



MARCH-APRIL 2021

REGULATING ENERGY STORAGE



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Solar coolers seen speeding up Covid-19 vaccine rollout



Electric Vehicles - from Evolution to Revolution



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Regulating Namibia Energy Storage

Large scale energy storage has become a major focus of attention as intermittent renewable energy is becoming more prevalent in Namibia. The storage to complement intermittent renewables, if they are to replace base-load capacity, must be able to meet demand over many days, not simply hours.

At household level, behind the meter, battery storage is also being promoted as it reduces grid demand.

The Electricity Control Board (ECB) has set into motion plans to develop Energy Storage Regulations for Namibia. The rapid increase in the generating capacity by renewable energy sources in the country, has meant that electricity storage on a large scale can no longer be ignored.

Once again, we applaud the approach that the ECB has taken to widely consult stakeholders in the energy sector before finalising the regulations. We believe these rules will be a win-win and will provide the much-needed guidance in the development of

this emerging sector, aided by the falling costs of renewable and storage technologies.

Additionally, energy storage has been identified as a key to climate change mitigation. Globally, only 3% of power capacity is being stored. To limit global warming to below 2°C, energy storage capacity needs to triple by 2050.

The electricity grid is a complex system in which power supply and demand must be equal at any given moment. Constant adjustments to the supply are needed for predictable changes in demand, such as the daily patterns of human activity, as well as unexpected changes from equipment overloads and storms. Energy storage plays an important role in this balancing act and helps to create a more flexible and reliable grid system.

For example, when there is more supply than demand, such as during the night when low-cost power plants continue to operate, the excess electricity generation can be used to power storage devices. When demand is greater than supply, storage facilities can discharge their stored energy to the grid. By

introducing more flexibility into the grid, energy storage can help integrate more solar, wind and distributed energy resources. It can also improve the efficiency of the grid – increasing the capacity factor of existing resources – and offset the need for building new pollution-emitting peak power plants.

We believe that the benefits of energy storage are immense as the technology can act as a generation, transmission or distribution asset – in a single asset. By using energy storage during brief outages, businesses can also avoid costly disruptions and continue normal operations.

As our energy supply mix gets cleaner with low- and no-carbon resources, energy storage will without a doubt help that supply mix evolve more easily and reliably. Read more about energy storage inside.

Happy Reading!
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Cover picture:

UNLOCKING RENEWABLES POTENTIAL: Namibia, through the Electricity Control Board, has set into motion plans to introduce Energy Storage Regulations which are envisaged to further unlock the country's vast renewable energy resources endowment.

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The New Energy Storage Revolution



Supercaps have the following advantages over Lead Acid and Lithium Ion (LiFe) Batteries:

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ECB develops Energy Storage Rules

The Electricity Control Board (ECB) has started holding consultations with stakeholders in the energy sector in order to inform content for the development of Energy Storage Regulations for Namibia. The first workshop on the subject was held in Windhoek on 31 March, with discussion centering on the Draft Assessment Report on Regulating Energy Storage.

Energy Storage Technologies convert energy into a form that can be stored and subsequently converted into useful energy as and when required. The energy can be stored in any form, including as electrical energy, thermal energy and gravitational potential energy.

The intermittent nature of renewable energy resources prevents the larger uptake of renewables in Namibia. Energy Storage thus presents a great opportunity for power to be captured when it is available and released on demand. It is widely believed that cost-effective Energy Storage can potentially unlock the limitation of using intermittent renewable generation which will create additional avenues for the integration of intermittent generation sources into the generation mix.

The ECB expects the consultations with energy stakeholders to be finalised by the end of October 2021, with Ministerial endorsement of the Energy Storage Regulations earmarked for November. The regulations are then expected to be promulgated early in 2022.

ECB Chief Executive Officer Foibe Namene noted that Namibia has experienced a renewable energy revolution over the past few years, with more developments in the sector envisaged to follow soon.

"We all know the challenges posed by the intermittence of renewable energy resources. Energy Storage thus becomes a very crucial intervention," she said, adding that Energy Storage is expected to play a significant role in the successful integration of renewable energy into the national grid in the foreseeable future.

Namene noted that Energy Storage costs were expected to decline over



ECB CEO Ms Foibe Namene

the next few years therefore making the technology more viable.

According to the International Renewable Energy Agency, battery storage systems are emerging as one of the key solutions to effectively integrating high shares of solar and wind power within global energy systems.

In addition to increasing installed power generation capacity, developing systems that offer a consistent and reliable power supply is a top priority for African nations. Accordingly, Energy Storage has a significant role to play in supporting stable electricity grids by augmenting generation capacity, facilitating a continent-wide energy transition and spurring growth within the renewable sector and beyond.

Energy Storage developments offer a vital solution for the security of renewable energy supply. However, one of the key challenges regarding

renewable power generation concerns reliability of supply, in which natural disruptions, such as drought or lack of wind, are known to cause supply disruptions. The utilization of Energy Storage technologies, therefore, presents an opportunity for capturing and storing energy that can be released to meet demand on an as-needed basis. Energy Storage provides a continuous flow of clean energy during periods of high demand or when renewable energy is unavailable.

Additionally, Energy Storage offers enhanced power accessibility for the majority of Africa's population that lives in remote locations with limited access to national grids. The development of these storage technologies can enable the storage of vast amounts of electricity both on- and off-grid, offering improved methods for storing and dispatching power.

Applications of Energy Storage Systems in Namibia

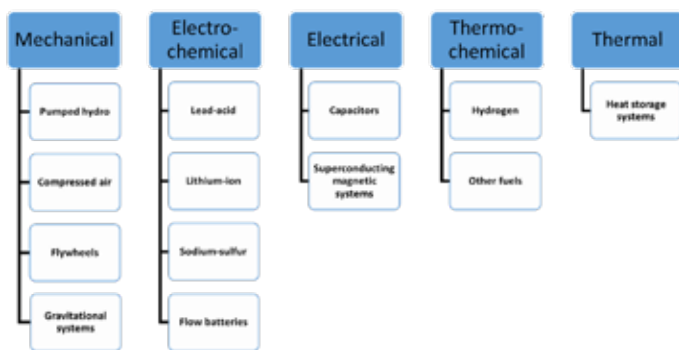
Detlof von Oertzen

A staggering variety of energy storage systems exist. Typical applications include electrical storage in consumer products, thermal storage in solar water heaters and building materials, electrical storage used in solar home systems and uninterruptable power supplies, large-scale battery storage systems supporting transmission and distribution grids, pumped storage facilities used to generate electricity, storage uses in large thermal power stations and numerous others.

