THE PHILIPPINES AND SUPER *TYPHOON* YOLANDA:

THE CASE FOR IMMEDIATE RESTORATION OF ELECTRICITY

This report was produced by TransGas Development Systems, LLC, a New York-based energy company.

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TRANSGAS
Development Systems


34

TABLE OF CONTENTS

MESSAGE FROM THE CHIEF EXECUTIVE OFFICER

TransGas Development Systems, LLC, a New York-based energy company, was invited by the United Nations Development Programme to undertake a technical assessment of the damages caused by Super Typhoon Yolanda to the electrical infrastructure of the Philippines with the aim of identifying ideal locations for the placement of turbine generator units that would guarantee the immediate restoration of electricity to local businesses and communities.

The ongoing electricity crisis has been having a devastating impact to the local economies of the areas affected by the Super Typhoon. As reported in the front page of the New York Times on 3 February 2014[1], a mounting exodus of skilled workers places an additional burden to the region already plagued by the worst consequences of a natural disaster. For instance, the NYT reported that over one-third of the students at the University of the Philippines campus in Tacloban have transferred to other towns as they face a deteriorating economy in their hometown. The Times warns "without power and other basics, businesses are finding it difficult to recover. And without commerce, the city will continue to lose money – and talent".

We quickly responded to the United Nations request and promptly dispatched a senior engineer to the Yolanda-affected regions. He undertook two comprehensive technical and fact-finding missions in December 2013 and January 2014 to work with local authorities in identifying locations for the installation of the TransGas' turbine generator units.

We have also facilitated a mission by a representative from Spain's ACS Group, a strategic partner of TransGas and one of the largest and most renowned construction and engineering companies in the world. The ACS' technical mission to the Philippines has contributed decisively to the assessment of the extent of the damages and the complexity involved in the installation of the much-needed emergency electrical generators, including the TransGas' turbines. In addition, our international relations advisor was sent to the Philippines to facilitate consultations with the Central Goverment, civil society organizations and charities, the media and the diplomatic community.

As our technical analysis evolved and as we engaged local communities and businesses, we began to realize that our findings would be important to the overall reconstruction effort and also help inform decision makers in other countries that are impacted by natural disasters. With this in mind, TransGas has put together this report on a pro-bono basis as an advocacy tool for the Filipino local authorities and electrical cooperatives that are in desperate need of donations of equipment and external funding to restore the power infrastructure.

[1] *http://www.nytimes.com/2014/02/04/world/asia/after-typhoons-devastation-a-philippine-town-is-losing-those-who-could-rebuild-it.html?_r=0*

Simply put, people need electricity to start re-building their lives. We believe that re-building the electrical infrastructure must be an early-recovery action if one is serious in building long-term resilience and human wellbeing. Electricity restoration must also ensure that the new infrastructure is more resilient to natural disasters and more adequate to fostering inclusive economic growth.

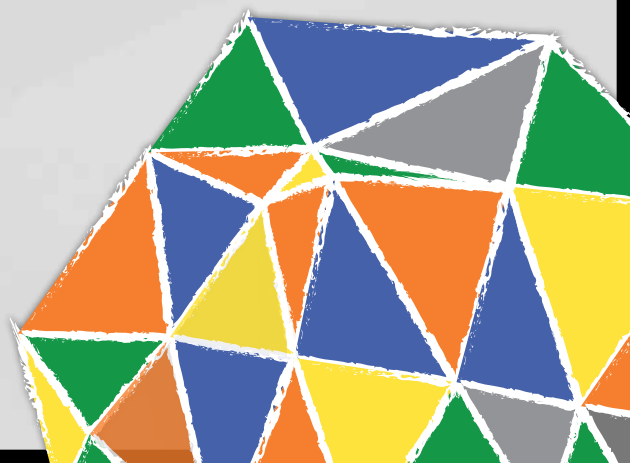
We at TransGas are proud to have conducted our analysis in permanent dialogue with the local government units, cooperatives, utilities, unions, the Energy Department in Manila, the United Nations and the multilateral financial institutions. As a collaborative effort, our assessment was made possible thanks to the consultations and interviews with citizens and government stakeholders and the various field visits we have conducted in all areas affected by Yolanda.

The strength and enthusiasm of all the Filipinos we have met in our missions was breathtaking. Their Government's commitment and ongoing efforts towards the recovery are laudable. For instance, few countries could have managed to clear a massive amount of debris in the roads affected by the Super Typhoon in less than four days. An enormous achievement in such harsh conditions.

We hope that the recommendations of this report provide useful support to the Philippines authorities and foster new thinking in post-disaster relief and reconstruction efforts.

The Filipinos can keep counting on us.

ADAM VICTOR
PRESIDENT AND CHIEF EXECUTIVE OFFICER



KEY MESSAGES

ELECTRICITY MUST BE RESTORED IMMEDIATELY

"AT NIGHT, (THE CITY) IS MAINLY PLUNGED INTO DARKNESS, AND THE FEW TEMPORARY HOUSES COMPLETED BY THE GOVERNMENT HAVE BEEN DECLARED TOO CRAMPED FOR HUMAN HABITATION."

The above description by New York Times on 3 February 2014 portraits a dramatic situation that is been experienced by hundreds of thousands of Filipinos. The historic dimensions of the Super Typhoon explain the ongoing electricity crisis and the recurrent power outages – almost 2000 electricity transmission facilities were severely damaged. The scope of the destruction overshadows the ability of any government to respond by itself.

Another important factor is that the existing disaster response models do not reflect the central role that energy, especially electricity, play in more sophisticated economies, such as the Philippines. As a result of this, electricity restoration ends up being marginalized in traditional relief assistance by the international community, hampering the local authorities' efforts to tackle the energy and power infrastructure gaps. The marginalization of the electrical sector in the ongoing recovery efforts has negative effects not only to the immediate needs of an economy, but also hinders investments geared towards re-building infrastructures with a long-term resilience-building vision.

TransGas' crisis management is committed to to change this unfortunate reality and has made a strong case for the electrical and power sectors when working with the Filipino local partners.

Responding to a demand by local authorities and the communities that were hit hardest by the Super Typhoon, TransGas has concluded a survey to locate strategic sites for 25-50MW diesel fueled gas turbine generator units which would provide the critically needed electric capacity and voltage support so as electricity can be restored in the near term. TransGas has focused on local communities that require immediate and future dependable electric power "peaking services" to strengthen the electric grid and assure higher reliability during normal operating conditions and future natural disasters.

The TransGas survey was conducted in connection with the concerned local government units, utilities, cooperatives, unions, businesses and citizens associations and concluded that the priority sites for the emergency generator units are located in Eastern Samar and Bantayan Island. The complete description of the survey's findings is available under the section on "Emergency Restoration of Electricity: Allocation of Generator Units", page # 12.

NATIONAL OWNERSHIP IS FUNDAMENTAL TO THE RECONSTRUCTION OF ELECTRICAL SYSTEMS

The international community can do a lot to support the reconstruction of the electrical system of the Philippines, especially in supporting national capacity building by bringing technical expertise and advice based on world-class experience. The international community can also play a pivotal role in procuring and supplying the Filipino electrical authorities with the much-needed equipment, helping tackle the ongoing deterioration of the economic and social conditions of the areas affected by the Super Typhoon.

Strengthening the capacity of the Filipino authorities to respond to the electrical crisis can benefit from global expertise based on other countries' successes and failures. This can be only achieved with multi-stakeholder collaboration and mutual learning, enabling national authorities to build their own expertise.

