

A Large Lens Solar Energy Concentrator

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Technical Field

This invention in general relates to human energy needs. More particularly this invention relates to novel large lens solar concentrator for various uses. Solar energy can supply 20,000 times the energy need of the whole world without pollution for millions of
 10 years. But there are no cheap and efficient lens or mirror concentrator devices now.

State of Art

Existing solar energy devices are: 1.flat plate collectors using a metal heating plate inside a glass sheet box with poor concentration and giving 60-70°C hot water only with less
 15 heating on cloudy days.2.Giant Mirror based concentrators with multiple mirrors focusing on a tower with large area of land use and inefficient for money invested. 3. Concave mirrors [dish type] focusing on to a point with good concentration, but needing a large support that needs sun-tracking [wasting energy] 4. Small lenses that concentrate a small energy and also needs sun tracking. There are no simple devices to harness solar energy. 5. Photo- voltaic
 20 energy is 5-10% efficient and costly.

World needs safe, nonpolluting, cheap, massive energy- no safe devices as yet. Sun will shine for million years more and is the driver of this earth's life- wind, hydro electric, ocean energies -all are solar based! Solar energy is variable and is around 1000-watts/sq.meter area/ hour useful for few hours, more in summer, more on clear days, more near equator!

25 Ideal solar device should be: 1. Concentrating for high temperatures for efficient energy transfer and minimal losses.2 Cheap for all areas! 3. Long life with minimal or no solar tracking energy losses! 4. Easy to fix, run and use. 5. Safe and reliable. 6. Multiple uses from the same device 7. Storage for night supply. There are no devices as of now!

The following description gives critical examination of the solar devices known in the art.
 30 It also discusses the shortcomings of the conventional methods. Further in order to overcome the problem associated with solar harnessing, the invention offers the solution to overcome the impediments in the construction and the process of using the same.

Constraints in all existing lens or mirror solar devices are as follows:

1. There is no economic, efficient concentration of energy.
2. The devices are too small or too complex and inefficient.
- 5 3. The sun tracking losses from morning to evening is large as device is moved.
4. There are no simple storing methods.
5. The maintenance needs are large as these are open to nature.
6. Single use only.

Accordingly the object of the invention is to identify the problem associated with the
 10 conventional solar energy conversion. An extensive search has been carried out using the
 Internet and related patent specifications were studied for large lens concentrators with
 minimal sun tracking losses, none was found. Since the present invention is radically
 different, in using a large lens with a small focus and a smaller mirror to reflect onto heating
 coil for various uses in the same device, the inventor is unable to site any patent specification
 15 out of the available databases.

The invention is directed to a novel type of solar concentrator using simple lenses
 with least sun tracking losses. Lenses are better than mirrors: 1. Lenses are lighter in weight,
 needing lower weight fixtures. 2. Lenses concentrate to the ground, ground based heat use is
 cheaper than mirrors that direct and concentrate up on to a tower [more cost] or upper focus
 20 3. Lenses do not need to be tracked, only their focusing zero weight solar rays need to be
 tracked eliminating a huge energy loss. 4. Lenses are easy to maintain as mirrors corrode.
 5. Plastic lenses are lower than mirrors in weight and easy to make.

Accordingly it is the primary object of the invention to invent a novel large solar
 concentrator, which is unique in design and construction, working and use.

25 It is another object of the invention to indicate a novel process by virtue of which the
 device can be effectively utilized. Further objects of the invention will be clear from the
 ensuing description.

Summary of the invention:

30 The device comprises of a very large diameter composite glass or plastic lens say 2-
 4 meters or more diameter supported on a pillars. The lens concentrates and focus solar rays

to ground- west in morning, east in evening. A smaller parabolic mirror receives the concentrated rays and reflects to a heating black, rough, thick copper coil placed below the lens, to heat a high boiling liquid, which transfers the heat to a secondary coil for various uses, say steam for electricity, process steam, desalination etc. A high boiling point

5 circulating fluid from a cool oil tank is passed through the tower copper coil and the hotter fluid is sent to hot oil tank and a secondary heat exchanger that creates, steam, desalination, ammonia based refrigeration, etc, and cooled oil is pumped back to the reservoir for reuse. The mirror avoids costly sun tracking losses. A series of closely packed lenses forms a solar farm. A rollable cover enclosed in a top arm, covers the lens on dusty nights. This arm has

10 also a lens cleaning dust blower and remover to keep the lens clean for maximal efficiency. Temperature sensing of tower hot coil, hot oil tank, secondary exchanger feed a control for efficient use without mechanical tracking!

