**SDG 1.1 what get by SDGC ?**

**(Solar Desalination Geoassisted Continuous)**

**Watermaker - SDGC toward SDGs/UN 1.1**

(Target 1.1: By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day).

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# In-Depth Analysis of the Solar Desalination Geoassisted Continuous (SDGC)

# 1.Introduction

***1.1 Contextualizing Water Scarcity and the Role of Desalination***



*Children in Baidoa, Somalia, which is experiencing a severe drought (Haq, 2023)*

Water scarcity is an increasingly pressing issue in today's world, affecting millions of people across various continents. As the population continues to increase, the need for fresh, potable water becomes more intense, exacerbating existing shortages. While several options exist to boost the world's water supply, desalination has emerged as a viable and efficient method to convert seawater or brackish water into a resource that is fit for human consumption, agriculture, and industrial use.One of the most innovative solutions in the field of desalination is the Solar Desalination Geoassisted Continuous system, commonly referred to as SDGC. This system addresses many of the limitations of traditional desalination methods. The utilization of renewable energy sources for the desalination process not only makes SDGC environmentally sustainable but also confers it a distinct advantage over other methods like Reverse Osmosis, which rely heavily on fossil fuels. This energy-efficient approach does not compromise the performance indices, making it comparable to existing technologies.

The scalability of the SDGC system makes it adaptable to various needs, from small residential setups to large industrial installations. This adaptability also offers a unique solution to logistical challenges often faced in water supply systems. The distributed and pervasive nature of the technology allows it to be deployed in various locations, thereby mitigating logistical constraints, which are typically a considerable impediment.Furthermore, SDGC shows immense potential for serving the general plant engineering industry, especially in the production of hydrogen. The system takes aggressive measures toward the inorganic load, thereby substantially improving the overall water cycle's performance. By converting saline or contaminated water bodies into "fresh" water, the system addresses multiple challenges simultaneously, from meeting industrial water quality standards to sustaining agriculture and potentially alleviating water scarcity for human consumption.

The objective of establishing an assembly and testing site for the SDGC tanks serves multiple stakeholders. Prefabricated and container companies, hydromechanics, financial investors, operators in the freshwater sector, and purification operators are all potential beneficiaries. By enabling a streamlined process from design to assembly, SDGC aims to enhance the production efficiency with client-specific requirements based on available inputs and desired outputs. Finally, it is important to note that the methods adopted by the SDGC system focus on harnessing renewable energy sources, such as solar and wind, and even thermal gradients from the Earth, to optimize the distillation process. By working in collaboration with both internal and external laboratories, the system ensures that the installations remain at the pinnacle of technological advancements. This collaborative approach fortifies the prospects of the SDGC system as a sustainable, efficient, and scalable solution to one of the most pressing issues of the 21st century: water scarcity.

***1.2 The Importance of Renewable Energy in Water Treatment***

The significance of renewable energy in the field of water treatment cannot be overstated, especially when considering the global challenges of climate change and resource depletion.The energy requirements of conventional water treatment techniques frequently rely largely on fossil fuels. Although these techniques have shown some degree of effectiveness, the environmental cost they impose is becoming intolerable. Fossil fuel consumption produces greenhouse gas emissions that contribute to global warming, which intensifies the scarcity of water by changing precipitation patterns and raising the frequency of extreme weather events (Gielen, et al., 2019). Therefore, inevitably, traditional approaches to water treatment may make the very issue they are meant to address worse. However, renewable energy provides an alternative that solves this dilemma. By harnessing energy from sustainable sources like the sun, wind, and thermal gradients, water treatment processes can drastically reduce their carbon footprint. The use of renewable energy not only alleviates the strain on the planet's finite resources but also paves the way for sustainable water management solutions that can stand the test of time. This is precisely what the SDGC system aims to accomplish.

In the case of the SDGC system, the integration of renewable energy takes center stage. By leveraging solar power, among other green energy sources, the system achieves a distillation process that is not only efficient but also environmentally responsible. Solar panels or other forms of energy capture are deployed to convert natural energy into heat, which then powers the desalination process.



*Solar-Powered Desalination*

This closed-loop design minimizes waste and maximizes efficiency, allowing for the continual treatment of water with minimal energy loss.Cost efficiency must also be discussed when evaluating the use of renewable energy in water treatment. Although the initial investment in renewable energy infrastructure can be high, operational costs are generally lower compared to fossil fuel-based systems. In addition, renewable energy solutions often benefit from government incentives and subsidies, making them more financially viable in the long run. This economic advantage strengthens the case for systems like SDGC, which could otherwise be considered too expensive for widespread adoption.

It is also important to note that renewable energy can also be applied to water pumping, filtration, and other essential processes in the water treatment chain. By replacing fossil fuels across these applications, it is possible to create a comprehensive water management strategy that is not only effective but also sustainable. This holistic approach would have far-reaching implications, from conservation efforts to the promotion of social equity by providing access to clean water in underprivileged communities.Another pivotal point is the replicability and scalability of renewable energy-powered systems like SDGC. Given their modular design, these systems can be adapted and implemented across various scales and geographies. This flexibility means that renewable energy can be integrated into water treatment projects not just in developed nations but also in developing countries where both water scarcity and energy availability are pressing issues. Therefore, as the global community struggles with the escalating crises of climate change and resource depletion, turning to renewable energy for water treatment is the best option.

***1.3 Scope and Purpose of the SDGC***

The Solar Desalination Geoassisted Continuous (SDGC) system’sobjective goes beyond addressing water scarcity through desalination; it aims for sustainable management of water resources using renewable energy. This commitment to sustainable practices renders the system especially relevant in today's world, where eco-friendly solutions are not just preferable but imperative. The technology is highly scalable, making it applicable for both small, localized settings and larger, industrial scales. Moreover, the system can be adapted to serve varied purposes, such as reclamation of water bodies or food production, thereby broadening its utility. On the other hand, the scope of the SDGC system also extends to addressing logistical issues, which often plague water treatment projects. By using prefabricated and containerized components, the SDGC system accelerates the setup process, thereby alleviating some of the logistical constraints that can hinder the implementation of water treatment solutions. This modular approach contributes to the system's versatility, enabling it to be deployed in diverse contexts, from urban centers to remote rural areas.

Financially, the SDGC system aims to attract a range of stakeholders, including prefabricated and container companies, hydromechanics, financial investors, and operators in the freshwater and purification sectors. This broad target audience reflects the system's multifaceted utility and its capacity to integrate into existing water management frameworks. The financial model also foresees a production-oriented approach, whereby the design and assembly processes are tailored according to client needs and available inputs. In addition, performance indices for the SDGC system are comparable to those of Reverse Osmosis methods, which are commonly used but rely on fossil fuels. The renewable energy focus of the SDGC system not only ensures an eco-friendly approach but also promises performance levels that can compete with established desalination technologies. This factor enhances its appeal and marketability, as it breaks the stereotype that sustainable solutions are less effective than their conventional counterparts.

Addressing the water cycle's inorganic load is another purpose served by the SDGC system. This focus results in enhanced performance related to the broader water management framework. It emphasizes not just the provision of fresh water but also the treatment and reclamation of water bodies, thereby contributing to a more holistic and sustainable approach to water management. Finally, the SDGC system also has a role in the burgeoning hydrogen production industry. Fresh water is a critical input in the production of hydrogen, and by providing an eco-friendly and efficient means of producing fresh water, the SDGC system indirectly contributes to the sustainability of hydrogen production processes. Therefore, scope of SDGC is broad, encompassing desalination, water reclamation, and even contributions to other industries like hydrogen production. Its purpose is rooted in the principles of sustainability, efficiency, and adaptability, making it a relevant and promising solution in the quest for sustainable water management.

# 2.Historical Context and Evolution of Solar Desalination Geoassisted Continuous (SDGC) System

***2.1 Traditional Water Desalination Techniques***

To understand the advancements represented by systems such as the Solar Desalination Geoassisted Continuous (SDGC)when it comes to water desalination, it is essential to look into traditional methods that have historically served as foundations for this practice. Traditional desalination methods are principally divided into two categories: thermal and membrane processes. Thermal processes, such as multi-stage flash (MSF) and multi-effect distillation (MED), depend on boiling water and then condensing the steam to produce fresh water (Tayefeh, 2022). On the other hand, membrane processes like Reverse Osmosis (RO) involve the use of a semipermeable membrane to separate salts and other impurities from water. Both approaches have been employed widely but come with their own set of challenges, mainly concerning cost and energy consumption.