The TransGas' crisis management engagement is based on the principle of national ownership and has the ultimate aim of building national capacities. This explains why the present assessment was carried out by listening to the demands of and working in close collaboration with local partners in the Philippines, including the following:

- **Department of Energy, Office of the Secretary**
- **Department of Social Welfare and Development, Disaster Risk Reduction & Response Office**
- **Philippines Rural Electric Cooperative Association (PHILRECA)**
- **Federation of Rural Electric Cooperatives, Guiuan**
- **Eastern Samar Electric Cooperative (ESAMELCO)**
- **Bantayan Island Electric Cooperative (BANELCO)**
- **Northern Panay Electricity Cooperative**
- **Bantayan Island Power Corporation (BIPCOR)**
- **Office of the Governor of Leyte**
- **Visayas State University**
- **Leyte Normal University**
- **Local Government Units: Tacloban City, Caibiran, Leyte City, Ormac, Cebu, Bogo, Danao City, Daanbantayan, Santa Fe, Madridejos, Iloilo City, Roxas City, Panay Town, Panitan Town, Pototan, Capiz, Bibiran, Jaro, Salcedo and Quinapondan.**

"CONNECTING LOCAL RESEARCH CENTRES, UNIVERSITIES AND EXPERTS NETWORKS WITH CENTRES OF EXCELLENCE WORLDWIDE CAN ADVANCE KNOWLEDGE BUILDING AND PREPAREDNESS TO EMERGENCY RESPONSE AND RECOVERY."

RECONSTRUCTION MUST AIM AT BUILDING BACK STRONGER AND MORE RESILIENT

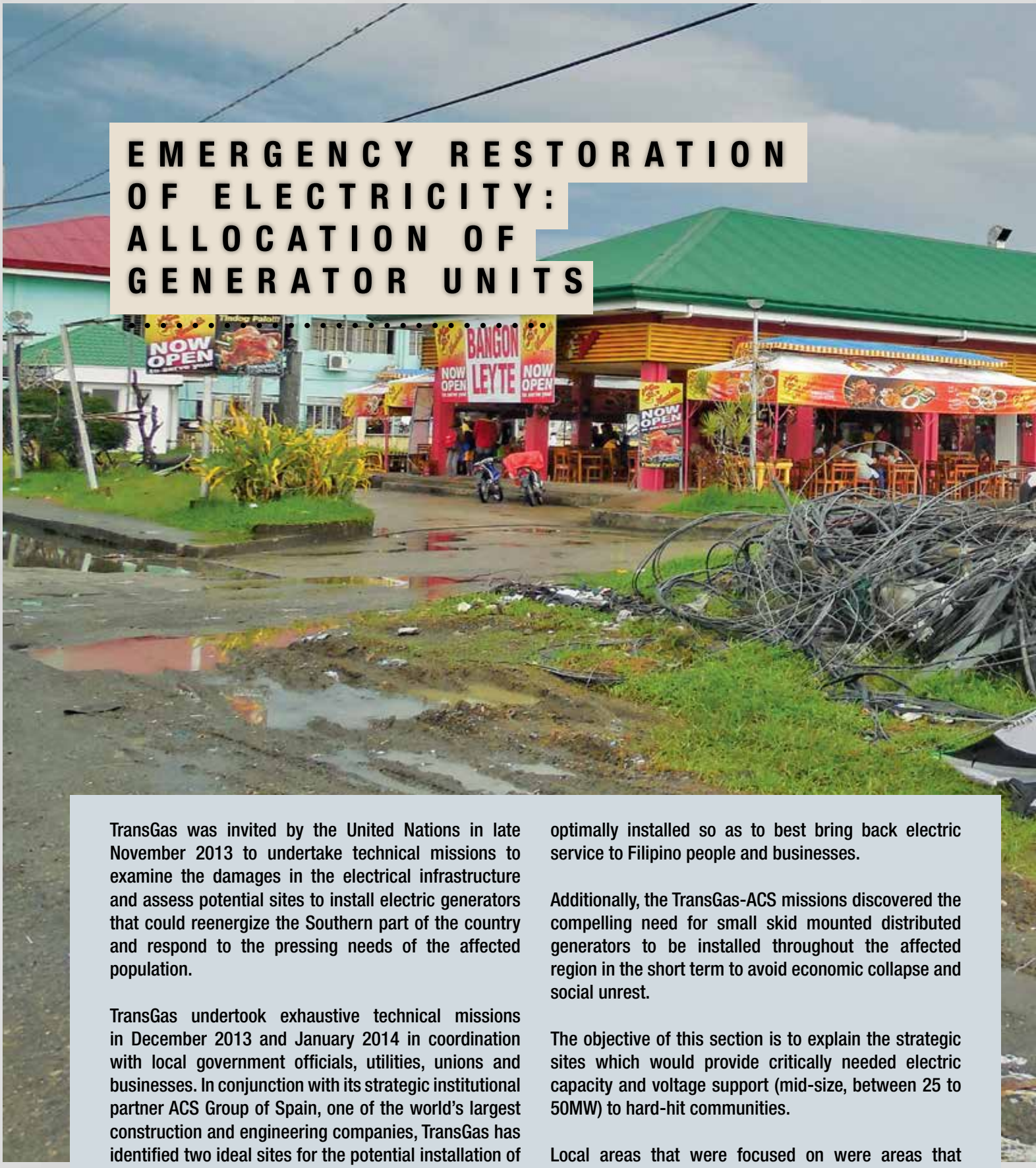
Although there is a need for the allocation of emergency electricity generation units to avoid an imminent economic and social collapse, the reconstruction must be based on a long-term vision aiming at local communities that have access to the knowledge and infrastructures required to be better prepared to withstand natural disasters.

Knowledge exchange can play a decisive role in supporting a long-term vision that enhances the resilience of local communities. Connecting local research centres, universities and experts networks with centres of excellence worldwide can advance knowledge building and preparedness to emergency response and recovery.

Aware of the importance of this, TransGas has met with the Presidents of two of the most influential knowledge centres in the Yolanda-affected regions, namely: Eastern Visayas State University and Leyte Normal University.

TransGas held discussions on the institutions' capabilities in electrical engineering and planning and helped facilitate dialogue between community leaders and the universities. TransGas is now ready to respond to the request for the facilitation of technical exchanges with overseas universities and has been in touch with colleges and research institutions in the U.S. State of West Virginia, which has an advanced and well-structured knowledge network on emergency response and recovery.

EMERGENCY RESTORATION OF ELECTRICITY: ALLOCATION OF GENERATOR UNITS



TransGas was invited by the United Nations in late November 2013 to undertake technical missions to examine the damages in the electrical infrastructure and assess potential sites to install electric generators that could reenergize the Southern part of the country and respond to the pressing needs of the affected population.

TransGas undertook exhaustive technical missions in December 2013 and January 2014 in coordination with local government officials, utilities, unions and businesses. In conjunction with its strategic institutional partner ACS Group of Spain, one of the world's largest construction and engineering companies, TransGas has identified two ideal sites for the potential installation of emergency electrical turbines.

The two sites described in this section correspond to where 25-50MW skid-mounted gas turbines could be optimally installed so as to best bring back electric service to Filipino people and businesses.

Additionally, the TransGas-ACS missions discovered the compelling need for small skid mounted distributed generators to be installed throughout the affected region in the short term to avoid economic collapse and social unrest.

The objective of this section is to explain the strategic sites which would provide critically needed electric capacity and voltage support (mid-size, between 25 to 50MW) to hard-hit communities.

Local areas that were focused on were areas that require immediate and future dependable electric power "peaking services" to strengthen the electric grid and assure higher reliability during normal operating conditions and future natural disasters.

SITE SELECTION 1

ESAMELCO:
Nominal 25MW Hardened Emergency and Peak Electric Power Generation Plant

After Yolanda Typhoon, the Eastern Samar Electric Cooperative (ESAMELCO), located in one of the Philippine's most hard hit areas, was unable to restore full power due to insufficient and undersized power lines between Taft and Paranas until the main transmission line to Saint Rita was restored. Further, after this line was restored the electric power reliability remains erratic with frequent trips due to voltage instability.