The main energy storage types include:

1. mechanical storage, such as pumped hydro-electric storage, compressed air storage, flywheels, gravitational energy storage systems and others;
2. electro-chemical storage, such as found in batteries, for example lead-acid, lithium-ion, sodium-sulphur and flow battery energy storage systems;
3. electrical storage, such as capacitors and superconducting magnets;
4. thermal energy storage, such as heat storage systems; as well as
5. thermo-chemical and chemical energy storage, including fuels such as biomass, coal, hydrogen, liquid petroleum and its gases and many others.

Figure 1: Energy storage types [Source: VO Consulting]



Storage for the Electricity Industry

Of relevance to the electricity industry are grid-connected and off-grid storage applications. Electricity from variable supplies does not always match the momentary demand for electrical energy. This implies that periods in which temporary supply deficiencies or overproduction exist which are increasingly being managed using storage.

In 2021, most of Namibia's generation capacities are powered by intermittent renewable energy resources, including run-of-river hydropower, solar photovoltaic (PV) generation and wind power. All current Independent Power Producers (IPPs) except one wind IPP use solar PV. The additional uptake of intermittent generation therefore depends, amongst other factors, on the judicious deployment of storage.



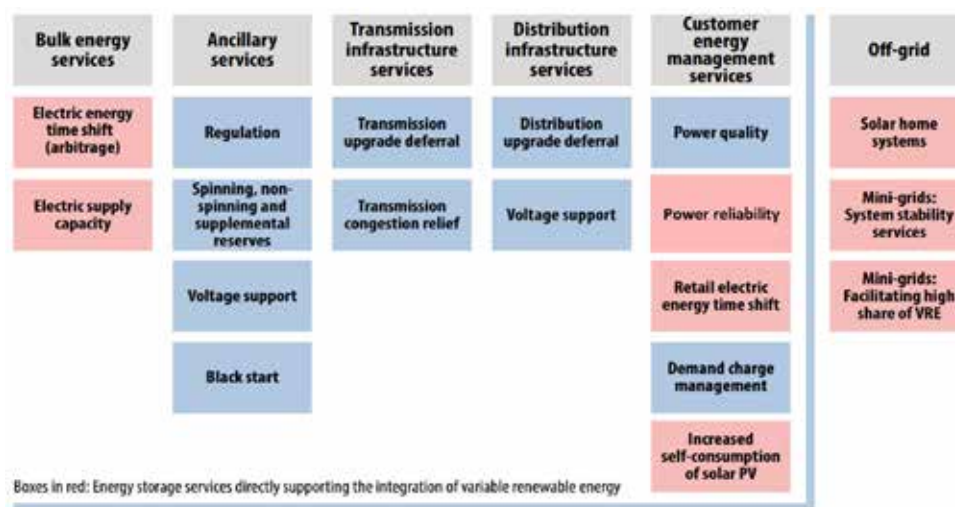
Dr Detlof von Oertzen

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Electrical Storage Applications

Electrical storage has numerous applications and is well-suited to address many challenges arising in the electricity industry, including the management of grid infrastructure. Applications include energy-based uses, power-based uses and combinations thereof, as shown below.

Figure 2: Electrical storage applications in the electricity industry [Source: IRENA (2017)]



A grid-connected end-user can benefit from the following electricity storage services:

- Increasing self-consumption from own generation sources;
- Providing emergency / uninterruptable power supplies;
- Time-shifting consumption and active peak shaving; as well as
- Grid supply and infeed via battery storage systems, including those in electric vehicles.

For IPPs operating intermittent generation supplies, storage creates the following opportunities:

- Energy trading/arbitrage, i.e. procuring electricity when grid prices are low and dispatching capacity when prices are high;
- Time-shifting, i.e. timing supplies to optimally meet the demand;
- Frequency response, i.e. controlling electrical outputs;
- Self-balancing, i.e. optimising the reliability of outputs from own generation sources; and
- Resource adequacy, i.e. ensuring that contracted capacity is available when needed.

For an electricity utility, modern electrical energy storage solutions offer the following services:

- Time-shifting of supplies to reduce the overall cost of the generation mix;
- Energy trading by procuring in periods of oversupply and selling in times of high demand;
- Power quality management, control and network stability;
- Peak shaving and management by minimising own peak demand periods and peak shifting;
- Ramp rate control by supplying when variable generation outputs are unavailable;
- Reactive power provision and static voltage stabilisation;
- Flicker and harmonics compensation to optimise the

quality of supply;

- Network decongestion and efficiency enhancements; and
- Emergency power supply for protection and control equipment.

Conclusion

Today, a large variety of systems and technologies rely on energy storage devices. As yet, the legal and regulatory provisions that govern the uptake and use of storage do not exist for Namibia's electricity industry – these are currently developed by the Electricity Control Board.

Namibia's market for storage applications remains small and storage has no tangible impact on the electricity industry's current operations. However, the pace at which cost-effective storage becomes available is expected to significantly affect the electricity industry in future.

The rapid decline of renewable energy and storage costs has profound impacts on non-renewable energy generation assets. Increasingly, storage enables the reliable, clean, safe and viable supply of electricity in settings that could previously only be served by fossil-fuelled power supplies. Modern electricity storage solutions also enable further progress in the electrification of off-grid communities and businesses, for example by way of mini-grids.

Namibia's vast renewable energy resource endowments, specifically its solar and wind resources, can be further unlocked using contemporary electricity storage systems.

An indication of the trend towards the further uptake and use of storage technologies is provided by the rapid pace at which solar technologies are being embraced by commercial, industrial and domestic end-users. The benefits associated with such supplies can be of further enhanced when used in combination with storage, including that in electric vehicles.

NEC champions long lasting Solar Solutions

NEC Power & Pumps can look back on more than 60 years of providing clean, reliable and affordable solar energy to clients all over Namibia and Botswana.

No matter if rooftop, free field or installed on trackers, NEC solar panels in Namibia have huge potential to harness the sun's abundant energy both for grid-tied as well as Island Solar Systems. One of the issues with renewable energy is the cyclic availability; energy is available only when the sun is shining, or for wind turbines only when the wind is blowing, while demand might be constant or highest during the night. This causes high demand from the national grid during certain times of day.

With a Hybrid or full Island System the energy that the Solar or Wind System provides can be stored in batteries. This stored energy can then again be used at night or during times of high demand. This can significantly contribute to stabilising the National Grid.

Although Namibia is not experiencing load shedding currently, the ability to store self-generated renewable energy would allow us to be less dependent on the Eskom grid. This investment on a Personal, Commercial, Industrial or even National level to store renewable energy in battery storage would therefore be a logical and a financially sound decision in the long run.



