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Newsletter of the Sustainable Energy Industry Association of the Pacific Islands

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COP28: Key Takeaways from this year's climate change conference

(Article extracted from: https://www.afghanaid.org.uk/)

Caption: Noticeable impacts of Climate Change in Tuvalu

From November 30th-12th of December, COP28 brought together 84,000 people, including delegates from all 199 Parties to the UN Framework Convention on Climate Change, to action meaningful change to tackle the ever-worsening climate crisis. 2023 has been the hottest year on record, with countries across the world facing devastating disasters induced by changing weather patterns and rising temperatures, only reinforcing the need for wide-ranging interventions to protect our planet. For countries disproportionately impacted by climate change, such as Afghanistan, this need is even greater. So, what has been achieved at this year's COP28?

1. Loss and Damage Fund

After extensive discussion around the creation of a Loss and Damage Fund last year, the initiative has finally been greenlit. This fund will pay for the loss and damages caused by climate-related disasters including floods, droughts, hurricanes, and other extreme weather events. Parties within COP have pledged $700 million in funding to help lower-income countries recover from the effects of climate change, with the United Kingdom committing just over $75 million. While this is a huge milestone for climate justice, the funding still falls extremely short of what climate-vulnerable populations will need to rebuild their homes, livelihoods and communities when climatic disasters inevitably strike.

2. Fossil Fuel Non-Proliferation Treaty

The Fossil Fuel Non-Proliferation Treaty is a proposed international agreement aimed at addressing the global challenges of climate change by phasing out coal, gas, and oil and laying the foundation for greater use of renewable energy. Treaty members, including the World Health Organization, declare that a transition to renewable energies is not just an option, but rather, necessary for the survival of the planet, as fossil fuel emissions make up 75% of global gas emissions annually. This will be key in stemming the increasing rise in global temperatures, especially in countries like Afghanistan, where the temperature has risen by 1.8°C between 1950 and 2010, twice the global average.

3. Food and Agriculture Declaration

More than 130 world leaders have endorsed the "Emirates Declaration on Sustainable Agriculture and Food Systems", which highlights the crucial intersection of climate change and global food systems. This declaration sets a global commitment to adopt more sustainable agricultural practices, cutting carbon emissions within the food system, and promoting food security, all whilst promoting the UN Sustainable Development Goals.

4. Climate, Relief, Recovery, and Peace Declaration

One of the final achievements of the conference was the COP28 Declaration on Climate, Relief, Recovery, and Peace. It outlines a non-binding call to action for governments, international organizations, financial institutions, and other stakeholders to collectively address climate resilience in highly vulnerable countries and communities, especially those affected by conflict and severe humanitarian needs

An analysis of the 10MW Butoni Wind Farm in the Tropical SW Pacific Island of Fiji

(Extracted from: Wind Engineering Volume 46, Issue 4; February 2, 2022)

Caption: Butoni Wind Farm (PC: Energy Fiji Limited)

This study carried out an analysis of the 10 MW Butoni wind farm in the tropical southwest Pacific Island of Fiji using 6 years of uninterrupted near-surface wind observations (2013-2018). The standard wind-industry software, WAsP is used to analyze and evaluate the wind characteristics of the wind farm and the surrounding areas. The modelled and operational annual energy production (AEP) are discussed with the related economic analysis together with the main causes for the under-performance of the wind farm. The results revealed that the mean wind speed, power density and the AEP at the Butoni wind farm are below the utility-scale standard of 6.4 m/s, 300 W/m^2 and 500 MWh/year/turbine respectively, at 55 m above ground level (AGL). The main reason for the under-performance of the wind farm is that it was commissioned for *a low mean wind speed regime* of Wind Power Class 1. The wind farm has a lower-than-expected capacity factor of 5.4% and a higher wind shear coefficient of

0.35. An economic analysis revealed that the payback time is 24.5 years, and the cost of energy generation is FJD $ 0.55/kWh.