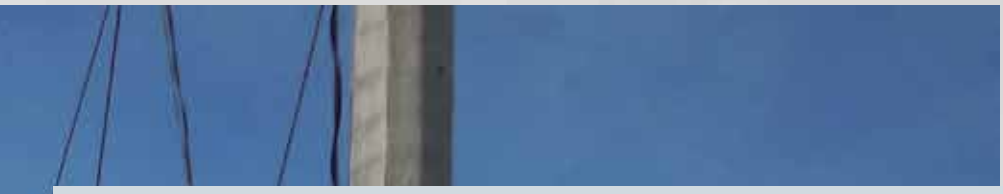
ESAMELCO supports and recommends the addition of a "locally installed approximate 25MW power generation unit" capable of fast start capacity to strengthen the grid serving their area. This local injection of stable electric power would help avoid future power outages, system shutdowns, brownouts, and blackouts under the current normal operations.

The area is served by ESAMELCO, with headquarters in Borongan. The recommended site is the Quinapundan Substation located at approximately 11.184575, 125.542512 approximately 30km North-west of Guiuan. This is the terminus for the Santa Rita to Quinapundan 69kV transmission line. This substation is connected to the Borongan substation then on to the Taft substation.

A 25MW power generation installation at this location would be optimum and provide emergency power and peaking intermediate baseload power to 23 cities with 60,000 customers in 2012.

The Cooperative delivered 60 MW through slightly over 1,300 km of power lines, about half 13.3 or 7.62 kv primary lines and half 220 v secondary lines. It servers an area with a population of 500,000 covering around 4,500 km2. They have a customer density of 43 per km. The cooperative had a System Average Interruption Duration Index of 1,826 in 2012 compared to 1.5 in the USA. The majority of the interruptions were due to low or high voltage from the transmission line. Therefore, voltage instability is a factor along with the inability of transmission system to power during transmission maintenance.


HIGH VOLTAGE
KEEP OUT



The Cooperative and the Local Governmental Units support the requirement of installing a self-contained 25MW diesel-fueled "hardened" type installed emergency power unit within their local grid. They believe that in normal times the cost of the operation and management will be at or below that of the peak power they are currently buying, but will give them the added security they require in the Philippines most frequently-hit region.

The option to immediately install a turbine at this location was discussed at length with the General Manager during the initial site visit, who, along with several board members and the engineer for Guiuan were in agreement that such an option was desirable.

The concept has already been demonstrated by the cooperative in Roxas City which maintains an aged diesel generator (1950') that not only averts them purchasing peak power on the spot market but allowed them to power up their distribution even with the main transmission lines down.

The ESAMELCO team was prepared for the discussion with plot plans for the property showing the current 4 hectares with an additional 7 hectares that can be acquired.

Based upon elevation and high ambient temperature - climatic conditions the estimated performance of the recommended emergency turbine generator at full capacity would be approximately 8176 Liters / 28,500 Kwh = 0.29 liters/kwh. The Philippine Department of Energy's published price is Php 41.75-46.00/ liter as of January 14, 2014. This results in a price that the responsible local officials deem acceptable.

Logistics for shipments to Quinapundan substation would include movement to Guiuan via freighter. Upon arrival offshore Guiuan, the barge carrying the turbine would be lowered in the water and pushed by tug to shore. There the turbines will be lifted onto trucks for transport 35 km to the site on existing paved road.

SITE SELECTION 2

Bantayan Island: Nominal 25MW Hardened Emergency and Peak Electric Power Generation Plant

After Typhoon Yolanda, the Bantayan Island Electric Cooperative (BANELCO), located in one of the Philippine's many small island groups hit hard, was unable to restore full power due to damage to the single power plant they have access to until the transportation was reestablished with the mainland and technicians and supplies could be delivered. Further, after the repairs the 50-year old plant still only provides erratic supply with frequent trips of the island's grid. BANELCO and the local governmental units support and recommend the addition of a "locally installed approximate 25MW power generation unit" capable of fast start capacity to strengthen the grid serving their area. This local injection of power would help avoid future power outages, system shutdowns, brownouts, and blackouts under the current normal operations and more important, increase response time – restoration of electric distribution due to natural disasters which threaten life support operations, public health and the area's commercial recovery.

Bantayan is a cluster of islands. There are approximately 200,000 residents on the islands. There are also ten major resorts, mostly on the Southern tip of the main island: the Ogtong Cave Resort; the Yooneek Beach Resort; the Budyong Beach Resort; the Tickety Boo Beach Resort; the Anika Island Resort; the Sta. Fe Beach Club; the Sunday Flower Beach Hotel & Resort; the Tristan's Restaurant and Beach Resort and the Kota Beach Resort. These resorts play an increasing role in the local economy. It is believed that with stable power the segment could grow to compliment the current egg and fishing economy.

Currently power is provided on the main island by the private generating company of Bantayan Island Power Corporation's (BIPCOR) with its five bunker/diesel-fired power plants with an installed capacity of 8.34 megawatts and dependable capacity of 6.64 MW, as follows:

1 unit of 1.7 MW Bunker-fired diesel engine generators
2 units of 0.319 MW, Pure Diesel-fired for peaking
2 units of 3.0 MW, Bunker-fired as main units

The recommendation of the local government is to place the gas turbine in the Municipality of Santa Fe, which is the main gateway of the Bantayan group of Islands and comprises Madridejos. It is where the seaport of Pantalan, an airport, and the wharf for ferry docks from San Remegio, Hagnaya and mainland Cebu are located.

Alternatevely placing the gas turbine on the Hilantagaan Island allows for Hilantagaan Island and Kinatarkan Island to be connected by submersible cable going to mainland Santa Fe and Kinatarkan Island.The local government units of the island have received support from the Regional Development Authority for their petition to the Department of Energy for undersea cables to connect the major islands to the mainland. However, the cost of connecting to the mainland was deemed too great and they have been pursuing the alternative of self-generation of power.

Since the island has never had reliable power and the typhoon made matters worse, the real projected electric consumption is difficult to estimate. If compared to energy per capita of the Eastern Samar region, which has had much more reliable electricity, it could easily reach 25MW.

The installation on the islands will be difficult as there are no docks capable of handling a large generator. A road will have to be prepared from an acceptable beach using the LCT craft the community currently uses for transporting large trucks and equipment.

A location in Santa Fe would be easier as the dock currently handles large cargo and the roadways into the center of the island are paved and wide. The distribution system on the Island consists of 7.62 kv primary lines and 220 v secondary lines.

Because of the uncertainity involved in locating a generator on Hilantagaan Island, new proposed generation would only apply to a Santa Fe location. It would not include submarine cables and would likely require installation of a new substation. If it is desired to pursue this option, further engineering studies will need to be done.

TECHNICAL ASSESSMENT: A LOCAL AND REGIONAL OVERVIEW

TransGas has identified three Filipino regions whose electrical distribution and power infrastructures have suffered the most dramatic damages, namely:

- **WESTERN VISAYAS**
- **CENTRAL VISAYAS**
- **EASTERN VISAYAS**

The damages in the above regions pose the most significant challenges to the recovery following Super Typhon Yolanda.

The affected regions of the Philippines have reached a level of dependence upon the availability of electricity consistent with late stage 4 of the 5-stage Rostow scale of economic maturity, roughly equivalent to the United States and Germany in early 20th century.

Few storms of the magnitude approaching Yolanda have impacted economies this advanced. This is further complicated by the geographical expanse and complexity of the Philippines nation. Unlike nations with contiguous internal boundaries, the affected areas are often separated by substantial water bodies making cooperative assistance difficult.

