HYBRID POWER SUPPLY

ID 130843

1. Participation Type - Please select how you are participating in this Challenge:

Solver (Individual)

2. Solution Level – Please select the Technology Readiness Level (TRL) of your solution:

Production ready (TRL 7-9)

3. Partnering - Are you interested in partnering?

Yes

4. Problem & Opportunity – Please highlight the innovation in your approach to the problem, its point of difference, and the specific advantages/benefits this brings (up to 500 words)

It is currently assumed that the existing system consists of a simple diesel powered generator supplying power directly to a pump. Specific technical data of the existing system is not known so an accurate conclusion regarding the operating efficiency is not known. We have however made some assumptions as can be seen in Attachment 1. With the focus on reducing fuel dependency, the proposal revolve around a cost effective solutions to replacing fuel fuel consumption where possible, whilst improving and increasing the operating efficiency of the overall system.

A practical solution to reduce fossil fuel dependency in Syrian irrigation systems is the implementation of a hybrid system. This system consists of three main components: a diesel generator, a battery storage unit, and an electric motor-driven pump). The integration of these technologies can optimize energy use, reduce fuel consumption, and improve the efficiency and reliability of irrigation systems, and overall cost of operation.

Diesel Generator for Battery Charging and split load: Instead of running the diesel generator continuously to directly power water pumps, the generator can be used intermittently to charge a battery storage system. By using the generator in a controlled, optimized manner, it can operate at its most efficient point—when it is under a constant load rather than being throttled to match the varying demands of the pump. This ensures that the generator runs for shorter periods, reducing fuel

consumption, emissions, and wear and tear. Additionally, the intermittent operation of the generator prolongs its lifespan, reducing maintenance costs.

Battery Storage: The battery storage system acts as an energy reservoir, providing continuous power to the irrigation pump even when the diesel generator is off. This decouples the irrigation system's power demand from the generator's operation, allowing more flexible and efficient management of energy. Batteries can store surplus energy produced during times of low demand, ensuring that the pump can operate even during periods when the generator is not running. Moreover, batteries can provide backup power in case of generator failure or fuel shortages, ensuring uninterrupted irrigation.

Benefits of the Hybrid Solution - Fuel Efficiency: By operating the diesel generator only when necessary to charge the batteries, the hybrid system significantly reduces diesel consumption. The generator runs at peak efficiency. Over time, this translates to substantial savings in fuel costs for farmers, as well as a reduction in greenhouse gas emissions.

Solution for the future - the proposal outlines the possibility to expand the hybrid system with solar panels for power generation years after initial install and operation. As can be seen in Attachment 3, the cost savings made by operating as a hybrid solution can be used as a further investment once the payback period of the initial investment has been achieved.

5. Solution Overview – Please describe the features of your solution and how they address the SOLUTION REQUIREMENTS (add supporting data, diagrams, etc. as attachments below) (500 words).

The proposed solution fulfills all the technical requirements of the challenge because it focuses on how to operate in a more efficient way the electric driven submersible pump.

Our assumption for the annual consumption and cost in mentioned in the Attachment 1

The first step of the proposed solution is to install a battery system with inverter to improve the pump operation and reduce the fuel consumption. This new setup should decrease the fuel consumption by at least 30%. Our assumption is also confirmed in the reference paper "Hybrid Diesel Generator – Battery Systems For off- grid rural applications". The solution is shown in Image 1.

Assuming that the solution will be paid back in approximately 4 years, the accumulated savings will help for the procurement and installation of a full solar panel in steps keeping the diesel generator as backup only. A comparison and a Timeline is shown in the attachment 2 and 3. *The solution is shown in Image 1*.

The cost estimations are available in the attachment 4, 5 and 6.

6. Solution Feasibility - Please provide supporting information and rationale, such as references and precedents, that will help the IRC evaluate and validate the feasibility of the solution (up to 500 words)

The existing diesel generator and pump installation may be considered primitive compared to the available technologies available on the industrial market, but it is understandable as it is the most basic and cheapest solution for the application. Advanced solutions as proposed are commonplace in industry, with continued development in the field of energy generation to reduce fossil fuel consumption driven by the focus on sustainability. Many long standing heavy industries such as mining, oil and gas, have facilities dating back decades. Many of these facilities undergo a continuous improvement programme where such focus on reducing energy consumption lead to such solutions as those in this proposal being implemented.