Statement of Drawings:

15 These and other objects and features of the invention will become more apparent upon perusal of following description taken in conjunction with accompanying drawings wherein:

Figure 1 shows in elevation the details of large lens concentrator.

Figure 2 shows the various components lens, supports and oil circuit.

20 Figure 3 shows the exploded view of the action, in hot day.

Figure 4 shows another embodiment of the invention with robotic mirror.

Figure 5 shows a solar farm with one lens covered.

Figure 6 shows some uses-secondary exchanger.

DESCRIPTION OF PREFERRED EMBODIMENTS

25 The following specification describes salient features of invention, the method of construction, the method of use and the advantages of the novel invention.

The novel device has a single novel very large lens- plano-convex or convex that receives a large area of solar rays and focuses to a smaller area for high temperature heating, e.g. 4 meter lens has an area of 12 sq.meter with 12 KW heat energy available, more than

30 needed for a family! The lens focuses down making collection easier and cheaper than mirrors that focus up and needing towers to collect energy! A smaller parabolic mirror

collects the focused rays and reflects on to a black, rough thick copper tube coil, with a circulating high boiling liquid that is heated to 200* C or more. This hot oil is sent to a secondary heat exchanger coil, where water is made into steam for running a generator, or process chemical reactions, desalination, etc. and cooled oil is recirculated for continuous power.

The novel device according to the invention is fixed to any open surfaces or roof for easy solar collection by all.

The novel concentrator according to invention is better because the thermal conversion is better with higher concentration, has lesser radiation losses, multiple uses in the same device is new for various uses, such as steam for cooking, power, air cooling or heating. Solar tracking is simpler with lower energy losses, as the zero weight concentrated rays are focused to the heating coil by a novel smaller mirror. Multiple uses in same device with no sun tracking energy waste is new.

Special feature of the invention is that it is easy to set up, run, and stop even by illiterates too.

The novel device has higher efficiency due to higher temperature heating, no big sun tracking energy losses, multiple uses. The existing concentrators have not been improved for decades. The object of the invention is to overcome the inherent defects. To this end the new invention is addressed!

The device comprises of a very large diameter [say four meters, with a two meter focal length] transparent plastic lens 1, formed of series of segments 2 arranged in an arc forming a big lens, for correct focusing! A central tower 3 has a series of black, thick wall copper tubes 4. This tube has high boiling point oil for heat removal and feeds a high temperature oil tank 5, from where the hot oil is circulated by a pump 19 to a secondary heat exchanger coil 6 for various uses as steam etc. The cooled oil is sent to a cool oil tank 7 with a pump 20 to feed the tower coil tubes 4 for more heating. The cool oil tank has a filter to clean oil. The secondary coil can produce steam, desalination, process steam, etc as needed.

A smaller circular parabolic mirror 8 around the tower gets the down focused sun rays and reflects on to the copper tubes 4, producing energy. The sunrays in the morning strike the lens and refract to west and vice versa in the evening, hitting the mirror all day for continuous energy harvest without any sun tracking losses. A series of coil 9 around the -

mirror cools the mirror and feeds the tower coil. The parabolic circular mirror has to be designed for each area of earth as the angle of sunrays from morning to evening for all days varies! The mirror coil 9 is connected to cool oil tank 7, for cool oil feed and the other end to tower coil to feed warm oil for the tower coil, with cooling of mirror and heat extraction!

5 Parabolic mirror and the large lens are a new novel combination for no sun tracking losses with a concentrated energy never before possible!

The lens segments 2 are made as segments when arranged side by side forms a large lens, each segment having three or more holes 17, with spring loaded bolts 10 that hold the lens segments on a supports 11, all the supports forming a large lens supporting mesh. The
 10 supports have three or more pillars 12 to hold the lens arc above the ground! A cleaning and covering arm 13 with a rolled cover 14, and a dust blowing holes 15 is supported on one pillar for covering the lens in dusty nights and cleaning the lens for maximal transparency of the lens. A motor 16 in the arm rolls the cover. The motor [electrical or hydraulic] can rotate to spread or roll the cover in opposite direction! The air holes are supplied from a
 15 compressed air source. The arm 13 sweeps above the lens for cleaning or covering.

The secondary coil 6 has the hot oil coil, getting hot oil from the hot oil reservoir and the secondary coil with water circulating for steam production to run steam turbines or use the steam for processing of chemicals. Cooled oil is sent to the cool oil tank 7 for recirculation.

There are temperature sensors 18 (directly fixed or infrared remote sensors), in the tower
 20 coil, hot oil reservoir, secondary coil. An electronic control 19 senses the temperature of the oil in the tower, hot oil reservoir and secondary coil minimally and feeds the hot oil to secondary coil as needed for continuous use! The control also controls the arm 13 to clean or cover the lens.

