, the placement of glass or UV coated film or polycarbonate sheets **15** between the solar panels **14** or panel rows, followed by the Gutters **25** placed at a level below the solar panel **14** and roofing partitioning sheets or glass or UV coated film or polycarbonate sheets **15** on the roof for collecting, harvesting rain water falling on roof; where the Gutters **25** are also used as

pathways for mopping, cleaning solar panels **14** and roof of the enclosed space; below which are placed the filters **22** for reducing intensity of illumination that is passed to the plants in the greenhouse **10.**

This embodiment also discloses an insulation layer **28** as illustrated in a **Fig. 7**.; where the said insulating layer **28** made either of natural or man-made materials is disposed below the ground level **16** by excavating the ground nearly up to the base of the foundation **11** i.e. at a depth commensurate to the depth of active roots of the plants or crops to be cultivated, to avoid percolation of water & nutrients in the ground beyond their root zones **29** and for accumulation of the excess water not consumed by the irrigated plants on the insulating layer **28** enabling collection of the unused water back in a tank **34** for recycling during subsequent irrigation cycles. The **Fig. 4.** illustrates a sectional view of the cooling coils **19** placed in front of exhaust fans **17** as shown in the expanded view in **Fig. 3.**

The embodiment further discloses the container **30,** as illustrated in **Fig. 8.** where the container **30** is fabricated out of metal or plastic and is made of multiple sections **31** provided with top supports **32** and bottom supports **33**. The bottom support **33** of upper container **30** is placed on top support **32** of the lower container **30** that multiple containers **30** can be stacked one above another forming the multi-tier container **30**, equipped with pipes for watering the cultivated crops as illustrated in **Fig. 9.** The containers **30** are also equipped with insulating layer **28** to eliminate percolation of water and leaching of nutrients provided to crop or plants, thereby enabling multi-tier farming of dwarf plants and crops.

The embodiment further describes the arrangement of the various components of the said solar plant with enclosed space system **100** more clearly understood from **Fig. 1.** and **Fig. 2** where**;** the said solar panels **14** of the solar plant **13** are installed at an elevated height of approximately 2 meters or more depending upon the height of the plants to be cultivated or other activities to be conducted below the solar plant arrangement **(A)**. The solar panels **14** placed in slanted position achieving the tilt angle equivalent to latitude of the place of installation and arranged with desired spacing between them so as to avoid any panel coming under shadow of another solar panel **14** or any other object. The gaps between the adjacent solar panels rows as well as between solar panel **14** and side walls of the enclosed space arrangement **(B)** or the greenhouse arrangement **(C)** created beneath the said solar plant arrangement **(A)** is covered by the roofing, partitioning sheets in case of arrangement **(B)** or glass or UV coated film or polycarbonate sheets **15** in case of arrangement **(C)** forming a filter **21** that restricts the Ultra-violet bandwidth

of the sunlight to pass. The sealants and beading materials used for placement of the solar panels **14** and roofing, partitioning sheets in case of arrangement **(B)** or glass or UV coated film or polycarbonate sheets **15** in case of arrangement **(C)** make the enclosed space arrangement **(B)** or the Greenhouse arrangement **(C)** waterproof. Below the roof is placed the filter **22** that protects the plants cultivated in the Greenhouse from high intensity of illumination. The gutters **25** or channels, are connected to the pipelines **26** extended along the fabricated structure **12**, such that the water carried from the gutters **25** through the pipelines **26** is collected and further stored in the farm pond **27** for use over a period. Water accumulated on the insulating layer **28** is flushed out, carried through pipelines and stored in a tank **34** created for the purpose for recycling and reuse of the water. The solar plant arrangement **(A)** provides electricity generated to the enclosed space arrangement **(B)** and the greenhouse arrangement **(C)** to be used for lights such as LED bulbs required beyond day hours in the enclosed space and for functioning of the motors associated with cooling and heating coils **23**, running the exhaust fans **17**, or pulling harvested water from the farm pond **27** or recycled water from the tank **34** for irrigation and other equipment in the enclosed space and also at other places.

In an embodiment, the wind mills are installed as an addition to the solar plant arrangement **(A)** so as to reduce intermittence of electricity generation by solar plants **13**. In yet another embodiment, electricity storage system such as gravity storage system or battery storage system or other available storage means, is disposed to totally eliminate intermittence of electricity generation by solar plants **13** and windmills arrangement.

The heating and cooling arrangement **(E)** of the said solar plant with enclosed space system **100** facilitated by a fan-and-pad unit may be understood clearly from the **Fig. 3, 4, 5** and **6**; where the air conditioning of the enclosed space arrangement **(B)** and the greenhouse arrangement **(C)** is required so as to maintain temperature range between 15°C to 30°C; with an ideal at 23°C conducive to the proper growth of plants for enhanced production or for comfort of the occupants and safety of delicate things; thus the temperature of the air inside is required to be cooled when ambient climate is hot while it is required to be heated utilizing heat generated by solar plants with help of heating coils placed below solar panels when ambient climate is extremely cold.

According to the preferred embodiment, the cooling arrangement of the present system **100** as illustrated in **Fig. 3.** and **4**. includes pipes either with perforations thereon or pipes wrapped in porous pad or textile fabric like gunny cloth, fabricated to form cooling coils **19** of desired size,

shape and decor such that cooling coil is equipped with a mechanism to spread, sprinkle water on wrapped pipes of cooling coil. In the preferred embodiment, the cooling coil is made of pipes wrapped in porous pad or textile fabric like gunny cloth whereon water is spread or sprinkled. In yet another embodiments the cooling coils are made of pipes with perforations thereon such that small quantity of water seeps out from the pipes. The cooling coils are installed in front of fan either independently or in front of series of fans disposed on one wall of the enclosed space. A small tank **18** containing water, air or coolant is installed at convenient place near fan or series of exhaust fans **17** whereby the water, air or coolant, as the case may be, in tank **18** is circulated in the cooling coils with the help of small pump operated with aid of electric motor. For further cooling, the exhaust fan of a desired size is operated at desired speed such that the water or coolant seeping out of perforations on pipes or water sprinkled on porous pad or textile fabric wrapped around pipes (depending upon the pipes used) gets evaporated at a faster rate being subjected to the speedy flowing of air through the exhaust fans **17**. The rate & extent of evaporation is regulated by varying size and speed of fan and size of cooling coils **19**. The forced evaporation utilizes heat from the water, air or coolant in the pipes of cooling coil and tank **18** thereby lowering the temperature of the area around cooling coils **19** while the water, air or coolant in cooling coil and tank **18** gradually gets chilled by continued forced evaporation. The chilled air is then spread throughout the enclosed space through nozzles which lowers the air temperature in the enclosed space, the Greenhouse **10**. In the alternate, the chilled air, water or coolant is continuously sprinkled on porous pad **20** disposed on other wall of the enclosed space, the Greenhouse **10** resulting in chilling the air around the porous pads **20**. Operation of the fan creates partial vacuum in enclosed space thus forcing the chilled air around porous pad **20** to enter into the enclosed space, the Greenhouse **10** thereby providing an enhanced cooling effect, substantially reducing temperature of the air in the enclosed space, the Greenhouse **10** to the range between 15°C to 30°C; and ideally around 23°C. Apart from that, water is used in the tanks **18** and cooling coils **19** to enable increasing humidity in the air during summer days when the atmospheric humidity of the enclosed space is below 40%; whereas air is used in the tanks **18** and cooling coils **19** instead of water to enable cooling the air in enclosed space during rainy days wherein the humidity exceeds above 60%.

In an embodiment, the heating arrangement of the system **100** as illustrated in **Fig. 5.** and **6**.; where in addition to generating electricity, the solar panels **14** also convert part of sunlight into heat energy such that the temperature beneath solar panel **14** increases to around 25°C more than the ambient temperature. The heating arrangement includes heating coils **23** made of pipe

grid disposed at the lower face of the solar panels **14** and a hot water tank **24** is installed where the water, heat-transfer-fluid or air in the said tank **24** and pipes of heating coil is circulated with help of a pump. Water, heat-transfer-fluid or air in the pipes of heating coils **23** gets heated due to the heat generated beneath solar panels **14** which is transferred to the connected tank **24**. Hot air in the tank **24** and heating coil beneath solar panels **14** is spread in the enclosed space, the Greenhouse **10** through nozzles. In an embodiment, the hot air or water or heat-transfer-fluid is sprinkled/spread on the porous pad **20** which results in increasing temperature of air around the pad. While the exhaust fan operates, it blows or sucks out air from the enclosed space, the Greenhouse **10** creating relative vacuum therein thus forcing the hot air around the pad to enter the enclosed space, the Greenhouse **10**. In an alternate embodiment, warm air in tank **24** is released directly into the enclosed space, the Greenhouse **10** through nozzles, without transmitting through the porous pad **20**. The warming effect amounts to 25°C more than ambient climate thereby increasing the temperature of air in the Greenhouse **10** above 15°C nearly to an ideal temperature of 23°C. In yet another embodiment, heating and cooling of the enclosed space or Greenhouse is done with conventional methods & equipment.

