### SUSTAINABLE ENERGY FOR DISASTER RESILIENCE

Cyclone Fani Response 2019





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Authored by: Anjora Sarangi

Graphic design: Ankit Singh

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### **EXECUTIVE SUMMARY**

Response to the environment of t

Today, India loses over 5000 lives to disasters each year, with additional losses in the form of infrastructure, assets, and livelihoods.<sup>1</sup> Odisha has had a particularly troubled history when it comes to disasters. The state's geographical vulnerabilities coupled with acute poverty and inequity, exacerbates the problem. Last year, coastal Odisha was hit by one of the most severe cyclones the country has seen – Cyclone Fani. In the last century alone, the state has experienced 263 cyclonic disturbances out of a total of 1035 that have occurred in India.<sup>2</sup>

SEEDS and SELCO Foundation came together to work with the local communities in Puri district of Odisha to strengthen their rebuilding efforts after Cyclone Fani. This report discusses their joint work on the ground in using sustainable energy as a tool for disaster resilience. The interventions concentrate on strategic infusion of energy and sustainability-based features for faster recovery and long-term resilience. What emerges is a replicable and scalable model for community resilience.

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# I

### SYNERGY BETWEEN SUSTAINABLE ENERGY AND DISASTER RESILIENCE



# The current short-sightedness of the disaster-energy nexus

n the last 50 years, India has seen an exponential rise in extreme climatic events with a marked acceleration between 2000 and 2019. Climate emergency is causing shifts in microclimatic zones which have drastic consequences across different sectors.<sup>3</sup> During a disaster, electricity is one of the first services to be struck down. Electrical supply infrastructure is usually highly complex, geographically extended and with varying levels of connectivity making it difficult to balance supply and demand. Damage to electrical systems affect essential services that depend on it such as water supply, healthcare, communication systems, etc. Disruptions in water supply and wastewater drainage can even pose a serious threat to public health, hygiene, and sanitation in the area, putting lives at risk. The level of loss after a disaster depends upon the coping capacity of the community. Those with low coping capacities are often affected by disasters in cycles, getting hit by the next one before they have recovered from the previous one. Immediate relief and response activities in the aftermath of a disaster are usually focused on relieving suffering and stabilising the environment. However, they are usually short-term solutions and rapid reactions to unplanned events which may not be sustainable.



ccess to a safe built environment along with decentralised energy can be a powerful combination for combating complex challenges after a disaster and for inclusive rehabilitation and rebuilding. Investment in infrastructure strengthening can break the link between poverty and disasters. The investment should focus on benefiting the poorest who reside in informal settlements and are the most vulnerable. They are also the ones spending the most on maintaining their energy needs.

At times, simple building design improvements and retrofitting can help secure structures during a disaster, thereby avoiding loss of life and property. For example, after the catastrophic earthquake in Nepal in April 2015 which killed 8000 people, SEEDS built transitional shelters keeping in mind earthquake safety and resilience as well as local climatic conditions. Use of locally available materials and features such as cross-bracing rendered these shelters both safe and sustainable. Moreover, these shelters were built by the families themselves, with socio-technical support and training. This helped in immediate relief in the short run as well as engendering long term community resilience.

According to the World Bank, countries should not only depend on existing infrastructure in the long run but also build decentralised energy for faster recovery after disasters. Decentralisation ensures that the whole network is not disrupted when one weak point fails. It enables re-building to focus on the areas which need to be prioritised first. A microgrid can maintain power during a disaster as it is a localized grid that is able to disconnect and isolate itself from the utility. Similarly, an individual solar home system could be a smarter solution than dependence on the central grid-power during a disaster. This was done in Vanuatu, an island country in South Pacific Ocean after a tropical storm hit in 2015, bringing down the power lines. Those who had opted for solar home systems prepared beforehand by dismantling and storing the equipment to be reinstalled after the storm had passed.<sup>4</sup> A one-time intensive installation and engagement enabled the region to take back control over its immediate environment and strengthen coping capacity in subsequent emergencies.

The demand for it can be generated through use of innovative means. For example, during an owner-driven reconstruction project post-floods in the Kosi river basin in Bihar, which SEEDS was facilitating, we promised solar lighting solutions for households which completed their work within six months. While it acted as an incentive for them to finish rebuilding their houses in time, it also generated a larger demand for home solar lighting solutions in the locality. 27

-Dr. Manu Gupta Co-founder, SEEDS

### Some priorities going forward

In the provides the use of renewable energy, energy and resource efficiency and innovative technology, collectively forming a sustainable energy ecosystem. Historically, there has not been an overlap of sustainable energy and emergency aid, but the potential for energy-based technology for disaster relief and long-term community resilience is significant.