A series of lens concentrators as in fig 5, serves as a solar farm. The lenses 1, are
 25 arranged closely to save on space. All the tower coils send hot oil to a central hot oil tank 5, which feeds the secondary coil for various uses. The cooled oil is sent to the cool oil storage tank 7 that feeds the tower coils, forming a large farm. The cleaning arms 13, may all act at the same time to clean the lens, cover or expose to sun.

The lenses are made as segments of a circular lens to minimize the cost of fabrication,
 30 transport and erection or service. The segment can be made for area needed [power needed], refractive index of the plastic used, by molding in desired dies with needed cavity and

surface for bending and concentrating light. Instead of a giant single lens, a series of segments are easy to make and assemble. The appropriate pillars and lens support is fabricated. The lens segments are fixed by spring-loaded bolts¹⁰ for correct single focusing! The tower with copper coil is fixed below the lens. The circular parabolic mirror [made of mirrored glass or reflecting vacuum coating on a base] is fixed around the tower. The oil circuit- cool oil tank, mirror tubes, tower coil, hot oil tank, secondary exchanger is connected with temperature sensors as needed and fixed. The secondary circuit is completed say, water reservoir, secondary exchanger, and turbines, cooled steam condensed and recirculated. Once lenses are exposed to sun, the rays of sun are focused to mirror and reflected to tower coil, heating the oil, which flows to hot oil tank and fed to the secondary exchanger where steam is formed and oil cools, cool oil is sent to cool tower for recirculation. The sun rays in morning is refracted to west, midday down, evening to east, then striking the mirror fig.3, is reflected on to heating copper coil for continuous power. The hot tank and hot oil tube after tower is insulated to reduce radiation loss.

The lens can be cleaned by a blast of compressed air from holes¹⁵ in the arm¹³. The cover¹⁴ is spread by switching on the motor¹⁶, to cover on dusty nights or rerolled for sun exposure see fig.5 where a lens is covered. A series of lenses will form a solar farm. After cleaning of lens, all the lenses focus to the tower copper coil, heating the oil and sending to hot oil reservoir, secondary exchanger where power is made, cool oil collected to cool oil tank for reuse. All lenses create more energy, without equipment shadow effect as seen in existing devices like mirrors. Electronic controls for single or farm is easy. Temperature sensors¹⁸, attached to hot tower coil, hot tank, secondary coil, feeds the control¹⁹ which then pumps cool oil to the tower coils, hot oil to secondary coils for continuous power! The control in the evening, can cover or in morning clean and uncover the lenses! Insulated hot oil tanks can supply energy in nights

The device can be modified. The lens can be made as two or more circular segments with different segments for each circle for a single focus. Adhesive may fix lens segments on lens supports. Pillars number and structure may be varied. A small parabolic mirror attached on a wheeled robot²¹ as in fig 4 may replace circular mirror, but this needs power and controls for moving continuously. Heating coil can be fixed on this robot (not shown, and moved for for sun orientation) directly for heating oil, with elimination of tower and parabolic mirror!

The circuit for heating, can produce steam directly in the tower coil. Tower coil can be enclosed in a glass cage to minimize radiation losses. Tower coil may be circular or wavy in contour. Secondary coil can feed all the various needs as, steam for power²², process heat, air-drying²³, air-cooling by heating the ammonia generator²⁴, desalination ²⁵as in fig.6.

5 with the same lens.

Electronic control for temperature sensing (direct or infrared remote sensors) of tower coil, hot oil tank, secondary exchanger and calculating the feed to exchanger for smooth power, cleaning or covering lens on dusty rainy days can be modified with soft ware for remote

10 control. Solar farm will have more complex control. On the moon, the mirrors are not needed and heating coil is fixed to ground focus. The heating coil may be carried on moving robot too, eliminating parabolic mirrors. Compressed air can move pillar arm to roll or cover the lens (for motor) and clean the lens too.

It will be apparent to those skilled in the art that modifications to the invention

15 described herein can readily be made without departing from the spirit of the invention. Protection is sought for all the subject matter described herein including any such modifications.

