H-RESs – Optimizing Storage

Hydrogen based Renewable Energy Storage system

Powered By Nature

Renewable energy is 'variable' as a primary source of power, with no power when you need it, or too much at the wrong time. As a result, Solar PV systems are sized for the worst season of the year. Batteries may be efficient at storing energy, but the real issue is the cost and efficiency of charging these, while at the same time providing the autonomy needed.

Batteries are also the 'Achilles Heel' of many renewable energy projects as they are prone to temperature, limited by cycling, DOD, slow rate of charging, suffer from capacity loss and are frequently substituted every few years. We need to use technology that exploits Hydrogen fuel's potential as a 'energy store', in combination with renewables.

H-RESs produces Hydrogen during periods when the available energy from renewables is in excess of the needs of the load, typically during solar peak hours and in the summer seasons.
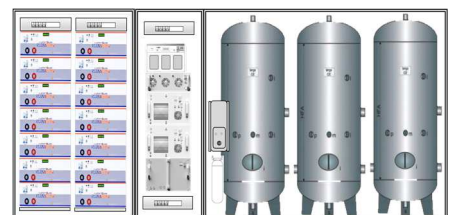
H-RESs uses Hydrogen to produce electricity during periods in which the available energy from renewables is available in quantities less than the needs of the load, typically during the winter seasons.

H-RESs collects Hydrogen during times of the day when the energy production is low, thus maximizing renewable efficiency. Typically, early morning and late evening when PV production tapers off and is not suitable for typical battery charging regimes.

H-RESs is a storage technology which can integrate into any existing PV, Wind or Hydro based renewable energy systems.

H-RESs can be used for both backup power and peak shaving. The former enables your business to avoid downtime due to power outages while the latter reduces your electric utility bill by making sure you get the most out of your solar power.

H-RESs consists of the following interchangeable components connected to any renewable energy source solar LTs (long term) storage + STs (short term) + SDEMS (control electronics).

System Components

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Long Term Storage (LTs), a "Self-Recharging" fuel cell & Storage Vessels which allows users to get rid of Diesel Generators, thus eliminating fuel logistics, heavy maintenance, frequent substitution & fuel price uncertainty.

Short Term Storage (STs), supercapacitor-based energy storage system. LTs is a safe, efficient and effective alternative to chemical batteries. No oversizing for DOD, Temperature, efficiency loss, slow rate of charge. You size according to your daily load needs.

Hydrogen Storage (LT's)

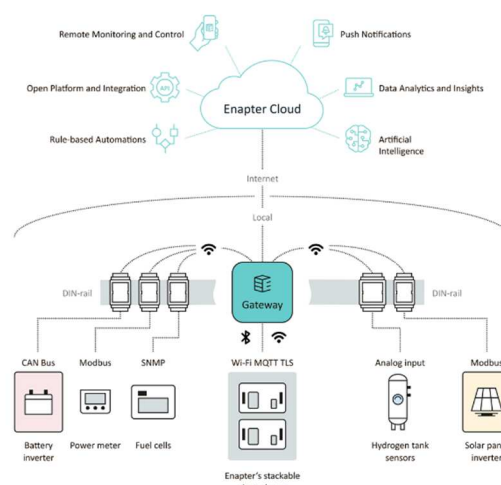| 1m3 Steel Vessel	1.5m3 Steel Vessel	12 Magazine Cluster
35m3 / 50kWh	52.5m3 / 75kWh	126m3 / 180kWh
In 50kWhincrements 1m3 In 75kWh increments 1.5m3 vessel @ 35 Bar		180 kWh increments using a 9-cylinder magazine

SuperCap Storage (STs)

Super Cap.
3.55 kWh Module
7.1 kWh Module
7 *3.5kWh modules or 6 * 7.1kWh / per cabinet

There is no limit on either STS or LTS size and capacity configurations and you can have multiple variations of both.

Software Defined Energy Management System (SDEMS).

The singular solution for power management. SDEMS is a comprehensive, fully integrated, power electronics hardware and software platform that delivers utility grade power from any combination of DC or AC sources including 100% renewable generation and storage. With SDEMS, there is no requirement to integrate multi-vendor equipment to manage MPPT, PV charging, Inverting, safeties, switching, control, logging and monitoring.
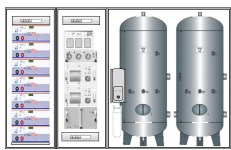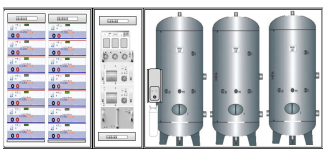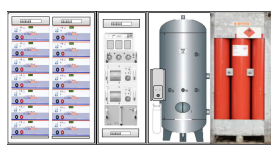
Sizing H-RESs

Size the Solar PV and Energy Storage for a normal 24-hour day

1. Solar PV and management of power to the loads, will be managed by SDEMS
2. During normal PV generation days, energy to the load will be provided by STs.
3. During low PV generation days, autonomy provided by Self Recharging Fuel Cell (SRFC) using energy already harvested and stored in the LTs.
4. The SRFC will act as a backup system used to top up STs, if PV or renewable source cannot maintain 100% charge by the end of the day.
5. SDEMS will track the STs voltage level and will activate to carry the load (and charge the STs) when the voltage level reached a certain set point.

SDEMS is an AI based system with a rules engine and will 'learn' by collecting and analyse data to predict whom and when energy is needed.

✓ Communication between components will enable exchange of energy at the right time and at the most reasonable cost making the total microgrid sustainable and more reliable. As PV is normally sized for the worst weather season, this excess power potential available for Hydrogen Production during the best weather season.
✓ H2 is the lowest cost storage medium potentially offering unlimited autonomy.

Example Configurations

STs 7.1 kWh	STs 28.8 kWh	STs 49.7 kWh	STs 49.7 kWh
LTs 50 kWh	LTs 100 kWh	LTs 150 kWh	LTs 280 kWh

Enclosure Options

Outdoor Cabinet	Container	Shelter

Sizes of commercial solar systems

10 kW	Produces an average of 1,082-1,250 kWh per month Best suited for a building with an estimated roof of 2,500 sq ft.
20kW	Produces an average of 2,165-2,500 kWh per month Best suited for a building with an estimated roof of 5,000 sq ft.
40kW	Produces an average of 4,330-5,000 kWh per month Best suited for a building with an estimated roof of 10,000 sq ft.
120kW	Produces an average of 13,000-15,000 kWh per month Best suited for a building with an estimated roof of 30,000 sq ft.
240kW	Produces an average of 26,000-30,000 kWh per month Best suited for a building with an estimated roof of 60,000 sq ft.