Note: Commissioned in 2008. 37 Turbines (assuming average wind speeds of 5.47m/s) each generating a capacity of 275kW, for a combined total of approximately 10MW. From 2012 – 2021, output dropped regularly from 6809 MWh (2012), 5674 (2015), 2558 (2018), 1136 (2020) to 293 (2021) 2021 = 4% of 2012 output. (The 0.7 MW Somosomo hydro ≈ 2,500 MWh or 25 x 10 MW Butoni wind output).

A Fiji Submission to Climate Investment Funds on Renewable Energy Integration

On 3 October 2023, Fiji's Ministry of Finance held a *Stakeholder Consultation Workshop on Fiji's Draft Renewable Energy Integration Investment Plan,* which was to be submitted to Climate Investment Funds (CIF; cif.org) for consideration 6 October. SEIAPI Executive Committee member Peter Johnston was invited, participated, and on 4 October, provided written comments to the Ministry Finance.

The draft plan sought finance and technical assistance for investments to enhance the flexibility of Fiji's energy system that allow for the integration of variable renewable energy, and for greater access to renewable energy in areas with limited connectivity. There are two components: 1) to create a 'Green Energy Circuit' on Viti Levu, and 2) further electrifying the outer islands, plus a range of targeted technical assistance.

The draft plan should be available from: https://fijiclimatechangeportal.gov.fj/ppss/climate-investment-funds-cif-renewable-energy-integration-rei-investment-plan-ip/. If not, it can be obtained from the SEIAPI Secretariat. The submission to the Ministry of Finance is available at SEIAPI.com. As there was insufficient time for the Executive Committee to review it, the submission is not formally from SEIAPI. The final plan as submitted to CIF is not yet online.

On 10 October, the CIF considered and endorsed Fiji's revised submission as summarized by the CIF below:

CIF Endorses Renewable Energy Integration in Fiji

Abridged and slightly edited from: https://www.cif.org/news/cif-endorses-100-million-energy-integration-costa-rica-and-fiji (10 November 2023)

The governing board of the Climate Investment Funds (CIF) has endorsed a wide-ranging investment plan to transform the energy system of Fiji and help enable the grid system to absorb and channel more clean power. The plan represents a first-of-its-kind effort, with funding in highly concessional capital to scale clean energy transmission solutions, enhance the flexibility of energy systems, and finance other efforts to make integrating renewable energy more flexible, cost-efficient, and resilient. Fiji received US$30.51 million (about F$68 million) as an initial allocation, funded through CIF's Renewable Energy Integration (CIF REI) investment program.

As a Small Island Developing State, Fiji wants to grow solar generation and has ambitious goals to achieve 100% renewable energy generation by 2036, with net zero annual GHG emissions by 2050. Fiji's plan, supported by the Asian Development Bank (ADB), the International Finance Corporation (IFC), and the World Bank, will help upgrade transmission lines and power stations throughout the country, create new solar plants on Fiji's largest island, provide technical assistance on energy grids and systems, and finance the electrification of outer islands — bringing electricity access to rural communities. At full implementation, Fiji plans to increase renewable energy generation capacity by 40 MW and provide an additional 91,104 MWh of renewable energy output per year by 2026; connect 200,000 people to the grid; provide 7,000 Fijians on the outer islands with more affordable, reliable, and clean energy by 2026; and reduce emissions by 50,000 tCO2e per year by 2026.

New Zealand aims for an emissions-free power grid

In New Zealand, renewable energy accounted for 81% of electricity generation in 2020 rising to 87% by 2022. The opposition right-wing National Party – which opposes the target of 100% RE to the grid by 2030 target – looks set to lead the next government. Nonetheless, the current Labour government has established a NZ$2bn (US$1.2bn) fund to attract private sector investment to deliver the goal. It is the first in New Zealand to specifically target private finance for climate infrastructure.

"This fund will accelerate New Zealand's emissions reductions, with a particular focus on our path to 100% renewable electricity. This will unlock technology such as battery storage, wind and solar generation, green hydrogen production and more electric vehicle chargers," said Minister of Energy and Resources Megan Woods.