### Role of energy through the disaster cycle

decentralised energy system would enable governments to reduce the impact of disasters which in turn could improve human well-being by avoiding recurring recovery and rehabilitation costs. But how do we develop a resilient system for future catastrophes?

SEEDS and SELCO Foundation have built an energy enabled model for community resilience for long term sustainability. The success of this system depends on four pillars:

### RELIABILITY

A dependable ecosystem, including continuous electrical supply through sustainable energy, and robust early warning systems to aid faster resumption of services after disasters

### **EFFICIENCY**

Local alternatives based on community managed resources to open new opportunities to meet critical needs during disasters such as clean drinking water

### **AFFORDABILITY**

Cost effective technologies and design features to reduce energy consumption

### **SUSTAINABILITY**

Reduce dependency on fossil fuels and use of locally available resources



Community resilience needs to be built through different phases of the disaster cycle. The most essential sectors must be strengthened first including emergency services, shelters, health, education, and the environment. The table below gives an example of the activities to be undertaken across different phases of a disaster for improved resilience.

	Pre disaster	During disaster	Post disaster
	Build reliable and robust early warning system	Ensure energy supply in relief shelters within 24 hours	Provide essential communication for search and rescue
Emergency Services	Ensure that communication system is disaster resilient		Ensure reliable mobile telephony
	Passive design features and building technology to reduce energy consumption		Ensure energy supply in shelters for adequate lighting and
Shelter	Build decentralised system to ensure energy supply		ventilation
	Essential facilities to have access to decentralised energy	Critical medical equipment to have emergency power back- up	Energy supply for adequate lighting and ventilation in field hospitals
Health			Access to energy for water supply and sanitation units
	Retrofit buildings to reduce energy consumption		Ensure access to decentralised system to avoid disruption of
Education	Access to decentralised energy Innovative design elements to create awareness		education 
	Conserve ecosystems that act as natural barriers against hazards		Social forestry initiatives to restore the natural ecosystems
Environment	buffer plantation for pro- tection against cyclonic winds		





# Odisha's geographical vulnerabilities and the impact of Cyclone Fani

disha is one of the most disasterprone states in India and has been dubbed as the 'disaster capital' of the country.<sup>6</sup> Cyclones, floods, droughts, tsunamis, and earthquakes have been ravaging the state for 90 of the last 100 years. Although the geographical location of the state lends itself to being more sensitive to extreme weather influences, Odisha has also faced immense ecological damage in the past few decades. Deforestation has led to 52 per cent land facing erosion, clearing of mangrove forests have caused frequent cyclones and siltation has resulted in river deluge.<sup>7</sup>

Last year in May 2019, Odisha was struck by the strongest storm that India had seen in 20 years – Cyclone Fani.<sup>8</sup> With wind speeds touching 200 kmph, Fani wreaked havoc on coastal communities of Odisha with Puri district being one of the worst affected. The storm was categorised as an Extremely Severe Cyclonic Storm, claiming 64 lives, and caused damages of over Rs. 200 billion.<sup>9</sup> Over half a million houses were damaged and 15 million people affected across Odisha.

Despite being besieged by calamities repeatedly, Odisha has developed a successful disaster preparedness strategy and was able to minimise fatalities during Cyclone Fani, which was recognised by the United Nations (UN).<sup>10</sup> The state has received high praise for its handling of disasters in the past. The Odisha State Disaster Management Authority (OSDMA) and Odisha Disaster Rapid Action Force (ODRAF) were set up in 1999 after the super cyclone, which was six years before the National Disaster Management Authority (NDMA) was founded in the centre. In October 2020, the state government announced the sanction of Rs. 205 crores for hi-tech equipment, enhancing training and capacity building for disaster preparedness.<sup>11</sup> While the state has displayed strong political will and a proactive response mechanism, it now needs to focus on improving recovery and resilience building efforts.



### A model to build back better

n the immediate aftermath of Cyclone Fani, there was an urgent need to provide aid to the affected communities. SEEDS reached out to over 600 families in Penthakotha area in Puri, which was the worst affected during the cyclone, with relief in the form of health, hygiene and home utility kits, followed by orientation programmes on Water, Sanitation and Hygiene (WASH) for over 2000 people. Lastly, over 120 transitional shelters were also constructed to rehabilitate the displaced families as part of early recovery efforts.

As a next step to accelerate rehabilitation and recovery, SEEDS and SELCO Foundation have leveraged their skills for humanitarian action and sustainable energy use to design a model of green recovery for disaster resilience. The interventions were targeted at building the community's capacity to absorb shocks, recover faster and be better prepared and informed for the future. It follows a comprehensive bottom-up approach to improve the overall quality of life of people in the community especially focusing on sustainable and decentralised energy for disaster resilience.