20 **Advantages of the new invention:**

1. Energy conversion by lens takes place at ground level saving on tower costs.
2. Lenses have low weight and supporting pillars, etc are cheaper to erect.
3. Circular parabolic mirror has no sun tracking energy losses!
4. Energy concentration is more as large lens area focuses to smaller area.
- 25 5. Life of device is more, as there are few moving parts.
6. Using high boiling oil in insulated tubes and tanks reduces thermal losses.
7. Solar tracking is new and novel with easy cleaning of lens at ground level.
8. Electronic control with (remote) sensors easily monitors and runs the device.
9. The same device has now many uses by changing the secondary circuit.
- 30 10. Every open space serves as energy creator without pollution.
11. Solar is eternal and device will give us pollution free energy in day or night

We Claim:

1. A large lens solar concentrator comprising of a large composite lens fixed on a supporting lens frame assembled on pillars, the said lens having below it a circular parabolic mirror, the said mirror having at its center a smaller tower with heating coils, the said coil heats circulating oil from a cool oil tank and sends to a hot oil tank connected to a secondary exchanger for work, the cooled oil is sent to cool oil tank, the said concentrator having electronic controls to circulate oil for continuous power, the said pillar has an upper arm with a rollable cover and compressed air holes for covering and cleaning.
2. A solar concentrator as claimed in claim 1, wherein the composite lens comprises of lens segments arranged in one or more concentric circles as needed, each lens segment having three or more holes, the said segments are assembled on a support by spring loaded bolts, such that all the segments when assembled form a single focus lens, concentrating a large area of solar collection on to a small area of focus for high concentrated heat source.
3. A solar concentrator as claimed in claim 1, wherein the lens support comprises of two or more pillars, the said pillars having at the top a circular frame divided into segments as that of the lens segments, each support segment having holes with a spring loaded bolt to receive and hold the lens segments to form a stable support for the single focus composite lens.
4. A solar concentrator as claimed in claim 1, wherein one pillar has an arm, the said arm having inside a motor to roll or unroll a cover for the lens, and a tube with air holes to blow away dust for a clean, clear lens, the said arm is placed above the said lens and swung for cleaning and covering the lens.
5. A solar concentrator as claimed in claim 1, where in a smaller circular parabolic mirror is placed below the lens to reflect the refracted solar rays, the said mirror reflecting onto a tower heating coil, the said mirror having cooling coils behind for cooling the mirror, the said mirror being made as complete or segments fitted together.
6. A solar concentrator as claimed in claim 1, where in the high boiling liquid is stored in cool oil tank and pumped through tubes to mirror coil, the central tower heating coil and after heating is sent through insulated tubes to insulated hot oil tank and a secondary exchanger, wherein heat is transferred and cool oil is fed to the cool oil tank for continuous power.

7. A solar concentrator as claimed in claim1, where in the cool and hot oil tanks are insulated from radiation losses and each has a motorized pump, for correct and continuous circulation by the said electronic control.
- 5 8. A solar concentrator as claimed in claim1, wherein a central tower is placed below the lens at the center of the parabolic mirror, the said tower having a thick, rough, black heat absorbing tube coil connected to cool and hot oil tank tubes, for removing the heat of collected solar energy all day.
9. A solar concentrator as claimed in claim1, wherein the said secondary exchanger has the hot oil tube with hot oil from the hot oil tank and another heat removing coil for steam
10 creation, air heating, ammonia generator or desalination, etc circuits
10. A solar concentrator as claimed in claim1, wherein temperature sensors (direct or remote) of the tower hot coil, hot oil tank, secondary exchanger are connected to an electronic control that controls and regulates oil flow from the cool oil tank to mirror coil, the tower coil and the hot oil tank and the secondary exchanger for correct and continuous oil circulation
15 for continuous energy.
11. A solar concentrator as claimed in claim 1, wherein a series of large lenses are arranged on pillars side by side, to form a solar farm, all the hot tower heating coils of all lenses are connected to a central hot oil tank with a secondary exchanger and a cool oil tank, all hot oil forming large heat source for a massive power plant
- 20 12. A solar concentrator as claimed in claim1, wherein the hot oil tube after the tower coil, the hot oil tanks and tubes to the said secondary exchanger are insulated to prevent radiation losses.
13. A solar concentrator as claimed in claim1, wherein the said electronic control runs the oil tank pumps, with temperature sensor input for continuous power and works the arm for
25 cleaning and covering.
14. A solar concentrator as claimed in claim1, wherein the combination single focus lens is plano convex or convex or fresnel type.
15. A solar concentrator as claimed in claim1, wherein cool oil tank has oil filters to clean oil of dust and impurities.
- 30 16. A solar concentrator as claimed in claim1, wherein circular or wavy heating coil is placed below the lens and moved on a robot for sun tracking for direct heating .

17. A solar concentrator as claimed in claim1, wherein a smaller parabolic mirror on a moving wheeled robot collects the lens focused solar rays and reflects to the tower coil for energy instead of the circular parabolic mirror.

- 5 18. A solar concentrator as claimed in claim1, wherein a solar concentrator as described in the specification and as illustrated by way of drawings.