NEC is therefore promoting a move towards self-storage. This applies to Home Systems, as well as Industrial and Commercial Systems. And even MegaWatt Storage blocks installed strategically by NamPower around the country, would improve Power Factor as well as efficiencies on the country's long powerlines. This would also stabilize the grid with relatively small battery storage blocks. Each station to provide maybe only 30 to 40min peak demand coverage. This would allow other power stations to react to changing conditions.

For this reason of high power demand as well as long term reliability, NEC has established a long term relationship with KiloWatt Labs to distribute and service Supercapacitor Batteries for Namibia. This Storage technology has profound benefits over Lead Acid and even LiFE (Lithium Ion) Battery Storage:

The two main factors would be that Supercaps are not significantly affected by environmental temperatures and will not lose capacity if temperature remains below 45°C.

They also have a very high charging and discharging tolerance. They can handle 5 – 100% charging in just 45 minutes and up to 10 cycles a day.

A further advantage is that Supercaps are not chemically based batteries and therefore do not show degradation over time; they will therefore provide the same usable power in 10 years as their new rating. This makes them easier to size and to upgrade, as new Parallel Banks can be added over the units' lifetime without having a negative memory effect from the old units affecting the new units. Also, NEC provides the units with 10-year swap out guarantee, which gives the client peace of mind, compared to the industry standard repair warranty where it normally costs the client money to have their unit shipped and repaired.

All this results in a usable life expectancy of 40 000 cycles at even very high depth of discharge of 95%, giving about 35 to 40 years of usable lifetime depending on the usage.

With this technology NEC is bringing the future of storage to Namibia and allowing investors to make long term decisions, something that has not been possible in the storage market before. As even the latest LiFE Battery packs generally would provide only 7 700 or 8 000 cycles at



Although Namibia is not experiencing load shedding currently, the ability to store self-generated renewable energy would allow us to be less dependent on the Eskom grid.

70% DoD, resulting in a working life of around 20 years, thereby comfortably outperforming Lead Acid batteries which used to be the standard for the past 40 years.

NEC continues to deliver unique and tailor-made Power Solutions to clients and is dedicated to providing a better overall system for long term use in the future.

Installing a battery powered Hybrid or full Island Solution is not the cheapest option in the short term, but with this leading technology, NEC is providing clients with an option to work on overall system life expectancies of over 25 years, which then

provides one of the cheapest and reliable electricity available today.

The road ahead is full of opportunities and with the introduction of the Supercapacitor Battery Storage solution - the historic weak link in a renewable energy system has been transformed into the strongest, most long lasting component of an off grid / Hybrid solar system, providing the client with peace of mind and a long investment horizon.

For more information, please contact us at:

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Electric Vehicles - from Evolution to Revolution

Conrad Roedern

Volkswagen held a “Power Day” on 15 March 2021 and announced a “Power Roadmap” which is an unparalleled kick-off to an automakers’ total transformation. The event is worth watching (<https://www.youtube.com/watch?v=vdnRfNwj1Fg>) and is packed with strong statements and announcements from VW’s CEO, Mr Herbert Diess.

“Let me begin with the obvious: E-Mobility has won the race!” This is an astonishing statement because until now the big German automakers resisted change and procrastinated by insisting that that they wanted to stay open for all motor technologies; these range from hydrogen and fuel cells to synthetically produced fuels. Mr Diess, who is a friend of Tesla’s CEO Elon Musk, realised the lead of the battery-electric-vehicle (BEV) but also the extreme challenge set by Tesla’s headstart. He went on affirming that *“E-Mobility is the key pillar of Volkswagen’s forward-strategy”, “Our goal is to secure a pole position in the global scaling of batteries”, “We are planning to operate 6 battery factories with 40 GWh each across Europe” and “We will make charging as easy as fuelling...”*

These statements show the preparedness to put “all eggs into one basket” with what appears to be the most promising technology of the day: the BEV. *“Our transformation will be fast, it will be unprecedented. The transformation will be bigger than anything the industry has seen in the last century.”*

How does Volkswagen intend to deal with all the disruptive



Mr Conrad Roedern

effects accompanying this radical change? Electric cars are so much simpler to build and they require so much less of the – until now – profitable after sales services. And probably the long period of growth in car-sales is over by now; with 55 million cars in Germany and approximately 1 billion cars globally, atmospheric carbon emissions and traffic jams are some of the tell-tale signs pointing to more intelligent ways for (public) transport.

In order to prevent being marginalised, Volkswagen swiftly shifts focus to become less a car maker and more an energy provider; something that has been solely the domain of oil and electricity giants.

Volkswagen openly communicates that: *“We will create the largest public high-powered charging network” and “We are combining mobility and energy in an innovative way...”*

Power will become a new core competence for Volkswagen”. With these and similar statements of commitment, Volkswagen enters the domain that has traditionally been held by large electricity providers. And they intend to invade this space quickly and aggressively, thereby boosting the smart-grid-based energy transition (“Energiewende”) which got half-way stuck in most countries of the developed world.

“The electric car will become an integral part of a future energy system” says Diess. *“EVs will become mobile power banks. They will bring the green energy transition to a new level.”* Existing technologies, like Vehicle-to-Home (V2H) and Vehicle-to-Grid (V2G), make the aggregate number of BEVs a provider of electricity storage and – very important for grid stability – ancillary grid services.

It is quite likely that – for the first time – a player of the calibre of VW, will overcome what has halted the “Energiewende” before, namely the almost untouchable sovereignty of past “energy-dinosaurs” that have repeatedly taken entire governments as hostage in their claims such as “...if our centralised model of energy distribution is abandoned...the lights will go out”. So, Volkswagen’s initiative is more than good news for all promoters of a swift energy transition.

Lessons for Namibia

The times where Namibia remains a paradise for gas guzzlers will soon be over! The automotive sector must urgently acquaint themselves with electric mobility and embrace rather than block this important development.

From the multitude of advantages that a transition to BEVs will include, the following two must be highlighted: EVs will run on our very

own energy source, namely green regenerative electricity (mainly from PV-Solar and Wind) and – once introduced in numbers – they will provide distributed grid-storage which is necessary to balance variable electricity demand and the fluctuating supply of renewable energy sources. One example serves to illustrate this: On average, private cars remain stationary for 23 out of 24 hours per day.

Once the first 150,000 BEVs are part of a Namibian smart-grid, and assuming that each such car makes available 30kWh of storage to the grid (for money, of course!), a distributed battery system of 4.5 GWh capacity becomes available, which is about 50% more than Namibia's requirement during night time. Even more significant will be the constant reduction of the price of electricity storage, driven down by the momentum of the cost-volume-cycle and based on



An illustration of a battery cycle

ongoing improvements of Lithium-ion batteries. This also implies that affordable **stationary** storage will become the order of the day and should be – from now on – a mandatory complement of any

Solar or Wind park. As storage solutions for Namibia are debated, these considerations should be high on the agenda of the ECB, NamPower, the REDs, REIAoN and all other role players.