Crown-owned New Zealand Green Investment Finance (NZGIF) has launched a solar loan programme which will initially finance the country's largest residential power purchase agreement (PPA) portfolio, managed by New Zealand's solar Zero. According to NZGIF, "It can be difficult to bring large-scale finance to opportunities like [residential solar], primarily because of the disaggregated nature of it. So, it is important to work with operators who are experienced and who can do all of that on the ground installation, management, and maintenance." In 2022, the share of solar in the overall electricity mix – less than 1% – is "surprisingly low". With a huge amount of hydro, there's a drought risk, and solar can be a less cost-competitive option.

This is an abridged and edited version of the full article, available at *New Zealand zeroes in on an emissions-free power grid* (10 Oct 2023) https://www.energymonitor.ai/finance/sustainable-finance/new-zealand-zeroes-in-on-an-emissions-free-power-grid/?cf-view&cf-closed

New Hurricane Now Twice as Likely to Strengthen and Grow, Study Finds

A warming planet means warmer oceans, which fuel storms to grow and strengthen at a much faster rate compared to a few decades ago. (20 Oct 2023 by Angely Mercado) https://gizmodo.com/hurricanes-now-twice-as-likely-to-strengthen-and-grow-1850945134

Edited and excerpted. A study published by prestigious nature.com found that Atlantic hurricanes are now twice as likely to grow from a small storm to a strong Category 3 hurricane in just a day. For tropical storms that formed in the Atlantic Ocean from 2001 to 2020, 8.1% upgraded from Category 1 to Category 3 or stronger in 24 hours. From 1971 to 2000, only 3.2% of storms strengthened that quickly. The increase in quickly strengthening storms occurred alongside rising ocean temperatures, which are known to fuel tropical storms.

Stronger storms mean greater damage to infrastructure and displacement of coastal communities, but faster-intensifying storms make it harder for people to prepare or evacuate. Such events can be difficult to forecast and predict, leading to potentially escalated damages as well as difficulties when communicating the approaching hazard to coastal residents. This year is an El Niño formation year, which means more hurricanes in the Pacific.

There is a solution: mitigating climate change by phasing out oil and gas infrastructure to stop the planet from becoming even warmer. "One of the messages from this work is that there is an urgency. If we don't make some pretty big changes and rapidly move away from fossil fuels, this is something we can expect to see worsen in the future."

The original study is available in full below:

Observed increases in North Atlantic tropical cyclone peak intensification rates
(19 October 2023 This is an open access (free scientific study) available from: https://www.nature.com/articles/s41598-023-42669-y

Desalination system could produce freshwater that is cheaper than tap water.

MIT engineers and collaborators developed a solar-powered device that avoids salt-clogging issues of other designs. Jennifer Chu | MIT News September 27, 2023 https://news.mit.edu/2023/desalination-system-could-produce-freshwater-cheaper-0927

Engineers at the Massachusetts Institute of Technology (MIT) and China have developed a solar-powered system that extracts fresh water from seawater that is cheaper than tap water, according to one of the developers. The system could provide clean drinking water sustainably to off-grid coastal communities living near a sea water source.

Here is a summary from MIT News:

The configuration allows water to circulate in swirling eddies, similar to the thermohaline circulation of the ocean. This circulation, combined with the sun's heat, drives water to evaporate, leaving salt behind. The resulting water vapour can then be condensed and collected as pure, drinkable water. Leftover salt continues to circulate through and out of the device, rather than accumulating and clogging the system.

The system has a higher water-production rate and a higher salt-rejection rate than all other passive solar desalination concepts currently being tested.

The researchers estimate that the system scaled up to the size of a small suitcase could produce 4 to 6 litres of drinking water per hour and last several years before requiring replacement parts. At this scale and performance, it could produce drinking water that is cheaper than tap water.

"For the first time, it is possible for water, produced by sunlight, to be even cheaper than tap water," says Lenan Zhang, a research scientist in MIT's Device Research Laboratory.

