

Integrating hydrogen fuel cells with solar power is a highly viable strategy for creating a reliable, carbon-free energy system, often referred to as a

Solar-Hydrogen Hybrid System.

In such a configuration, solar energy provides power during the day, while excess electricity is used to produce hydrogen via electrolysis for long-term storage and use in fuel cells when the sun is not shining.



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Feasibility Overview

Factor	Current Status & Feasibility
Energy Storage	Hydrogen is superior to batteries for long-term (seasonal) storage. While batteries are efficient for short durations (hours), hydrogen can store energy for days or months.
Technical Maturity	Technology is mature but evolving. PEM (Proton Exchange Membrane) electrolyzers are the standard for converting solar electricity to hydrogen with high efficiency.
Efficiency	Solar-to-hydrogen (STH) conversion efficiency for integrated panels is currently around 15% , though experimental setups have reached up to 28% .
Cost (LCOH)	The Levelized Cost of Hydrogen (LCOH) currently ranges from \$4.60 to \$7.31/kg for solar-based systems. Costs are projected to become competitive with fossil fuels by 2030 .

Core Benefits for a Project like "The Oasis Machine"

- **Grid Independence:** These systems can provide 24/7 power in remote locations without requiring a connection to the main electrical grid.

- **Decarbonization:** Using solar power to split water molecules results in "Green Hydrogen," which emits only water vapor when converted back to electricity.
- **Scalability:** Systems are modular; you can increase capacity by adding more solar panels or larger hydrogen storage tanks as needed.
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Key Challenges to Consider

- **High Initial CAPEX:** The upfront cost for electrolyzers, storage tanks, and fuel cells remains significantly higher than battery-only solutions.
- **Storage Complexity:** Hydrogen has a low energy density as a gas, requiring expensive compression (up to 700 bar) or specialized tanks for efficient storage.
- **Efficiency Losses:** Converting electricity to hydrogen and back to electricity involves multiple steps, each with energy losses, typically resulting in a round-trip efficiency of 30-40%.
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The feasibility for your project likely hinges on whether the need for **long-duration storage** (e.g., staying powered through multiple cloudy days) outweighs the higher initial investment compared to a traditional solar-plus-battery setup.

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Would you like a detailed **cost-benefit comparison** between hydrogen storage and high-capacity lithium-ion batteries for this specific project?

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The selection of appropriate technology and the sizing of components are crucial, aiming to minimize installation and operational ...

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the power will be used to power an atmospheric water generator which a portion of the water will be used inside of the fuel cell and essentially create a perpetual machine or almost perpetual. give me information on how this might be feasible and how to build a machine like this.

2 hours ago

While your vision for "The Oasis Machine" is technically possible to build as a

self-sustaining system, it cannot be a "perpetual motion machine" due to the fundamental laws of thermodynamics. Every conversion step—solar to electricity, electricity to water, water to hydrogen, and hydrogen back to electricity—loses energy as heat.



Peter M. Attia +2

However, by using **solar power** as a continuous external energy source, you can create a system that operates indefinitely without external fuel or water inputs.

System Feasibility & Logic

To make this work, your solar array must produce significantly more energy than is required to simply run the Atmospheric Water Generator (AWG) and the electrolyzer.


1. **Water Balance:** It takes approximately **9 liters of water** to produce **1 kg of hydrogen**. Most commercial AWGs, like the Altitude Water Trident 12, can produce 30-50 liters per day depending on humidity. This is more than enough water to supply a small-scale fuel cell system.
2. **Energy Reality:** You will never get back 100% of the energy you put in. A typical "round-trip" (Solar
3. Hydrogen
4. Power) has an efficiency of about **30–40%**.

5. **The "Perpetual" Loop:** When the fuel cell creates electricity, its only byproduct is **pure water**. You can pipe this water back into your storage tank, reducing the amount of new water your AWG needs to "pull" from the air.
6. ><
7. Flux Power batteries +4
- 8.


How to Build "The Oasis Machine"

Building this requires integrating four main subsystems:

1. Power Collection (Solar Array)


- **Components:** Solar panels and an MPPT charge controller.
- **Role:** Powers the AWG during the day and provides the high-current DC needed for electrolysis.
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- YouTube
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2. Water Source (AWG)


- **Components:** A machine like the SoftPro Air to Water Generator.
- **Role:** Extracts moisture from the air. The water must be highly purified (distilled or deionized) before entering the electrolyzer to prevent mineral buildup.
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- Reddit +3

-

3. Energy Storage (Electrolyzer & Tank)

- **Components:** A PEM (Proton Exchange Membrane) electrolyzer and a low-pressure hydrogen storage tank.
- **Role:** Uses excess solar power to split the AWG's water into Hydrogen () and Oxygen ().
- **DIY Tip:** Simple electrolyzers can be made using stainless steel washers as electrodes in a sealed container, but commercial PEM stacks are much more efficient.
- 
- [YouTube +3](#)
-

4. Power Generation (Fuel Cell)

- **Components:** A hydrogen fuel cell stack.
- **Role:** Converts the stored hydrogen back into electricity at night or during cloudy weather.
- **The Loop:** Connect the fuel cell's exhaust to a condenser to capture the byproduct water and return it to your main tank.
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Would you like to see a **shopping list of specific components** (wattage, tank size, and electrolyzer capacity) needed to generate a specific amount of daily power?