In an embodiment, the rainwater harvesting, percolation prohibition and water recycling arrangement **(G)** including the use of gutters **25** and insulating layer **28** providing two ways of water sourcing is illustrated in accordance with Fig. 2 and 7; where for direct sourcing of water, entire amount of rain water falling on the roof of the Greenhouse **10** made of solar panels **14** and roofing sheets or glass or UV coated film or polycarbonate sheets **15** will be harvested with help of gutters **25** disposed thereon such that water so harvested is carried through the pipelines **26** and stored in nearby farm pond **27**. The quantity of water so harvested would be equivalent to the area of the roof of the enclosed space, the Greenhouse **10** multiplied by precipitation during entire season per year. Additionally, for indirect sourcing of water and enhancing water use efficiency in agriculture, percolation of water and nutrients in the ground is avoided by disposing an insulating layer **28** made either of natural or man-made materials such as plastic/rubber sheet, reinforced cement concrete or plain cement concrete or stones, tiles is spread, laid on excavating the required land portion, at the bottom and on sides of the excavated portion. The excavated soil is refilled, if necessary, by reinforcing with adding more fertile soil or coco peat; thereby enabling converting any rain fed land, saline land, marshy land into well irrigated fertile land. The root zone **29** of the trees, plants, crop is thus, insulated to avoid percolation of water & nutrients beyond the insulating layer **28** in as much as the ground is excavated nearly up to the base of the foundation **11** i.e. up to a depth that commensurate to

the depth of active root zone **29** of the plants or crops to be cultivated such that the quantity of water not consumed by the cultivated plants is collected back on the insulating layer **28** placed below root zone **29** of the cultivation; enabling it to be transported through pipelines to the tank **34** for storage and can be recycled and used for subsequent irrigation cycles.

Yet another embodiment describes way for an efficient cultivation using a multitier container **30** fabricated out of metal or plastic, made of multiple sections **31** provided with top supports **32** and bottom supports **33** enabling stacking the containers **30** one above another and equipped with pipes for watering the cultivated crops as illustrated in **Fig. 9.**; wherein the said container **30** is also equipped with insulating layer **28** to eliminate percolation of water and leaching of nutrients provided to crop or plants, thereby enabling enhanced cultivation within a limited enclosed space.

The plants cultivated in the enclosed space, Greenhouse **10** generally consume excess CO_2 emitted by them during earlier night hours, approximately 4 to 5 times more than the ambient CO_2 level in the atmosphere for photosynthesis during next early day hours thereby making more carbohydrates and energy whereas up to 60 tons of more CO_2 are consumed by these plants per year for enhanced photosynthesis. The plants in the morning hours, utilize the same CO_2 emitted by them during earlier night hours which is trapped within the enclosed space thereby helping in carbon sequestration by substantially reducing CO_2 in the atmosphere.

In another embodiment, number of the solar plant with enclosed Greenhouse are installed in a region calculating food, energy, employment requirement and poverty amongst people therein such that food and energy security in the region is achieved, the employment requirement therein is met with and poverty amongst people is alleviated.

In yet another embodiment, rain water harvested by the rainwater harvesting, percolation prohibition and water recycling arrangement **(G)** in excess of requirement in the solar plant with enclosed space system **100**, is made available in the neighboring area for drinking and other uses.

In yet another embodiment, the roof with or without solar panels or a wire mesh roof, with retractable side curtains made of transparent materials of desired height is disposed on a tree or on number of trees with help of scaffolding or light air/gas balloons; where the side curtains are in installed position during night hours when the CO2 emitted by trees during night hours gets trapped in the side curtains which is 4 to 5 times more than ambient CO2 level; the side

curtains are kept in installed state up till few hours in next morning when trapped CO2 becomes available for consumption by the trees for more photosynthesis. Thereby, trees consume more CO2 and in-turn sequester more CO2 from the atmosphere. The side curtains are retracted thereafter throughout remaining day hours when trees get ambient level of CO2 for consumption for photosynthesis in a regular manner. The trees thereby, consume enhanced quantity of CO2 and thus, sequester up to 5 times more CO2 from the atmosphere. While a fully grown tree in normal circumstances consume up to 12 tons of CO2 in a year, with such roof and retractable side curtains such tree will sequester up to 60 tons of CO2 from the atmosphere. In an embodiment, such system is installed on large number of trees and forests enabling sucking up very large quantities, billions of tons CO2 from the atmosphere.

Working Example:

The manner and method of practicing and applying the present invention can be understood more clearly using an example provided below. The steps to assemble the present system for a unit of 240 KW solar plant with an enclosed space of 1 acre consists of the following:

Step I: Ground Work:

An area of 1 acre of land is excavated up to 4000 cubic meters using an excavator machine for installing a solar plant of 240 KW capacity with an enclosed greenhouse of 4000 square meter; as the depth of active roots of most of the fruit plants, vegetables, flowers, cereals, and pulses is less than 1 meter. Bottom of the excavated portion will be made slanting towards one of the convenient point commensurate to terrain at the location so that water not consumed by the cultivation and accumulated on the insulating layer flows to the lower end for convenient collection.

Approximately 138 foundations of 1 meter height are laid for erecting columns with a spacing of 6m x 6m both length and breadth wise using reinforced cement concrete. Little high bunds of soil/ concrete will be made on the bottom of the excavated portion with desired gap along the slope so as to divide bottom into possible parts so that accidental leakage, damage in the insulating layer, obstruction in water accumulation restricts only to the damaged area; but do not affect water accumulation on entire area of insulating layer.

A tank of 80 square meter to store recycled water is created such that the capacity of such water storage is more than quantity of water required for one time watering of cultivation. Trenches & pipes will be provided to flush out water accumulated on the insulating layer and to carry water to the said water storage tank.

Farm pond around 10-meter deep is made at a convenient place by excavating approx. 200 square meter area for storing harvested rain water where the capacity to store harvested rain water is equivalent to area of roof in square meters X average precipitation in meters X 1000 litres. Lining of plastic sheet of 500 microns is provided to the farm pond. All gutters on roof will be connected by pipes to carry harvested rain water to be stored in the farm pond. Entire quantity of rain water falling on the roof of Greenhouse & on solar panels will be so harvested & stored in the farm pond.

Lining of Plastic sheet of 700 micron is provided in the excavated portion and on all four vertical sides up to neck of the excavated portion. The initially excavated soil of 4000 cubic meters is refilled and if required, more fertile soil and coco-pit is mixed to the soil. The land area is then ready for solar plant installation and Greenhouse for agricultural cultivation.

Step II: Structure:

For effective control of climate inside Greenhouse, width of the Greenhouse shed is kept low at around 30 meters.

Stronger pipes or sections made of steel or Fiber Glass Reinforced Plastic pipes filled with concrete are erected on all foundations along the extreme sides of the proposed structure.
Pipes or sections of desired strength made of steel or fibre glass reinforced plastic filled with concrete will be erected on all remaining foundations.

Around 132 pipes, sections will be connected by beams of pipes, sections made of steel square pipes of 100 m x100 m filled with concrete lengthwise or widthwise at the height of 5 meters from the ground to support gutters; and at the height of 6 meters for placing solar panels.
Double line of pipes or sections will be laid on beams at height of 5 meters and gutters formed from hard plastic sheet of 80 cm wide are placed on beams and these support pipes, sections on beams at the height of 5 meters. Gutters will help collecting rain water falling on roof & provide space to walk over for purpose of cleaning surfaces of solar panels and materials in the

gaps between solar panels. 4 aluminium ladders with 50 cm width are placed at all the corners of the structure.

The structure is then ready for installation of solar plant as also for creation of open space or Greenhouse beneath for farming activities etc.

Step III: Installation of Solar plants:

For obtaining a total capacity of 240 KW, 738 solar panels of 2 meter X 1 meter dimension with photovoltaic modules of 325 W are installed either vertically or horizontally at a distance of 6 meters between the solar panel rows.