While the extent of the structural damage observed was widespread and extensive, the present assessment will focus on the electrical aspects required to facilitate health, safety, livelihood and recovery.


THE PHILIPPINES
EASTERN VISAYAS
WESTERN VISAYAS
CENTRAL VISAYAS

REGIONAL FOCUS

LEYTE

Upon arrival at the Tacloban airport the extent of the damage to the electrical infrastructure was apparent. Utility distribution poles, sometimes called power poles or telephone poles, were either toppled of broken with lines on the ground. Transformers were either missing, damaged or laying on the ground. Since individual electric meters are located on the poles rather than in the buildings, they also were down and damaged.

The tangle of power and communication wire presents not only a safety issue for persons in the immediate area; it also represents a significant recovery issue. International electric safety associations recommend that wire, cable, switches, transformers, voltage protective components such as circuit and switchboards, that are exposed to floodwaters should be replaced. When exposed to water or excessive moisture, they may be damaged due to mildew or corrosion. This damage can result in insulation or termination failures. The problem is more severe if the components have been subjected to salt water. Since most of the structures along the coast were subjected to saltwater and all with roof damage were subjected to water, it is likely that, if not replaced none of these items should be repowered unless a qualified person has inspected and certified they are safe. Our interviews also found a shortage of qualified municipal inspectors or electricians capable of certifying the safety of a structure to be connected. The local Cooperative is considering diverting some of their staff to do final inspections before hookup to prevent electrocutions or fires.

While some areas have power in Tacloban City as of a meeting with the Electric Cooperative Engineer on 28 December 2013 less than 1,000 of their 60,000+ customers were connected. Pockets of observable power in the city and surrounding communities are mostly generators. Upon approach most were either directly connecting to their generator or had disconnected their building from the existing distribution system. We expressed concern that some of the downed lines may be inadvertently energized by property owners connecting a generator to their internal wiring.

If the ability to connect to the distribution system is to be delayed, the use of generators should be considered as an immediate action, followed by the relocation to prepositioned locations or hardening of these units where they are to serve as backup power in the event of future storms.

Without access to ice, small vendors have only limited ability to safely hold perishable food items. As it is likely to a considerable time until they have access to reliable electricity, the location and powering of one or more ice plants is recommended as a short-term action.

Transmission lines which carry the electric power from the large stationary generators to Electric Cooperative substations from which distribution lines branch off to supply the surrounding businesses and homes also suffered some damage as did the substations themselves. According to the Electric Cooperative, the damage to the substation did not include the hard to replace large transformers. However, several of the high voltage towers leading to and from these substations were damaged. Since the demand is greatly limited by the loss of the distribution system, short-term actions are to be considered.

The Electric Cooperative has limited safety equipment for working on live wires and rolling stock, i.e., auger trucks, bucket trucks and cargo trucks. They report this is greatly limiting the pace of their progress and the stress on the line crews. An effort to acquire these should be an immediate action.

The Electric Cooperative is undergoing a cash-flow issue that may be relieved in the near-term with loans from the Federal Government. Not only will this potentially affect the ability to maintain staffing levels but will impact their ability to place deposits on critically needed materials with long lead times such as transformers, switches, electric meters, etc. Recommend continued advocacy and monitoring of adequate funding for the critical component of recovery.

SAMAR

The drive from Tacloban City to Guiuan in Samar afforded an opportunity to observe the extraordinary effort put forth by the Philippines in early recovery. The roads, though damaged in several places, were able to be traveled with minimal effort.

The area following the coast of San Pedro Bay had experienced significant wind and storm surge damage. Structures were in various states of destruction ranging from missing roofs to only floors left. The electric infrastructure suffered a similar fate. Noting the direction of the winds as the typhoon passed, it was interesting the compare that to the state of the utility poles. Those poles that were parallel to the direction of the wind were either still standing or only slightly leaning. However, those that perpendicular to the wind were all down. While further study would benefit a solution, it is likely that the wind resistance of the mass of communication wires may cause the poles to exceed their rated lateral strength.

The wooden poles tended to fair better than the concrete with the steel mostly down flat with a few bent in the middle. Upon examination of several broken concrete poles it was found that the internal reinforcing wire mesh and re-bar were not continuous at the point of the breaks. While the sample was too small to extrapolate, it appears that at least some failed due to manufacturing flaws. Of those that had fallen, several did not appear to have been placed deep enough in the soil and the soil did not appear to have been adequately compacted after installation. It was later found in discussion with the Electric Cooperative that they do not have an auger truck thus have placed all the poles with hand digging. The knowledge of the proper sizing, placement and use of guy wires for the poles may benefit from training. It is recommended that immediate action be taken to provide those installing new utility poles with the knowledge and tools necessary to properly install new poles so as to reduce their risk of falling in the next storm.

Guiuan is located on the eastern most tip of Samar and was thus the first significant population center hit. There are few buildings that were not totally destroyed. The community's livelihood is dependent on fishing and coconuts. The two ice plants and the fish processing plant were damaged along with their fish processing plant. Without these the community does not have an economic base.

The electric distribution system is totally destroyed, with many of its transformers ruined. Some have been salvaged by survivors to obtain the PCB laced oils to use for cooking in the immediate aftermath of the storm.

All the electric meters were either damaged or subjected to storm water rendering them beyond repair. The hospital has an operating generator and the municipal building has a small generator for emergency operations.

Ice plants typically require 70-85 kWh/ton. A 150 t/day plant would require 531 KVA at full capacity in the tropics. Generally a larger plant is more economical to operate than a smaller one. However, since there will be a lack of refrigeration in the region for an extended period and considering that fishing boats from along the east coast of Samar and possibly Leyte could utilize the ice it is not unreasonable at this point to assume that two plants would be required. While the costs of the plants maybe beyond the scope of immediate action, providing the power to would add momentum to secure the financing to restore this livelihood critical resource.

The Electric Cooperative in this area has only been able to run a single phase line into Guiuan which will serve the government. They are not considering laterals as yet due to lack of transformers, switches and meters. The substation at Guiuan is the first of three that are placed in series, each about the same size and served by the same transmission lines. The 69kv line is functioning although the voltage and frequency are frequently unstable. The Cooperative has had to create a make-shift control panel to allow staff who now man the substation 24x7 to manually reset it when the voltage either peaks 10 per cent about of 10 per cent below, which happens several time per day.