A Nissan Leaf currently in daily use in Windhoek seen here at a charging port

Modified Single Buyer framework earmarked to add 450MW solar power

The Electricity Control Board (ECB) expects the newly introduced Modified Single Buyer (MSB) framework to add 450 megawatts of solar power to the national generation capacity, once fully implemented.

The MSB is a new market platform for the electricity industry in Namibia and it builds incrementally on the existing Single Buyer (SB) model i.e. it represents a modification of the existing market structure. Introduced in 2019, MSB allows large electricity customers to buy up to 30 percent of their demand directly from an Independent Power Producer (IPP) rather than from NamPower.

The MSB further provides an opportunity for the deployment of new generation technologies such as battery storage.

“About 450 MW is an additional capacity (solar photovoltaic equivalent) that will be added to national generation capacity through MSB,” said ECB Chief Executive Officer Foibe Namene.

The ECB estimates that there are more than 20 large power users in the country, which includes mines, local authorities, regional distributors, and farms. Some have already applied to the ECB to be able to source 30% of their power from individual power producers of their choice, provided they are connected to the main grid.

The ECB believes that allowing large consumers to source their energy elsewhere rather than only from NamPower will ensure the continued flow of investments into local electricity generation as they will be guaranteed customers.

Namibia currently has 25 solar photovoltaic generation plants and one wind farm outside Lüderitz, in operation. IPPs and NamPower jointly produce 643, 3MW of power. Of this total generation only 183, 8MW is produced by IPPs, through Power Purchasing Agreements (PPAs) with NamPower.

According to the ECB data, 20 IPPs have invested N\$2, 7 billion towards electricity generation in the country in the last five years.

Namibia aims to meet its total energy needs



ECB CEO Ms Foibe Namene

within the next few years with solar playing a key role towards attaining this target. Namibia has one of the highest solar radiation in the world, which makes it conducive to adding more solar generation plants.

Namene said the National Integrated Resources Plan (NIRP) outlines the country's aim to diversify its energy sources for electricity generation, including renewable energy sources. As a result, a ministerial determination was issued in 2019 to add an additional 220MW to the country's generation capacity, with NamPower to add 150MW, and individual power producers 70MW.

NamPower has already commenced projects to meet the envisaged 150MW in additional power, with one of the projects (20MW from the Omburu photovoltaic power plant) to be completed this year.

The Khan Project (also 20MW) will be developed by IPP Access Aussenkjer Solar One Namibia. The two projects were initiated in 2018, when NamPower crafted its new Corporate Strategy and Business Plan for the period 2019-2023. In line with the new strategic intent and the determination by the Minister of Mines and Energy, the NamPower Board approved the implementation of six new generation projects under the strategic pillar of “Ensuring Security of Supply”.

Four other projects, including the Omburu 20MW Solar PV, will be built by a contractor where the plant would be owned and operated by NamPower and funded from NamPower's balance sheet. These also include a 40MW NamPower Wind Power Project, a 40MW NamPower Biomass Power Project; and the 50MW NamPower Anixas II, Firm Power Project.



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Drive a Nissan Leaf – and leave the tailpipe behind

Namibia engages United Arab Emirates renewable energy investors

Namibia has formally kickstarted engagements with investors from the United Arab Emirates (UAE) in various sectors of the economy, including renewable energy.

Deputy Prime Minister Netumbo Nandi-Ndaitwah led a high-powered ministerial investment seeking delegation to UAE from 7 to 9 March, which engaged business leaders in Dubai.

Namibia is seeking to attract investments from UAE mainly in the sectors of agriculture, water, renewable energy, mining, health and tourism.

“The outbreak of the Covid-19 pandemic has disrupted world economies and has exposed the vulnerabilities of most economies.

A recovery plan to bring back economic growth and embrace the new normal must be a collective priority for all countries, Namibia included. Workable ways and means to revive economies, to create necessary jobs and to embrace the new normal, have to be found and implemented,” said the Deputy PM.

Nandi-Ndaitwah said the visit to the UAE was expected to bear tangible benefits for the Namibian economy, mostly because the targeted investment projects are in sectors



Deputy Prime Minister Netumbo Nandi-Ndaitwah

that will contribute to sustainable and inclusive economic growth and create jobs.

In the UAE the Namibian delegation had engagements with stakeholders and entities such as the Emirates Group, DP World, the International Holdings Company, the Dubai Chamber of Commerce, the UAE

Tourism Department and the Dubai EXPO 2020 team, who were all keen on exploring opportunities that Namibia has to offer.

Energy (in particular renewable energy), logistics, agriculture, tourism and infrastructure development were identified as strategic areas of priority and interest by potential investors from the UAE.

What is expected now is for the Namibian technical team to prioritize and prepare key bankable projects and opportunities to facilitate concrete investment deliberations to be concluded in a timely manner.

Namibia is also expected to go all out to promote itself as a renewable energy hub for Southern Africa at the World Expo 2020, now rescheduled to take place in Dubai, United Arab Emirates, from 1 October 2021 to 31 March 2022, under the theme: “Connecting Minds, Creating the Future”, with the aim of luring big investors in the sector.

Namibia is crafting a strategic advertising and public relations campaign leading up to one of the world’s major expositions, the World Expo 2020, with the renewable energy sector, as well as mining and tourism sectors, providing an exceptional value proposition for attracting investment and creating awareness about what Namibia is able to offer and deliver.



A medical staffer stands next to a solar-powered refrigerator used to keep vaccines cold in the Democratic Republic of Congo

Solar technologies seen speeding up Covid-19 vaccine rollout in Africa

Efforts to vaccinate essential workers in Namibia and other developing countries have only just begun. By current estimates, achieving Covid-19 herd immunity (to current strains) will require at least 75% of the world's population to be vaccinated. Some developing countries haven't reached that level of coverage even for common vaccine-preventable diseases like measles and polio.

While many developing countries just started to receive their Covid-19 vaccines through donations and under COVAX, the success of national distribution efforts depends on a functional cold chain. This is an uninterrupted system of storage, transport and delivery of vaccines at

low temperatures all the way from national warehouses to local clinics and into the arms of people.

Most vaccines must be stored between 2°C and 8°C. This is the case for polio and measles vaccines as well as the Covid-19 vaccines from Johnson & Johnson and AstraZeneca-Oxford. Others have temperature requirements that are notoriously more difficult to maintain. The vaccines from Moderna must be stored at between -25°C and -15°C. The Pfizer-BioNTech requires -70°C, but can be kept between -25°C and -15°C for up to two weeks.