Diagram of a diagram of a flash and heat recovery

Description automatically generated

The energy implications of traditional desalination techniques are significant. Thermal processes require substantial amounts of energy to boil water, making them energy-intensive and thus costly. Membrane methods, although somewhat more energy-efficient than thermal processes, also require high energy input, especially for pumping water through the membrane at considerable pressure. This elevated energy demand invariably results in increased operational costs, making desalination an expensive option for water treatment. High energy costs also translate into environmental consequences. The energy for traditional desalination is often sourced from fossil fuels, which contribute to greenhouse gas emissions. Therefore, while these methods address water scarcity, they exacerbate another global challenge: climate change. This paradox forms part of the ongoing debate on the sustainability of traditional desalination methods, as they offer a solution to one environmental issue while contributing to another.

Financial implications further compound the challenges. Installation and maintenance costs for traditional desalination systems can be high. These costs often restrict the implementation of desalination projects to regions with sufficient financial resources, thereby limiting their applicability in less affluent areas where they might be needed the most. These limitations have prompted the search for more efficient, cost-effective, and environmentally sustainable methods.Moreover, the production of fresh water through traditional methods produces a brine byproduct that must be managed appropriately. The disposal of this brine poses environmental and logistical challenges, adding another layer of complexity to the water desalination process. In some instances, the brine is returned to the sea, but this solution is not without environmental concerns, as the high salt concentration can negatively impact marine ecosystems.

Despite these challenges, traditional desalination techniques have evolved over time to become more efficient and somewhat less costly. Technological advancements have led to improvements in energy recovery systems and membrane materials, making the process more viable than in the past. However, these advancements haven't fully mitigated the primary challenges related to energy consumption and cost, thereby leaving room for alternative methods like SDGC that rely on renewable energy sources and offer potentially more sustainable solutions.

***2.2 Beginning of the Use of Renewable Energy in Water Desalination***

Transitioning from traditional techniques, the focus gradually shifted toward integrating renewable energy into water desalination systems as a means to alleviate some of the drawbacks associated with older methods. Renewable energy promised a cleaner, more sustainable solution to the energy consumption issues that plagued traditional desalination methods. Solar power, wind energy, and even geothermal sources have been explored for their potential application in water desalination.Initial attempts into the application of renewable energy in desalination were met with mixed results. Solar desalination, for example, leveraged the natural abundance of sunlight in certain regions to heat water and produce steam. While this reduced the dependence on fossil fuels, the technique was not without its shortcomings. Inefficiency in energy collection and conversion led to limited production capacities. Moreover, solar desalination often relied on expensive photovoltaic cells and thermal collectors, rendering the technology economically unfeasible for widespread adoption.

On the other hand, wind energy also found some application in desalination, particularly for pumping water through membrane systems. However, the variable and intermittent nature of wind posed challenges for consistent operations. Additionally, the wind turbines themselves required significant investment and were subject to wear and tear, leading to maintenance challenges that further added to the overall costs. In addition, geothermal energy offered another avenue for renewable energy application in desalination. While effective in certain geological conditions, the limitation of geographical applicability made it a less than universal solution. Areas without geothermal activity could not benefit from this method, and the initial set-up costs were often expensive.Another hurdle that impeded the initial progress of renewable energy in desalination was the lack of technical expertise and established procedures for integrating these new energy sources into existing or new desalination systems. In the absence of standardized protocols and optimized system designs, the implementation often suffered from inefficiencies that negated some of the benefits of using renewable energy.

However, despite these setbacks, the integration of renewable energy into desalination processes has seen gradual improvements over time. Advances in material science have led to more efficient solar collectors, while improvements in turbine design have made wind energy a more viable option. Innovations in energy storage have also helped mitigate the intermittent nature of some renewable energy sources, making them more reliable for sustained operations. Also, the growing awareness of climate change and the push for sustainability have further propelled research and development in this sector. As a result, renewable energy applications in water desalination are increasingly viewed as not only an alternative but as an imperative for future development.In light of these developments, systems like the Solar Desalination Geoassisted Continuous (SDGC) represent a synthesis of lessons learned from both traditional methods and initial attempts at renewable energy integration. By focusing on scalability, efficiency, and the use of renewable energy, SDGC and similar systems aim to address the historical challenges that have limited the broader application of desalination technologies.

***2.3 Origin of Solar Desalination Geoassisted Continuous System***

Now that the traditional methods are clearly explained, what is the origin of the Solar Desalination Geoassisted Continuous (SDGC) system. This technology represents a significant leap in the efforts to make desalination processes more efficient and sustainable. Inspired by the limitations of existing methodologies, the architects of SDGC set out to design a system that would not only overcome these challenges but also pave the way for future advancements in the field.The inspiration for SDGC emerged from a collective realization about the urgency of water scarcity and the unsustainable nature of existing desalination systems. There was a need for an energy-efficient, scalable solution. While earlier systems employed renewable energy to some extent, SDGC aimed for a more integrated approach, where energy efficiency was not an add-on but a core component of the design. This system considered not just the immediate needs of water production but also the long-term impact on natural resources and climate.

Early prototypes of the SDGC were focused on optimizing the use of solar energy, a choice dictated by both its abundance and its reduced environmental impact compared to fossil fuels. These prototypes experimented with various configurations of solar collectors, thermal gradients, and storage systems to maximize energy capture and utilization. These initial versions served as valuable testing grounds for identifying design efficiencies and flaws. Lessons from these preliminary models informed subsequent iterations, each bringing the SDGC closer to its objective of being a highly efficient, scalable, and sustainable desalination system.Another critical element in the development of early SDGC prototypes was the focus on modular design. Recognizing that water scarcity is a problem that varies in scale from community to community, a modular approach would allow for customized implementations. Whether the need was for a small rural installation or a large urban facility, the modular nature of SDGC made it adaptable to varying requirements.

In collaboration with research laboratories and industry partners, the early prototypes underwent rigorous testing and evaluation. This phase was vital for refining the system's mechanical and operational aspects, from improving the durability of components to enhancing the efficiency of energy use. The results were promising. Even though SDGC was in its infancy, these tests demonstrated its potential to be more efficient than existing desalination systems, particularly those relying solely on fossil fuels.Another salient feature that set the SDGC apart from its predecessors was its focus on minimizing the logistical constraints often associated with large-scale water desalination. By employing a distributed and pervasive approach, the system could be implemented across diverse geographical locations without the complications of centralized facilities and the accompanying infrastructure.As progress was made, financial investors began to take notice. Increased investment accelerated the pace of research and development, allowing for the quicker actualization of advanced prototypes and, eventually, functional models ready for broader application.

***2.4 Progression and Current Status of Solar Desalination Geoassisted Continuous System***

After the system was established, several evolutionary milestones have been experienced. With the foundational ideas and prototypes in place, developers have concentrated their efforts on progressive iterations to elevate the system to its current operational status. In its initial configuration, the SDGC was labeled as Version 0 (v0). This prototype, as previously discussed, focused primarily on the basic integration of solar energy into desalination. The emphasis was on feasibility: could a solar-driven process produce desalinated water with a significant level of efficiency? It could, but there was room and the necessity for improvement.Version 1 (v1) followed, introducing a more advanced thermal management system, and optimized solar collector arrangements. Designers also considered water throughput, scaling up the prototype to handle larger volumes of water. Energy efficiency was a significant focus in this iteration, leading to a considerable reduction in operational costs. With the success of v1, research and development expenditures increased dramatically, giving SDGC the financial boost it needed to advance.

With Version 2 (v2), a new layer of complexity was added. Incorporating lessons from the earlier versions, v2 unveiled an improved modular design that could be adapted for various scales of operation, from village wells to urban water treatment facilities. Enhancements were also made in the system's software to better regulate energy use and water flow, further optimizing the efficiency of the desalination process.Ultimately, Version 3 (v3), the most recent version, incorporates a multitude of insights from its predecessors. The creation of components that are lighter and more durable has been made possible by developments in material science. These materials are more recyclable and sustainable in addition to being resistant to harsh weather. Additionally, a significant advancement was achieved in automating the maintenance processes, which decreased the need for manual labor and the possibility of human error. Additionally, real-time data analytics is now incorporated into the system to offer insightful information about performance and facilitate prompt interventions for maximum productivity.