At location with terrain either plane or declining towards south, solar panels will be installed on each of the rows using the beams at the height of 6 meters as shafts for solar panels. Solar panels will be installed in stationary manner, facing south achieving tilt angle equivalent to latitude of the location. Solar panels can also be installed facing east with single axis tracking mechanism. The tracking mechanism will rotate all the shafts at a desired speed in view of sun-path so that all panels follow sun all along the day.

At locations with terrain declining towards east or west, solar panels will be installed facing east with single axis tracking mechanism. The solar panels will be installed achieving tilt angle towards south equivalent to latitude of the location. The single axis tracking mechanism will rotate all the shafts at a speed in view of sun-path so that all panels follow sun all along the day. Solar panels can also be installed facing south achieving tilt angle equivalent to latitude of the location, in stationary manner.

At locations with terrain declining towards north, height of columns will be adjusted so as to make tilt angle of solar panels equivalent to latitude of the location. Solar panels will be installed facing south in a stationary manner or facing east providing single axis tracking mechanism.

Solar panel rows are placed at a distance of 6m from each other so that no panel is covered by the shadow of other panel. Sealant or Rubber/plastic bidding is used between adjacent panels to eliminate water leakage from the gaps. Inverters and balance of System are put in place at appropriate locations. On installation of solar panels, evacuation arrangement is made on obtaining right of way from neighbouring land owners or with underground cabling from each

of the unit up till the nearest grid of distribution agency. Bay at the sub-station such as transformers and insulators are installed in case of non-availability there. All units at a location will be connected to the grid using the same transmission lines.

Step IV: Creating greenhouses:

There will be types of situations such as solar panels installed either vertically in stationary manner or installed vertically with single axis tracking mechanism; or installed horizontally in stationary manner or installed horizontally with single axis tracking mechanism.

In case of stationary solar panels, the gap between solar panel rows up to gutter at the middle of each of the rows will be constant and will be filled with glass or UV coated plastic or polycarbonate sheets; whereas in the case of units with solar panels with single axis tracking mechanism, the gap between solar panel and gutter at the centre will be changing throughout the day depending on sun position in the sky. In such cases, the gap will be filled by two frames made of glass, polycarbonate or UV coated plastic, capable of folding with change of distance between solar panel rows and the gutter with rotation of solar panels, wherein the film will get adjusted either by sagging or stretching in the distance between solar panel rows and the gutter at the centre commensurate to change in distance throughout a day.

5 doors, each 5m x 3m in length and width are placed on both sides either width wise or lengthwise. 30 exhaust fans of 1.25 m are installed on one wall and porous pads made of polyurethane foam or cellulose pad with dimensions of 125m x 2m x 0.25m are installed on the other wall with water sprinkling facility.

Further, 30 cooling coils of 2m x 2m fabricated from steel pipes either perforated or wrapped in porous pad or textile fabric like gunny cloth, are placed in front of the fans and a tank of around 1000 litre capacity is disposed near cooling coils. Water is sprinkled on porous pad or textile fabric like gunny cloth wrapped around pipes of cooling coils, and air, water or coolant is allowed to pass through these coils for forced evaporation harnessing warm & fast air flowing from fans so as to chill the air, water or coolant in the cooling coils. PVC pipelines are provided to pour chilled water on porous pad on other wall of the enclosed space. Similar PVC pipes are also provided to carry chilled air to be spread in the greenhouse through foggers, nozzles. This mechanism reduces temperature of air, water or coolant in the chilling coils to the level well below the temperature level at a location. Water is used in chilling coils when humidity level

in the greenhouse is low while air is carried in the chilling coils when humidity is high. This helps to maintain temperature in the greenhouse at around 23 degrees Celsius as well as humidity at around 50%.

All remaining portion of all four sides are covered using glass or UV coated PVC or Polycarbonate sheet. PVC pipe lines with nozzles/sprinklers will be disposed horizontally above each of the rows of solar panels and collapsible glass/film frames and pressurized water is spread for the purpose of cleaning, mopping up solar panels and roof.

Variety of trees, plants, crops such all fruits including Grapes, Pomegranates; all Vegetables like tomato, exotic vegetables; all Flowers like roses, Gerbera etc.; other crops like Cotton, Sugarcane; multi-tier crops like Turmeric, Strawberry, Pulses and Cereals are cultivated in greenhouses beneath solar plants in a multi-tier manner.

For multi-tier farming, steel square pipes are fabricated into approximately 2666 containers, each of 1m x 1m x 1m in size and capable of being stacked one above another. PVC pipes are placed in the containers to carry water. Insulating layer of 700-micron plastic sheet is placed at the bottom of the containers up till desired height on all sides. Fertile soil up to 20 cm is filled above the insulating layer in the containers commensurate to depth of active roots of plants, crop to be cultivated. A 20 cm space is kept for water and remaining area is kept available for dwarf crops to grow. The stacked containers can be removed out of the greenhouse with help of fork-lift trucks for the purposes of weeding out or any work in the soil or for harvesting.

Water for irrigating the crop is provided through flooding method or by drip irrigation system and PVC water pipe lines are placed for the purpose. Evaporation of water is negligible since farming is done in the enclosed premises & exposure to heat or sun is minimum. Further, every drop of water not consumed by crops, plants will be collected back on the insulating layer and carried through pipeline for storage in the recycled water tank, having not been allowed to percolate beyond insulating layer beneath the soil in the containers. Thus, 99% water use efficiency will be achieved in agriculture. Water used for cleaning solar panels & Greenhouse covering will also be collected back and reused.

Meters / Sensors will be installed on each shed, to measure wind-speed at every moment; and in the greenhouse to measure temperature, CO2 level, intensity of illumination, and humidity level round the clock. All these sensors/meters will be connected to the central monitoring system and all parameters will be recorded on continuous & regular basis for close monitoring at various level. At least 10 cameras will be installed in & around the enclosed premises with

recording on continuous & regular basis for close monitoring at various level. Cows commensurate to cultivation acreage are reared for organic nutrients. Boards are placed in each unit for exhibiting performance.

5 A bill of materials and things required for a unit of 240 KW solar plant & 1-acre enclosed space / greenhouse beneath is provided in the table below:

Sr. No.	Component	Material used	Quantum	Specifications
1	Land	Any land whether arable or not; whether irrigated or not	4000 mtr2 for Enclosed space, 1600 mtr2 for side spaces, 200 mtr2 for farm pond, 80 mtr2 for recycled water tank 120 mtr2 for 2 small cold & hot water tanks.	Totally 6000 mtr2
		Solar plant	240 KW	
		Greenhouse / enclosed space	1 acre	
2	Excavation	Excavator machine	4000 cubic meters	
3	Foundation	RCC pile with spacing 6 mtr X 6 mtr	138 Foundations up to 1 meter height	
3	Insulating layer	Plastic sheet of 700 micron thickness	4335 mtr2	
4	Columns on extreme sides	Steel square pipes 150 mm X 150 mm – 6 meter length	54 pipes	
5	Columns others	Steel square pipes 100 mm X 100 mm – 6 meter length	84 pipes	
6	Farm Pond	Excavator machine & Plastic lining 500 mcn	Excavation of 200 mtr2 up till 10 meter depth = 2000 mtr3	
7	Recycle water pond	Excavator machine & Plastic lining 500 mcn	Excavation of 80 mtr2 up till 10 meter depth = 800 mtr3	
8	Small tanks for Hot, Cold water	Excavator machine & RCC	2 tanks with Excavation of 60 mtr2 up till 10 meter depth = 600 mtr3 + 600 mtr3	
9	Refilling soil	Excavator machine	4000 cubic meters	More fertile soil or coco peat added, if required
10	Length wise Beams	Steel square pipes 100 mm X 100 mm – 6 meter length	132 pipes	At 6 meter height
11	Width wise Beams	Steel square pipes 100 mm X 100 mm – 6 meter length	115 pipes	At 5 meter height
12	Gutters	Hard Plastic sheet of 80 cm width	720 meters	At 5 meter height
13	Supports for gutters	Steel square pipes 40 mm X 40 mm – 2 lines	1440 meters	At 5 meter height

