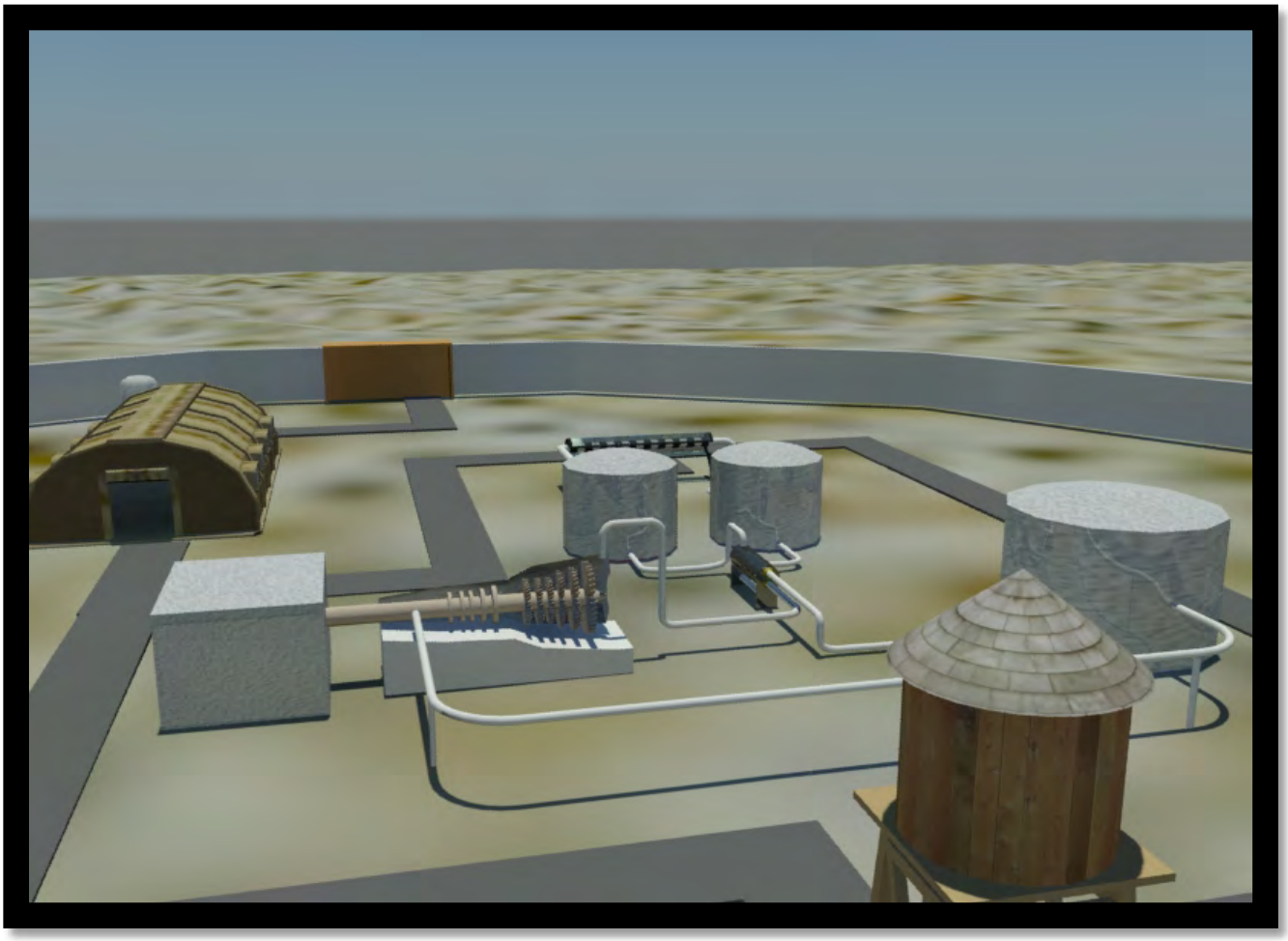
SolarLens Collector

LENS-BASED CONCENTRATED SOLAR POWER (CSP) SYSTEMS



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ABSTRACT

Concentrated solar power CSP systems usually use mirrors to collect a large area of sunlight and concentrate it onto a small area called the receiver. Electrical power is produced when the concentrated light is converted to heat, which usually drives a steam turbine connected to an electrical power generator.

Current CSP systems produce thousands of megawatts of electricity, which attracts investors towards this industry on a much wider range. However, the regular CSP systems require many factors in order to be efficient; a proper level of solar irradiation, less days of shaded sun and vast area of land.

Added to the previous, sun tracking is an essential requirement, and those factors can limit the use of such clean type of energy. Therefore, thinking of ways to develop CSP systems is a crucial step towards commercializing it into domestic-scale products.