In assessing the progression of SDGC, the focus has been on continuous improvement. From the elemental beginnings in v0 to the highly sophisticated and efficient v3, each iteration has incorporated advancements that make the system more robust, efficient, and adaptable. What started as a simple concept has evolved into a formidable solution, capable of addressing the world's water desalination needs in an environmentally conscious manner.Through incremental but impactful advancements, SDGC has maintained its relevance and proven its worth as an effective, renewable energy-powered desalination system. Financial backing and scholarly attention have been consistent, demonstrating that both market and academia see the system's long-term potential. Thus, as of now, SDGC stands as a prominent example of how technological innovation can successfully intersect with environmental sustainability and societal needs.

# 3.The Science Behind Solar Desalination Geoassisted Continuous (SDGC)

***3.1 Principle of Solar Desalination***

What role does science play in SDGC? At the core of SDGC is solar desalination, a process inspired by natural phenomena for water purification. This foundation manifests in the technology's aim to simulate and harness natural processes, converting them into a scalable, man-made system for desalinating water (Xu, et al., 2022).In nature, the hydrological cycle serves as a fundamental model for solar desalination. Sunlight evaporates water from seas, rivers, and lakes. The vapor rises and condenses into clouds. Eventually, it precipitates as rain, offering a purified form of water. Essentially, this natural process leaves behind impurities, including salts and other contaminants, demonstrating an innate mechanism for water desalination. SDGC borrows from this basic principle, employing solar energy to facilitate the evaporation and condensation of water, which effectively separates it from undesirable components like salt and minerals.

Solar energy plays an integral role in the operation of the SDGC system. Panels or collectors capture sunlight and convert it into heat. This heat is then utilized to raise the temperature of the saline water source to facilitate evaporation. As the water evaporates, it leaves impurities behind. The generated steam is then cooled and condensed into water, providing a purified resource. By mimicking the natural hydrological cycle, SDGC ensures a desalination process that is not only efficient but also environmentally benign.One must also appreciate the geoassisted aspect of SDGC. While solar energy is the primary driver of the desalination process, geothermal energy plays a supportive role in maintaining optimal temperatures. Utilizing the Earth's inherent thermal stability helps in retaining the heat necessary for effective evaporation and condensation. This combination of solar and geothermal energy sources effectively enhances the system's efficiency while minimizing the environmental impact.

Particular emphasis has been given to optimizing the system for various weather conditions. Unlike conventional systems that require a consistent energy source, SDGC's dual reliance on solar and geothermal energy allows it to function efficiently even when solar energy is not optimal. During cloudy days or nighttime, the geothermal aspect continues to sustain the process, making the system versatile and reliable. The integration of solar and geothermal energies ensures a resilient system that can adapt to various environmental conditions, thereby marking a significant step forward in harnessing renewable resources for water treatment.By translating these natural processes into a scalable technology, SDGC represents a meaningful stride in the endeavor to address the growing global water crisis. As water scarcity remains a pressing issue, technologies like SDGC offers a continuous flow of solutions.

***3.2 Geo-assistance in Desalination***

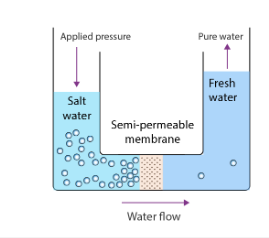
Expanding upon the principles of solar desalination, a remarkable component that enhances the efficiency and reliability of the Solar Desalination Geoassisted Continuous (SDGC) system is the incorporation of geoassistance. A significant factor in this is the use of thermal gradients within the Earth’s crust. This allows the system to function effectively even when sunlight, the primary energy source, is less abundant, such as during cloudy days or at nighttime.Thermal gradients refer to the differences in temperature that occur naturally within layers of the Earth's crust. In essence, temperature increases with depth. Utilizing these temperature differences can provide a consistent source of heat energy, which can be harnessed for various purposes, including desalination. In the context of the SDGC system, this geoassisted component ensures that optimal temperatures are maintained for the water desalination process.

The mechanism employs a heat exchanger that taps into the thermal gradients present below the Earth’s surface. Through the exchanger, a fluid circulates into the subterranean depths, becoming heated by the Earth’s natural warmth. As this fluid ascends, it transfers its heat to the saline water in the desalination unit. This process ensures that a consistent temperature is maintained, facilitating continuous evaporation and, consequently, desalination.By using Earth's own thermal energy, the SDGC model reduces its dependence on solar energy alone. This is significant for several reasons. Firstly, it adds a layer of reliability to the system. If clouds cover the sky or night falls, the geoassisted component can keep the process running smoothly. This results in higher efficiency as the system doesn’t need to pause or slow down due to lack of solar energy.

In addition, the use of geothermal energy can lead to lower operational costs. While the initial installation might require some investment, the ongoing costs are substantially reduced since the Earth’s thermal energy is essentially a free resource. This makes the SDGC system not only efficient but also economically viable. Also, from an environmental perspective, using geothermal energy adds to the sustainability of the system. It’s a renewable source of energy that does not produce greenhouse gases or other pollutants. Thus, combining solar and geothermal energy sources makes the SDGC system one of the more environmentally responsible choices for water desalination.

***3.3 Comparison with Reverse Osmosis***

Comparing the Solar Desalination Geoassisted Continuous (SDGC) with traditional reverse osmosis techniques, certain parameters must be assessed meticulously. Reverse osmosis, a widely-adopted method for water desalination, utilizes a high-pressure pump to push water through a membrane, thus separating the salts from fresh water. Though effective, it has some drawbacks, including a significant reliance on fossil fuel energy for its high-pressure systems. On the other hand, SDGC emerges as an innovative approach with environmental merits. Utilizing solar power and geothermal energy to facilitate the desalination process, SDGC diminishes the dependency on fossil fuels, thereby contributing to the reduction of greenhouse gas emissions. Whereas reverse osmosis primarily relies on electricity generated from fossil fuels, the SDGC harnesses readily available natural resources, thereby mitigating the carbon footprint.



Performance metrics are also pivotal in understanding the efficacy of desalination techniques. Reverse osmosis systems generally exhibit high levels of efficiency but at an environmental cost. The consumption of electricity is particularly high, and maintenance costs can be substantial due to membrane fouling and replacement. On the contrary, SDGC demonstrates similar efficiency but with a significant reduction in operational costs and environmental degradation.Moreover, SDGC displays flexibility by incorporating a range of renewable energy sources, making it adaptable to various geographic locations and climatic conditions. Reverse osmosis lacks this flexibility and is more rigid in its operational prerequisites. In addition, one cannot overlook the fact that reverse osmosis systems are more mature technologies with established infrastructures worldwide. In contrast, SDGC is relatively nascent but promising, and it has the potential to revolutionize the field of water desalination by integrating renewable energy sources effectively.

Therefore, investment into research and development for optimizing SDGC technologies could make it not just a viable but a preferable alternative to reverse osmosis in the near future. Pilot projects and small-scale implementations of SDGC have already begun to demonstrate its viability.It is also worth mentioning that both techniques have their applications and are not mutually exclusive. In specific scenarios, a hybrid approach incorporating features of both could offer optimal performance while reducing environmental impact. In such cases, reverse osmosis could handle bulk desalination, while SDGC could serve as a complementary system, particularly in regions abundant in renewable energy resources. Therefore, while reverse osmosis remains a reliable and effective method for water desalination, SDGC offers a greener alternative that could potentially change the way things are done.

# 4. Technological Components of Solar Desalination Geoassisted Continuous (SDGC)

***4.1 Anatomy of the SDGC Tank***

Understanding the construction of the Solar Desalination Geoassisted Continuous (SDGC) tank is essential for appreciating its functional mechanics. The tank serves as the cornerstone of the system, where the entire process of water desalination unfolds. It is typically designed as a vertically oriented cylindrical structure, although variations can occur based on specific geographical and operational needs.Materials chosen for the construction often include corrosion-resistant metals or high-strength polymers to withstand the saline water environment. At the base of the tank, one often finds an intake pipe that draws saline water into the system. This pipe is equipped with a filtration unit to remove larger impurities before the water enters the main chamber.