14	Ladders	Aluminum – 50 cm width	4 ladders	At every corner
15	Solar panels	Photovoltaic modules of 325 W	738 panels	Totally 240 KW
		Tilt angle of solar panel	Equivalent to latitude of the site	
		Single axis tracking mechanism	For 6 rows with 133 solar panels on each row	
		Distance between adjacent solar panels	0	
		Distance between solar panel rows	6 meters	
16	Balance of System for solar plant	Cables, Inverters etc.	For 240 KW	
17	Panel Blanks	Glass Frames	54 frames	
18	Water proofing roof & sides	Rubber/Plastic beadings, sealants	For 792 frames & Glass/Plastic frames on roof and frames on all 4 sides	
19	Evacuation	Cables & wires	3.2 kilometer	Up to DISCOM Grid
20	Bay at Sub-station	Transformers, insulators etc.	As required	If required
21	Filling gaps between panel rows and sides	UV coated Plastic film of 500 micron thickness	6500 mtr2	
22	Doors	Doors each of 3 meter width & 5 meter height	5 doors on each width side = 10 doors	
23	Exhaust fans	Fans of 1.25 mtr diameter	30 fans	
24	Cooling coils	Steel pipes fabricated to form coil of 2 mtr X 2 mtr size	30 coils	
25	Coolant or water	Cooling liquid or water in cooling tank	1000 liters	
26	Heating coils	Copper or Aluminum pipes fabricated to form coil of 2 mtr X 1 mtr size	738 coils	
	Heat Transfer Fluid or water	HTF or water in hot water tank	1000 liters	
27	Porous pads	Polyurethane foam or cellulose pad	125 mtr length X 2 mtr width X 0.25 mtr thickness	
28	Pipelines	PVC pipes	For carrying rain water harvested on gutters on roof to farm pond	
		PVC pipes	For carrying water flushed out from insulating layer to recycled water tank	
		PVC pipes	For circulating cold water or coolant between cooling coils & cold water tank & porous pad	
		PVC pipes	For circulating hot water or heat transfer fluid between heating coils & hot water tank & porous pad	

		PVC pipes	For irrigation water from farm pond & from recycled water tank	
29	Containers	Steel square pipes fabricated in to containers of size 1 mtr X 1 meter X 1 meter with insulating layer up till half	2666 containers	For multi-tier farming
30	Sunlight Filters	UV coated plastic film or Polycarbonate sheets on roof between solar panel rows & on all sides	6500 meters	
		Shed net Fabric	4000 meters	
	Lighting	LED Bulbs	2000 bulbs	
31	Meters & Sensors	CO_2 meter, Temperature gauge, Wind speed meter, Humidity meter, Illumination intensity meter	15 rows X 4 sensors/meters 15 rows X 4 sensors/meters 6 meters on top surface 15 rows X 4 sensors/meters 15 rows X 4 sensors/meters	6 times the numbers for multi-tier farming
32	Camera	CC cameras	10 numbers	To watch & record every movement
33	Cows	Desi cow	1 cow	For organic farming
34	Plant cultivation	All Fruits	Grapes, Pomegranates, Fig, Guava, Mango, Banana etc.	
		All Vegetables	Fruit vegetable as well as leafy vegetables	
		All flowers	Roses, Gerbera, Tulip, Zendu etc.	
		All Cereals	Maize, Sorgum, Bajara, Rice Wheat etc.	
		All Pulses	Toor, Masoor, Matki, Moong etc.	
		Other crops	Sugarcane, Cotton, oil-seeds	
		Multi-tier crops	All dwarf crops including strawberry, Turmeric etc.	
35	CO_2 supply	CO_2 cylinders	50 cylinders as & when required	Initial stage of growing plants

Advantages, Technical advancements & Economic significance:

The unique solar plant with enclosed space system **100** of the present invention provides multiple advantages owing to the technical advancements and economic significance over the traditional methods as listed below:

1. Installation of solar plants or windmills or both; of desired capacity for reducing intermittence of electricity generation by solar plants; coupled with electricity storage systems like Gravity storage or Battery storage or other storage means to totally eliminate intermittence of electricity generated in solar plants and wind power plants.
2. The sunlight filtration arrangement made of filters **21** and **22** associated with the solar plant arrangement and enclosed greenhouse arrangement respectively, such as Glass, UV coated film or Polycarbonate sheets prohibits the entry of UV bandwidth and shed-net fabric reduce intensity of illumination in the enclosed space.
3. The sunlight filtration arrangement helps meeting varied light requirement of different plants, crop cultivated or for desired activities conducted beneath solar plant; and creates better conditions conducive for proper growth of plants, crop in the Greenhouse and for the comfort of people engaged in the activities and delicate things in the enclosed space.
4. Use of sealants and beading materials for solar panel joints, roof and sides of enclosed space makes the Greenhouse arrangement water proof.
5. Vents or exhaust fans enable venting out air beneath solar panels and air in the enclosed space, the Greenhouse.
6. Arrangement of exhaust fans on one wall and porous pad on other wall helps for cooling temperature during hot summer days.
7. Effective Temperature control arrangement as cooling driven by forced evaporation of water spread on fabric wrapped on cooling coils **19** placed in front of exhaust fans; whereas heating driven by heat generated by solar panels with help heat-transfer-fluid in heating coils **23** placed below solar panels.
8. In the solar plant with enclosed space **100,** the temperature beneath solar panels i.e. at the connection point is maintained at 25 degree Celsius which helps enhancing the efficiency of solar plants. Regular watering the plants, crop also eases out the temperature control system.
9. The temperature control arrangement provides air conditioning of enclosed spaces without use of refrigerant with elimination of high capital as well as high operation cost as of traditional Air Conditioning Systems & Machines.
10. The solar plant with enclosed space **100** may be of variable height capable such that it can be used for multiple purposes such as Greenhouse for agriculture, Shed for cattle or goats, poultry, storage godown, work place for industrial or commercial activities, office premises, residence etc.

11. Harvesting of entire quantity of rain water falling on solar panels and on remaining part of roof of enclosed space using gutters associated with the roof, pipelines **26** for transportation of water so harvested and farm pond **27** for storage of rainwater harvested helps sourcing of water for use over a period.
12. 99% efficient water use, conservation and prohibition of water percolation and leaching of nutrients provided to plants by eliminating percolation of water provided for irrigation with help of insulating layer **28**.
13. Increased water use efficiency provide great advantage in reducing water use in agriculture which is currently 80 % worldwide.
14. Eliminating leaching of nutrients with help of the insulating layer **28**, helps reducing use of chemical nutrients and thus, help maintaining sound health of the ground, soil.
15. Minimum to no water percolation beyond insulating layer **28** enabling storage and recycling of water for future irrigation cycle; thereby providing a unique water reticulation system.
16. The insulating layer disposed in the excavated ground converts all rain fed land, saline land, marshy land into irrigated fertile land.
17. The CO2 sequestering mechanism that is capable of being deployed on existing trees and forests owing to enhanced trapped CO_2 utilization by increasing photosynthesis thereby reinforcing reforestation efforts being carried out worldwide.
18. The CO2 sequestering mechanism provides great mitigation measures against Global warming and resultant Climate change and provides way to get back to CO2 level in the atmosphere during pre-industrialization era within few decades.
19. Use of multi-tier containers capable of being stacked one above another for growing dwarf plants crops enabling enhanced food production.
20. Use of multi-tier containers provides way to increase food production multi fold and thus, to provide way to world food security.
21. Common use and sharing of land, foundation and structure, part of roof, temperature control mechanism, water reticulation harvesting and sourcing arrangement for both the solar plant arrangement and the enclosed greenhouse arrangement leads to reduction in capital expenditure and provides dual-benefit for both the components i.e. Greenhouse as well as solar plant.
22. The solar plant and enclosed space beneath being a closed premises, solar plant will have full protection from wind turbulence as turbulent air doesn't get entry in the premises and beneath solar panels.

23. The solar plant with enclosed space, Greenhouse **100** provides two-pronged mitigation measures against Global warming firstly by generation of more renewable energy by solar power plants and secondly, by more photosynthesis by up to 4 to 5 times, by the plants, crop in the Greenhouse; thus, reducing tons of CO2 from atmosphere during its lifetime.
24. The solar plant with enclosed space, Greenhouse **100** also provides effective adaptation measures to overcome adverse effects of climate change.
25. The solar plant with enclosed space, Greenhouse **100** provides great saving of land, materials and efforts otherwise required independently both for the solar plant and for the enclosed space, Greenhouse.
26. The solar plant with enclosed space, Greenhouse **100** with temperature control provides enhancements in renewable power generation and in food production and thereby, help reducing levellised cost of renewable power and also reduce cost of production of food items.
27. A uniquely designed, cost-effective, multi-purpose system enabling enhanced generation of renewable power as also covered farming supplemented with controlled temperature, humidity and intensity of illumination; with protection from ultra violet rays from sunlight, rain water harvesting and water sourcing, conservation and recycling arrangement allowing enhanced food production and enhanced generation of renewable power.
28. The invention thus, provides way to the world food and energy security as well as to eliminate global warming and fight climate change adversities.

