

Renewable Energy Systems Seen Through the All Hazards, One Health, One Nature Framework

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High Alert Institute, Inc. (a 501c3 Not-for-Profit)

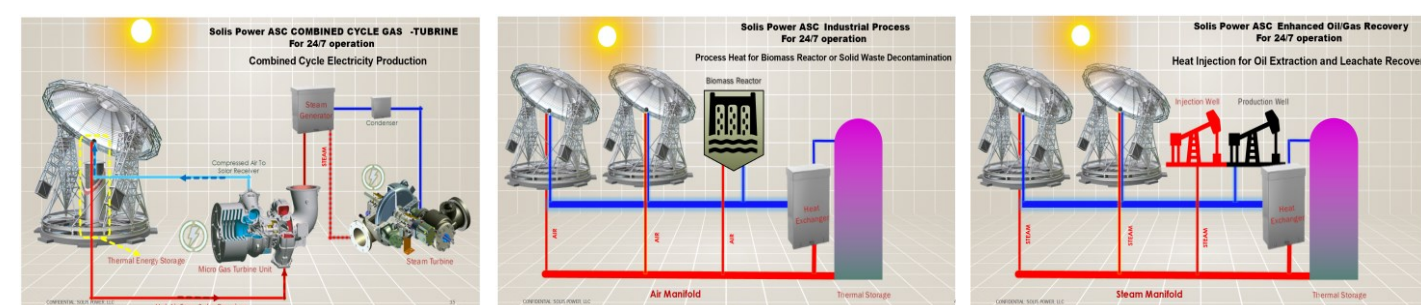
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Regulatory agencies and governments worldwide are undergoing a paradigm shift mandated by legislation and treaties. This shift to an All Hazards, One Health, One Nature (AHOHN) Framework has been brought to the forefront by the COVID-19 pandemic and the heightened appreciation of climate change consequences. The Healthcare and the Emergency Management (disaster response and recovery) Sectors are two essential industries in the AHOHN Framework that historically have been significant contributors to carbon emissions, solid waste, landfills, waste water and environmental contamination. Technological advances in renewable energy and energy storage systems that improve sustainability and reduce the environmental impact of disaster response and recovery are now available. Elevating the environmental leadership role of healthcare in the AHOHN Framework, healthcare systems, hospitals, health professionals and accrediting agencies have signed the White House / US Department of Health and Human Services Health Sector Climate Pledge. Key to objectives for all signatories to the Health Sector Climate Pledge is the 50% reduction of carbon emissions by 2030 and net-zero emissions by 2050. The Renewable Energy Industry is poised for a central role in these new legislative, regulatory, and funding landscapes. The High Alert Institute has four projects to advance the renewable energy in disaster management and healthcare while improving sustainability, reducing environmental impacts and mitigating health effects.

Concentrator Solar Thermal

Many sectors in the AHOHN Framework as well as non-AHOHN industries must generate trillions of BTU as hot air, steam, hot water, or other hot liquids/solids. Add to this the non-thermal uses of electricity in these same sectors. While solar PV can provide energy to meet all these needs on a small scale, the industrial and healthcare needs for both electricity and thermal energy exceed the space and budget available for sole reliance on solar PV to meet sustainability goals. However, solar concentrator based thermal systems with thermal storage hold the promise of providing high efficiency thermal energy capture and electricity generation. These systems also have potential for healthcare and industrial-scale power back-up during local and regional disasters. The High Alert Institute is participating in a Joint Venture with Solis Power, LLC to demonstrate three separate applications for solar collector based thermal technology in AHOHN and AHOHN related sectors. The first Solis Power system will be a 24-hour concentrated solar electricity generation plant which utilizes thermal energy storage and commercially available gas and steam turbines to enable both daytime and nighttime power generation. The second system will utilize the concentrated solar technology to generate heat that is suitable for use in high temperature industrial processes. Finally, the third system will demonstrate the capability of the concentrated solar technology for enhanced oil and gas recovery as well as solid waste (recyclable solids) decontamination applications.



Wind Energy Conversion System Noise Mitigation

Wind turbines generate noise from multiple mechanical and aerodynamic sources. Although technology advances have led to quieter turbines, noise from wind turbines remains a public concern. The problems associated with wind turbine noise have been one of the more studied environmental impact areas in wind energy engineering. Noise levels can be measured, but, similar to other environmental concerns, the public's perception of the noise impact of wind turbines is in part a subjective determination.

While reduction in overall sound level an important effect of this multi-substrate approach to multi-modal noise sources, it is equally important to reduce of wind turbine noise annoyance, nuisance and dissatisfaction. Scientific research has also demonstrated the health impacts of environmental noise on both animals and humans. The strategic placement of each mitigation technology not only reduces noise transmission and resonant amplification, but also changes the spectrum of frequencies contributing to the overall wind turbine noise.