The internal architecture of the tank is compartmentalized, although without physical partitions, to facilitate different stages of the desalination process. At the lower section, heating elements are installed to initiate the evaporation of saline water. These elements are powered by geothermal energy, sourced from underground heat, thereby reducing the dependency on external electrical power.Above the heating elements lies the evaporation zone, where the heated water turns into vapor. This zone is critical for the effective separation of salt and water. It has been designed to maximize surface area, thus enhancing the rate of evaporation. The vapor then rises to the upper section of the tank, where the condensation process occurs. Here, cooling coils or plates are installed to transform the vapor back into liquid form.

This condensed water is nearly devoid of salt and other impurities. It is then collected in a separate chamber or directly channelled out through an outlet pipe for storage or immediate use. Importantly, the energy for the cooling process is often sourced from solar power, captured by photovoltaic cells located near or on the tank. These solar panels not only provide the required energy but also help in making the entire system sustainable and less reliant on fossil fuels.An additional feature in some SDGC tanks is the use of a secondary loop for pre-heating incoming saline water. This loop utilizes residual heat from the condensation process to warm the new inflow of saline water, thereby improving overall energy efficiency.

In terms of maintenance, the SDGC tank is designed for easy access to all its internal components. Whether it is the replacement of heating elements or the cleaning of cooling coils, the design accounts for straightforward disassembly and reassembly procedures. Moreover, the robust material choices aid in prolonging the lifespan of the tank, minimizing the need for frequent replacements.The thoughtfulness in the design and architecture of the SDGC tank is evident. Every component is carefully engineered to perform its role effectively while minimizing energy consumption and environmental impact. Therefore, the tank is not just a static container but a dynamic element that plays a critical role in the SDGC’s capacity to provide a sustainable solution for water desalination.

***4.2 Heating Mechanisms and Radiatorsof SDGC***

The SDGC has other integral components know as radiators and heating mechanisms. These elements work in cycle to facilitate the desalination process. Their function primarily lies in maintaining the necessary thermal conditions that enable the efficient conversion of saline water into its desalinated state.Radiators in the SDGC system serve a dual role. First, they aid in the dissipation of excess heat from the system, ensuring that temperature levels remain within desired operational limits. Second, they act as a medium for transferring heat to the saline water, initiating the phase transition from liquid to vapor. Material selection for these radiators often favors highly conductive metals like copper or aluminum, which offer the dual benefits of efficient heat transfer and resistance to corrosion.

However, the real innovation in SDGC lies in its heating mechanisms, specifically the incorporation of heat pumps and natural energy sources. Heat pumps are devices that transfer thermal energy from one place to another, usually from a low-temperature reservoir to a high-temperature one. In the context of SDGC, heat pumps serve to circulate the geothermal energy harvested from the Earth's subsurface to the water within the system. The mechanics of these heat pumps are designed to operate with high energy efficiency. They often incorporate a refrigerant that undergoes a closed-loop thermodynamic cycle. The refrigerant absorbs underground heat at a low pressure and temperature, then compresses to a high pressure and temperature before releasing this heat into the SDGC tank. Following the heat transfer, the refrigerant reverts to its original low-pressure, low-temperature state, thereby completing the cycle. This cyclical process allows for the continuous and efficient transfer of geothermal energy into the system.

As for natural energy sources, the SDGC exploits the abundance of solar energy. Photovoltaic cells, often placed around the tank or in adjacent areas, capture sunlight and convert it into electrical energy. This energy is then either stored in batteries for later use or directly channeled to power components like the cooling coils or secondary heating elements. Some designs even incorporate wind turbines as an auxiliary energy source, particularly in locations with substantial wind energy potential.Importantly, the control systems governing these heating mechanisms are programmed for real-time adaptability. Sensors continuously monitor temperature, pressure, and other operational parameters, allowing for dynamic adjustments to optimize performance and energy use. Thus, not only do the radiators and heating mechanisms fulfill their fundamental roles, but they also contribute to the system's ability to adapt and evolve in response to varying conditions.

***4.3 Condensation Mechanism of the SDGC System***

The condensation process is a crucial part of the Solar Desalination Geoassisted Continuous (SDGC) system's anatomy that needs to be examined. This takes place inside the boundaries of a tank that has been specially constructed, where empty space plays an essential role. This empty space is essential to the effectiveness and efficiency of the condensation process.When dealing with desalination, the key objective is to separate salt and other impurities from water to produce fresh water. In the SDGC system, this is achieved through a solar-assisted heating mechanism that transforms the liquid water into vapor. As the water vapor rises, it encounters a cooler area within the tank, typically managed through radiators and external cooling mechanisms. This is where the condensation process begins. Theempty space is the site where water vapor gets transformed back into liquid form. The absence of other materials or particles in this space ensures that the vapor encounters minimal obstacles, thereby allowing for a more effective condensation process.

Additionally, this vacant area facilitates better circulation of vapor within the tank. By providing room for the vapor to expand and move, the empty space aids in the even distribution of vapor, ensuring that it comes into contact with cooler surfaces for condensation to occur. This uniform distribution is crucial for the overall efficiency of the system, reducing the likelihood of "hot spots" or areas where condensation is suboptimal.Furthermore, this empty space can be manipulated to adjust the efficiency of the condensation process. For instance, altering the volume of the empty space could affect the rate at which water vapor cools and condenses. This flexibility makes it a variable of interest in the ongoing research and development efforts aimed at optimizing the SDGC system.In addition to facilitating the condensation process, the empty space in the tank also plays a role in the system's energy efficiency. Less resistance in this area means less energy is required to move the water vapor, thereby conserving the solar and geo-assisted energy sources powering the SDGC system.

***4.4 Optimization Strategies for Energy Efficiency***

Achieving energy efficiency remains a pivotal concern for the Solar Desalination Geoassisted Continuous (SDGC) system. To minimize energy wastage and maximize output, thorough attention has been given to aspects like insulation and heat exchangers. A well-insulated tank minimizes energy loss to the environment, thus ensuring that the desalination process proceeds with minimal resource expenditure. Insulation materials that are commonly used include foam and specialized thermal wraps. The choice of insulation material can significantly influence the efficiency of the system, and multiple tests have been carried out to determine the most effective substances for this purpose.

Heat exchangers serve a dual function: first, to capture and recycle residual heat, and second, to effectively transfer heat to water without loss. The exchangers are generally made from materials with high thermal conductivity such as copper or aluminum. These materials facilitate rapid heat transfer, thereby minimizing the time taken for desalination. By employing heat exchangers, the SDGC system elevates its capacity to convert saline water to freshwater with greater energy efficiency.Moreover, advancements in heat exchanger design have been incorporated into newer models of the SDGC system. For instance, the introduction of plate heat exchangers offers improved heat transfer rates over the traditional shell-and-tube variants. This not only boosts efficiency but also reduces the overall size of the system, which is a vital consideration for installation in regions with space constraints.

Another measure for increasing energy efficiency is the integration of control systems that can dynamically adjust insulation and heat exchanger parameters based on real-time data. These control systems, often employing advanced algorithms, optimize energy use throughout the desalination process. With this technological addition, not only does the system maintain high performance, but it also accommodates for variable conditions such as fluctuating ambient temperatures and water salinity levels.However, it is crucial to mention that the installation of sophisticated insulation and heat exchangers may incur higher initial costs. Despite this, the long-term savings achieved through reduced energy consumption and increased water production rates can offset these expenses, presenting a favorable cost-benefit scenario.

# 5. Operational Mechanisms of Solar Desalination Geoassisted Continuous (SDGC)

To comprehend the full potential and efficacy of the Solar Desalination Geoassisted Continuous (SDGC) system, it is essential to dissect its operational mechanisms. This section serves as a comprehensive examination of the sequential processes involved in the SDGC's functioning, commencing with the preparatory phase.