To minimize the capital expenditure, it is intended that the existing diesel generator and pump remains in place. The proposal outlines an extensive and fully complete solution in “stages”. The first stage achieves the goal of reducing fuel consumption. The following “stages” further optimizes the operation and further reduces the fuel consumption, but requiring additional capital expenditure. The savings made from the first stage of the proposal is intended to be used to fund the subsequent stages.

7. Experience – Please describe expertise, use cases, and skills you or your organization may have in relation to your proposed solution, and state your interest in potential partnership (up to 500 words)

The solution has been jointly developed by Sebastiano Levi and Danh Nguyen

Sebastiano Levi: Sebastiano Levi | LinkedIn
Qualifications: Masters Degree in Mechanical Engineering, Project Management Professional awarded by the Project Management Institute,
Experience: over 10 years experience in CAPEX projects in industrial chemical field

Danh Nguyen: Danh Nguyen | LinkedIn
Qualifications: Masters Degree in Mechanical Engineering, Chartered Member of the Institute of Mechanical Engineers, Project Management Professional awarded by the Project Management Institute, Executive MBA awarded by the Quantic School of Business and Technology
Experience: over 10 years experience in CAPEX projects in industrial chemical field

8. Solution Risks – Please describe any risks you see with your solution and how you would plan for this (up to 500 words)

While the hybrid solution offers numerous benefits, several challenges must be addressed for successful implementation. The initial capital investment of approx $4700 for the battery and inverter may be prohibitive for small-scale farmers. Financing options, or international aid programs will be essential to make these technologies accessible.

Moreover, the technical knowledge required to maintain and operate hybrid systems may be limited in rural areas of Syria. Training programs and technical support will be necessary to ensure that farmers can manage the system effectively. Finally, the availability of quality batteries in the Syrian market could pose logistical challenges, requiring coordinated efforts to ensure a stable supply of components. This may require additional effort to source from the international market.

As Syria has been designated a “State Sponsor of Terrorism” since 1979 by the USA and many first world countries, procurement of advanced technological solutions and equipment is extremely difficult and restricted. It will be necessary to engage with internationally recognised organizations such as The Friends of the Syrian People that supports rightful and legitimate aspirations of the Syrian people for a peaceful, democratic, pluralistic and inclusive society, for support, advice and guidance on permitted trade routes and waivers which enable our proposed solutions to be delivered to the end users.

With the numerous sanctions against Syrian in place, there are many opportunistic individuals which permit, whether legally or illegally, trade to be executed. For their services, a premium is charged on top of the usual procurement costs. Where

possible, we would ideally work directly with the end user. Engaging with organizations and NGOs which are active in Syria would provide greater security of delivery without having to go through the middle men.

9. Timeline, capability, and costs – Please describe what you think is required to deliver the solution, including estimated time and cost Please use this dummy Google Sheet template https://docs.google.com/spreadsheets/d/1ZjxtxSy9N4LY8phAHn9v8fO90BBTnPulTKmHJBd4lf0/edit?gid=0#gid=0 to total up your summary, capital, and operating costs and add as an attachment (up to 500 words).

The cost estimations are available in the attachment 4, 5 and 6.

The timeline estimation is available in the attachment 3.

10. Online References – Please provide links to any publications, articles or press releases of relevance (up to 500 words)

"*Hybrid Diesel Generator – Battery Systems For off- grid rural applications" as* attachment 7

Battery vs Diesel Generators: The case for hybrid power | Clean Energy

Hybrid power systems for off-grid locations: A comprehensive review of design technologies, applications and future trends - ScienceDirect

11. How did you find this Challenge? – please indicate what drew you to this Challenge, including any relevant advertising or marketing that you followed to this Challenge.

We found out about this challange by reading an article about the Wazoku plattform.