While considerable emphasis has been placed herein on the specific elements of the preferred embodiment, it will be appreciated that many alterations can be made and that many modifications can be made in preferred embodiment without departing from the principles of the invention. These and other changes in the preferred embodiments of the invention will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the invention and not as a limitation.

CLAIMS:

I claim,

1. A solar plant with enclosed space system **100** and method thereof interalia consisting of;
   A. A solar plant arrangement;
   B. An enclosed space arrangement;
   C. An enclosed greenhouse arrangement;
   D. Sunlight Filtration arrangement;
   E. Heating and Cooling arrangement;
   F. Humidity Control arrangement;
   G. Rainwater Harvesting, percolation prohibition & water recycling arrangement;
   H. CO2 sequestering mechanism; and/or
   I. Multi-tier containers arrangement;

wherein the said system **100** consists of a greenhouse **10**, foundation **11**, fabricated structure **12**, solar plant **13,** solar panels **14**, roofing, partitioning sheets or glass or UV coated film or Polycarbonate sheets **15**, vents or exhaust fans **17**, cold water tank **18**, cooling coils **19,** porous pad **20**, Filters **21** and **22**, Heating coils **23**, hot water tank **24**, gutters **25**, pipelines **26,** farm pond **27**, insulating layer **28,** multi-tier containers **30** and recycled water storage tank **34**;

characterized in that the said solar plant arrangement **(A)** forms a part of roof to an enclosed space arrangement **(B)** or greenhouse arrangement **(C)** associated with a sunlight filtration arrangement **(D)**, heating and cooling arrangement **(E),** a humidity control arrangement **(F),** a rainwater harvesting, percolation prohibition and water recycling arrangement **(G),** CO2 sequestration mechanism **(H)** and/or multi-tier stackable containers arrangement **(I);**

wherein the solar panels **14** of the solar plant arrangement **(A)** are installed at a desired elevated height commensurate to height of plants, crop to be cultivated or height required for carrying desired activities, forming part of the roof of the enclosed space or the greenhouse **10** supported by a foundation **11** and a fabricated structure **12**;

wherein the wooden planks, plywood, asbestos or other roofing, partitioning sheets in case of an enclosed space arrangement **(B)** whereas glass, UV coated film or the polycarbonate sheets **15** in case of Greenhouse arrangement **(C),** cover the gaps between solar panels **14**

and panel rows and the side walls to create the enclosed space arrangement **(B)** or Greenhouse arrangement **(C)** on the same land and using same foundation **11** and structure **12**;

wherein the filters **21** forms a part of roof and side walls for restricting entry of UV bandwidth of sunlight; and the filters **22** placed below roof in case of enclosed space arrangement **(B)** or above plants or crops in Greenhouse arrangement **(C)** for reducing intensity of illumination forming a Sunlight filtration arrangement **(D)**;
wherein Lights such as LED bulbs are disposed in the enclosed space or the greenhouse for providing illumination to the cultivation in the Greenhouse or to other activities in the enclosed space beyond day hours or in excess of available sunlight;

wherein the exhaust fans **17** are placed on one wall of the enclosed space or the Greenhouse **10** for venting out air where a tank **18** is disposed at convenient place, cooling coils **19** are arranged in front of the exhaust fans **17**; and the porous pads **20** are placed on other wall of the enclosed space or the Greenhouse **10** for cooling, maintaining temperature in the enclosed space or the Greenhouse **(10)** during hot climate;

wherein the heating coils **23** are disposed beneath solar panels **14** and hot water tank **24** is disposed at convenient place for heating air in the enclosed space or the Greenhouse **10** during cold climate; such that the arrangement of cooling coils **19**, heating coils **23**, tanks **18, 24** with exhaust fans and porous pad forms a unique fan-and-pad unit of the heating and cooling arrangement **(E)** for desired and precise temperature regulation;

wherein Humidity Control arrangement **(F)** is put in place where water is used in the tank **18** and in cooling coils **19** as well as in tank **24** and in heating coils **23** for cooling or heating the temperature and at the same time increasing humidity in the enclosed space or the Greenhouse **10** when ambient humidity level is less than 40%; whereas air is used in the tank **18** and cooling coils **19** as well as in tank **24** and in heating coils **23** for cooling or heating the temperature for decreasing humidity in the enclosed space or the Greenhouse **10** when ambient humidity level is higher than 60%;wherein conventional methods, traditional air conditioning equipment are also used for the temperature and humidity control in the enclosed space;

wherein gutters **25** created on the roof and connected to pipelines **26** for collection, harvesting of rain water and also for use as pathways for cleaning of solar panels **14** and

glass or UV coated film or Polycarbonate sheets **15** or other materials on the roof of the enclosed space or the Greenhouse **10**; a farm pond **27** created nearby for storage of harvested rain water; and insulating layer **28** disposed beneath root zones **29** of plants, crop that prohibits percolation of water & nutrients beyond the insulating layer **28** and allows accumulation of excess water not used by the cultivation which is flushed out and stored in tank **34** for reuse, recycle during subsequent irrigation cycle or need, form a unique rainwater harvesting, percolation prohibition and water recycling arrangement **(G);**

wherein the roof and sides of the Greenhouse **10** forms a CO2 sequestration mechanism **(H)** wherein the CO2 emitted by plants, crop during night hours is trapped and not allowed to get mixed in the atmosphere, thus, increasing the CO2 content in air in the enclosed space, the Greenhouse **10**, 4 to 5 times more than the ambient CO2 level and the plants, crop in next early morning hours, utilise such enhanced quantity of CO2, do more photosynthesis, make more carbohydrates and grow more; and at the same time they cause reducing substantial quantity of CO2 from the atmosphere forming an effective CO2 sequestration mechanism **(H)**;

wherein a multi-tier containers arrangement **(I)** is disposed in which containers **30** of desired dimensions containing space for soil, for water & for growth of dwarf plants, made of multiple sections **31** provided with top supports **32** and bottom supports **33,** are stacked one above another and are equipped with pipes for watering the cultivated crops, also equipped with the insulating layer **28** made of non-permeable sheet such as of stone tiles, plastic, rubber or metal placed at the bottom of the containers and on side walls up till desired height; and with pipes for carrying water not used by the cultivation and accumulated on the insulating layer **28** to the recycled water storage tank **34**;

and wherein the arrangements **A, B, C, D, E, F, G, H** and/or **I** function in co-ordination enabling enhanced food production and enhanced generation of renewable power and environment protection by mitigation measures against global warming and measures to adapt to and fight the ill effects of climate change (Fig. 1, 2, 3, 5, 7 & 9).

2. The system **100** as claimed in Claim 1, wherein the said solar plant arrangement **(A)** enables electricity supply to the enclosed space arrangement **(B)** or Greenhouse arrangement **(C)** to be used for LED bulbs, functioning of the motors associated with cooling coils **19** and heating coils **23**, exhaust fans **17**, or pulling harvested rain water from the farm pond **27** or

pumping recycled water from the tank **34** for irrigation and other equipment in the enclosed space or the Greenhouse and also enables electricity supply for use elsewhere by connecting the solar plant arrangement (**A)** to the electric distribution company's grid.

3. The system **100** as claimed in claim 1, wherein the glass or UV coated film or Polycarbonate sheets **15** disposed between solar panels, panel rows & gutters and on side walls of the Greenhouse **10** are capable of being retracted, partially of fully when needed.

4. The system **100** as claimed in claim 1, wherein the said sunlight filtration arrangement **(D),** Rainwater Harvesting, percolation prohibition & water recycling arrangement **(G)** and Multi-tier containers arrangement **(I)** are capable of being employed and used also in farming on open agricultural land.

5. The system **100** as claimed in claim 1, wherein the said arrangements **A, D, E, F, G, H** and/or **I** are capable of being employed and used in case of enclosed spaces for any other activities.