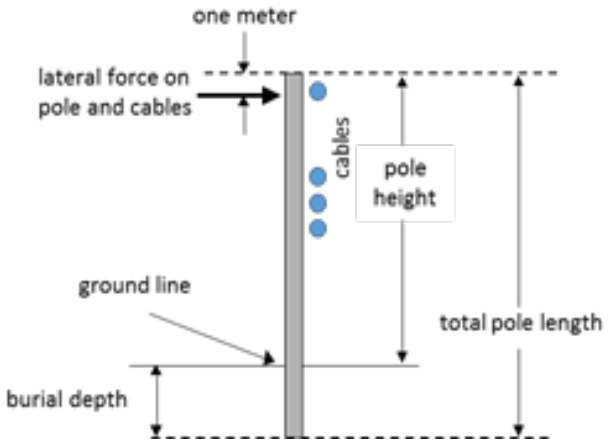
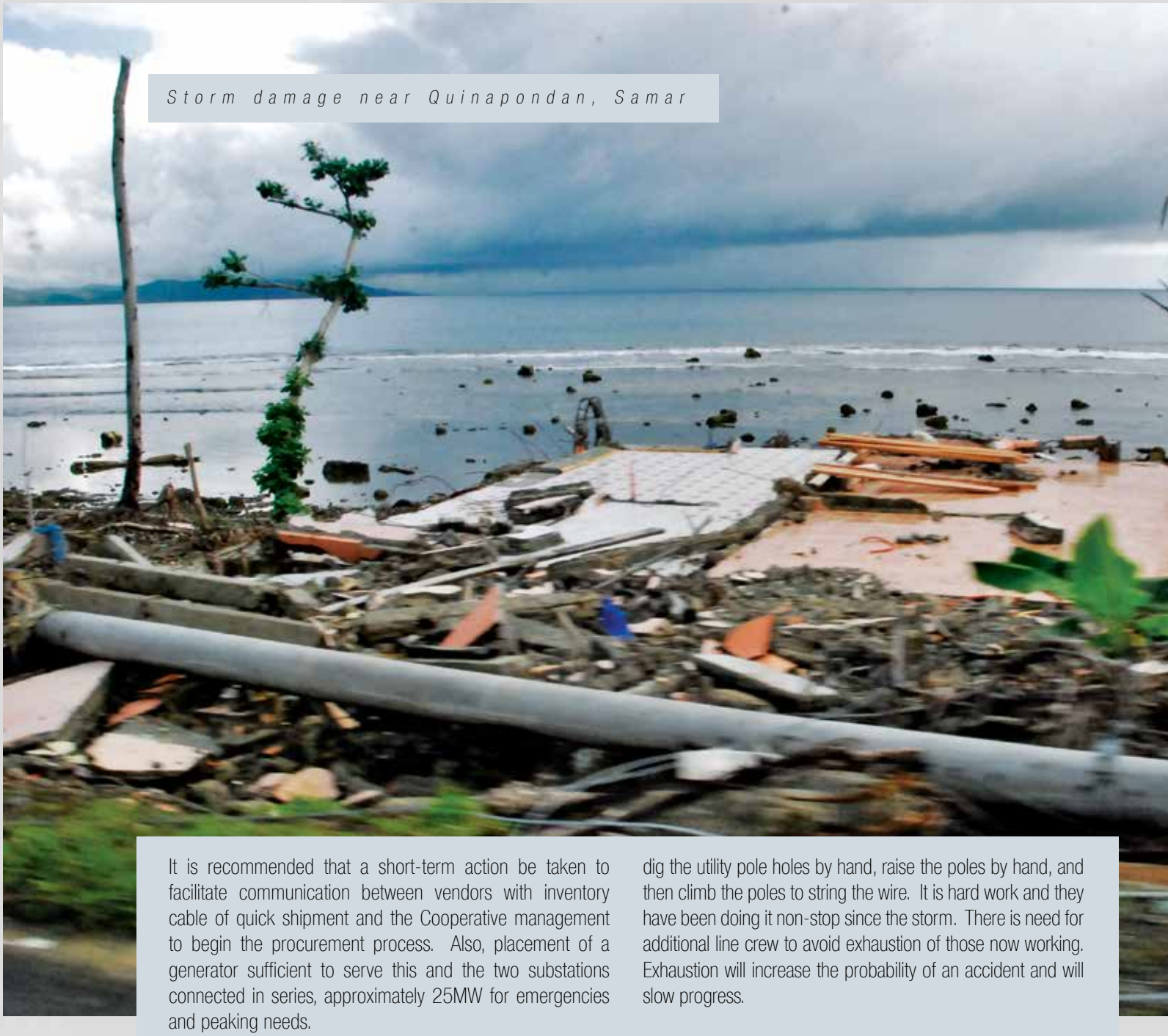


Illustration of lateral forces on a utility pole



Storm damage near Quinapondan, Samar

It is recommended that a short-term action be taken to facilitate communication between vendors with inventory cable of quick shipment and the Cooperative management to begin the procurement process. Also, placement of a generator sufficient to serve this and the two substations connected in series, approximately 25MW for emergencies and peaking needs.

Clustered around the municipality are numerous islands and islets, like Tubabao, Calicoan, Sulangan, Homonhon and Suluan. These islands are not connected to the grid and use small generators privately owned or owned by the local government. An immediate action is recommended to provide reliable generators to these island and sat-phones to warn of impending danger.

The line crew here was typical of those described at other Cooperatives. There are approximately 100 people working in the area. They sleep in tarpaulin covered structures with open walls and raised plywood floors. They leave at dawn and return at dusk. They have limited safety equipment and must dig the utility pole holes by hand, raise the poles by hand, and then climb the poles to string the wire. It is hard work and they have been doing it non-stop since the storm. There is need for additional line crew to avoid exhaustion of those now working. Exhaustion will increase the probability of an accident and will slow progress.

An immediate action should be undertaken to begin a cash-for-work program aimed at clearing utility right-of-ways in advance of the line crews, which will accelerate their pace.
An immediate action should be undertaken to identify those electric crews that do not have adequate housing and provide the same.

In addition, an immediate action should be undertaken to advocate for the use of trained line supervisors from unaffected Electric Cooperatives to train temporary line crew members to supplement those currently working. It is recommended that recruitment and employment be handled by the existing Cooperatives with only training provided by external partners.

Opening and checking electric meters for damage near Guiuan

Line crew returning for their shift at dusk near Salcedo, Samar


UNDP

BILIRAN

Driving from Tacloban to Biliran provided an opportunity to view the damage inland from the coast on Leyte. The pattern of severe damage decreased but the effects of loss of electricity were evident with closed shops and irrigated rice patties not planted. Only a few inland fisheries appeared to be functioning and those only where access to natural flowing water was available.

Power line damage was still evident on the Eastern side of hills. While not receiving the storm surge as near the coast, the interior of Leyte still had winds strong enough to rip roofs off buildings, tear the tops of the coconut trees out and topple utility poles. Due to less damage, Electric Cooperative line crews had been able to make progress but only on the single phase lines into the town centers. Their objective was described as first powering the government building, a bank and a church. The great distances needed to be covered in the country still did not leave time to make lateral connection to many structures.

At the town of Caibiran several building including the government building were damaged. In conversations with the Mayor and the Cooperative engineer it was learned that the town was cut off for some period as the communication lines went down and they were too far from the next cell town. The town only has one computer with an old modem. This was typical of the very rural town we visited. It is recommended that a medium term action be taken to provide these towns with backup generators capable to powering the government building, a clinic and a sat-phone.

In proceeding to Ormac we stopped to meet with the local government of the Leyte City. This is another small town that sustained considerable damage. The government building was totally destroyed, the high school and the grade schools are uninhabitable. The government is functioning out of what was the athletic director's office in the basketball auditorium. The distribution lines are in either down or without out power. The local market has a few stalls that are sharing generators. There are no restaurants open and the meat market cannot hold product to the day after it is processed. The town has no ambulance and their only fire truck was damaged in the storm. There is a small generator in the auditorium that was used as the evacuation center which provides power to the local government operation.

UNDP cash-for-work project key to cleaning up debris near Jaro, Leyte

As the Cooperative line crews still have significant progress to make before reaching this town, a cash-for-work program to clear power line right-of-ways should be a short term action.

Ormac on the Western coast of Leyte was not as severely damaged as the towns of the East coast, however as the typhoon passed winds ripped roofs and downed utility poles. Power has been only partially restored to the city center and little is evident in the surrounding area. The local Electric Cooperative's engineer appeared to have been very well prepared. They have sufficient trucks and equipment to conduct restoration and are proceeding as fast as possible. This Cooperative also has a functioning planning and trading group and was the only which did not have problems with supply and peaking purchases. They reported that they have long term supply agreements in place and have been able to manage their peak purchase in a manner that has avoided the 3-6 times base rates other Cooperatives stated.