Keeping vaccines seamlessly refrigerated is an especially daunting challenge where electricity is unavailable or unreliable. A 2013 review spanning 11 African countries

found that just 28% of clinics and hospitals had reliable electricity, and 26% had no electricity access at all. Updated data on energy access in health facilities is scattered and sparse, but we are working on a new comprehensive review.

Unreliable power is extremely costly for vaccination efforts. Each year, nearly 50% of freeze-dried and 25% of liquid vaccines are wasted. This is in large part due to cold chain electricity disruptions.

Thus, to deliver Covid-19 vaccines at the required scale, the problem of energy access at health facilities must be confronted. But realistically, entire national grids can't be overhauled overnight to provide universal, uninterrupted power. So what can be done?

Solar as a solution

In many cases, the answer may be to go solar. Solar photovoltaic solutions, like other decentralised renewable energy systems, come in countless configurations. These typically include battery storage and can be used along with existing electricity sources like the national grid or a diesel generator.

This flexibility means that photovoltaic systems can be deployed rapidly and modularly to provide health facilities with power, often more reliably than the grid. Electricity is essential for vaccine cold chain and other services needed during a pandemic.

Health facilities in areas with limited electricity have long relied on gas-powered “absorption type” refrigerators. Solar-powered refrigerators are more reliable and efficient. Photovoltaic refrigerators with batteries store energy from solar panels for later use. In this way power is available even on cloudy days or at night, or (for grid-connected clinics) during a power outage.

Other photovoltaic refrigerators do not use batteries at all. Solar direct drive refrigerators use solar energy to directly freeze water into an ice wall. This keeps the storage container cold for days, even when solar energy isn't available.

Solar direct drive refrigerators have had a profound impact in “last-mile” settings. These include rural parts of the Democratic Republic of Congo (DRC), where it's hard for health facilities to get fuel and batteries and they are far from the national grid. In 2020, Gavi, the vaccine alliance, supported a massive rollout of solar direct drive refrigerators. It led to a 50% increase in monthly immunisation sessions in the nine poorest provinces of the DRC just in the last year. These refrigerators have been instrumental in boosting the proportion of health facilities in the DRC with working cold chain equipment, from 16% in 2016 to



Namibia and other developing countries have started vaccinating citizens against Covid-19

nearly 80% today.

Subzero storage solutions

Most solar refrigerators are equipped to store vaccines only at standard temperatures (between 2°C and 8°C). Solar-powered solutions for subzero storage and transport are available, though not yet at wide scale. For example, the MOTE vaccine cooler, developed by Nigerian startup Gridc, has solar-powered batteries that can maintain stable internal temperatures as cold as -20°C for up to 24 hours.

For the time being, however, the most widely used subzero storage and transportation devices forgo electricity altogether. They use passive cooling instead, essentially functioning as giant, highly insulated “super-Thermoses”.

Solar power can also help with another essential electricity-dependent component of vaccine delivery systems: information and communication technologies. These enable national health programmes to monitor vaccine stocks and refrigerator temperatures in remote, rural health facilities in real

time, and alert them when deviations occur that may compromise their integrity.

In rural areas that are far from the grid, cellular and internet connections are often more difficult to access. But in recent years, solar-powered cell towers have strengthened and expanded telecommunications networks in areas with unreliable power in countries such as Guinea, the DRC and Mali. Off-grid cell towers have also been used to power vaccine refrigerators in settings such as Zimbabwe. These refrigerators also rely on the cellular network to relay monitored temperature data to health facility staff.

Solar-powered cold chain technologies can be game-changers in the fight against Covid-19 in resource-limited settings in sub-Saharan Africa and beyond. As the COVAX initiative scales up across the continent, governments and development partners should consider how solar-based solutions can aid vaccine delivery. They are invaluable tools – perhaps even equal in importance to the vaccines themselves.

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Namibia, Botswana tout Coastal desalination plant utilising solar

The Namibian government is looking at recommendations for suitable desalination options, water transfer systems and power supply, with the inclusion of renewable energies, as the country battles water security.

The German government has been supporting Namibia to explore opportunities for the desalination of seawater as an additional and climate resilient water source. The findings of a desalination feasibility study, which was financed by German Development Cooperation, through KfW, to the tune of N\$19, 5 million and implemented by NamWater, have been shared with stakeholders.

As part of the driest region in Sub-Saharan Africa, Namibia faces unique challenges to its water resources as rainfall is unevenly distributed, both geographically and seasonally. Windhoek, as well as the coastal towns of Walvis Bay and Swakopmund, are under pressure to

meet the increasing water demand at a time when water resources are becoming ever more unreliable and over-exploited, which is not sustainable.

A feasibility study was commissioned to provide technical and commercial concepts for sustainable solutions for the water supply to the Central Coast and Central Area of Namibia, including Windhoek as well as en route users. This will aim to provide a comprehensive decision making tool for the Namibian Government on desalination solutions for the water supply to the Coastal and Central areas.

Within the framework of the feasibility study, a detailed analysis of the future water demand in the respective areas including recommendations for suitable desalination options, water transfer systems and power supply, with the inclusion of renewable energies, was carried out.

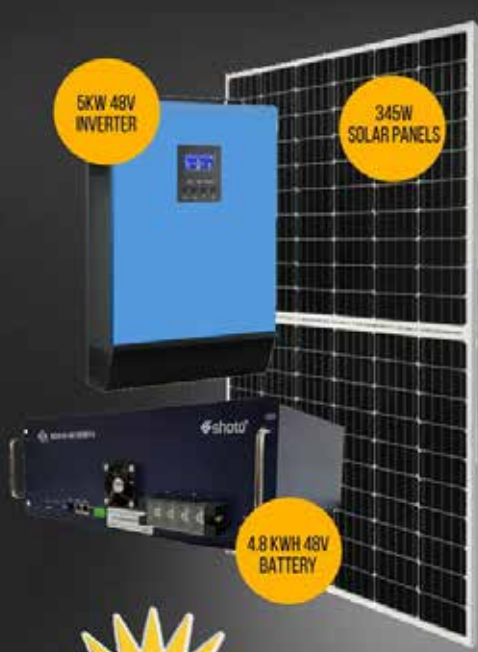
Indications are that Namibia will consider constructing a multi-billion dollar desalination plant at Walvis Bay with an

estimated production capacity of more than 36, 5 million cubic metres of potable water per year.

The project, likely to be a public-private partnership, would be implemented using the already existing water infrastructure in the central coastal area. The plant would be powered with electricity from the grid, supplemented by solar power.