6. The system **100** as claimed in claim 1, wherein the said heating and cooling arrangement **(E)** consists of the cooling coils **19** of desired size, shape and decor are made from perforated pipes containing water or pipes wrapped in porous pad or textile fabric enabled with a mechanism to sprinkle or spread water thereon such that water, air or coolant from a tank **18** placed at a convenient location near the series of exhaust fans **17** is circulated using an electric motor, in the pipes of each cooling coil **19** installed in front of a respective exhaust fan **17** of desired size and speed, disposed on one wall of the enclosed greenhouse **10**; thereby allowing water seeping out from perforation on pipes or water sprinkled on the porous pad or textile fabric wrapped on pipes of the cooling coils to evaporate at a faster rate and extent subjected to the speedy flow of air through the exhaust fans where the continuous forced evaporation enables chilling of the water, air or coolant in the cooling coils **19** and the tank **18;** whereas continuous sprinkling of chilled air, water or coolant on the porous pads **20** on the other wall enforces chilling of air surrounding the porous pads **20** such that the chilled air is forced into the enclosed space or the greenhouse **10** as the operation of fans **17** creates partial vacuum in the enclosed space arrangement **(B)** or the greenhouse arrangement **(C)** allowing enhanced cooling effect substantially, providing temperature ranging between 15°C to 30°C (Fig. 3. and 4.).

7. The system **100** as claimed in claim 1, wherein the said heating and cooling arrangement **(E)** consists of the heating coils **23** made of pipe grid disposed at the lower face of the solar panels **14** through which water, heat-transfer-fluid or air is circulated with help of a pump such that the water, heat-transfer-fluid or air in the pipes of heating coils **23** gets heated due to the heat generated beneath solar panels **14** and transferred to the connected hot water tank **24**; thereby allowing continuous sprinkling of the hot air or water or heat-transfer-fluid on the porous pad **20** thereby increasing temperature of air around the pad such that the hot air is forced into the enclosed space or the greenhouse **10** as the operation of fans **17** blows or sucks out cold air and creates partial vacuum in the enclosed space arrangement **(B)** or the greenhouse arrangement **(C)** enabling enhanced warming effect amounting to temperature rise of air in the enclosed space or the Greenhouse **10** to 15°C - 25°C (Fig. 5. and 6).

8. The system **100** as claimed in claim 1, wherein the said heating and cooling arrangement **E** consists of mechanism to alternatively spread the chilled air or water in the cooling coils **19** and the tank **18** and hot air or water in the heating coils **23** and hot water tank **24** directly in the enclosed space arrangement **(B)** or the Greenhouse arrangement **(C)** enabling enhanced cooling or heating effect and at the same time increasing or maintaining humidity level in the air in the enclosed space or greenhouse **(10).**

9. The system **100** as claimed in claim 1, wherein the heating and cooling arrangement **(E)** enables to attain and maintain the desired level of temperature cooling by regulating extent & rate of forced evaporation by adjusting size & shape of cooling coil and/or size & speed of rotating fan.

10. The system **100** as claimed in claim 1, wherein the heating and cooling arrangement **(E)** is capable of being employed and used for air conditioning any enclosed spaces.

11. The system **100** as claimed in claim 1, wherein the humidity control arrangement **(F)** is capable of being employed and used for humidity control in any enclosed spaces.

12. The system **100** as claimed in claim 1, wherein conventional methods and traditional air conditioning system & machines are also used for heating and cooling of the air in the enclosed space or Greenhouse.

13. The system **100** as claimed in claim 1, wherein the rainwater harvesting, percolation prohibition & water recycling arrangement **(G)** includes;
a direct sourcing of water where the entire amount of rainwater falling on the roof of greenhouse including on solar panels **14** and on roofing sheets or glass or UV coated film or polycarbonate sheets **15** is harvested through gutters **25** or channels connected to the pipelines **26** into a farm pond **27**;
and an indirect sourcing of water by disposing an insulating layer **28** made either of natural or man-made materials like plastic/rubber sheet, reinforced cement concrete or plain cement concrete, stones or tiles placed below the ground excavated nearly up to the base of the foundation **11** i.e. up to a depth commensurate to the depth of active root zone **29** of the plants or crops to be cultivated; and then refilling same soil or rich soil or coco peat into the excavated land portion thereby making feasible to convert any rain fed, saline and marshy land into irrigated fertile land such that the root zone **29** of the plants or crop is insulated to avoid percolation of water & nutrients beyond the ground level **16** or root zones **29** of plants, crops such that the quantity of water not consumed by the cultivated plants is collected back on the insulating layer **28** placed below root zone **29** of the cultivation; enabling it to be transported through pipelines **26** for storage in the tank **34** to be recycled and used for subsequent irrigation cycles thus, attaining a high degree of water use efficiency.

14. The system **100** as claimed in claim 1, wherein the said CO2 sequestration mechanism **(H)** is capable of being employed and used for covered farming as well as for farming on open land and also for single tree or many trees together or in dense forests for sucking huge quantities of CO2 from the atmosphere.

15. The system **100** as claimed in claim 1, wherein the multi-tier containers arrangement **I** provides an efficient system for cultivation using a multitier container **30** fabricated out of metal or plastic, divided into multiple sections **31** having top supports **32** and bottom supports **33** enabling stacking the containers **30** one above the other, equipped with pipes

for watering the cultivated crops; wherein the said containers **30** are also equipped with insulating layer **28** to eliminate percolation of water and leaching of nutrients provided to crop or plants and also with pipes for carrying water not used by the cultivation and accumulated on the insulating layer **28** to the recycled water storage tank **34**; thereby enabling enhanced cultivation within a limited space.

16. The system **100** as claimed in claim 1, wherein windmills of desired capacity are installed in the windy region for generation of more renewable power as also for reducing intermittence of electricity generation by solar plants; coupled with electricity storage systems like gravity storage or battery storage or other storage means to totally eliminate intermittence of electricity generated by solar plant or wind power plant.

17. The system **100** as claimed in claim 1, wherein the system is capable of being used for carrying out diverse activities such as for covered, protected farming or for other activities including cattle rearing, goat rearing, poultry farm, packaging house, storage godown, residence, office, work shop.

18. The system **100** as claimed in claim 1, wherein the solar plant arrangement **(A)** with enclosed space arrangement **(B)** or Greenhouse arrangement **(C)** equipped with few or several of the Sunlight Filtration arrangement **(D),** Heating & cooling arrangement **(E),** Humidity Control arrangement **(F),** Rainwater Harvesting, percolation prohibition & water recycling arrangement **(G),** CO_2 sequestering mechanism **(H)** and/or multi-tier containers arrangement **(I)** is installed on roof of a building.

19. The system **100** as claimed in claim 1, wherein desired capacity of solar power plant using number of solar panels of desired wattage capacity is installed so as to meet the need for electricity for activities to be carried out in enclosed premises beneath solar plant or for use at other places or for effective, economical evacuation and also ensuring that cultivation beneath do not starve for sunlight enough for their proper growth.

20. The system **100** as claimed in claim 1, wherein such enclosed spaces equipped with at least one of the arrangements **A, C, D, E, F, G, H** or **I,** are created in a multi-tier manner.

21. The system **100** as claimed in claim 1, wherein rain water harvested by the rainwater harvesting, percolation prohibition and water recycling arrangement **(G)** in excess of requirement in the solar plant with enclosed space system **100**, is made available in the neighboring area for drinking and other uses.

22. The system **100** as claimed in claim 1, wherein the method and manner of practicing the invention comprises the steps of;

I: Ground work comprising steps of;

excavating land required for installing desired capacity of solar power plant with enclosed space beneath for Greenhouse farming up to depth of active roots of the trees, plants, crop to be cultivated;

laying foundations for erecting columns for installation of solar plant with desired spacing;

laying insulating layer of non-permeable material of desired thickness at the bottom of excavated portion & all four vertical sides up to neck of the excavated portion;

refilling the excavated soil back in the excavated portion;

enriching the soil with more fertile soil &/or coco-pit where necessary;

creating a tank to store unused water;

providing trenches to flush out unused water accumulated on the insulating layer, from the excavated portion and pipes to carry water to the recycled water storage tank;

creating a farm pond to store harvested rain water;

thereby making the land area ready for erecting structure for solar plant installation & for installation of Greenhouse for agricultural cultivation or for enclosed space for other activities;

II: creating structure comprising steps of;

erecting pipes or sections of desired strength made of metal or fibre glass reinforced plastic with or without filling concrete therein, on foundations.

connecting erected pipes, sections by beams of pipes, sections made of metal or fibre glass reinforced plastic with or without filling with concrete therein, width wise at a desired height.

connecting erected pipes with like beams of pipes or sections length wise at a desired height.