They also are experiencing delays due to equipment and staff shortages are frustrated by lack the of capital reserves. While they had not received funding from the Federal loan program, they have a notice of award. Serving 112,000 customers, they estimate that over half of the individual electric meters will require replacing. There are anticipated shortages of transformers and other distribution components that will impact schedules as the move beyond the initial efforts to power city centers. They report they have powered some laterals into neighborhoods but, unlike others, have taken the position that all properties on a lateral must be approved or disconnected before they will energize it. They also expressed concern about the quality of inspection and are doing it themselves or through a handful of local electricians they have certified as competent. It is recommended that a short term action for facilitating contact between the Cooperative and vendors of distribution equipment be advocated and that an immediate action for coordinated cash-for-work crews to clear rural power line right-of-ways be taken.

Typical individual meter location

Coconut tree damage with downed pole and new pole next to it in distance.

Sign in Ormac indicating post storm pricing

CEBU

Upon landing at Cebu, we proceeded to the Northern end of the island and up the Eastern coast of the island stopping at Danao City. The local mayor explained that while spared the force of the storm that the lack of electricity was affecting the livelihoods of the citizens who depended upon power for farming and retail operations. The next stop was Bogo where storm damage was again evident, however power had been supplied to the central business district. We headed South uphill for about 20 km where damage was evident along the ridgelines. Multiple utility poles were down and there was no evidence that power was available.

As approaching Daanbantayan at the Northern most tip on the island damage grew more severe. The roof of the ferry building was damaged as were many buildings in the city. Primarily a fishing and resort community, there were many damaged boats along coast. According to the ferry operator most of the resorts were severely damaged and none had power other than generators yet. Several NGOs were seen waiting for the ferry and conversations indicated that the livelihood damage was significant.

BANTAYAN

Bantayan Island is the main and largest island of the island group which includes numerous smaller islands. The islands were in the direct path of the typhoon as it left Leyte and Samar. The buildings on the dock were totally destroyed. As we moved into Santa Fe, the small city on the Southern end of the island, there were few buildings that had not sustained significant damage. The main island is powered by an undersized generator that frequently cause blackouts and brownouts. The storm damage only compounded the situation by destroying the distribution infrastructure that supported the three small towns of Santa Fe, Madridejos and Bantayan.

The community has an ambitious plan to place a large generator on an adjoining island and installing undersea cables to connect all the islands. The costs will exceed the range of early reconstruction. However, there is a need for a short term action to supply addition generation to supplement the existing system on Bantayan Island. There is a need for an immediate action to supply power at a lower level to three of the surrounding islands that have no power.

The economy of Bantayan is centered around fishing, eggs and tourism. The chicken coops were destroyed during the storm. The chicken are roaming the island and the eggs produced by those that farmers were able to contain cannot be taken to market on the mainland due to a lack of refrigeration. A short term action is recommendation is to assist in securing a refrigeration unit large enough to store wholesale eggs for transshipment on the barges to the mainland.

Transportation remains an issue for Bantayan. The fishing crew expressed concern that some of the NGO's do not want to assist in providing boats that are made of wood as they are opposed to cutting down trees. The fishermen said that they were concerned that if a fiberglass boat leaks at sea they will not be able to repair it and it will not float as wooden boats do. They also noted that wooden boats are priced as part of their fishing culture.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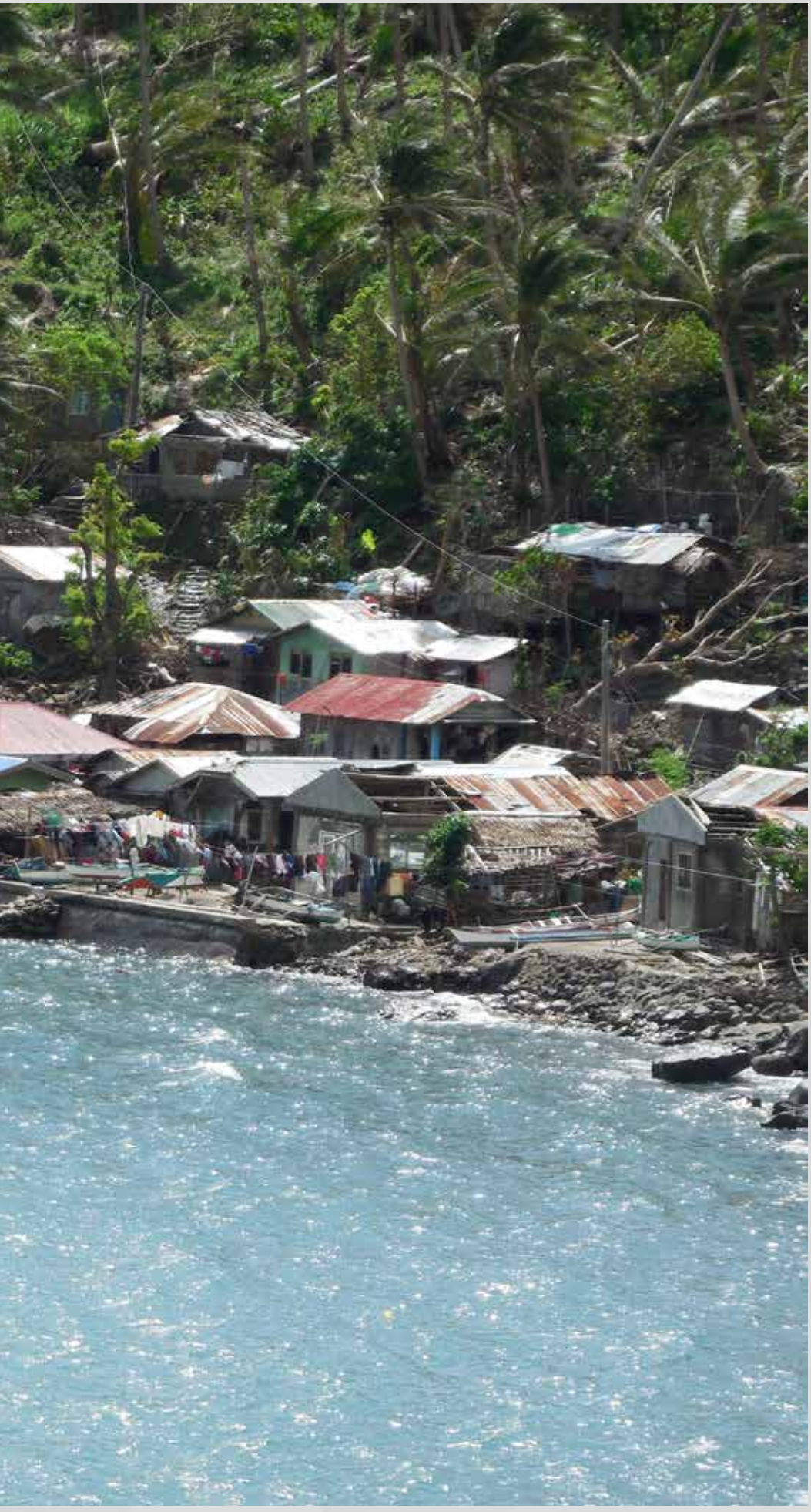


Coastal village near Santa Fe.