### **Bottom-up approach**

Communities require sustainable energy, health and education, safe built environment, and capacity building to cope with disasters and become resilient. This can be aided by an enabling policy environment, reliable information systems and financial security at the state and national level.

### Assessment

uri District had the highest number of destroyed pucca buildings after the cyclone with Puri Rural accounting for 69% of the total number of affected houses among the 14 districts.<sup>12</sup> Electricity supply was cut off entirely in Puri and was restored in parts of the city only after 12 days.<sup>13</sup>

The project team carried out transect walks in four villages, conducted risk assessment and developed a vulnerability profile of the area. Biranarsinghpur Primary School located in Biranarsinghpur village and the Community Health Centre (CHC) in Chandanpur village, both in Sadar Block of Puri were identified as the main intervention points since the school serves as a relief shelter for the community during the disasters and the CHC is the only healthcare facility in the vicinity.



### **Planning and design**

participatory approach was adopted for deciding interventions, locations, and design. This was to ensure accountability and responsibility of the community. In-depth surveys, interviews, and focus group discussions were carried out with all concerned stakeholders including panchayat and ward members, block and district officials, school and CHC management. The design for the interventions were done in close collaboration with students for child-friendly elements in the school and with CHC staff to understand the shortcomings in the health facility.

### Interventions

The project interventions first aimed to provide immediate benefits to the community including access to a safe built environment and decentralised energy. For example, landscaping was carried out in the school premises in the form of strategically positioned vegetation to reduce the surface heat gain and improve the microclimate. Energy efficient fixtures were also installed in both the school and the health facility to reduce the power consumption. Other interventions aimed to build awareness and effect long term behaviour change included innovative solutions such as a weather station and a carbon footprint calculator in the school. These would empower children to become sensitive to climate emergency and act as young change agents in their communities. Decentralized energy would improve energy security during disasters, ensure safety to the most vulnerable, establish ownership and wider acceptance of solar technology.



### Mobile solar home lighting units

Lighting, ventilation, mobile charging facility to improve energy security and safety in community settlements during disasters and in peace time



Basanti Nayak, a resident of the Pratap Purusottampur Gram Panchayat talks about her experience of the cyclone, "Our house was severely damaged and communicating with people was very difficult at the time. We had to travel long distances over an hour away, paying up to Rs. 50 for the journey just to find phone charging points. The shelter we have moved to, now has solar units that can charge mobile phones. This has been a big sigh of relief."



**Transitional** 

Safe and dignified living

vulnerable families post

space for the most

shelters

disaster

- MM

Solar lighting in transitional shelters will reduce the community's dependence on kerosene. Khetramoni Bhoi from Bira Balabhadrapur village says, "The outcomes will be exceptionally positive. The solar lighting units will make our lives safer and easier. We will save money and no longer have to search for firewood or travel to the nearest town to buy costlier kerosene."

### Interventions in the Biranirsinghpur Primary School and Chandanpur Community Health Centre



**Safe built environment** Structural rehabilitation and upgradation of buildings to create a safe and sustainable environment

### Solar panel installation



Installation of rooftop solar panels to help provide decentralised energy access and improve energy security during disasters



Health and hygiene Improving health and hygiene by providing safe drinking water, handwash stations and toilets



Provision of solar water pump to maintain water supply for drinking and sanitation needs during disasters



Public address system to communicate critical advisories during emergency

#### Prov back supp

**48-hour power backup** Provision of 48-hour power backup during disasters to support the critical electrical load requirements

#### **EOC and evacuation maps** Emergency operation cabin

Emergency operation cabinet (EOC) to store first aid box, search and rescue gear. Evacuation maps and signage to facilitate safe evacuation

Disaster risk reduction training

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Capacity building of stakeholders in search and rescue, fire safety, first aid and evacuation



**Emergency lighting** Emergency lighting fixtures in the relief shelter to aid effective navigation through space and promote psychological well-being of the occupants

Solar maintenance training Capacity building of local electricians and community members to operate and maintain the solar energy system and operate the system





# Improved infrastructure, lighting, and water facilities in the school

ith the introduction of solar panels and power backup over the last year, conditions have improved significantly. Ms. Sadhana Chatterjee says "Our school is a cyclone shelter and lack of electricity has resulted in multiple complications. The provision of 24-hour lighting has come as a big relief, so life can continue as normal now even during an emergency. An added benefit of solar street lighting is reduced risk of snake bites in otherwise dark and isolated areas."

"The school is undergoing a complete overhaul with retrofitting and repair work including wall painting, landscaping, improvement in toilet facilities for access to people with disabilities. The water filter installed can be used by the larger community for their household needs. I believe these improvements will boost enrolment from higher income families in the school, who are currently sending their children to private schools that are far away. It will also boost our students' morale." The government primary school at present is mostly attended by children from low-income households belonging to marginalised communities.