creating gutters of desired width on the roof at a desired height for collecting rain water falling on roof and whereon persons can also walk for cleaning surfaces of solar panels and materials in the gaps between solar panels;

connecting all gutters on roof by pipeline to carry harvested rain water to the farm pond;

placing ladders or lifts at all corners of the structure for climbing on the roof;

thereby, making structure ready for installation of solar plant as also for creation of Greenhouse for farming activities;

III: installation of solar plant comprising steps of;

installing solar panels using either lengthwise or widthwise beams at a desired height as shafts for solar panels;

installing solar panels either in stationary manner, facing equator achieving tilt angle equivalent to latitude of the location or facing east with single axis tracking mechanism;

rotating all the shafts at a desired speed with help of tracking mechanism in view of sun-path so that all panels follow sun all along the day;

installing dummy panels made of glass or UV coated plastic or Polycarbonate sheets or acrylic sheets, as desired, in the blanks, if any;

using sealant or rubber/plastic bidding between adjacent panels to eliminate water leakage;

putting in place inverters and balance of system;

making evacuation arrangement on obtaining right of way or with underground cabling up till the nearest grid of distribution agency;

installing bay at the sub-station in case of non-availability there;

connecting all solar plants at a location to the grid using the same transmission lines;

IV: Creating greenhouses comprising steps of;

filling the gap between solar panels up to gutter at the middle which is constant in case of stationary solar panels, with frames made of glass or UV coated plastic or polycarbonate sheets;

filling the gaps between solar panels and gutter at the centre in case of single axis tracking mechanism with two frames made of glass, polycarbonate or UV coated plastic, capable of folding to adjust with change of distance between solar panels and the gutter with rotation of solar panels that will be changing throughout the day depending on sun position in the sky;

disposing desired number of doors of desired dimension on sidewalls;

installing desired number of exhaust fans on one wall and porous pad on the other wall with water sprinkling facility;

placing cooling coils made of metal or plastic pipes either with perforations or wrapped in porous pad or textile fabric like gunny cloth, in front of the fans and disposing a tank nearby and circulating air, water or coolant therein for forced evaporation of water seeping out of the perforations or water sprinkled on porous pad or textile fabric like gunny cloth wrapped around pipes of cooling coils, harnessing warm & fast air flowing from fans so as to chill water/air/coolant circulated in such cooling coils;

laying suitable pipelines for pouring chilled water on pads;

providing pipes to carry chilled air to be spread in the enclosed space or greenhouse;

using water in chilling coils when humidity level is low while circulating air in the chilling coils when Humidity is high;

covering extreme sides of the structure using transparent materials such as glass or UV coated plastic or polycarbonate sheets;

disposing suitable pipe lines with nozzles/sprinklers above solar panels and glass, polycarbonate of UV coated plastic film frames and spraying pressurized water for cleaning, mopping up roof including solar panels;

providing lanes of desired width between adjacent units;

cultivating desired trees, plants, crops in Greenhouses or carrying out other desired activities beneath solar plants;

cultivating dwarf crops in a multi-tier manner;

using desired number of soil, metal or plastic containers of desired size, capable of being stacked one above another for multi-tier farming;

placing insulating layer of desired thickness at the bottom of the containers up till desired height on all sides to prohibit percolation of water or nutrients;

placing plastic or metal pipes of desired thickness at the top of the containers to provide water for irrigating crop in the containers;

placing plastic or metal pipes of desired thickness at the bottom of the containers to carry water that is not consumed by cultivation and accumulated on the insulating layer;

filling fertile soil above non-permeable sheet in the crates up till desired height commensurate to depth of active roots of plants, crop to be cultivated;

leaving some height for water to be irrigated and desired height for open area for dwarf crops to grow in each of the containers;

cultivating desired crops in these containers stacked one above another;

taking these crates out with help of fork-lifts or other available means for the purposes of weeding out or any work in the soil or for harvesting;

minimizing evaporation of water since farming is done in the enclosed premises & exposure to heat or sun is minimum;

collecting back every drop of water not consumed by crops, plants, on the insulating layer and carrying unused water through pipeline for storage in the tank, having not been allowed to percolate beyond insulating layer beneath the soil in the containers;

collecting back water used for cleaning solar panels & greenhouse covering for reuse;

installing meters and sensors in and around to measure wind-speed, temperature , CO2 level, intensity of illumination; and humidity level round the clock;

connecting these sensors/meters to the central monitoring system and recording all parameters on continuous & regular basis for close monitoring at various level;

installing cameras in & around the enclosed premises with recording facility on continuous & regular basis for close monitoring at various level;

rearing number of cows equal to cultivation acreage for organic nutrients;

placing boards and a notice board for exhibiting performance.

23. The system **100** as claimed in claim 1, wherein method of creating sunlight filtration arrangement comprises the steps of;

disposing filters made of textile fabric or plastic beneath the roof, above cultivation, for reducing intensity of illumination of sunlight in the Greenhouse or on open agricultural land;

installing filters made of ultra-violet resistant materials in the gaps between solar panels, below solar panels or on side walls of the enclosed premises or at other desired places for restricting ultra violet bandwidth of sunlight from entering in the enclosed space, the Greenhouse;

installing filters made of heat resistant materials in the gaps between solar panels or below solar panels or on side walls of the enclosed premises or at other desired places for restricting heat from entering in the enclosed space, the Greenhouse;

placing these filters below solar panels or in gaps between solar panels or at other desired places above trees, plants, crop so as to filter sunlight falling on the cultivation and make available only bandwidth of sunlight that is conducive for proper growth of plants, crop in the Greenhouse or on open agricultural land or which is useful for other activities to be carried out in the enclosed space;

disposing lights such as LED bulbs etc. for providing illumination to the cultivation or to the activities in the enclosed space beyond day hours or in excess of available sunlight.

24. The system as claimed in claim 1, wherein the method of creating cooling and heating arrangement for air conditioning of enclosed spaces comprising the steps of;

fabricating cooling coils made of metal or plastic pipes with minute perforations thereon or pipes wrapped in porous pad or textile fabric like gunny cloth, of desired size, shape, & decor;

disposing perforated tubes or sprinklers for spreading, sprinkling water on such pipes of the cooling coils;

installing cooling coils in front of fans for forced evaporation;

installing small tank containing water, air or coolant at convenient place near fan or series of fans and connecting to cooling coils;

circulating water, air or coolant, as the case may be, in the tank & cooling coils with help of a pump;

operating fan or exhaust fans of desired size at desired speed to vent out hot air in the enclosed space;

forcing evaporation of water or coolant seeping out of perforations on pipes or water spread, sprinkled on porous pad or textile fabric wrapped around pipes of the cooling coil, with warmer air speedily blowing from the fan;

regulating the rate & extent of forced evaporation by size & speed of fan and size of cooling coil; where the forced evaporation takes heat out of water, air or coolant in pipes of the cooling coils such that the water, air or coolant in cooling coils and tank gradually gets chilled with continued forced evaporation of water seeping out or water spread, sprinkled on pipes of cooling coils;

releasing the chilled air in tank and cooling coils into the enclosed space;

spreading, sprinkling chilled air, water or coolant on porous pad installed on other wall which results in chilling air around the pad;

operating the exhaust fans to vent out air and create vacuum to some extent in the enclosed space so that chilled air around the porous pad enters into the enclosed space;

achieving cooling effect to bring down and maintain temperature in the enclosed space to the desired level by regulating the rate & extent of forced evaporation, by adjusting size & speed of fan and size of cooling coil;

using water in the tank and cooling coils when relative humidity in the enclosed premises is lower than 40%, and using foggers for sprinkling chilled water which will help not only in reducing temperature in the enclosed space but will also cause to increase humidity in the air in the enclosed space and using air in the tank & cooling coils instead of water when relative humidity in the air in the enclosed space is higher than 60%, so that humidity will not be increased but will be reduced by cooling the air in the enclosed space;

installing heating coils made of metal, glass or plastic pipes filled in with air, water or heat transfer fluid, disposed beneath solar panels to absorb heat generated by solar panels;

installing a tank connected to these heating coils and disposing a pump at convenient place to circulate air, water or heat transfer fluid in the heating coils; where the water, heat transfer fluid or air filled in the heating coils and tank gets heated with absorption of heat from solar panels;

spreading hot air in the heating coils & tank, in the enclosed space; while in case of use of water or heat transfer fluid, spreading, sprinkling hot water or hot fluid in heating coils & tank on the pad on the wall which results in increasing temperature of air around pad; during cold climate, as the exhaust fan operates, it blows or sucks out air in the enclosed space which creates relative vacuum in the premises and the hot air around the pad enters into the enclosed space;

regulating the warming effect so as to bring the temperature level of air in the enclosed space above 15 degree Celsius, ideally to 23 degree Celsius as against ambient chilled climate.