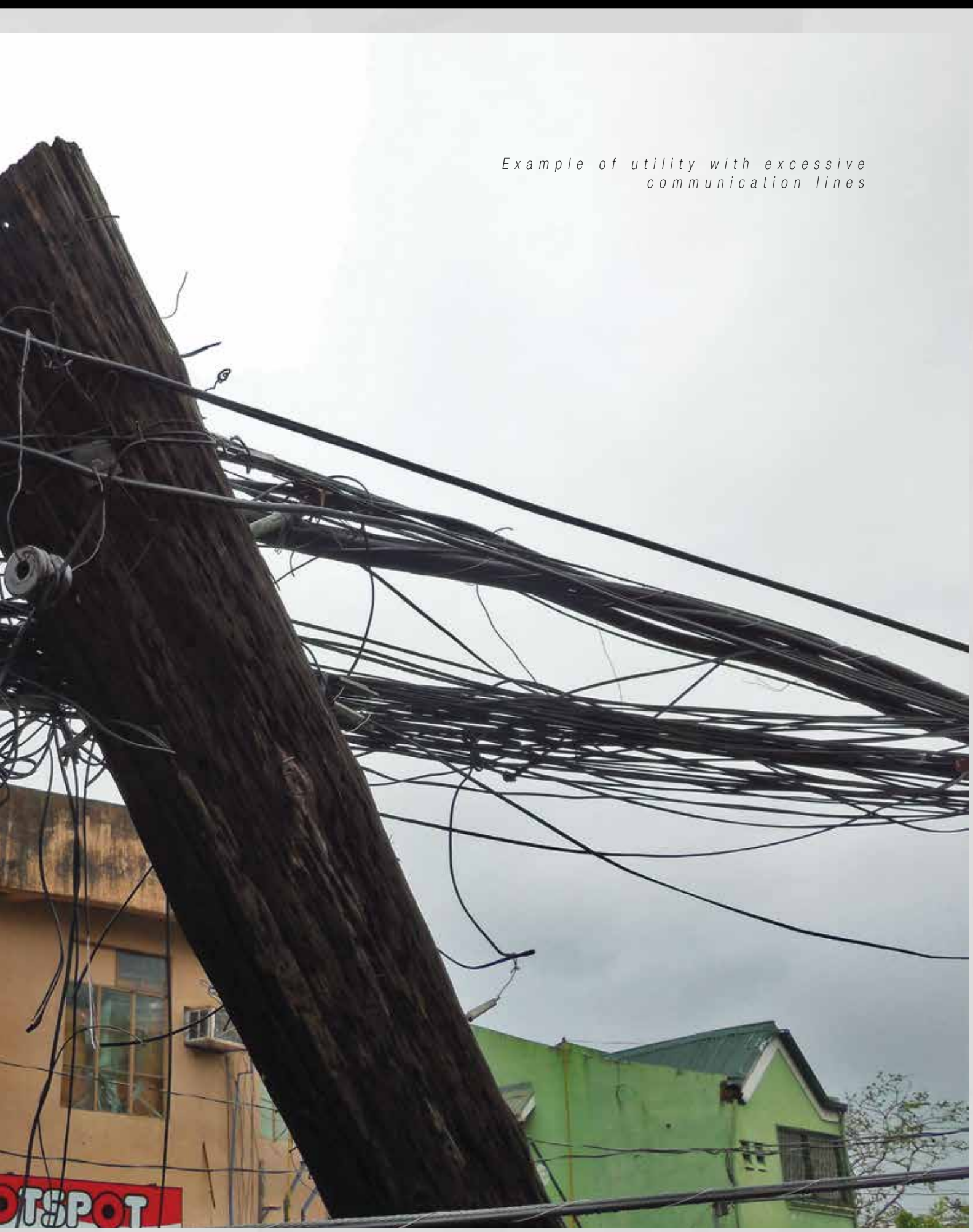
PANAY

In Iloilo City we were met by UN staff from the Roxas office. We drove through the center of the island passing fish farms, banana and fruit trees, and rice fields. The rice cultivation area includes provinces of Iloilo and Capiz, with 311,000 ha rainfed and 179,000 ha irrigated with the latter being the most productive in the nation. In addition to delaying the second season planting and damaging to those areas not already harvested, flooding following the storm has left thousands of hectares underwater for as much a month.

Additionally damage was observed to coconut, banana and fruit trees in tree plots throughout the region. Inland aquaculture mostly consisting of oyster, mollusk and tilapia were also damaged. Many of these are dependent upon electricity for aeration and water movement. Therefore, even those that did not suffer direct storm damage have been affected by the lack of reliable power. Several persons interviewed stated that the fish were dying for lack of power. Since these are not located in high population density areas, the deployment of solar and wind power units may speed the recovery of this vital livelihood issue.

In meetings with local government officials in Panay Town and Panitan Town, the issue of resources to speed the restoration of electricity where discussed. Coordination between the local Electrical Cooperative and the local communication companies was the focus of one conversation. The Mayor of Panay Town agreed to conduct a pilot effort to coordinate the Electric Cooperative, the two telephone companies and the two cable companies to address the issue of shared utility poles and finding ways to reduce their susceptibility to failure due to excessive wind resistance caused by excessive cabling. It is recommended that this efforts lessons learned are passed to other communities.

The Electric Cooperative in this region was extremely helpful. They have their own large diesel generator that allows them to handle peak loads at reasonable prices. This model appears to be applicable to other Cooperatives as well. The large unit is only used during peak loads or if the grid supply is interrupted. Because the generator predates the utility reorganization, the only cost to the rate payers is for operation and maintenance.



Example of utility with excessive communication lines

Finding ways to provide Cooperative based generating capacity for peak and backup without passing the capital cost to the rate payers may be an alternative for increasing both reliability and emergency response. Between the Northern Panay Electric Cooperatives and the mainline generation stations, 138 large transmission towers are down. Despite this, the local cooperative was able to continue supply electricity to those customers still connected until the grid was reestablished through use of their generator. They have started bringing transformers from downed poles back to their yard for inspection and repair if possible. As others had noted, they expect a delay in reconstruction due to the lack of distribution system transformers and switches.

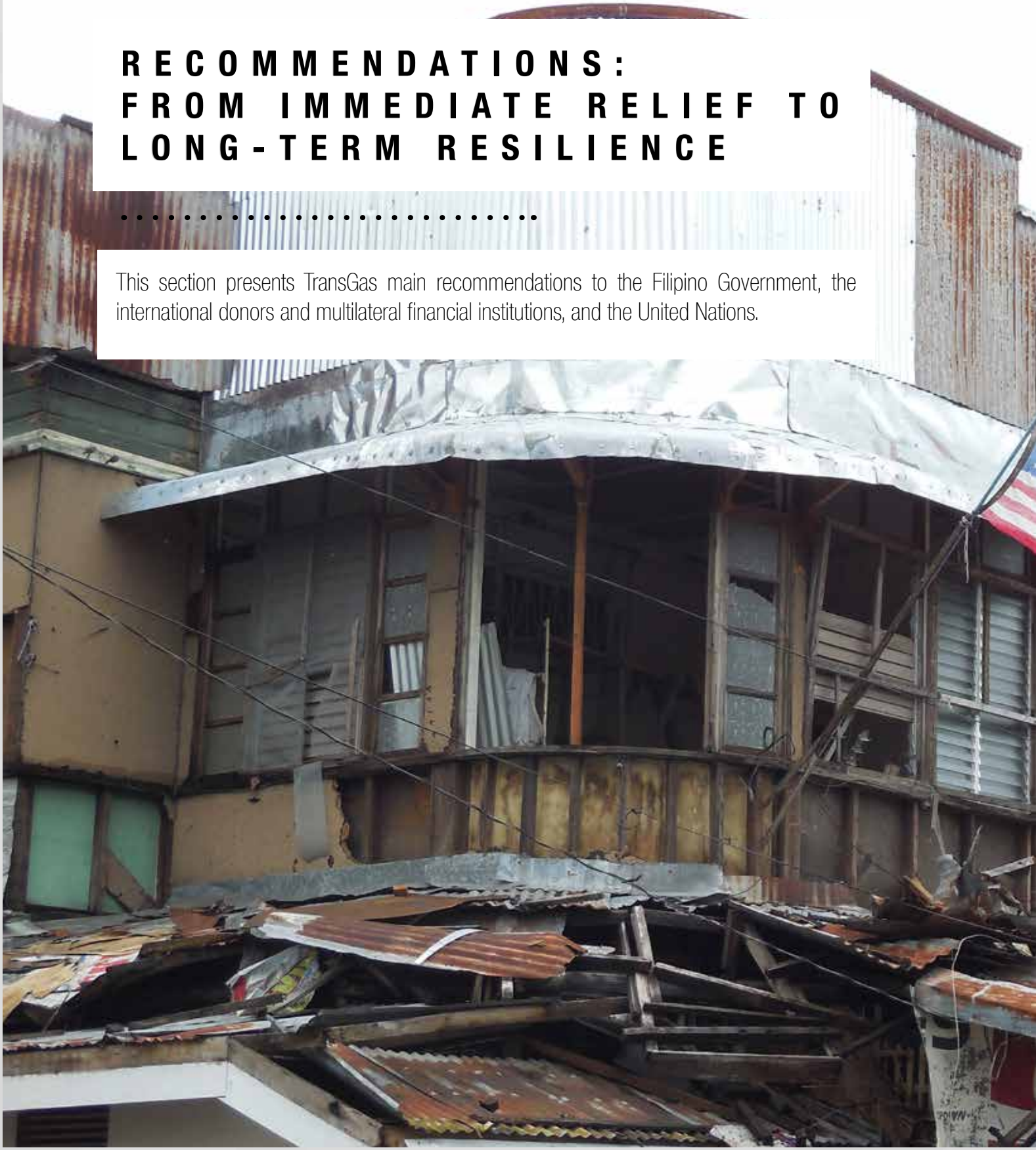
Local government units had similar issues regarding emergency generators. There is a need to develop a process for determining where and how big the generators should be. I recommend that this be followed up as an immediate action in order to best utilize limited resources.