Improved output with tracking solar PV?

Tracking is a common feature among land-based solar arrays. Instead of remaining in one position, solar panels equipped with a tracker follow the sun throughout the day to take advantage of the most efficient angles. Due to the extra mechanisms involved, tracker-equipped solar panels are more expensive to install and maintain than fixed-position panels. Ideally, though, they boost solar conversion efficiency and enable the array to generate more electricity in less space. The US Energy Department's National Renewable Energy Laboratory reported in 2018 a global average improvement in solar energy conversion of 9% for solar panels mounted on a single tracking axis, with individual improvements ranging from 4% to 15%. Floating solar arrays can be more efficient, due to water-cooled air around the panels.

Tracking can be economical in sunny areas but is not financially attractive in some US locations with considerable cloud cover. "Solar-tracking technologies that follow the path of the sun across the sky are effective at capturing direct radiation because they can be aimed directly toward the sun," the US Energy Information Agency notes: "However, these tracking technologies have no benefit when capturing diffuse radiation because diffuse radiation is not concentrated in a certain trackable direction."

For members interested in floating solar with tracking see the full article below:

Floating Solar Poised for World Domination, With Tracking (Oct 2023) The floating solar revolution is coming to America, along with a new high tech tracking system to boost efficiency. https://cleantechnica.com/2023/10/12/floating-solar-poised-for-world-domination-with-tracking/

TECHNICAL ARTICLE

Types of Inverters

Within AS/NZS 4777 there are two definitions:

Inverter: A device that uses semiconductor devices to transfer power between a d.c. source(s) or load and an a.c. source(s) or load.

Multiple mode inverter (MMI): An inverter that operates in more than one mode. For example, having grid-interactive functionality when grid voltage is present, and stand-alone functionality when the grid is de-energized or disconnected.

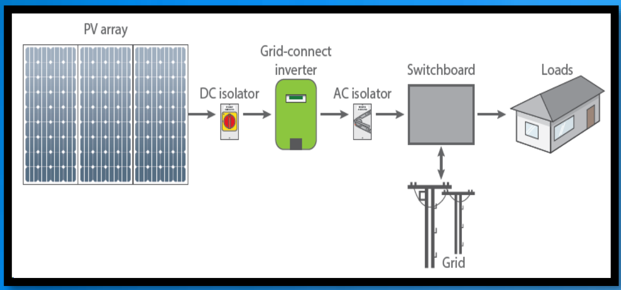
The problem is that though there are two definitions, there are still many types of inverters based on the differences in the operating functions of the inverter.

There are six main types of inverters on the market that could be used in a BESS that is coupled to a grid connected PV system. These are: PV grid connect, PV battery grid connect inverter, battery grid connects inverter, stand-alone inverter, inverter/charger and interactive inverter/charger. (A minimum of 1 inverter is required for a BESS system to operate as battery systems produce d.c. electricity, and typical household appliances use a.c. electricity.

Note: The term battery inverter is used here when the inverter input is connected to the battery system.

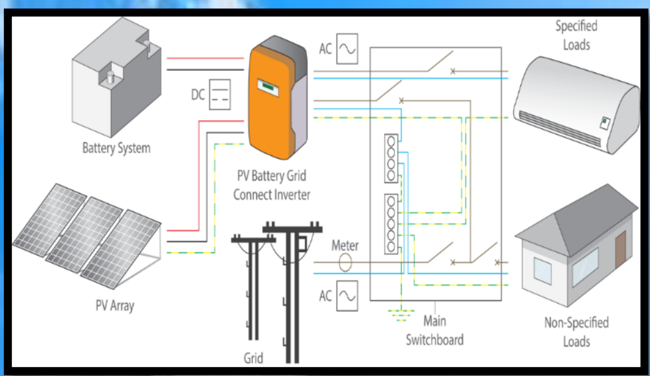
1.1. PV Grid Connect Inverter

A PV grid connect inverter has a PV inlet port and an a.c. port for interconnecting with the grid. The inverter is capable of producing an a.c. output that can interact with the grid. It cannot independently produce a.c. output as it requires a reference to a.c. power (typically the grid or another a.c. source). Therefore, a PV array cannot power loads via a PV grid connect inverter without additional equipment. They typically contain an MPPT for controlling the PV array output.