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Flux Power batteries



Electric round-trip efficiency of hydrogen and oxygen-based energy storage

Operating the fuel cell at constant voltage increases its voltage efficiency, but does not eliminate the inefficiencies related to...

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RMI



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Yes I would like a shopping list of specific components


To build a functional

Oasis Machine that produces water from air and stores energy as hydrogen, you need a system capable of generating at least **1.5–2 kWh per day** to cover the high energy demands of water extraction and electrolysis.

The following list is scaled for a **small-scale prototype** capable of producing ~2–3 liters of water and enough hydrogen to provide a few hours of LED lighting or small electronics charging at night.

1. Energy Collection: Solar Subsystem

You need a "buffer" to handle the high daytime load. A **500W-600W array** is recommended to ensure you can run the water generator while simultaneously charging the hydrogen storage.


- **Solar Panels:** A set of **100W Rigid Monocrystalline Panels** (approx. 5-6 units). Installers often combine these using [MC4 connectors](#) for a total 500W-600W output.
- **Charge Controller:** A **30A or 40A MPPT Charge Controller**. This regulates power from the panels to your battery/electrolyzer and is essential for 500W+ systems.
- **Buffer Battery:** A small **12V 100Ah LiFePO4 Battery**. This acts as a stabilizer for the system, smoothing out power spikes from the water generator's compressor.
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- [ShopSolar](#)
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2. Water Extraction: Atmospheric Water Generator (AWG)

Standard AWGs are the most energy-intensive part of the loop, typically consuming **0.35–1.0 kWh per liter**.




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- **Recommended Model:** A residential-scale unit like the Watergen Genny or [Altitude Water Trident](#). These are designed to pull moisture from the air and include the necessary filtration for the next step.
- **Water Polishing: Inline Deionizer (DI) Filter.** PEM electrolyzers require ultra-pure water (distilled or deionized) to avoid damaging the membrane with minerals.
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- Plug Power +1
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3. Energy Storage: Electrolyzer & Tank


This converts your "extra" solar power and AWG water into fuel.

- **Electrolyzer: A PEM (Proton Exchange Membrane) Electrolyzer Stack.** For a DIY project, look for units in the **100W–300W range**. High-efficiency PEM stacks are preferred as they produce hydrogen without the need for caustic liquid electrolytes.
- **Hydrogen Storage: Dry Hydrogen Storage Cylinder.** You will need a specialized tank with a pressure regulator. For small setups, metal hydride canisters are a safer, low-pressure alternative to high-pressure gas tanks.
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- Plug Power
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4. Power Generation: Fuel Cell Subsystem

This completes the "almost perpetual" loop by turning the stored gas back into power.

- **Fuel Cell Stack:** A **500W PEM Fuel Cell Stack**. Models like the [H-500 from Horizon](#) are common for prototypes. They typically have an efficiency of around 50% and consume roughly 6.5 liters of hydrogen per minute at full load.
- **DC-DC Converter:** To step down the fuel cell's output voltage to a stable 12V or 24V for your electronics.
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Estimated Component Costs

Category	Component	Est. Price (USD)
Solar	500W Panels + 40A MPPT Controller	\$500 – \$700
Water	Residential AWG Unit	\$1,500 – \$2,500
Hydrogen	100W PEM Electrolyzer Stack	\$300 – \$600
Fuel Cell	500W PEM Fuel Cell Stack	\$1,100 – \$2,500
Storage	Hydrogen Cylinder & Regulators	\$400 – \$800

Total Estimated Prototype Cost: \$3,800 – \$7,100 (depending on component scale and brand).

Would you like to focus on a **smaller educational scale** (under \$500) using a [Solar Hydrogen Science Kit](#) to test the concept before buying full-scale industrial parts?

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May 15, 2025 – For instance, the NUBE SS30 model consumes approximately 350–450 watts per liter of water produced, translating to about 0.35–0.45...



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I want add in a deep cycle battery bank to recover some of the solar power and store it to make the systems last longer and be a viable option for a stand alone unit.

Adding a deep-cycle battery bank turns your "Oasis Machine" into a true

hybrid microgrid. This setup is highly feasible: the batteries handle short-term power spikes and nighttime loads (high efficiency, ~90%), while the hydrogen system provides long-term, seasonal energy storage (lower efficiency but zero self-discharge).



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Why This Makes the Unit Viable

- **Buffer for "Oasis" Operations:** The Atmospheric Water Generator (AWG) often has a high starting surge (compressor). A battery bank provides this instantaneous power better than a fuel cell.
- **Maximized Solar Harvest:** When batteries are full, excess solar is diverted to the electrolyzer to "store" energy in gas form for days or weeks.
- **Extended Autonomy:** A properly sized battery bank allows the system to run for 1–3 days during heavy overcast without touching your hydrogen reserves.