***5.1 Preparatory Phase***

The preparatory phase plays an instrumental role in determining the subsequent efficiency and reliability of the SDGC system. Before commencing the desalination process, there are several key preliminary steps, including the initial water filling and the fine-tuning of parameters.In the first step of water filling, the tank is filled with saline or brackish water up to a prescribed level, which is determined by multiple factors. These include the tank’s capacity, the estimated evaporation rate, and the desired volume of freshwater output. A careful approach to this stage can prevent overfilling, which may otherwise hamper the system’s thermal efficiency. Sensors often monitor the water level, offering real-time data to ensure precision in this critical process.Once the tank is appropriately filled, the next step involves setting the initial operational parameters. These may encompass thermal settings, the regulation of heat exchangers, and the tuning of the control systems responsible for governing these variables. A proper initial setting is vital for the seamless integration of the SDGC's thermal gradient and solar desalination components.

Another indispensable part of this phase is regulating the system according to local environmental conditions. Variables such as ambient temperature, solar radiation, and relative humidity can greatly affect the desalination process. Therefore, it becomes imperative to adjust the system settings accordingly. Many modern SDGC systems come with automated calibration features, significantly reducing human error, and ensuring optimized performance.The preparatory phase also usually involves a review of the energy sources. Whether relying on solar, wind, or underground energy, it is essential to ensure that these sources are fully operational and efficiently harnessed. The preparatory phase concludes with the activation of the system’s pumps and heat exchangers, thereby setting the stage for the core desalination process to commence. Therefore, the preparatory phase is a cornerstone in the operation of an SDGC system.

***5.2 Steam Generation through Heat Induction and Vapor Formation***

Following the thorough preparatory phase, the SDGC system progresses to the critical stage of steam generation. This is where heat induction and vapor formation take center stage, playing pivotal roles in the desalination process. The effective conversion of saline water into vapor is fundamental to the functioning of the SDGC system and thus merits thorough scrutiny.The generation of steam is fundamentally dependent on the successful induction of heat into the water stored in the tank (Li, et al., 2017). Typically, this heat is sourced from solar energy, harnessed through photovoltaic cells or solar collectors. The energy thus captured is then transferred to the water body through a network of heat exchangers or direct thermal conduits. It is vital to have a uniform distribution of heat to ensure that the whole water volume reaches the necessary temperature for vaporization to occur efficiently.

In addition to solar energy, the SDGC system may also employ supplemental heat from underground thermal sources. Geoassistance serves as a powerful adjunct, contributing to maintaining consistent water temperature and facilitating more efficient vaporization. Underground energy can also act as a backup, especially during periods of low solar insolation, making the system more resilient.The formation of vapor is an intricate process influenced by several variables, including water salinity, ambient temperature, and applied heat. The aim is to elevate the water temperature to its boiling point, causing the molecules to become excited and transition from the liquid state to vapor. During this phase, it is essential to maintain the water at a constant boiling point to ensure that vapor formation is continuous and uniform.Saline or brackish water often has impurities that can affect the boiling point. Therefore, maintaining a consistent heat input is crucial for ensuring the complete transition of water molecules into vapor. This also mitigates the risk of impurities contaminating the vapor, a phenomenon known as "carry-over," which can compromise the quality of the produced freshwater.

Heat induction and vapor formation are interrelated processes that must be finely tuned to ensure optimal results. Too little heat, and the vaporization process will be sluggish, resulting in reduced freshwater output. Excessive heat, on the other hand, could lead to faster depletion of the water source and increased energy consumption, making the system less efficient.After vapor formation, the next logical step involves the migration of this vapor to a separate compartment where it will be condensed into freshwater. However, it is the steam generation stage that sets the tone for the entire desalination process. Its efficiency directly impacts not only the volume of freshwater produced but also the energy consumption and overall sustainability of the SDGC system.

***5.3 Condensation and Final Water Collection Mechanisms***

As the process advances from steam generation, the next focal point in the SDGC operation is the condensation of steam and the final collection of purified water. The duality of these processes (condensation and water collection) forms the terminus of the desalination cycle, and their efficient functioning is vital for the end product: freshwater fit for various applications.Condensation is the reciprocal of vaporization and represents the phase transition of water from gas to liquid. This occurs when the steam encounters a surface with a temperature below its dew point, facilitating the change from vapor to liquid form. Often, condensation chambers are equipped with cold plates or coils that have been cooled through various means, sometimes even using the ambient air when its temperature is sufficiently low.

The quality of the resulting freshwater is heavily reliant on the efficiency of the condensation process. It is crucial that the chamber is devoid of contaminants, as any impurities present could compromise the water quality. Moreover, the condensation chamber is typically designed to allow for maximum surface area contact between the steam and the cooling plates to speed up the condensation process, making it both efficient and effective.Once condensed, the water then moves to the collection area. This is aaccurately designed chamber that allows for the final purification steps to be executed before storage. Usually, the water passes through additional filtration systems to remove any remaining microscopic impurities. It is paramount to ensure that the water meets all the quality standards set forth by relevant agencies before it is deemed ready for storage or distribution.

Storage mechanisms vary in complexity depending on the intended application of the water and the scale of the operation. For smaller setups, simple tank storage may suffice, but for larger systems, multiple storage tanks equipped with quality-monitoring systems could be used. Some advanced SDGC systems also incorporate real-time monitoring of water quality, employing sensors that can detect impurities down to the nanometer scale.The final leg of the SDGC operation is characterized by a careful balance between efficiency and effectiveness. The process must be carried out swiftly to maximize output, but not at the expense of quality. Every parameter, from the temperature of the cooling plates in the condensation chamber to the quality of the filters in the collection area, is fine-tuned to optimize both the quantity and quality of the water produced.

# 6. Applications and Scalability Solar Desalination Geoassisted Continuous (SDGC)

***6.1Urban and Domestic Application of Small-Scale SDGC Systems***

Urban and domestic settings present unique challenges for water supply, including space constraints, high demand, and, in many places, a diminishing quality of available water sources. SDGC addresses these issues with impressive efficiency and practicality, especially when installed at a smaller scale. In these scenarios, SDGC can serve individual households, apartment complexes, and small communities, catering to their specific water requirements.One of the most attractive features of small-scale SDGC systems is their ease of installation. These systems are often compact and can fit into limited spaces, including urban rooftops or backyards. Such installations prove particularly useful in cities, where land availability is a pressing concern. By utilizing areas that are otherwise neglected, SDGC makes a strong case for maximizing the use of urban space for sustainable practices.

Operating a small-scale SDGC system can also be less complex and demanding, making it ideal for domestic use. For households, the water output from these systems is usually sufficient for daily needs, including drinking, cooking, and basic hygiene. And since SDGC largely relies on solar energy, the operational costs get significantly reduced over time. It is also important to note that small-scale SDGC systems can serve as a crucial educational tool for future generations. Schools and educational institutions can consider installing these units as a hands-on learning experience, enabling students to understand both the technology and the importance of sustainable water management.Moreover, the introduction of SDGC in urban and domestic settings has far-reaching employment opportunities. The requirement for installation and ongoing maintenance provides jobs for local communities, including those with limited technical skills. Training programs can be initiated to educate locals on system management, thereby contributing to the local economy and skill development.

One often-overlooked application of small-scale SDGC systems lies in their utility during emergency situations. Whether it's a natural disaster like a flood or earthquake or a man-made disruption, these systems can act as a quick-response water supply solution. Given their simplified operating mechanisms, they are easily managed and can be crucial for survival when regular water supply channels get disrupted. Therefore, the adaptability of small-scale SDGC systems to urban and domestic settings opens up a wide array of benefits. These range from immediate solutions for water scarcity to long-term economic and educational gains. As technologycontinues to improve, it holds the promise to significantly impact how communities think about and manage their most vital resource; water.

***6.2 Large-scale Installations: Agricultural and industrial sectors***

The adaptability of Solar Desalination Geoassisted Continuous (SDGC) is further highlighted when one considers its applicability in large-scale settings, particularly in the agricultural and industrial sectors. These areas have massive water requirements and face unique challenges that smaller implementations might not encounter. Addressing these challenges head-on, SDGC shows considerable promise in revolutionizing how water is supplied and managed in such contexts. In agriculture, water scarcity is often a limiting factor for growth and sustainability. Traditional irrigation methods can be water-intensive and less efficient. Here, SDGC can be a game-changer. By providing a consistent supply of desalinated water, it allows for more effective irrigation strategies. The use of solar energy also means that farms can be less reliant on fossil fuels, contributing to a more sustainable form of agriculture. The large tanks used in SDGC can store enough water to irrigate extensive areas of land, making it a practical solution for even the most ambitious farming projects.