Trying to minimize the required land area and eliminate the need of tracking systems, this project suggests improving the traditional CSP systems by replacing the large amount of mirrors that surrounds the receiving tower by a set of lenses; which form a hemi-cylindrical shape with a set of connected - relatively small receiving tanks at the focal points. Those lenses concentrate solar energy to heat up the working fluid inside those tanks, which exchanges the heat to produce steam that powers a steam turbine connected to an electrical generator.

1 INTRODUCTION

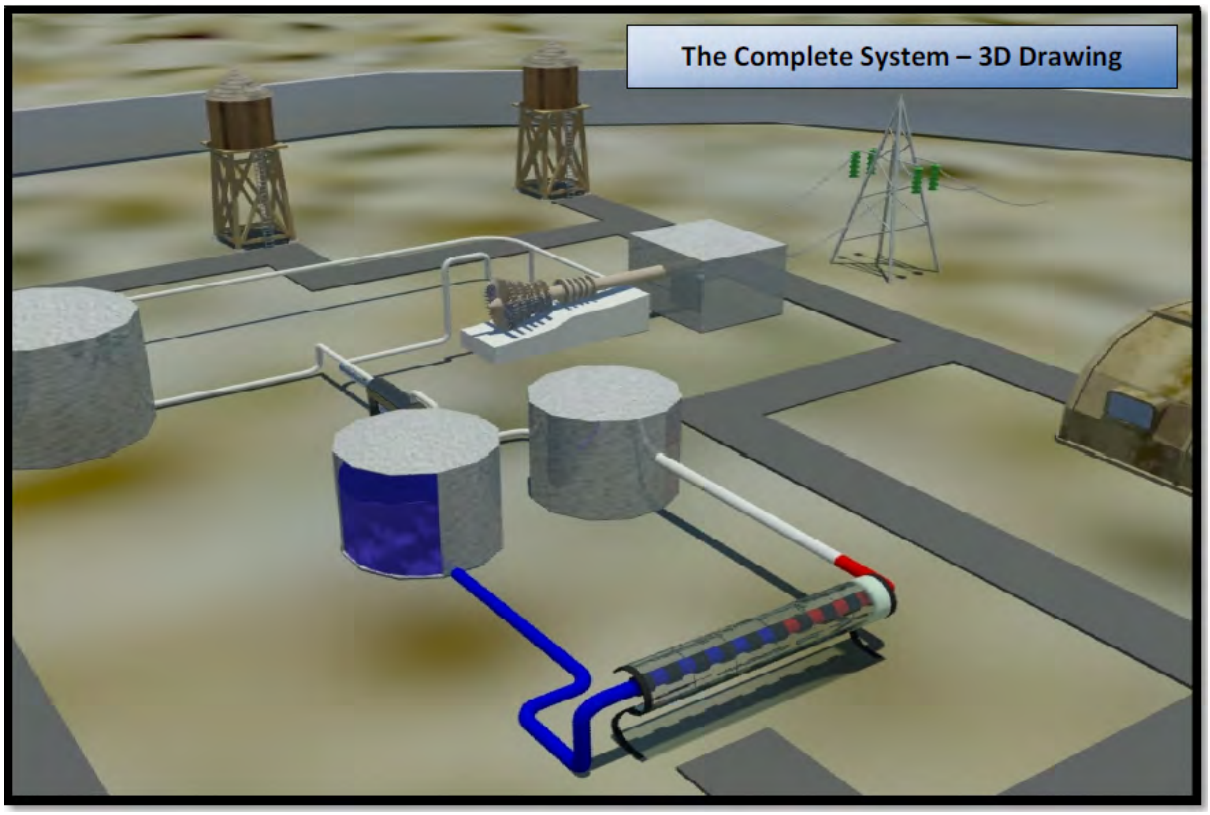
Alternative forms of energy help sustainable development through economic growth and pollution control. Replacement of fossil fuel by renewable and clean forms of energy would relieve the environment from serious types of pollution and relieve many countries from burdens of oil imports as well as the creation of new job opportunities.

The use of lenses in this research intends to result in a smaller-sized CSP system; therefore it could be easily suited in the construction to supply a building or group of buildings with electrical power. It also aims to increase the efficiency of collecting solar energy without the need for tracking systems.

2 THE PRODUCT (INNOVATION):

The product of ***SolarLens*** is basically an electricity-generating system that supplies up to 110 kW of power.
The system employs semi-cylindrical lens-based solar collectors that concentrate solar energy on a set of two liter receivers fixed at the lenses' focal points. The working fluid (Molten Salt) inside those receivers gains heat up to about 600-650°C and then transports to a main receiver tank of about 1 m^3. Afterwards, the molten salt flows into a heat exchanger where its heat will be rejected to the distilled water from an integrated reservoir.
The water boils and a 450-500°C superheated steam is then produced and passed in a steam generator that spins and generates electrical power.
The innovative part of this system lies in the lens-based solar collector that contains about 18 squared Fresnel lenses 23×23 cm (Total area of one collector is about 1 m^2). The amount of electricity generated depends on the number of collectors connected to the main receiving tank, and necessarily depends on the solar irradiation levels and weather conditions of the installation area.