A four year project in wind energy conversion system multi-modal noise mitigation by the High Alert Institute applied targeted Multi-Substrate noise mitigation, abatement and suppression technologies to the multi-modal noise sources of a typical wind turbine on a conical monopole. Post-mitigation sound levels of at 1 foot, 30 meters and 60 meters from the tower base were significantly reduced.

Sound Level Estimates Based on Multi-Substrate Noise Abatement	1' Sound Level dBA	30 m Sound Level dBA	60 m Sound Level dBA	Tower Base Sound Level with Noise Abatement	30 m Sound Level with Noise Abatement	60 m Sound Level with Noise Abatement
Turbine Mechanical Vibration	95	59	53	61	25	19
Turbine Electrical Vibration	95	59	53	61	25	19
Tower Reed Effect	80	44	38	56	20	14
Tower / Wind Turbulence	94	58	52	70	34	28
Blade / Tower Turbulence	94	58	52	70	34	28
Blade / Rotor Turbulence	94	58	52	70	34	28
Turbine & Tower Combined	101.4	65.4	59.4	75.2	39.2	33.2

Solar PV – Solar Thermal Hybrid Installation

Solar pool heating systems have been a standard option for heating pools worldwide for many decades. These PVC systems are also employed in aquaculture, hydroponics and other agricultural implementations. The principal advantage normally expected of solar pool heating systems is the definite operating economy as compared with conventional pool heating systems such as combustion heaters, electrical element heaters, and heat pumps. In general, where solar heating systems are employed for heating pool water, water is circulated by the primary pool filter pump through PVC pipes and tubes that act as both a radiant solar heat collector and as an air/water temperature exchange radiator. The primary shortfall of these unenclosed solar pool water heaters is that the maximum water temperature is limited to the maximum temperature of the air at the level of the roof deck. This limitation is of little importance during warm weather, but when the average daytime temperature is lower than the desired pool temperature, solar pool water heaters generally fail to provide the desired pool water temperature.

The Solar PV – Solar Thermal Hybrid Installation method, patented by the HIGH Alert Institute, is a heat concentration box arrangement that encloses the PVC solar water heater collector increasing the average ambient temperature at the roof deck. A one year project at the High Alert Institute's Lake Wales facility demonstrated a two-fold increase in solar pool water heater efficiency. In addition, this arrangement provided more electricity from solar PV than was used to filter and operate the facility's 48,000 inground concrete pool with water temperatures between 76°F and 92°F year-round.

Renewable Energy for Disaster Readiness

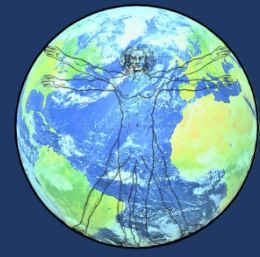
Key to the Technology & Innovation domain of the AHOHN framework is the repurposing of existing common off-the-shelf (COTS) technologies. While renewable energy has an established role in environmental stewardship and climate change, only recently have green COTS technologies been considered for application to meet the challenges of disaster readiness, business continuity, and determinants of health. Key to the widespread adoption and endorsement of renewable energy systems for disaster readiness is reliability of the systems under adverse conditions and during real-world disasters.

In 2015, the first of three renewable energy based back-up power systems was added to the existing Kohler propane fueled back-up generator system at the High Alert Institute's Florida facility. This first system was a 20kW an above grade backless Trina solar PV system with Enphase microinverters. In 2017, second system, a Bergy Excel 15kW wind turbine was installed. After a pandemic delay, the third system, a 35kW Q-Cell Solar PV with Generac PWRCELL inverters and Generac Whole Building Battery Back-Up was installed in 2022.

Real World data from these unmodified COTS systems demonstrated a wide variation in system reliability including fair weather operations, severe weather operations and hurricane/post hurricane operations.

- Kohler Propane Generator = 1% downtime 2014-2023
- Trina/Enphase Solar PV = 2% downtime 2015-2023
- Bergy Wind System = 8% downtime 2017-2023
- Q-Cell/Generac Solar PV = 13% downtime 2022-2023

The Kohler generator downtime was due to ATS controller board failure. The Trina/Enphase downtime was due to hurricane related mounting bracket failure leading to loss of a single panel. Bergy Wind Turbine downtime was due to a direct lightning strike on the turbine. Q-Cell/Generac PWRCELL downtime was due to inverter failures and ATS communication failures.



Renewable Energy Systems Seen Through the All Hazards, One Health, One Nature Framework

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- Regulatory agencies and governments globally are adapting to a new All Hazards, One Health, One Nature (AHOHN) Framework.
- The COVID-19 pandemic and rising awareness of climate change impacts have pushed AHOHN to the forefront.
- AHOHN Framework has been brought to the forefront due to the COVID-19 pandemic and heightened climate change awareness.
- Healthcare and Emergency Management are two significant contributors to carbon emissions, landfills, and environmental contamination.
- Technological advances in renewable energy and energy storage systems can reduce the environmental impact of disaster response and recovery making disaster response and recovery more sustainable.
- To advance its role in the AHOHN Framework, healthcare systems, hospitals, and accrediting agencies are committing to reducing carbon emissions.
- The healthcare industry has signed the Health Sector Climate Pledge, committing to reducing carbon emissions by 50% by 2030 and achieving net-zero emissions by 2050.
- The Renewable Energy Industry will have a significant role in these new legislative, regulatory, and funding landscapes.
- The High Alert Institute has four projects to advance renewable energy in disaster management and healthcare, improve sustainability, and mitigate health effects.