Industrial settings also stand to gain from implementing SDGC technology. Factories and manufacturing plants often require substantial amounts of water for cooling, cleaning, and other processes. Traditional desalination methods might not be sustainable or might require high operational costs. On the contrary, SDGC, once set up, has lower running costs, mainly because of its reliance on solar energy and underground heat. In addition, given its capacity for large-scale water production, it is well-suited for industries with high water demands. Another critical aspect to consider is waste management. Both agriculture and industry produce wastewater that, in many cases, goes untreated and is discharged into nearby bodies of water. The technology behind SDGC has the potential for adaptations that can treat and recycle this wastewater, enabling a more circular and sustainable approach to water use. In an age where environmental impact is under scrutiny, the capacity for waste minimization and water recycling sets SDGC apart from traditional desalination and water supply methods.

Employment is another area where SDGC’s large-scale implementation has an impact. The installation and operation of these systems would require a sizable workforce, providing job opportunities and spurring economic growth. This is particularly valuable in regions where water scarcity and unemployment are both pressing issues. Moreover, the skill set required for managing an SDGC system is not overly specialized, making it easier for locals to get involved after brief training periods. Finally, investment in SDGC technology also opens up avenues for research and development. Both the agricultural and industrial sectors would benefit from constant innovations and improvements to the system, be it in the form of higher efficiency, reduced costs, or increased capacity. This not only fuels scientific inquiry but also encourages cross-sector collaboration between the water industry, agriculture, and manufacturing sectors.

***6.3 Tailoring to Individual Requirements: The Adaptability of SDGC***

A notable quality of the Solar Desalination Geoassisted Continuous (SDGC) system is its adaptability to varied requirements, ranging from individual homes to entire communities, and from agricultural lands to industrial plants. This inherent versatility enhances its value, as it can be tailored to meet specific needs without significant changes to the fundamental technology.Imagine a region with an unusual mix of water requirements, where an industrial plant sits close to farmland, both near a densely populated urban area. A one-size-fits-all approach to water desalination would be inefficient here, but SDGC can adapt. The system can be customized to provide different grades of water, whether it is for irrigation, industrial processes, or domestic consumption. This fine-tuning allows for optimal resource use, minimizing waste.

When looking at the adaptability of the system in different climates and geographic locations, SDGC shines brightly. The use of solar power makes it particularly suitable for regions with ample sunlight, but the geoassisted part of the system allows it to harness underground heat as a supplementary or alternative source. This makes it viable even in less sunny climates. The modular nature of the technology allows for the addition of more solar panels or radiators, depending on the local energy availability and needs.The scalability of SDGC also adds to its customizability. For small communities or individual households, a single SDGC unit might be sufficient. However, for larger communities or industrial plants, multiple units can be installed to meet the demand. Each unit can also be customized in terms of its tank size, solar panel area, and other components to match the specific requirements.

Financial aspects should not be ignored when discussing adaptability. While the initial setup cost of an SDGC system may be a consideration, its low operational costs make it a financially viable option in the long run. The ability to start with a small-scale implementation and then scale up as needed provides flexibility in financial planning, reducing the financial burden and making it accessible for various applications.Furthermore, SDGC’s ability to treat and recycle wastewater adds another layer of customization. Depending on the local regulations and needs, the system can be fitted with additional filtration layers or treatment steps to recycle wastewater for non-potable uses. This contributes to sustainable water management and opens up new avenues for water use that might not have been feasible otherwise. Finally, user-friendly interfaces for control and monitoring of the SDGC system make it easier for people with minimal technical know-how to operate it effectively. The settings can be easily adjusted to change the rate of water production, salinity levels, and other factors. This user-friendliness ensures that the system can be managed efficiently, even by those who may not have extensive experience in water treatment technologies.

# 7. Legal and Economic Aspects

It is important to study the legal and economic dimensions of SDGC because they not only shape the accessibility and market penetration of SDGC but also influence its long-term sustainability.

***7.1 Ownership of Intellectual Assets: The Legal Safeguards in Place***

One of the cornerstones in the dissemination and scalability of any new technology is the legal framework that safeguards its intellectual assets. In the case of SDGC, various patents have been filed to protect its unique combination of solar power and geothermal energy for water desalination. These patents cover a wide array of components, ranging from the solar panels and heat exchangers to the specific mechanisms used in the condensation and collection of water.Filing for patents provides a strong foundation for SDGC by discouraging unauthorized replication of the technology. It gives legal recourse to the original developers, allowing them to enforce their exclusive rights in case of infringement. Without such protections, innovations would be at high risk of being copied, thereby disincentivizing further research and development in this domain.

However, patents are not everlasting. Typically, a patent's life span extends up to 20 years from the filing date, after which the technology enters the public domain. This timed exclusivity serves a dual purpose: it rewards inventors for their innovation while ensuring that knowledge eventually becomes publicly accessible. When a patent expires, other enterprises can leverage the technology, possibly contributing to further advancements and adaptations (Ehrnsperger, & Tietze, 2019).In addition to patents, other forms of intellectual property rights such as trade secrets and copyrights may also be relevant. While patents offer robust protection, they require full disclosure of the technological workings. In contrast, trade secrets can protect confidential information indefinitely but offer weaker protection against independent discovery. It is often a strategic decision on the part of the innovators whether to opt for patents or maintain certain aspects as trade secrets.

These protections also have economic implications. Ownership of a patented technology can be a significant asset for any organization. It opens up opportunities for licensing agreements, thereby generating a steady stream of revenue. Moreover, the promise of exclusivity often attracts investment, further fueling research and development initiatives.However, it's worth noting that navigating the patent landscape can be complex and expensive. Fees are incurred not just in filing but also in maintaining a patent, and these costs can be prohibitive for smaller enterprises or research institutions. Moreover, the geographical limitations of patents, valid only in the territories they are granted, can be aobstacle in the global performance of SDGC.

**7.2 *Market Viability: Economic Dimensions of SDGC***

One of the pressing questions is whether this SDGC technology, notwithstanding its technical achievements, can stand the test of economic practicality. In terms of market viability, one of the significant factors is the initial investment required for setting up an SDGC system. While solar panels and geothermal pumps do entail upfront costs, the return on investment is augmented by low operational expenses. Due to the renewable nature of solar and geothermal energy, the cost of power is virtually invalidated after the infrastructure is in place. This makes the technology highly appealing to regions with abundant sunlight and geothermal activity, as the payback period can be relatively short.

Another area that comes under analysis is the cost of water production per cubic meter. Reports suggest that the SDGC technology, due to its energy-efficient methods, can produce fresh water at a competitive rate compared to traditional desalination plants. This is particularly important for countries that face acute water shortages, as SDGC can be a financially viable alternative to other water sources like underground wells or imported water supplies.The scalability of the technology adds to its economic attractiveness. SDGC systems can be designed for small urban setups or expanded to cater to large agricultural projects. Flexibility in scale allows for a broad spectrum of applications, which in turn opens up multiple revenue streams. Be it supplying water to a high-rise building or an entire farming community, the adaptability of SDGC ensures that it has a place in different market segments.

Despite these promising aspects, some challenges can affect the market viability. For instance, areas that lack adequate solar exposure or geothermal activity may find the technology less appealing. There's also the competition from existing desalination techniques and water purification methods, which are well-established and have robust supply chains.The long-term sustainability of SDGC is also a factor that can affect its economic standing. For instance, the wear and tear of solar panels and other components can add to the operational costs over time. However, advancements in materials science are likely to mitigate such issues, further tipping the scales in favor of SDGC.In summary, the economic outlook for SDGC appears to be largely positive. With competitive production costs, scalability, and eligibility for governmental incentives, it poses a strong challenge in the water desalination market.

***7.3 Investment and Financing Models of SDGC***

Transitioning to the economic dimensions of Solar Desalination Geoassisted Continuous (SDGC) requires understanding the investment and financing models that support its development and scaling. Various channels can facilitate the infusion of capital, ensuring that SDGC can move from theoretical modeling to real-world implementation.One of the prevalent methods to attract investment is through license agreements. Typically, inventors or patent-holders of SDGC technology can license the rights to manufacture, sell, or use the technology to another entity. In return, they receive royalties or a one-time payment, ensuring a revenue stream that can fund further research and development. License agreements are especially important for smaller entities that may not have the capacity to take the technology to market on their own.