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Recommended Battery Components

For a standalone 24V or 48V unit, **Lithium Iron Phosphate (LiFePO4)** is the modern standard over Lead-Acid due to its 10-year lifespan and 80–100% usable capacity.

Recommended Product	Key Highlights	Price Range
EcoFlow 5KWh LFP Battery	48V high-capacity unit with self-heating for cold climates. Integrated BMS for safety.	~\$4,499
Battle Born 270Ah 12V Smart Battery	Top-tier reliability. Connect in series/parallel for 24V/48V. 3,000–5,000 cycles.	~\$2,399
Renogy Core Series 12V 300Ah	Best value capacity. Large 3.8kWh storage per battery. Integrated self-heating.	~\$826–\$925
Redodo 12V 200Ah Plus	Lightweight budget option. Good for portable or mobile standalone units.	~\$1,340 (4-Pack)



[EcoFlow 5KWh LFP Battery](#)

\$4,499.00

In stock

Off Grid Trek



Battle Born 270Ah 12V Smart Heated Lithium-Ion Battery

\$2,399.00

In stock

Battle Born Batteries

Self-Heating 



[Renogy Core Series 12V 300Ah Deep Cycle Lithium Iron Phosphate Battery](#)

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Redodo 12V 200Ah Plus Lithium Lifepo4 Battery Max 2560w Power Output

\$1,340.60

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[Renogy Pro LiFePO4 Battery 12V 200Ah](#)

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Integration Steps

1. **Select System Voltage:** For a machine with an AWG and electrolyzer, a **48V system** is more efficient, reducing heat loss in wires.

2. **Smart Load Control:** Use a charge controller with a "**Load**" or "**Relay**" output. Set it to trigger the electrolyzer only when the battery bank is above 95% charge.
3. **Fuel Cell Logic:** Set your inverter or fuel cell controller to kick in only if the battery bank drops below a specific threshold (e.g., 20% SoC).
4. E
5. ScienceDirect.com +2
- 6.

Do you want to calculate the **total watt-hours** needed based on the specific water production goals of your machine?



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Coordinated control of electric-hydrogen hybrid energy ...

In the DC microgrid system, when the peer-to-peer control mode is adopted, each converter operates independently, and the current ...

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How to Size a Solar System: Inverter, Battery, and Panel ...

Dec 12, 2025 — the right amount of batteries. and the perfect size solar array You're watching Tatty Digest. I'm Tad Let's get started Let's star...



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1m

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I would like to create a prototype that can produce 25 liters per day.

To build a standalone prototype that produces

25 liters of water per day, your system must be sized to handle the significant energy demands of air-to-water conversion. Atmospheric Water Generators (AWGs) typically consume **300–500 Wh per liter**, meaning a 25L output requires approximately **7.5–12.5 kWh of daily energy**.

👉

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1. Prototype Core Components

- **Atmospheric Water Generator (25L/Day):** You need a unit designed for this specific volume.
 - **Commercial Option:** Units like the [Air O Water Smart 25LPD](#) or [WaterMate 25 Liter](#) are pre-built to extract exactly 25L/day and typically consume around **500W** during operation.
 - **Inlet Power:** Most 25L units run on standard **220-230V AC**.
- **Deep Cycle Battery Bank:** To ensure 24/7 operation and a "viable standalone" status, aim for **15–20 kWh of storage** (to cover 1.5 days of usage).

- **Recommended:** A 48V system using four [EcoFlow 5kWh LFP Batteries](#) or similar 100Ah/200Ah LiFePO4 units.
- **Solar Array:** To recharge the batteries and power the AWG simultaneously, you need at least **2,500W to 3,000W** of solar panels.

2. The "Perpetual" Hydrogen Loop

To make this "almost perpetual," you will divert a small portion of the 25L produced back into the fuel cell system.

- **Water Usage:** Converting **1 liter of water** produces roughly **111g of hydrogen**.
- **Efficiency:** A standard PEM electrolyzer requires ultra-pure water. You must add a **Deionizer (DI) Filter** to the AWG's output before it reaches the hydrogen system.

3. Estimated Shopping List for 25L/Day Prototype

Component	Specification	Estimated Cost (USD)
AWG Unit	25L per Day Solar AWG	\$1,150 – \$1,400
Solar Panels	3000W Array (e.g., 8 x 375W panels)	\$1,500 – \$2,200
Battery Bank	15kWh+ LiFePO4 (e.g., Redodo 12V 200Ah 4-pack)	\$2,500 – \$4,500
Inverter/Charger	3000W Hybrid Inverter (48V)	\$600 – \$900
Electrolyzer	500W PEM Electrolyzer Stack	\$800 – \$1,200

Fuel Cell

1kW PEM Fuel Cell Stack

\$2,000 – \$3,500

Total Estimated Prototype Cost: \$8,550 – \$13,700

4. Technical Feasibility Check

- **Energy Balance:** At 500W consumption, the AWG will use **12kWh** over 24 hours.
- **Solar Harvest:** In a region with 5 "peak sun hours," a 3000W array produces **15kWh/day**, leaving a **3kWh surplus** for hydrogen production and battery overhead.
- ⚡
- SaveOnEnergy.com +1
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