Concentrator Solar Thermal

- AHOHN Framework and non-AHOHN sectors need trillions of BTU of thermal energy and non-thermal electricity.
- Solar PV can't meet these needs alone due to space and budget limitations.
- Solar concentrator based thermal systems offer high efficiency and potential for power backup during disasters.
- The High Alert Institute and Solis Power are partnering to demonstrate three applications for solar collector based thermal technology in AHOHN and related sectors.
- The first system is a 24-hour concentrated solar electricity generation plant with thermal energy storage and gas/steam turbines.
- The second system generates heat for high temperature industrial processes.
- The third system is for enhanced oil/gas recovery and recyclable solid waste decontamination.

Wind Energy Conversion System Noise Mitigation

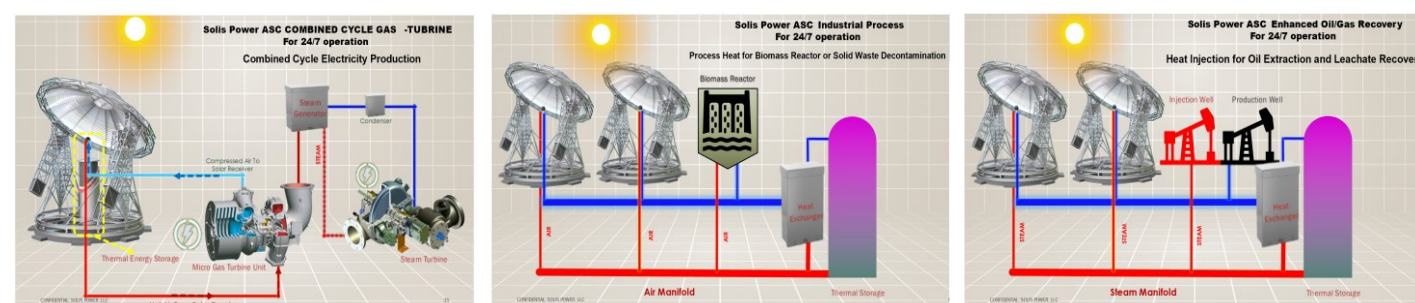
- Wind turbines generate noise from multiple sources.
- Technology advances have led to quieter turbines, but noise remains a concern.
- Wind turbine noise is a heavily studied environmental impact area in wind energy engineering.
- Quieter technology advancements have not fully addressed public concerns about wind turbine noise.
- Reduction in overall sound level is important, but reducing annoyance and health impacts is equally important.
- Environmental noise has health impacts on animals and humans.
- Targeted multi-substrate noise mitigation, abatement, and suppression technologies can significantly reduce post-mitigation sound levels..
- A four year project by High Alert Institute successfully applied targeted multi-substrate noise mitigation to a typical wind turbine, resulting in significantly reduced post-mitigation sound levels at 1 foot, 30 meters, and 60 meters from the tower base.

Solar PV – Solar Thermal Hybrid Installation

- Solar pool heating systems have been used worldwide for decades in pool heating, aquaculture, hydroponics, and agriculture.
- They are more cost-effective than conventional heating systems.
- Water is circulated through PVC pipes and tubes to act as a solar heat collector and air/water temperature exchange radiator.
- Unenclosed solar pool water heaters have a limitation of maximum water temperature based on the air temperature at the roof deck level.
- The Solar PV – Solar Thermal Hybrid Installation method, patented by the HIGH Alert Institute, encloses the PVC solar water heater collector to increase the average ambient temperature at the roof deck.
- A one year project at the High Lert Institute's Lake Wales facility demonstrated a two-fold increase in solar pool water heater efficiency and provided more electricity from solar PV than was used to operate a 48,000 inground concrete pool with consistent water temperatures between 76°F and 92°F year-round.

Renewable Energy for Disaster Readiness

- AHOHN framework relies on repurposing COTS technologies for disaster readiness and determinants of health.
- Recently, green COTS technologies are being considered for these applications.
- Widespread adoption of renewable energy systems for disaster readiness depends on their reliability under adverse conditions.
- High Alert Institute's Florida facility has three renewable energy-based backup power systems.
- Kohler propane generator had 1% downtime from 2014-2023.
- Trina/Enphase solar PV had 2% downtime from 2015-2023.
- Bergy wind system had 8% downtime from 2017-2023.
- Q-Cell/Generac solar PV had 13% downtime from 2022-2023.
- Downtime reasons include controller board failure, hurricane-related failures, lightning strike, and inverter/ATS communication failures.



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