In cases where a more significant transfer of technology, skills, or assets is necessary, joint ventures (JVs) emerge as a viable option. In a JV, two or more organizations pool their resources to create a new entity that takes on the responsibility of developing and commercializing SDGC. The benefit here is the shared risk and increased access to specialized skills and resources. The downside can be a complex structure of governance and profit-sharing, which requires carefully drafted agreements to manage potential conflicts. In addition, crowdfunding is another modern avenue that has found applicability in the renewable energy sector. Platforms allow innovators to present their idea to the public, who can contribute small amounts to fund the development or scaling of the project. This model serves to validate the technology's market appeal and can be an effective tool for raising capital without diluting ownership.

Moreover, governmental and non-governmental organizations frequently offer grants and subsidies for green technologies, including SDGC. These financial injections serve multiple purposes: they reduce the financial burden on the inventors, facilitate faster market entry, and encourage the development of sustainable technologies. Importantly, these funds often do not require repayment or equity dilution, thus retaining the original inventors' control over the project.Angel investors and venture capitalists represent another significant category of financiers. These individuals or firms offer substantial financial investment in return for equity and, often, positions on the board. The benefit here is not just the money but also the experience and networks that these investors bring with them. Their interest in SDGC would be a potent indicator of the technology’s commercial viability.

Moreover, traditional loans from financial institutions can also play a role, although they come with the liability of interest payments and the obligation for repayment regardless of the project’s success. Given that SDGC involves hardware like solar panels and geothermal pumps, asset-backed loans could be a practical choice. Finally, Public-Private Partnerships (PPPs) serve as yet another funding model. Here, a government body and a private entity collaborate, bringing together public interest and private efficiency. The government might offer tax breaks, land, or other resources, while the private firm offers technology and operational proficiency. This model works well when public welfare, such as clean water supply, aligns with the commercial interests of SDGC. The availability of these diverse financing options serves to highlight the economic feasibility and promise of SDGC.

**Conclusion**

In the discussion on sustainable solutions for water scarcity, the examination of Solar Desalination Geoassisted Continuous (SDGC) stands as an integral study. From its operational mechanisms to its scalability and economic viability, various facets of SDGC have been examined. Future research needs to address the limitations and challenges identified throughout this study. Efficiency gains, for example, remain a focus for future exploration. How can SDGC be further optimized to lower costs and increase output? Answering this could make the technology even more appealing for large-scale applications. Additionally, long-term ecological impacts of widespread SDGC implementation merit further investigation. As environmental conditions continue to evolve, the need for sustainable water solutions is likely to grow. Given this, future studies may also benefit from an interdisciplinary approach. Bringing together experts from the fields of engineering, environmental science, economics, and law can provide a more holistic understanding of SDGC's place in addressing global water scarcity.

In conclusion, the Solar Desalination Geoassisted Continuous technology presents a compelling solution to water scarcity, with diverse applications that range from small communities to large industrial setups. Nevertheless, its future depends on ongoing research, aimed at overcoming operational limitations and validating its long-term sustainability. The financial frameworks to support this are varied and accessible, indicating a viable path towards commercialization. Therefore, SDGC not only stands as a promising technological advancement but also offers hope for a future where clean, accessible water is not a luxury but a fundamental

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# Bibliography/Conclusion

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# Watermaker from SDGC (source) :

Patent:

[**SDGC**](http://www.expotv1.com/LIC/UIBM_SDGC.pdf) ,    [**https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016162896**](https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016162896) (sea and process water solar desalination);  [view1](https://www.bing.com/images/search?q=%28sea+and+process+water+solar+desalination%29+&FORM=HDRSC2)

Italy: GRANT

<http://www.expotv1.com/LIC/MISE_0001429306_SDGC.pdf>, ... mean "INDUSTRY (useful), NEW (no make before), INVENTIVE (teach some things)".

**Abstract/Description -** Patent:

[**SDGC**](http://www.expotv1.com/LIC/UIBM_SDGC.pdf),[**https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016162896**](https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016162896)

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# Summary – Applications (to SDGs)

[**SDGC**](http://www.expotv1.com/LIC/UIBM_SDGC.pdf)

[**https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016162896**](https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016162896)

**Water – great efficiency in DESALINING with renewable sources. SDGC** is dedicated to desalination (of sea water, brackish water or bodies of water to be reclaimed), has the advantage of using only renewable energy and with performance indices comparable to Reverse Osmosis (dependent on fossils);　the system is scalable from small to large installations, offering the possibility of implementing distributed **& pervasive** and counteracting critical logistics issues (often a serious problem). An infrastructural supply of "fresh" water towards the general plant engineering industry and in particular that for　the production of hydrogen. Drastic action towards the Inorganic load,　contributing to the performance on　" **Water cycle** ".

**Project:**

SDGC – Solar Desalination Geoassisted Continuous

**Objective :** Launch an assembly and testing site (procedures and manuals) for the production of SDGC tanks (of assorted cuts and functions, reclamation of water bodies or production for food purposes).

**Target:** Prefabricated and container companies, hydromechanics , financial investors, operators in the fresh water sector, purification operators

The project aims to activate a production site, from design to assembly (pro delivery and rapid assembly), with the development of production-oriented procedures agreed with the client (based on the available inputs) and the destinations of the outputs produced. The solutions rely on standard products from the water management and prefabricated market (including containers), assembled and tested with a view to optimizing distillation using solar energy and support from thermal gradients. In collaboration with internal and external laboratories, it will act as remote support for the installations in charge (EPC - Engineering , Procurement and Construction ).

**Summary:** This invention talks about how a machine can remove salt from sea water, salt water or water that comes from factories. This machine can use energy that comes from the sun, wind or underground. To remove salt from water, you need to make the water turn into steam and then turn it back into water (all at usual thermal conditions, for example how dew is produced). We plan to proceed as follows:

• put the water in a closed tank where the steam will be produced;   
• heat the water near the surface, so it produces more steam;   
• causes the steam to become water again, encountering colder surfaces (expanded metal arranged in a fan), adjacent to parts to which they will release the heat to even colder but liquid parts, fueling the convective motions in the liquid part, which then traces and reiterates the process;

• collects the condensed water, without salts, in suitable reservoirs and from which it is taken.

The machine is a well-insulated tank, into which water is introduced in continuous processes. Inside the tub there are devices that heat the water to make it steam. There are also means that turn the steam back into water and that collect the water without salt, transferring the energy by-passing critical areas (the key to conservation and reduced need for energy). These means are made like this:   
  
• the tank is filled with water up to a certain point (approximately 2/3), so the condensation process is completed in the empty space above;

• the half -radiators, which heat the water , are close to the surface of the water and will be powered by natural sources (possibly supported by heat pumps);   
• the means that create water vapor are on the surface of the water and heat in a limited way, inside the water, thus giving off a lot of heat;