The government of Botswana has also expressed interest in Namibia's plans to desalinate water for domestic use and discussions have been held with the country's president Mokgweetsi Masisi.

The construction of a desalination plant at Walvis Bay could help to reduce the deficit in drinking water production. The project is expected to require huge investments, in particular for the transport of water from Walvis Bay to Gaborone (via Windhoek). A distance of over 1 490 km separates the two cities but they are already connected by a road. The water pipeline could follow this route.



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This Puma service station in Windhoek is one of the several that have reduced their power costs by installing solar PV

Fuel service stations turn to solar power

Several service stations in the country are resorting to solar photovoltaic (PV) installations in an effort to reduce their energy consumption costs. The solar PV installations are also helping the businesses to reduce their carbon footprints.

Service stations are seen as ideal candidates for solar PV solutions as they generally have canopy space that sits in full sun. They also consume a lot of electricity, especially as many sites now include 24-hour retail stores as part of their service offerings.

A number of the fuel stations that have completed solar installations have considerably cut their monthly electricity costs, by up to 40% of their total monthly power

consumption.

Some of the service stations in the country that have resorted to solar power include Puma Energy in Dr Kuaima Riruako Street (formerly Bach Street), Engen sites in Windhoek, Outapi and Oshikuku, another Puma Energy site in Windhoek, a Shell station in Rehoboth and a Total station in Otavi. Numerous other installations are planned across the country in the coming months.

While initial solutions have focused on daytime power generation through grid-tied solar, existing systems are now being upgraded to include battery storage as that technology becomes more cost-effective.

The recent Africa Solar

Outlook report published by regional trade body the African Solar Industry Association (AFSIA) shone a light on the developing trend of petrol stations on the continent embracing photovoltaics.

Some 734 petrol stations in 29 African nations have at least partially shifted from conventional grid electricity to solar, according to AFSIA, with French energy company Total at the forefront of the transition.

Total has 'solarized' 540 petrol stations in 27 African countries, according to the report.

The AFSIA survey highlighted the plans of Zimbabwean energy company Zuva Petroleum, which wants to add solar and energy storage at 180 of its sites.

Old Mutual acquires controlling stake in Rosh Pinah solar plant

An infrastructure investment fund managed by the Old Mutual Investment Group Namibia, has acquired a majority stake in Aloe Investments Number Twenty-Seven, the company that owns and operates the 5MW solar photovoltaic plant at Rosh Pinah, in the //Kharas region.

These shares were previously held by Spanish company, AEE Power Ventures, which set up the project company and built the Rosh Pinah solar power plant which went into commercial operation in 2017. The 13.5 GWh produced annually by the solar farm are sold to NamPower under a 25-year power purchase agreement (PPA).

Details on the value of the stake purchased by Old Mutual were not forthcoming. However, the acquisition forms part of a joint

transaction with Sturdee Energy Namibia, which has acquired a minority stake in the plant.

Sturdee Energy is an African Independent Power Producer with a track record of developing, owning and operating 587MW of renewable energy projects.

AEE Power Ventures SL General Manager, Miguel Zaldivar, was elated by the Old Mutual transaction which he said places the majority stake in the power plant in the hands of Namibians, adding that “this will aid in transitioning Namibia’s energy supplies towards a greater share of supply from renewable sources”.

Head of Alternative Investments at Old Mutual Investment Group, Christoff Bauernschmitt, described the acquisition as a significant contributor towards the energy supply security in Namibia, saying: “We are pleased to be part of a

project that creates sustainable impact in the country. Old Mutual will continue to make sustainable investments that will make Namibians the owners of critical infrastructure assets.”

Panduleni Shaetonhodi, a representative of the consortium of previously disadvantaged Namibian shareholders in Aloe Investments, said: “We look forward to the benefit that the backing of an established institution such as Old Mutual, combined with the technical expertise of Sturdee Energy Namibia, will bring to realise the full potential of the project”.

The Rosh Pinah solar project was developed as part of the Refit programme (renewable energy feed-in tariff), launched by the Namibian government with the aim of injecting 70MW of electricity into the NamPower grid.



The 5MW Rosh Pinah solar PV plant

Namibia among nine African nations on track to join solar 'gigawatt club'

Namibia and eight other African countries are ramping up solar capacity which may see them join other world nations with installed capacity to produce over 1 GW of solar power, known as the 'gigawatt club'.

Of the 37 countries that are part of the solar 'gigawatt club', only two - South Africa and Egypt - are from Africa.

However, the first annual African Solar Energy Outlook 2021 report released by the Africa Solar Industry Association (AFSIA) on February 16, states that nine countries that are fast developing their solar infrastructure are Namibia, Botswana, Algeria, Zimbabwe, Zambia, Democratic Republic of Congo, Angola, Ethiopia and Morocco.

Nearly half the world's population without access to electricity (591 million) is in sub-Saharan Africa, according to the International

Energy Association. This new report provides policy directions for ensuring development of affordable energy through solar.

It provides a country-by-country snapshot solar generation status and key drivers of successful solar development across 54 nations in the African continent.

Emerging solar champions

In Zimbabwe, where over 91 per cent people do not have access to electricity, solar will be key to ensuring access to affordable energy.

Private sector will play a major role to in helping Zimbabwe go solar, the report predicts. The sector, which has been struggling with erratic power supply and grid shutdowns for years, is now planning sizable projects to serve their consumption as well as the grid, said the report.

Ethiopia and Botswana are expected to gain from a more traditional approach of international

tenders and should reap the benefits of this approach through bottom-low tariffs, according to the report.

On the contrary, the governments in Zambia, DRC and Angola have awarded private developers direct contracts for significant capacities without going through a tender.

Morocco has been appreciated in the report for its transparent and efficient tender and development process over the years.

