**Photovoltaic (PV) panels in Solar water purification**

**PART 1**

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| no | Design Criteria | Satisfy expected design criteria | Tick ( ) |
| 1 | At least use minimum 3 different approaches’ | Analyse (conducting a detailed analysis of the water quality in Yuendumu at a localized scale. It focuses on understanding the specific contaminants present in the local water source and tailoring the water treatment system accordingly. The analysis is typically conducted at the community level or specific water sources within the community.) | Y |
| Reduce (reducing the presence or concentration of contaminants in the water through treatment processes, such as filtration, disinfection, and sedimentation. The reduction is typically achieved at the point of water treatment or purification, and the scale is generally localized to the community or specific water source being treated.) | Y |
| Eradicate () |  |
| Prevent () |  |
| Predict (using predictive models, monitoring, and data analysis to forecast potential water quality issues or contamination events. Predictive models can help identify trends, patterns, and potential risks in water quality, allowing for timely interventions and preventive measures. The scale of prediction can vary, from localized predictions for specific water sources or communities, to regional or larger-scale predictions for broader areas.) | Y |
| 2 | At least use 1 or 2 different technologies | Example 1 (4G/5G technology) May be used in Remote monitoring, control, troubleshooting and diagnostics, Cloud-based Data Analysis, Mobile Apps for User Interface, … | Y |
| Example 2 (IoT) IoT can be used to remotely monitor and manage solar-powered water purification/filtration systems. Sensors can be deployed to collect data on water quality, system performance, and maintenance needs. This data can be transmitted wirelessly to a central system for real-time monitoring and analysis, allowing for timely interventions and optimizing system efficiency. | Y |
| Example 3 (RFID - Radio Frequency Identification) RFID technology can be used for inventory management, tracking, and maintenance of components and spare parts used in solar water purification/filtration systems. It can help streamline the supply chain, improve maintenance scheduling, and ensure timely replacement of parts, thus enhancing system reliability and performance. | Y |
| Example 4 (choose your own) |  |
| Example 5 (choose your own) |  |
| 3 | At least use 3 or more different devices | Example 1 (Sensor) Smart sensors can be used to monitor various parameters, such as water quality, flow rates, pressure, and system performance. This includes Water Quality Sensors, Flow Sensors, Solar Irradiance Sensors, Temperature Sensors, … | Y |
| Example 2 (IoT device) This includes IoT-based Remote Monitoring and Control Systems, IoT-enabled Water Dispensing and Billing Systems, IoT-based Predictive Maintenance Systems, … | Y |
| Example 3 (Supercapacitors’ device) This includes Solar/Wind energy Storage System, Power Backup System, Power Conditioning System, Voltage Stabilization System, Start-up Power System, … | Y |
| Example 4 |  |
| Example 5 |  |
| 4 | At least list minimum 3 benefits | Benefit 1: Renewable and Sustainable Energy Source: PV panels harness the power of sunlight to generate electricity, making them a renewable and sustainable energy source. | Y |
| Benefit 2: Long-term Saving: While the initial installation cost of PV panels may be relatively higher, they offer long-term pros. | Y |
| Benefit 3: Energy Independence and Reliability: PV panels provide a decentralized and independent source of electricity, reducing dependence on the grid or other external energy sources. | Y |
| 5 | At least list minimum 3 Impacts | Impact 1: Environmental impacts: PV panels are a clean and renewable source of energy, producing electricity without emitting harmful greenhouse gases or air pollutants. | Y |
| Impact 2: Social impacts: Access to clean and safe drinking water is a fundamental human right and plays a crucial role in improving public health and well-being. | Y |
| Impact 3: Economic impacts: While the initial installation cost of PV panels may be higher, they can offer long-term economic benefits. | Y |
| 6 | At least list minimum 3 guiding principles | Access & equity: Ensuring equitable access to clean and safe drinking water powered by PV panels is essential. | Y |
| Health & safety |  |
| Appropriateness |  |
| Affordability |  |
| Environmental health: Consideration of environmental health is crucial in designing and implementing PV-powered water purification/filtration systems. | Y |
| Sustainable livelihoods: Ensuring that the use of PV panels in water purification/filtration systems contributes to sustainable livelihoods for the local community is important. | Y |
| 7 | At least list minimum 2 Constraints | Constraints 1: Cost: The cost of PV panels and associated equipment, such as batteries, inverters, and controllers, can be a significant constraint, especially for communities with limited financial resources. | Y |
| Constraints 2: Maintainance and Operation: PV panels require regular maintenance and operation to ensure optimal performance and longevity. | Y |