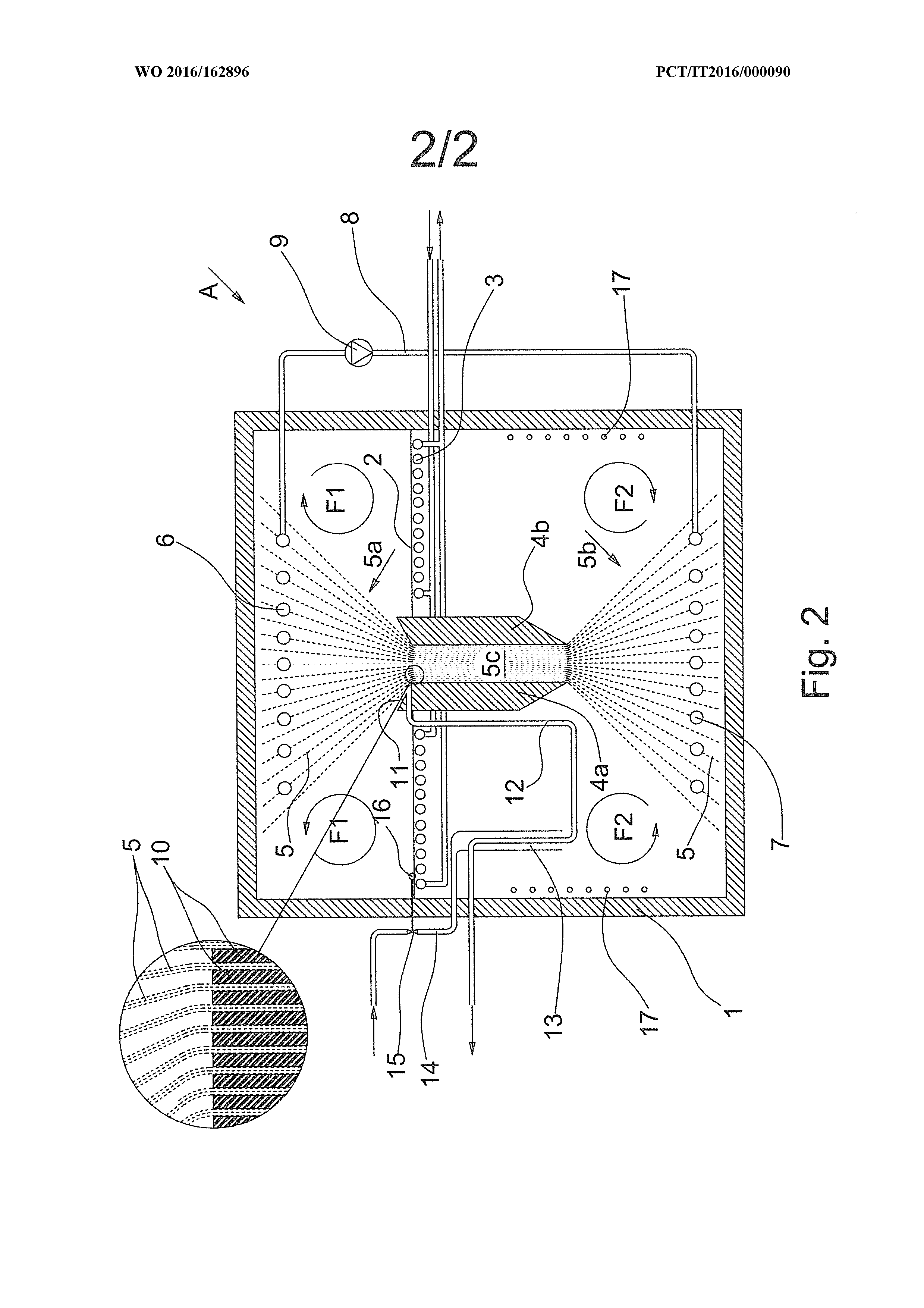
• from the proposed reservoirs, the condensed water (which arrives by gravity and free of any salt) is taken from the coldest surfaces encountered, similar to the temperature regimes of storm processes in the tropics.

The machine uses the available renewable energy well , both solar and environmental conditions, fueling convective motions, both in the aerial and liquid parts, taking care not to lose energy, thanks to adequate insulation and prepared exchangers; The machine can use both energy that comes from the sun, wind or underground, and energy that comes from other sources. This machine is used to make clean (distilled) water, useful for many things: for factories, for plants, for animals and also for people (suitably integrated with the desired salts for drinking and nothing for industries, which they like even less – hard waters). This machine can help remove countless impurities resulting from many industrial and anthropic processes in general. In an indirect way, therefore, to remedy many ongoing social disparities in many communities .

[***SDGs / UN\_en***](https://sdgs.un.org/goals) ***-*** [***SDGs / UN\_it***](https://sdgs-un-org.translate.goog/goals?_x_tr_sl=en&_x_tr_tl=it&_x_tr_hl=it&_x_tr_pto=wapp) ***Full Strategy to***

[***1***](https://sdgs.un.org/goals/goal1)[***2***](https://sdgs.un.org/goals/goal2)[***3***](https://sdgs.un.org/goals/goal3)[***4***](https://sdgs.un.org/goals/goal4)[***5***](https://sdgs.un.org/goals/goal5)[***6***](https://sdgs.un.org/goals/goal6)[***7***](https://sdgs.un.org/goals/goal7)[***8***](https://sdgs.un.org/goals/goal8)[***9***](https://sdgs.un.org/goals/goal9)[***10***](https://sdgs.un.org/goals/goal10)[***11***](https://sdgs.un.org/goals/goal11)[***12***](https://sdgs.un.org/goals/goal12)[***13***](https://sdgs.un.org/goals/goal13)[***14***](https://sdgs.un.org/goals/goal14)[***15***](https://sdgs.un.org/goals/goal15)[***16***](https://sdgs.un.org/goals/goal16)[***17***](https://sdgs.un.org/goals/goal17)[**SDGs/UN**](http://www.expotv1.com/JWT_to_SDG_UN.pdf)

[***http://www.expotv1.com/ESCP\_Hello.htm***](http://www.expotv1.com/ESCP_Hello.htm)



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(71) Applicant(s):

LAVANGA, Vito [IT/IT]; Via Terrazzano 85 I-20017 Rho (Ml) (IT) (for all designated states)

(72) Inventor(s):

LAVANGA, Vito; Via Terrazzano 85 I-20017 Rho (Ml) (IT)

FARNE', Stefano; Via Trasimeno 40/14 20128 - Milano (Ml) (IT)

(54) Title (EN): METHOD FOR THE CONTINUOUS DESALINIZATION AND DEVICE FOR THE IMPLEMENTATION OF SAID METHOD

(54) Title (FR): PROCÉDÉ POUR LA DÉSALINISATION CONTINUE ET DISPOSITIF POUR LA MISE EN ŒUVRE DUDIT PROCÉDÉ

(57) Abstract:

(EN): This invention refers to a method and a device for desalinating sea water, brackish water or from industrial processes. The device is suitable to use renewable energy sources such as solar or geothermal energy. The device is of the type that includes a tank (1) for the containment of the water to desalinate, in which there are heating means fitted to cause the evaporation of said water to desalinate, cooling means fitted to favour the subsequent condensation of the steam and means fitted to the collection of the condensed water and it is characterized in that: said tank (1), fitted to contain said water to desalinate, is filled up to a certain level (2); said heating means, for evaporating said water include a first heat exchanger (3), immersed in the water to desalinate and positioned nearby said level (2); said cooling means (5a), fitted to cause the condensation of the steam, are in heat exchange connection with the heating means (5b), immersed in said water to desalinate, said heat exchange simultaneously causing: a) the reduction of the temperature of said means (5a), therefore the suitable conditions for the condensation of the steam; b) the increase in temperature, into the depths, of said water to desalinate.

(FR): La présente invention concerne un procédé et un dispositif de désalinisation d'eau de mer, d'eau saumâtre ou provenant de processus industriels. Le dispositif est approprié pour l'utilisation de sources d'énergie renouvelable, telles que l'énergie solaire ou géothermique. Le dispositif est du type comprenant un réservoir (1) pour le confinement de l'eau à dessaler, dans lequel se trouvent un moyen de chauffage conçu pour provoquer l'évaporation de ladite eau à dessaler, un moyen de refroidissement conçu pour favoriser la condensation ultérieure de la vapeur et un moyen conçu pour collecter l'eau condensée, et est caractérisé en ce que : ledit réservoir (1), conçu pour contenir ladite eau à dessaler, est rempli jusqu'à un certain niveau (2); ledit moyen de chauffage, conçu pour provoquer l'évaporation de ladite eau à dessaler, comprend un premier échangeur de chaleur (3) immergé dans l'eau à dessaler et positionné à proximité dudit niveau (2); ledit moyen de refroidissement (5a), conçu pour provoquer la condensation de la vapeur, est en liaison d'échange thermique avec le moyen de chauffage (5b) immergé dans ladite eau à dessaler, ledit échange de chaleur provoquant simultanément : a) la baisse de la température dudit moyen (5a), et par conséquent les conditions appropriées pour la condensation de la vapeur; b) l'augmentation de la température, dans les profondeurs, de ladite eau à dessaler.

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Declaration made as applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate

Declaration of inventorship (Rules 4.17(iv) and 51bis.1(a)(iv)) for the purposes of the designation of the United States of America