The following computer drawing illustrates a simple-basic combination of the intended equipment to be used in the product;



SolarLens's system can be easily installed in remote areas as well, where the connection to a nearby grid is either inapplicable or unreliable. Therefore, SolarLens will also need to prove competitively better priced electricity compared to other off-grid means of power generation, such as diesel generators.
SolarLens intended to manufacture the specialized Fresnel lenses and fabricate the solar collectors. Other system parts such as tanks, pipes, control system sensors and steam generators are going to wither be supplied from partnering suppliers in the local market of the installation area, or transported from the nearest supplier in the region.

SEE THE PROTOTYPE VIDEO:
http://www.youtube.com/watch?v=phFXZ8VKkAk&feature=youtu.be

2.1 WHAT IS THE PROBLEM THAT WE ARE TRYING TO SOLVE?

The common advantage of all renewable energy systems is to get rid of the conventional types of fossil fuel energy. Current CSP systems require large areas of land along with high initial costs. Those regular systems are designed to supply considerably high electricity output which can be inappropriate for commercial use.

SolarLens's product provides the ability for commercializing a solar collector that could be used in a contained area within the construction of a building, a compound or any facility with relatively low energy requirements. The expensive construction of regular CSP systems can be lowered using our proposed concept.

2.2 HOW WILL OUR RESEARCH POSITIVELY IMPACT THE COMMUNITY?

The intended business will help getting rid of conventional-polluting energy resources through the use of renewable-clean energy.

SolarLens will start a new line of production which will necessarily require skilled manpower; this will create quality jobs for the local community, and will ensure continuous research work for the development and sustainability of the product.

3 WHAT IS THE GEOGRAPHICAL TARGET MARKET FOR THIS PROJECT?

The primary targeted market would initially be the Middle East where solar energy has very promising rates, along with the scarcity of energy resources. And the second targeted market will go farther into other countries which does not have enough energy resources, or where the electricity prices are considerably high.

The product will specially be helping distant locations (such as deserted areas) where electricity is either unavailable or unreliable.

3.1 SCALABILITY OF THE PROJECT:

The system is very scalable; SolarLens's products can be produced as single units and then linked to any type of a turbine-based electricity generator using the right size of heat exchangers.

3.2 AN ESTIMATE SIZE OF THE MARKET:

According to solar energy reports (especially in Photo-voltaic systems), similar market size can reach about US$200 million in the Middle East alone.

4 BUSINESS PLAN:

4.1 BUSINESS MODEL:

SolarLens will immediately specialize in providing low cost electricity for people in the Middle East, and will utilize two different business strategies to distribute the product. First, SolarLens will sell solar electric systems for domestic and commercial applications by allowing customers to finance the cost of these systems over time. Second, the company will offer free end-user services directly to customers by establishing service centers in the heart or near to their cities. At these centers, people will be able to get services ranging from sales and demand planning to equipment maintenance and post-sales support.

4.2 WHAT ARE THE STEPS TAKEN TO ASSES DEMAND FOR THE PROPOSED PRODUCT?

Several steps are being followed to come up with the final form of the product line, it includes:

1. Research about solar radiation levels in the region versus the demanded electrical power of the several community segments.

2. Optimize the currently-used solar energy technologies and study its business experiences in the targeted market.

3. Approach potential customers, present the idea of the product and collect their feedback.

4.3 WHO ARE OUR COMPETITORS IN THE MARKET?

The idea is unique and first of its kind, so there will be no direct competition to this product.

However, photo-voltaic panels can be indirectly influencing the targeted market wherever the installation of such PV systems would be possible.

4.4 COMPETETIVE ADVANTAGE:

The product's major competitive advantage would be the free-clean and continuous supply of electrical power. The containable system with relatively smaller sizes and cheaper initial costs will form a revolution in renewable energy. Continuous research towards a smaller sized system and a cheaper material that catches more solar power will always be the tool for maintaining the previously-mentioned competitive advantage.

4.5 MARKET AND SERVICE

SolarLens will immediately specialize in providing low cost electricity for people in Jordan as a sample marketplace and then in the Middle East, and will utilize two different business strategies to distribute the product. First, SolarLens will sell solar electric systems for domestic and commercial applications by allowing customers to finance the cost of these systems over time. Second, the company will offer free end-user services directly to customers by establishing service centers in the heart or near to their cities. At these centers, people will be able to get services ranging from sales and demand planning to equipment maintenance and post-sales support.

The main selling propositions of SolarLens products are mainly the price-efficiency ratio plus the continuous supply of green plug electricity. The price of SolarLens's electricity will be more than 60% cheaper than the typical grid electricity. In addition, an increase of about 15-25% in solar energy conversion efficiency is achieved, as compared to the best photovoltaic product in the market.