The school has a 12-member School Management Committee (SMC) that meets every month to discuss everyday functioning and address upcoming challenges. After Fani, the SMC members received an orientation on how to carry out safe evacuation, first aid, search and rescue operation. *"The training has helped build capacity at a local level to respond to the needs during future emergencies"*, believes Ms. Chatterjee. The SMC will take over responsibility of monitoring new additions to the school such as the water filter. It will lead to greater accountability of the authorities and higher engagement of parents and other members in their children's education.



"We overcome at least two disasters every year and our children go through a lot of turbulence. My only concern after cyclone Fani was the wellbeing of our students, faculty and members of our community."

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- Sadhana Chatterjee Head Mistress

## **Chandanpur CHC is prepared for emergency medical services**



he Chandanpur CHC is located about 7 kms away from where cyclone Fani made landfall in May 2019. It serves more than 1,00,000 people in the area. An initial assessment of the labour room and operation theatre (O.T.) indicated poor lighting conditions. For example, there were only two lamps in the O.T., and neither was functional during the assessment.

Dr. Poonia, Medical Officer says, "We conducted one delivery on the day of the disaster, with flashlights, and with no water supply, despite a storm raging above us. It was a miracle!" There were 4-5 accident victims that came in after the cyclone and on average the team conducted 3-4 deliveries every day. There was also a sharp increase in cases of diarrhea and skin diseases after Cyclone Fani. "We were short staffed on most days, worked overtime but were still not able to meet the needs of people during that time," says Shobhagya Laxmi Acharjee, Staff Nurse. "Roads were inaccessible, and I would walk for two hours in the morning from my house to reach the CHC for my 8AM shift. My phone would remain discharged the whole day because there was no access to electricity."

Going forward, both water and electricity shortages will be met by solar-powered system such as streetlights, charging stations, water heater and water pump. According to Dr. Poonia, "Power is the essence of all things in a health facility, especially in an emergency. Solar powered system has given us an alternative to grid-power and diesel generators. I strongly feel solar power should become an essential part of public health facilities throughout the country."



### Key takeaways

### Access to decentralised energy is critical in a disaster context

Decentralised energy helps secure continued access to lighting, ventilation, and water, thereby enhancing the response capacity of the community during a disaster scenario. When provided in critical public infrastructure, it makes a significant difference. It enables health facilities to continue delivering important services, schools that double up as relief shelters to provide clean drinking water to its residents, and communication systems to deliver public advisories. This ensures that loss of life and assets is minimised and communities cope better with the disaster situation.

### Adoption of sustainable energy has utility beyond the built environment

While adoption of sustainable energy technologies such as solar ensure a reliable and resilient alternative during disasters, reduced dependency on grid-power also helps in reducing carbon-footprint. Beyond its application in the built environment, it can be an extremely useful and sustainable mean for micro-enterprises such as flour mills and laundry whose livelihood is dependent on access to energy. It will aid such members of the community to recover rapidly in disaster situations.

### Capacity building and Early Warning System (EWS) are important tools to cope with a disaster

An important aspect of disaster preparedness measures is building surge capacity within the community. It can critically aid search and rescue operation, evacuation, and administration of first aid in emergency situations where physical access is cut off after a disaster. Tied to that is a reliable local EWS which uses tools such as public address systems which can be used to deliver important and actionable advisories to people during evacuations and when they are taking refuge in relief shelters. This ensures that community members go beyond being end-users of services and are capacitated to manage disasters themselves.





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### **About SEEDS**

SEEDS (Sustainable Environment and Ecological Development Society) is a not-for-profit organisation that enables community resilience through practical solutions in the areas of disaster readiness, response and rehabilitation. Since 1994, the organization has worked extensively on every major disaster in the Indian subcontinent – grafting innovative technology on to traditional wisdom. It has reached out to families affected by disasters and climate stresses; strengthened and rebuilt schools and homes; and has invariably put its faith in skill-building, planning and communications to foster long-term resilience. SEEDS is also India's first agency to be certified for the global Core Humanitarian Standards – an international certification system for quality and accountability in humanitarian response. For more information, visit www.seedsindia.org

### **About SELCO Foundation**

SELCO Foundation aims to develop innovative, sustainable – social, technical and financial models that impact climate change and poverty alleviation. It is a collaborative striving to work on solutions, support agents and build a sustainable ecosystem for clean energy access. SELCO Foundation seeks to holistically facilitate context-driven solutions and opportunities that result in improved well-being and livelihoods for underserved communities through sustainable energy and energy-efficient applications. The interventions are developed with a focus on local empowerment, replication and ethical scaling. For more information, visit our website at https://www.selcofoundation.org/

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15-A Institutional Area, R.K.Puram, Sector IV, New Delhi - 110022 www.seedsindia.org