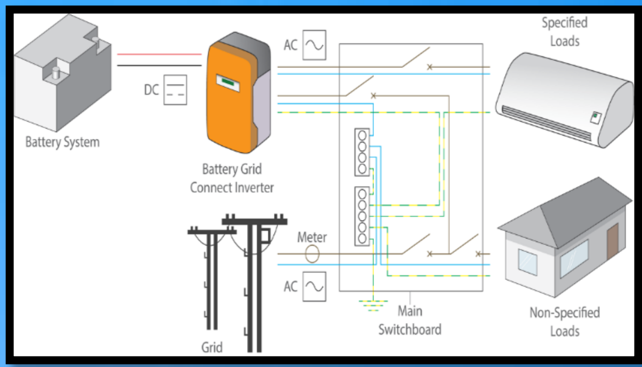
1.2. PV Battery Grid Connect Inverter

A PV battery grid connect inverter (hybrid) has both a PV inlet port and a battery system inlet port. It has an a.c. port for interconnecting with the grid and an a.c. outlet port for dedicated (specified) loads. Hence it is capable of operating with or without the grid. The multimode ability is required for the system to operate during certain conditions such as grid failures, or to offset peak loads. When it operates in this mode, the inverter isolates from the grid, and is often configured so it can still supply specified loads. When the battery system requires charging the inverter would switch into a battery charger to use the grid power to charge the battery system. The inverter would not provide power onto the a.c. input terminal when the grid is not available. That is, it has an anti-islanding protection.



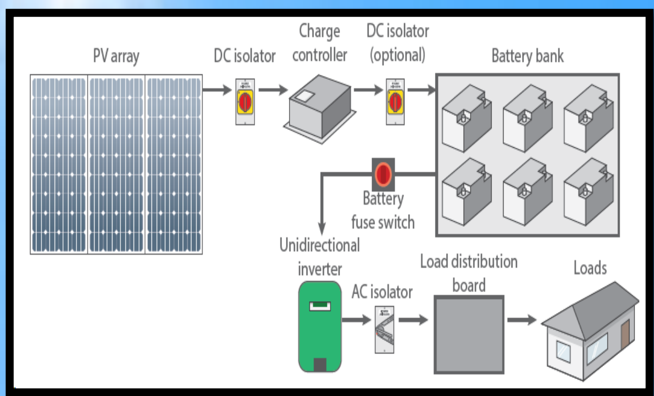
1.3. Battery Grid Connect Inverter

A battery grid connect inverter has a battery system inlet port. It has an a.c. port for interconnecting with the grid and an a.c outlet port for dedicated (specified) loads. It is able to synchronise with the grid and it can independently produce a.c. output if there is no grid. Hence it is capable of operating with or without the grid. The multimode ability is required for the system to operate during certain conditions such as grid failures, or to offset peak loads. When it operates in this mode, the inverter isolates from the grid, and is often configured so it can still supply system requires charging, the inverter would switch into a battery charger to use the grid power to charge the battery system. The inverter would not provide power onto the a.c. input terminal when the grid is not available. That is, it has an anti-islanding protection.



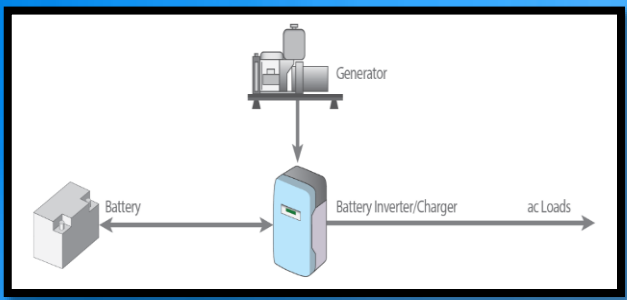
1.4 Stand-Alone Inverter

A stand-alone inverter has a battery system port and an a.c. outlet port. The stand-alone inverter is designed to provide a.c. power from the battery system which are typically charged by renewable energy sources. These stand-alone inverters are not designed to connect inverter output power onto the a.c. input terminal and therefore cannot inject power into the electricity grid. They can only be used in a grid connected PV system with BESS when the inverter is connected to dedicated loads either permanently or via a change-over switch when the grid is not available. A separate charger would be required to charge the batteries from the grid if required.