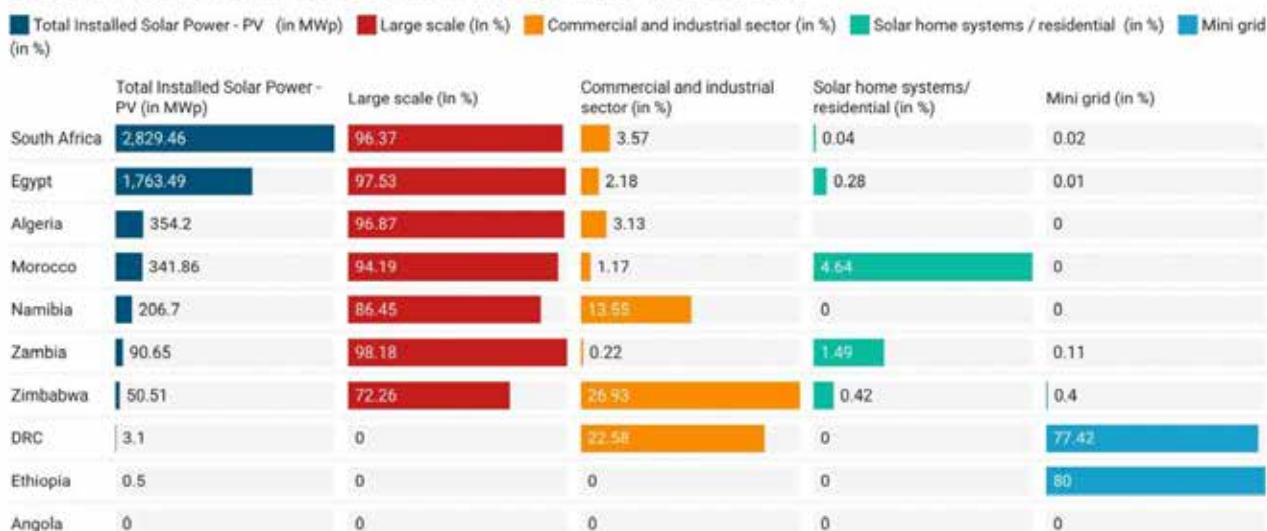
The existing solar champs, South Africa and Egypt, will continue their solar journey and add sizable capacities to their grid, according to the report.

South Africa currently has over 2.8 GW of installed solar power capacity. It plans to scale up to 8.28 GW by 2030.

To realize this target, the country plans to generate 1 GW of solar per year in 2023, 2025 and 2028-30, according to its energy department.

Egypt accounts for 23 per cent of the leading solar power projects

Status: Existing and other nations likely to join the GW club



Source: Africa Solar Industry Association (AFSIA) • [Get the data](#) • Created with [Datawrapper](#)



in the Middle East and North Africa region.

The nation will continue to build on the success of both government-led projects such as Benban solar park and decentralised projects, said AFSIA in the report.

The 1.8 GW Benban solar park developed by state-owned New and Renewable Energy Authority (NREA) at Aswan governorate was named the biggest solar photovoltaic park in the world in October 2019.

Upper hand

Africa's solar boom is likely to get a boost due to two advantages, said the report.

Many grids in Africa are considered

“weak” and have limited capacity to store. The solar capacity they can absorb at any point across the national infrastructure is limited to 30 MW in most of the cases.

But by coupling solar and storage technologies, this limitation could be overcome and significantly more solar capacity could be added and connected to the grid.

West Africa is leading the charge in such large-scale solar and storage projects

The solar boom is driven by the new and more flexible technologies brought to market along with drastic cost reductions of both solar panels and storage solutions, said John Van Zuylen, CEO, AFSIA.

Hydrogen is another game changer in the solar future of Africa. The continent is ideally positioned thanks to its excellent irradiation to play a pivotal role in the global solar-based green hydrogen market.

It is very likely that all global energy leaders and solar companies are already eyeing privileged partnerships in Africa's sunniest regions, the report said. Africa is likely to emerge as a global hub for production and export of green hydrogen.

While large-scale solar projects have dominated the sector over the past few years, the commercial and industrial sector is booming and could represent 30-40 per cent of all solar capacities in the coming years, said AFSIA.



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A SOLTRAIN bursary hand over in Namibia

SOLTRAIN Project awards 15 bursaries in solar thermal studies

The Southern African Solar Thermal Training and Demonstration Initiative (SOLTRAIN) Student Project Support Scheme is aimed at promoting masters or PhD theses dedicated to the topic of solar thermal energy.

The scheme provides financial support for students in order to encourage them to work in the field of solar thermal, to build up capacity and to promote the opportunities that solar thermal energy offer with regard to various applications and sectors, with the overall aim to reduce the use of fossil fuels for a sustainable future.

Successful students from all SOLTRAIN partner countries (Botswana, Lesotho, Mozambique, Namibia, South Africa, Zimbabwe) get study funding of up to 2 500 Euro (about N\$45, 000).

During the course of SOLTRAIN's third and fourth phases, three bursary calls have been put out, attracting a total of 40 applications. From these, 15 projects have been approved which contribute to the overall aims of the SOLTRAIN project which include promoting the use of solar thermal energy in the SADC region to reduce greenhouse gas emissions and to foster the change from fossil fuels to the use of renewable energies.

Applications were received from students from all of the SOLTRAIN

partner countries, and the SOLTRAIN steering committee was able to award four students from South Africa and Zimbabwe, two each from Lesotho, Botswana and Namibia and one student from Mozambique, meaning that all SOLTRAIN partner countries were represented. The gender breakdown of the applicants amounted to five female and ten male students.

The successful recipients dealt with topics like the potential analyses and transition of domestic hot water technology to solar thermal systems with respect to different applications like health, tourism and the industrial sector. Technology-oriented topics included the development and investigation of a solar absorber and a nocturnal radiator hybrid panel in Botswana. A full list of the topics covered so far includes:

- Comparative study of solar water heater and electrical geysers in terms of performance and financial benefits
- Design and performance monitoring of an innovative residential prototype solar air source heat pump water heater
- Design of a hybrid vapour absorption milk chiller (Solar and biogas) for small scale dairy farms in Zimbabwe
- Exploring solar thermal integration opportunities for the tourism and hospitality sector in Zimbabwe

- SOLTRAIN research study for solar thermal system expansion and stagnation management
- Design and fabrication of a small-scale solar maize dryer with automated dryer control in Zimbabwe
- Adsorption refrigeration system design through modelling adiabatic cooling effects
- Potential analysis for solar thermal systems in the health sector - Lesotho
- Solar Thermal Energy for Breweries - Lesotho
- Numerical and experimental investigation of the thermal performance of a solar absorber and nocturnal radiator (SAANR) hybrid panel for climatic conditions of Gaborone – Botswana
- Potential analysis for solar thermal systems in the Namibian health sector
- Domestic hot water technology transition to solar thermal systems: Barriers and opportunities in Maputo City – Mozambique
- Potential analysis for solar thermal systems in the health sector - Botswana
- Techno-economic assessment of a solar thermal industrial-scale system using compound parabolic collectors
- Development of a pilot-scale solar thermal dryer for the treatment of faecal sludge from on-site sanitation facilities

Shoprite Group going off grid with rooftop solar

The Shoprite Group has installed rooftop photovoltaic (PV) panels at 19 sites in Namibia and South Africa and now generates enough electricity to power over 1,100 households for a year from solar energy – the equivalent of 12,300 MWh of electricity.