**PART 2**

**Benefits:**

1. Renewable and Sustainable Energy Source: Unlike fossil fuels, which are finite and depleting, sunlight is abundant and freely available, making PV panels an environmentally friendly choice for powering water purification/filtration systems. By utilizing PV panels, the reliance on non-renewable energy sources can be reduced, leading to a more sustainable and eco-friendly solution.

2. Long-term Saving: Once installed, PV panels require minimal maintenance and have low operating costs as they do not require fuel or have moving parts. Additionally, PV panels have a long lifespan of typically 25-30 years or more, allowing for long-term savings on electricity bills. PV panels can also provide an opportunity for revenue generation through feed-in tariffs or net metering, where excess electricity generated by the panels can be fed back to the grid or stored for later use, resulting in potential financial benefits.

3. Energy Independence and Reliability: This can be particularly beneficial for remote or off-grid locations, such as the Yuendumu Indigenous Community, where access to electricity may be limited or unreliable. PV panels can provide a reliable and consistent source of electricity, ensuring continuous operation of the water purification/filtration system even during power outages or disruptions. This can lead to increased energy independence, improved system reliability, and reduced risks of water shortages or disruptions due to power failures.

**Impacts:**

1. Environmental impacts: By using PV panels to power water purification/filtration systems, the reliance on fossil fuels and other non-renewable energy sources can be reduced, resulting in a positive environmental impact. PV panels also do not consume water during electricity generation, unlike some conventional power generation methods, which can have significant water usage and environmental impacts. Overall, using PV panels can contribute to mitigating climate change, reducing air pollution, and conserving water resources.

2. Social impacts: By using PV panels to power water purification/filtration systems, communities, especially those in remote or off-grid areas like the Yuendumu Indigenous Community, can gain access to clean and safe drinking water. This can lead to improved health outcomes, reduced waterborne diseases, and enhanced quality of life. PV panels can also provide opportunities for skill development, job creation, and economic empowerment through local installation, operation, and maintenance of the PV systems, resulting in positive social impacts for the community.

3. Economic impacts: By reducing or eliminating the reliance on expensive fossil fuels for electricity generation, PV panels can result in cost savings on electricity bills, especially in remote or off-grid areas where access to electricity may be limited or costly. PV panels can also provide opportunities for revenue generation through feed-in tariffs or net metering, where excess electricity generated by the panels can be fed back to the grid or stored for later use, leading to potential economic gains. Additionally, PV panel installations can stimulate local economies through job creation, investment, and infrastructure development, resulting in economic growth and development.

**Guidelines:**

1. Access & equity: This includes making sure that the technology is accessible to all members of the community, regardless of their socio-economic status, geographic location, or cultural background. It also involves addressing any potential barriers or inequalities in terms of installation, operation, and maintenance of the PV systems, and ensuring that the benefits are shared equitably among community members.

2. Environmental health: This includes using environmentally friendly materials in the production, installation, and maintenance of PV panels, as well as ensuring that the systems are designed and operated in a way that minimizes potential negative impacts on the environment, such as water usage, waste generation, and pollution. Additionally, proper disposal and recycling of PV panels at the end of their lifespan should be taken into account to minimize environmental impacts.

3. Sustainable livelihoods: This includes considering the economic viability of the technology, as well as providing opportunities for local job creation, capacity building, and skill development in PV panel installation, operation, and maintenance. The systems should be designed in a way that supports long-term sustainability and resilience of the local livelihoods, and fosters economic empowerment and self-sufficiency within the community.

**Constrains:**

1. Cost: PV panels can be expensive to purchase, install, and maintain, which may pose challenges in terms of affordability and cost-effectiveness for some communities, particularly those in low-income or marginalized areas.

2. Maintainance and Operation: This includes cleaning, monitoring, and repairing or replacing components as needed. In remote or hard-to-reach areas, accessing and maintaining PV panels may be challenging, leading to potential constraints in terms of logistics, technical skills, and availability of spare parts.