

**ALERT!**

The Solution rewrite has been saved.

## EFFICIENCY ASSESSMENT REPORT

### PEARLAQUA DECA

PearlAqua Deca is a UV-C LED water disinfection platform designed for Point-of-Entry applications.

**Solution ID:** 12689

**Company:** AQUISENSE Technologies LLC

**Country:** United States

**Export Date:** 15.02.2021

### ASSESSMENT RESULTS



**APPROVED**

#### FEASIBILITY

- Credibility of concept	YES
- Scalability	YES

#### ENVIRONMENT

- Environmental benefits	YES
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#### PROFITABILITY

- Client's economic incentive	YES
- Seller's profitability	YES

### GENERAL COMMENTS FROM THE SOLAR IMPULSE FOUNDATION

The Solution is awarded the Solar Impulse Efficient Solution as:

- **It is fully satisfying the Eligibility Criteria** in terms of: (1) Nature of the Solution namely, physical/financial product, technology, industrial process, or service; (2) Ownership by a Member of the World Alliance for Efficient Solutions; (3) Contribution to at least one of the Sustainable Development Goals (SDGs), namely SDG 6, SDG 7, SDG 9, SDG 11, SDG 12; (4) Minimum maturity level, namely "prototype testing 1:1 in lab" (TRL 6 -7);
- **It is operating in accordance with the Solar Impulse Foundation's ethical position** as expressed by the Membership Agreement;
- **It is compliant with the conditions expressed in the "Liability Waiver Declaration"** signed by the Member in the framework of the labeling process and external reputational check;
- **It has been reviewed and pre-validated** by the Solar Impulse Foundation's team during the pre-screening stage, to ensure minimum standard of quality, in terms of relevance and completeness of the information provided in the application form;
- **It has been assigned and evaluated** according to the official "Label Standards" by three independent Experts with at least five years of Experience in one of the sectors of application of the Solution;
- **It has been assessed and formally validated (accepted)** by three External independent Experts based on the five criteria (credibility of concept, scalability, environmental benefits, client's economic incentive, seller's profitability). In particular, the three independent Experts performed valid assessments, thus provided complete and coherent answers in accordance to the official "Label Standards" and "Assessment Guidelines".
- **It received a minimum of two "YES" answers** from two different Experts on all five criteria, meaning that all the five criteria were satisfied and obtained a majority of "YES". As a result, the Solution does meet the requirements for being awarded the Solar Impulse Efficient Solution Label.

It is important to notice that, the outcome is attributed to the Solution itself and NOT to the entity submitting the Solution (the company).

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## FEASIBILITY

The Feasibility section is aimed at determining the technical viability of the idea behind the Solution, such as ensuring a Solution is feasible in the real world. This section is composed of two criteria and it considers: the technical requirements of the proposed Solution and captures its ability to be credible based on a resilient technology or concept (**Criterion 1**) and its potential to be technically scaled up and deployed in the real world (vs. in a laboratory environment) without additional constraints (**Criterion 2**).

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## EXPERTS REVIEWS

### CRITERION 1 - CREDIBILITY OF CONCEPT

Can the technology behind the Solution be constructed and operated as designed?

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YES

**First Expert justification** - Yes, the concept of the solution is highly credible: combination of UV-C LED and power adjusted to the water flow. the solution aims at producing UV-C light that has been proven to kill nearly 100% of bacteria. The same principle is already used for decades with traditional Mercury Lamps.

YES

**Second Expert justification** - Water disinfection with UV light is a well established concept used since many years. Therefore - maybe oversimplifying - the use of LEDs as UV light source is "just" a replacement of a vapor discharge lamp with one or several LEDs. It is well known that frequent on-off cycles degrade the life time of vapor discharge lamps whereas LEDs are less affected, so it is plausible that the LEDs can be switched on only when needed.

YES

**Third Expert justification** - Yes, the solution is feasible as designed and constructed. Artificially-produced UV-C has been used successfully as a germicide and bactericide for decades. It can kill or disable the growth of micro-organisms like bacteria, viruses and other pathogens, and it provides a chemical- free alternative to other disinfection methods, like using chlorine. The innovation lay on the fact that mercury lamp has been replaced with LED.

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### CRITERION 2 - SCALABILITY

Is the manufacturing (if a product) or distribution (if a service) of the Solution at scale technically feasible?

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YES

**First Expert justification** - Yes, all the parts required to assemble the solution are readily available at industrial scale. The team has already identified potential distribution channel with water treatment retailers. having a way to retrofit LED based UV-lamp into existing installation would bring numerous benefits as well.

YES

**Second Expert justification** - The product consists of industrially manufactured components that can be obtained in usual supply chains. Neither stainless steel fittings for connection, PTFE parts, UV-C LEDs, their power supply, flow sensors, nor required housing components seem difficult to supply.