The group says it has also fitted 649 solar panels to the roofs of its refrigerated trucks, which generate 760 MWh annually – enough power to run 1,040 refrigerators for a full year. These allow drivers to switch off truck ignitions at delivery locations, reducing noise and exhaust pollution, while keeping the cold chain intact.

There are now 18 Shoprite stores throughout Namibia and South Africa that are now harnessing the power of the sun to feed their daily energy needs. These include Shoprite stores in Oshakati, Otjiwarongo, Ongwediva and Tsumeb. The bulk of the solar powered stores are in South Africa. The Shoprite Group's largest installation, at its Basson distribution centre in Brackenfell, South Africa, is a significant move to reduce the company's impact on the environment. There are enough solar panels at this distribution centre to cover an entire soccer field.

The Shoprite Group's Basson distribution centre in Brackenfell, South Africa

The Shoprite Group has also adopted energy efficiency at its stores in a bid to reduce electricity usage, and has replaced fluorescent lights with energy-efficient LED lights to the tune of N\$98.3 million. The move, the group said, resulted in a saving of 83.8 million kWh of energy in the four years that the LED lights have been in use.

"We recognise that climate change poses direct and indirect risks to our business and the communities we serve," said Sanjeev Raghubir, sustainability manager for the Shoprite Group. "Therefore we are taking measures to tread more lightly



The Shoprite Group's Basson distribution centre in Brackenfell, South Africa

on our planet. Apart from these solar panel installations, we have also signed an agreement which will see the group procure 434,000 MWh of renewable energy per year for the next seven years.

Shoprite is the first retailer on the continent to close such a deal.

Shoprite recently scored an A- for its climate change and water security disclosures on the globally

recognised CDP platform, which further underlines the retailer's commitment to environmental sustainability.

The group recognises the impact of climate change and therefore commits to reduce greenhouse gas emissions, continuously improve energy efficiency, and strengthen the resilience and adaptive capacity of its operations and that of the communities in which it operates.



South Africa opens bids for **2.6GW renewables tender**

South Africa has launched a request for proposals for 2600MW of new renewable energy projects from independent power producers (IPPs). Interested parties have until 4 August, 2021, to submit applications into the country's fifth Bid Window under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

South Africa's Energy Minister Gwede Mantashe says the aim is to procure 1.6GW of onshore wind energy and 1GW of solar PV power.

The Department of Mineral Resources and Energy says project sizes will range from a minimum of 1MW to a maximum of 140MW for onshore wind and 75MW for solar PV. Projects must be able to be constructed and connected to the national grid as soon as 12 months from

commercial close, but not later than 24 months after commercial close.

Potential bidders will be updated via briefing notes of any new developments, important information on the bidding process and key dates around the bid submission process.

While coal still dominates the South African energy mix, the contribution from variable renewable energy sources, such as solar photovoltaics (PV), wind and concentrated solar power (CSP), surpassed the contribution from nuclear energy for the first time in 2020.

This is according to research conducted by the Council for Scientific and Industrial Research (CSIR), published in its Statistics of utility-scale power generation in South Africa in 2020 report.

The research is based on a range of data sources and is driven by an

Eskom data portal recently established in the interests of power system data transparency, which provides new insights on specific daily, weekly and monthly electricity production, load-shedding experienced in 2020, as well as the flexibility needs of the power system.

The report, which provides a landscape of declining electricity system production and demand between 2010 and 2020 in SA, notes coal power plants provided 184.4TWh of electricity in 2020 and coal still accounts for 83.5% of power generation.

It further notes SA has been gradually adding utility-scale wind, solar PV and CSP for years, increasing the installed capacity from 467MW in 2013 to 5 027MW by the end of 2020 – 414MW of wind and 558MW of solar PV were

added during the year 2020 alone.

Nuclear energy, meanwhile, contributed 11.5TWh (5.2%), and for the first time, variable renewable energy surpassed nuclear, contributing 12.4TWh (5.6%). The rest of the energy capacity was met by other sources, including diesel, hydro and pumped storage plants.

“In the unprecedented year that was 2020, system demand declined

by 11.8TWh (5.1%) compared to 2019, relative to pre-lockdown forecasts. This significant increase on the part of variable renewables was due to 415MW of wind and 558MW of solar PV becoming operational during the past year,” according to the CSIR.

By the end of 2020, the monthly wind, solar PV and CSP production combined varied between 784GWh

and 1 161GWh, with the maximum daily total energy from solar PV, wind and CSP combined being 59GWh on 1 December last year, according to the report.

Combined with other renewable energy, such as hydro plants and pumped storage, this supported 10.5% of the total system demand in 2020, equating to 23.1TWh of electricity.



The capacity of wind, solar PV and CSP energy produced in 2020.

Despite more than R450 billion spent on the Kusile and Medupi power stations, and the increase in sustainable power sources, SA's ability to generate electricity has declined by 10% over the past

decade, according to the CSIR's report.

The year 2020, described as “the most intensive” year for load-shedding, saw SA being plunged into 860 hours of darkness, and

for most of these hours the country suffered stage two load-shedding. The report also notes that tapping the energy-generating potential of SA's waters is crucial if the country is to overcome the energy crisis.



The average annual capacity factor of the solar PV, wind and CSP fleet in 2020.



Zim to offer 5-year tax break for solar investors

Investors who will participate in the generation of solar power in Zimbabwe are set to enjoy a five-year tax holiday, with those importing gadgets used to generate solar exempted from paying customs duty.

Zimbabwe doesn't have enough electricity to cover the entire country hence the need for alternative forms of energy like solar power. It requires an additional 9 000MW to support economic activities that will drive the country towards achieving an upper middle-income economy by 2030.

Zimbabwe's demand for power hovers around 2 000MW. However, due to ageing equipment, existing power plants are generating far below the national requirement.

Power Development Minister Soda Zhemu said it is not possible to connect every area to the national grid because of inadequate electricity to cover the whole country.



Zimbabwe Energy and Power Development Minister Soda Zhemu

"Alternative forms of energy like solar power should also be utilised like we have a lot of sunlight which can generate power. It is important that we have investors or people who will invest in the generation of solar power, and Government is going to give incentives to

investors who want to participate in the generation of solar," he said. "This can be done by local people or other businesses which might decide to import gadgets used for generating solar duty free."

Minister Zhemu said Government is also determined that those who are going to come to do different activities in Zimbabwe can be given "five years of tax holiday".

"Whatever they are going to generate during those five years, they are not obligated to pay tax to Government. This is done to motivate those who want to invest in the generation of solar energy so that the solar grids can be linked to the national grid," he said.

"However, we discovered that it is not possible to connect every area to the national grid because we do not have adequate electricity to cover the whole country."

The Minister said Government is also targeting different corners of the country so that Hwange and Kariba Power Stations can reach out to these areas.



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