25. The system **100** as claimed in claim 1, wherein the method for creating rain water harvesting, percolation prohibition and water recycling arrangement comprises the steps of;

creating gutters on the roof for collecting entire quantity of rain water falling on the roof including on solar panels; or

creating bunds around the open land for agriculture, in case other than of covered farming, for capturing & collecting entire quantity of rainwater falling thereon;

providing pipelines for carrying rain water so collected;

creating a farm pond at nearby place for storage of rain water so harvested;

disposing insulating layer made of natural or man-made non-permeable materials like stone tiles, plastic sheets, reinforced cement concrete or plain cement concrete, underground, on carrying out required excavation, at a depth commensurate to depth of active roots of trees,

plants, crop to be cultivated, so as to prohibit percolation of water & nutrients in the ground beyond their root zone;

disposing the insulating layer for collecting water for reuse, out of quantity of water provided for irrigation but which is not consumed by the trees, plants, crop and which quantity of water is not allowed to get percolated in the ground beyond the insulating layer;

providing trenches and pipe lines for flushing and carrying unused water so collected;

creating a tank for storing such collected unused water for reuse during subsequent irrigation cycles.

26. The system **100** as claimed in claim 1, wherein the method for creating CO2 sequestration arrangement for enhanced photosynthesis by trees & plants comprises the steps of;

providing roof with or without solar panels or wire mesh roof and retractable side walls made of plastic or metal sheets along all the sides supported by scaffolding or light air balloons which together cause to trap CO2 emitted by trees, plants, during night hours;

keeping the retractable side walls in installed position during night hours when CO2 emitted by trees, plants will get trapped in the enclosed space and also during initial hours after next sunrise, when the captured CO2 more than 1400 PPM (4 to 5 times more than ambient CO2 level) will be consumed in enhanced photosynthesis by trees & plants;

keeping the side walls in retracted position few hours after sunrise throughout day hours when ambient CO2 of around 350 PPM will be available and will be consumed by trees, plants in photosynthesis in usual manner; where again after sun set, keeping the retractable sides in installed position during night hours up till few hours after next sun rise and then in retracted position till sunset and so on;

enabling trees & forests to sequester 4 to 5 times more CO2 to help reducing 1100 billion tons of CO2 in the atmosphere in few decades.

27. The system **100** as claimed in claim 1, wherein the method to create a multi-tier container arrangement comprises the steps of;

making containers of soil or fabricated out of metal or plastic sections or pipes, of desired size capable of stacking one above another;

placing at the bottom of the fabricated containers and on sides up till desired height a layer of non-permeable material made of natural or man-made materials such as stone tiles, plastic, rubber or metal, of desired thickness to form an insulating layer;

filling fertile soil above non-permeable layer in the containers up till desired height commensurate to depth of active roots of the plants, crop to be cultivated;

providing desired height for soil, for water and for open space for dwarf crops to grow in the containers;

disposing pipelines made of metal or plastic to provide water to irrigate plants, crop in such containers;

providing pipelines also to carry water out of such containers which is not used by the cultivation and which is not allowed to be percolated beyond the insulating layer in the containers;

stacking desired number of containers up till desired height on open land or height available in the enclosed greenhouse;

cultivating desired plants, crop in such containers stacked one above another, in a multi-tier manner;

taking away these stacks of containers with help of Fork-Lift trucks or by other available means for the purposes of sorting them for weeding out or for carrying out desired work in the soil or for crop harvesting.

28. The system **100** as claimed in claim 1, wherein the system provides various advantages such as; use of filters **21** and **22** prohibits the entry of UV bandwidth and reduce intensity of illumination in the enclosed space and greenhouse **10;** use of sealants and beading materials to provide water proof enclosed space and greenhouse **10;** use of fan-and-pad system for venting out air, maintaining ambient temperature as per requirement with help of cooling coils and heating coils; harvesting, sourcing of rain water falling on solar panels or roof of enclosed space or the Greenhouse, prohibition of percolation of water and leaching nutrients beyond insulating layer and collecting unused water back for recycling and reuse during subsequent irrigation cycle; use of CO2 sequestering mechanism; enhanced food production using cultivation in multi-tier containers **30,** using same land, foundation, structure, part of roof, temperature control mechanism, water reticulation arrangement for both; the solar plant arrangement and the enclosed space arrangement or the greenhouse arrangement enabling saving land, materials & efforts that leads to reduction in capital expenditure for both components, and simultaneously enhancing efficiency of both these components and using the said solar plant with enclosed space system **100** for multiple purposes such as Greenhouse for agriculture, Shed for cattle or

goats, poultry, storage godown, work place for industrial or commercial activities, office premises, residence.

Dated 18th April, 2023.

5 For the applicant,

Mrs. Allison Katariya

(Patent agent of the applicant IN/PA 2190)

ABSTRACT

Title: A solar plant with enclosed space system

A solar plant with enclosed space system **100;** including a solar plant arrangement **(A)**, an enclosed space arrangement **(B),** a greenhouse arrangement **(C),** a sunlight filtration arrangement **(D),** a heating and cooling arrangement **(E),** a humidity control arrangement **(F),** a rainwater harvesting, percolation prohibition and water recycling arrangement **(G),** a CO2 sequestering mechanism **(H)** and a multi-tier container arrangement **(I);** wherein the solar panels **14** and partitioning sheets in case of enclosed space and glass, UV coated film or polycarbonate sheets **15** in case of greenhouse form roof of the enclosed space or the greenhouse **10** and filters **21** which along with filters **22** above plants filter sunlight; equipped with a fan-and-pad unit comprising exhaust fans **17,** cooling coils **19,** heating coils **23,** porous pads **20** and tanks **18, 24** for temperature and humidity control at desired precise level; gutters **25,** pipelines **26** for collection, harvesting of rain water and stored into a farm pond **27**; and an insulating layer **28** beneath root zone **29** of plants, prohibiting percolation of water and for accumulation of water not used by the cultivation and carrying & storing in recycled water tank **34**; a multi-tier containers **30** stacked one above other for growing dwarf crops in a multi-tier manner; thus providing a unique, cost-effective system enabling enhanced food production and enhanced generation of renewable power and environment protection by mitigation measures and measures to adapt to and for fighting the ill effects of climate change.

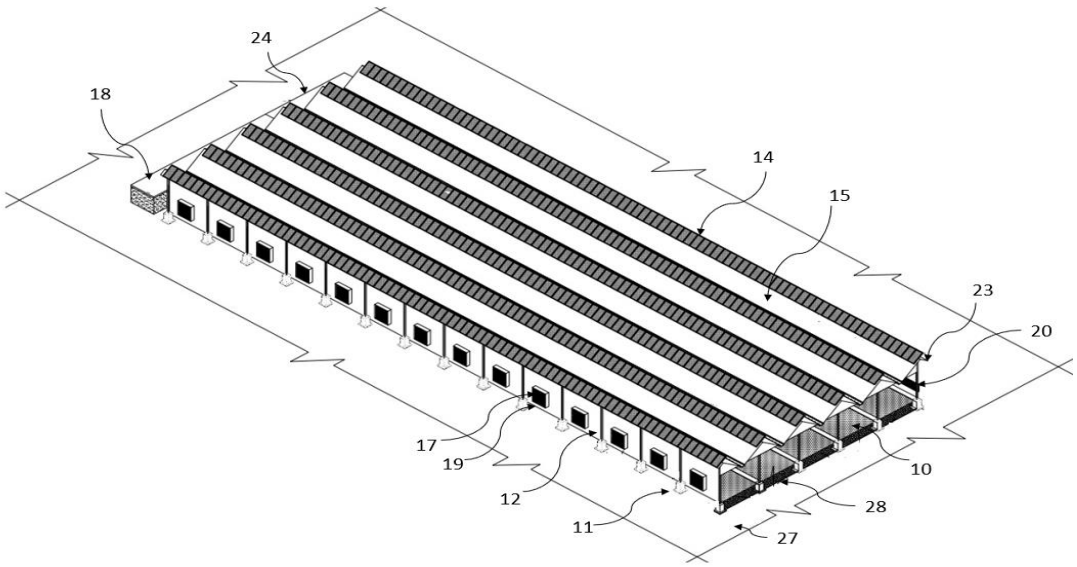

FIG.1