YES

**Third Expert justification** - Yes, the solution is scalable because the main component UV-C-LED is available on the market for other applications than germicide and bactericide application. The secondary components of the system are easily found in the industry. They just need a minor design adaptation and produce them at large scale on very well established processes.

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**Additional feedback / advice for the member**

**Third Expert -** As the UV-C intensity decreases as a function of the water "thickness", it would be interesting to carefully measure this parameter and design the most efficient system that get the maximum germicide and bactericide effect.

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## ENVIRONMENTAL IMPACT

The **Environmental Impact section** is aimed at determining the impact of the Solution at the different phases of its lifetime: production, transportation and distribution, as well as use and disposal phase.

This section is composed of one criterion and it considers: the potential to enable a direct positive impact (**Criterion 3**) on the environment compared to the mainstream alternative identified – referring to the scope of the following elements: Energy use, CO2 emissions, Water use/materials use, Air quality, Ecosystem preservation.

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## EXPERTS REVIEWS

### CRITERION 3 - ENVIRONMENTAL BENEFITS

**Can the Solution deliver an incremental environmental benefit versus a mainstream alternative, considering the lifecycle (production, use and disposal stages) of its value chain?**

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YES

**First Expert justification** - Yes, absolutely, the described solution delivers obvious environmental benefits with power saving and the absence of fabrication and yearly replacement of mercury lamp. On top, this solution will enable a higher usage of water from rain harvesting for private owners. Rain water harvesting is becoming critical specifically in region impacted by water scarcity.

YES

**Second Expert justification** - Mercury vapor discharge lamps are one of the few exceptions where the use of mercury is still tolerated in spite of WEEE, RoHS and Reach requirements. So any opportunity to avoid mercury is most welcome. Reduced energy consumption because of turning the UV source on only when needed leads to a reduced energy consumption adding to environmental benefits.

YES

**Third Expert justification** - The main environmental benefit is the electricity consumption reduction due to the use of LED UV-C. In fact, mercury lamp does not only produce UV-C but many kinds of waves lengths that do not contribute to the germicide and bactericide effect. Moreover, mercury lamp is more expensive and need more energy to be produced and recycled than LED.

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## PROFITABILITY

The **Profitability section** is aimed at determining the capacity of a Solution to deliver an economic incentive for the client, as well as to generate profits for the seller in a short term. This section is composed of two criteria and it considers: The capacity of a Solution to deliver an economic incentive (direct, indirect, or hidden economic savings) for the client (**Criterion 4**) compared to the mainstream alternative and the capacity of the Solution to generate profits for the seller (**Criterion 5**) in the short term, regardless of the marketing strategy and the novelty of the product.

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## EXPERTS REVIEWS

### CRITERION 4 - CLIENT'S ECONOMIC INCENTIVE

Is the total cost of ownership of the Solution lower (or same) compared to the mainstream alternative? Please evaluate this considering potential hidden benefits for society, and foreseeable regulatory changes within 5 years.

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YES

**First Expert justification** - The cost of ownership for the client has been well described by the team. Their analysis makes sense with a return on investment of about 3 years for the client. With scaling up the production, we would hope the pricing difference vs. traditional mercury UV-Lamp, would then reduce the payback time even further.

YES

**Second Expert justification** - If the cost of the new solution based on UV-C LED technology is comparable to the cost of a traditional UV water disinfection system with a UV mercury gas discharge lamp, over the lifetime of the product total cost of ownership should be lower because of a reduced energy consumption.

YES

**Third Expert justification** - The total cost of ownership is less than the mainstream alternative. The reason comes from the fact that intrinsically LED has a longer lifetime than mercury lamp. Moreover, the LED can support easily to be periodically switched on and off that is also beneficial for the lifetime and very well adapted to the functioning cycle of PearlAqua Deca. Finally, the electricity consumption of the LED is less than the mercury lamp.

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### CRITERION 5 - SELLER'S PROFITABILITY

Could the Solution itself be profitable for the seller within 5 years, with a sale's price at which clients would buy it? Please evaluate this regardless of the marketing strategy and the novelty of the product.

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YES

**First Expert justification** - Yes, the profitability forecast for the seller described indicate a breakeven budget as early as 2021. Moving forward profitability will increase further as the volume of production will increase due to larger purchasing volume for the required parts (reduction of 17% material cost as of December 2020).

YES

**Second Expert justification** - As for all industrially produced items, if the design of the UV-C LED based water disinfection system is similar to the classical alternative (which is highly probable), using economies of scale the material cost and production cost as well as distribution cost should be comparable and therefore also the seller's profitability.

YES

**Third Expert justification** - PearlAqua Deca announced to reach the breakeven in 2021. In light of the LED UV-C technology used and the full support of Nikkiso Inc. on Deep UV-LEDs

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for Quick Water Disinfection, there is no doubts that the profitability for the seller will come in 2021 or in 2022.

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