1.5 Inverter/Chargers

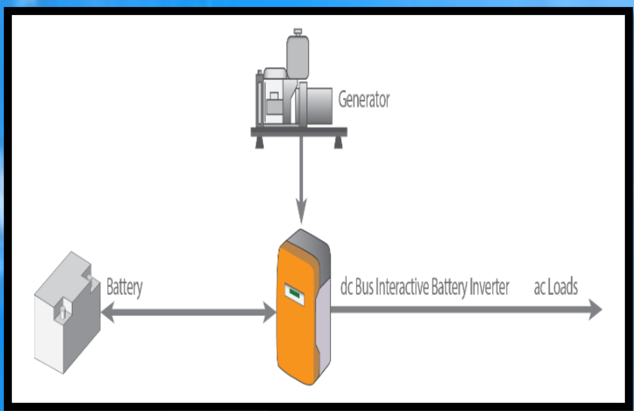
An inverter/charger has a battery system port, an a.c. input port for the grid (or fuel generator) and an a.c. output port for the loads. The inverter/charger has an inbuilt automatic changeover switch. When there is no a.c. power on the a.c. input terminal then the inverter operates as an inverter and the changeover switch connects the inverter/charger to the loads. When there is a.c. power present on the a.c. input port the inverter/charger will operate as a charger providing d.c power to the battery system while the changeover switch will connect the a.c. input power to the loads via the a.c. output port. These inverter/chargers are not designed to connect inverter output power onto the a.c. input terminal and therefore cannot inject power into the electricity grid.



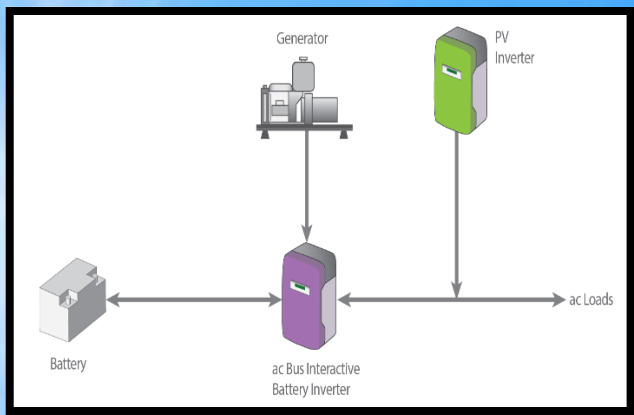
specified loads. When the battery Interactive

1.6 Inverter/Chargers

An interactive inverter/charger has a battery system port, an a.c. input port for the grid (or fuel generator) and an a.c. output port for the loads. The interactive inverter/charger has an inbuilt automatic changeover switch. When there is no a.c. power on the a.c. input terminal then the interactive inverter/charger operates as an inverter and the changeover switch connects the interactive inverter/charger output power to the loads. When there is a.c. power present on the a.c. input port, the inverter/charger will synchronise with the a.c. grid power so that the two power sources (grid and inverter) can operate in parallel providing power to the a.c. output load terminals. If the load peak demand is less than the inverter output rating then the interactive inverter/charger will switch to operate as a charger providing d.c power to the battery system while the changeover switch will connect the a.c. input power to the loads via the a.c. output port. These interactive inverter/chargers are not designed to connect inverter output power onto the a.c. input terminal and therefore cannot inject power into the electricity grid.



(dc bus interactive inverter)



(ac bus interactive inverter)

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