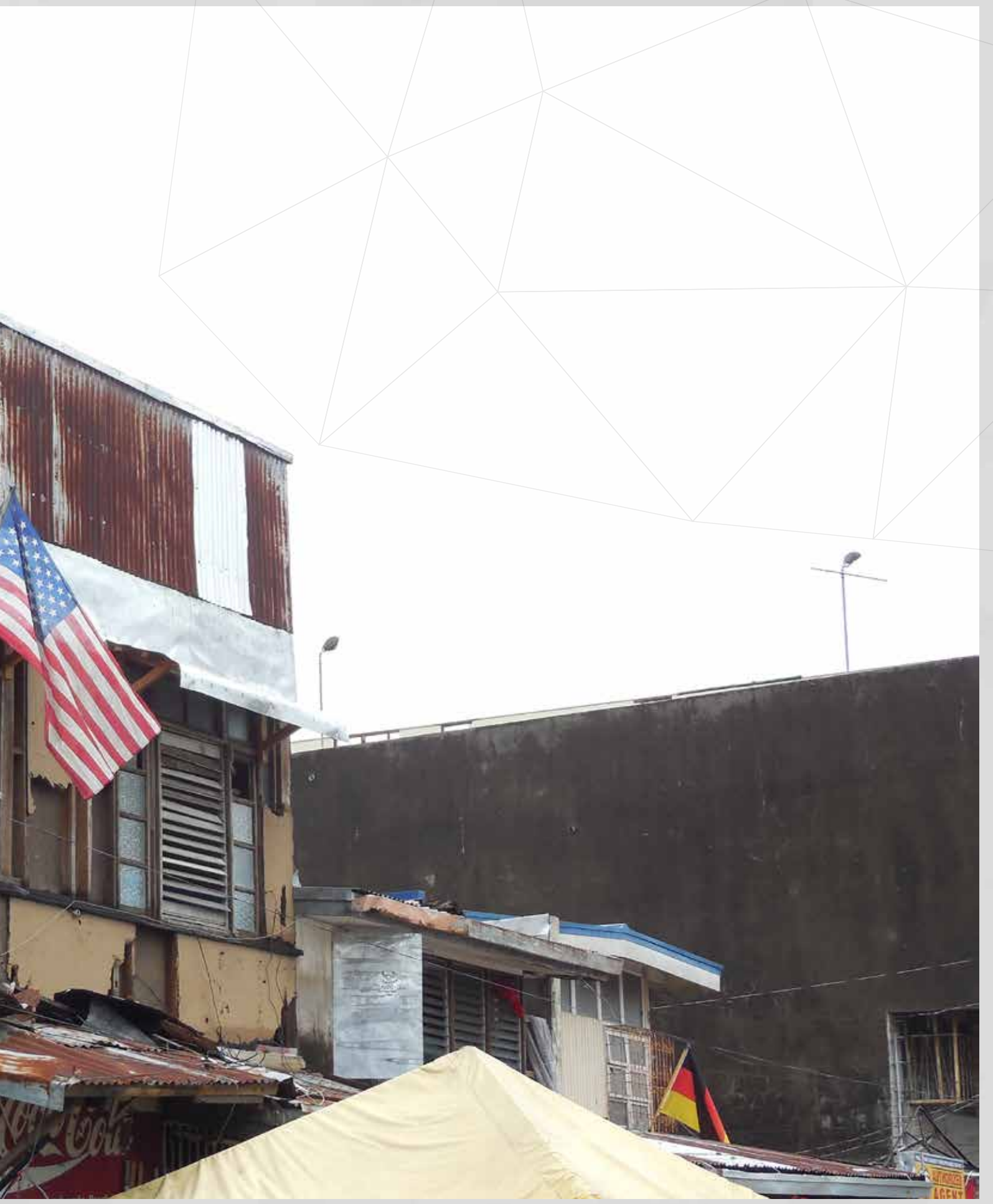
On the way back to Roxas City we passed near Pototan, famed for its Christmas Festival of Lights. Pototan has been declared by the Dept. of Tourism as the "Christmas Capital of Western Visayas". While not part of the electrical survey, it is noteworthy that this town decided to put up their annual light despite the fact that the roof of their civic center and several other municipal buildings were damaged. This speaks to desire of the Filipino citizens to rebound .

Inspecting transformers stored on a basketball court.

RECOMMENDATIONS: FROM IMMEDIATE RELIEF TO LONG-TERM RESILIENCE

This section presents TransGas main recommendations to the Filipino Government, the international donors and multilateral financial institutions, and the United Nations.





IMMEDIATE ACTIONS

Need	Vulnerability	
Restoration of electricity to all business and people	Ongoing power outages and persistent lack of electricity undermines ability to recover economic activitiy and leads to deteriorating social conditions, poverty, unrest and disease.	
Coordination	Lack of a dedicated energy cluster undermines opportunities to accelerate and enhance the progress of other clusters	
Detailed roadmap development	Without a detailed path to implementy the recommendations the process is likely to lose focus	
Unintentionally energized power lines	Increases the likelihood of accidental electrocutions and fires.	
Ability to safely store perishable food	Intestinal illness from high-protein food (fish, meat, eggs, dairy) that support the rapid growth of disease-causing bacteria.	
Safety equipment for utility workers	Potential injury or death.	
Hazardous chemicals	Uniformed use by citizens of oils from downed transformers for cooking.	
Power line right-of-way clearing	Debris in the right-of-way presents safety and logistical challenges for Cooperative crews trying to install new poles and lines.	
Shortage of line crews	Delays in progress and potential for injury to exhausted line crew workers.	

	Root causes	Recommendation
	Vulnerable electirical infrastructure and lack of emergency power and electricity restoration units.	Immediate placement of two large 25-50MW diesel fueled gas turbine generator units in locations detailed in above survey and procurement of generators for emergency response.
	The disaster response models do not reflect the central role that energy, especially electricity play in an advanced economy.	Create an energy cluster of all potential stakeholders to identify and coordinate efforts. Collect lessons learned for publications to inform future responses.
	Too many comcomitant actions	For each action select specific locations and next-steps and assign a responsible person or organization.
	Lack of understanding by property owners regarding the danger of connecting a generator without disconnecting the building from the distribution system.	Initiate a community education program.
	Lack of power for refrigeration and lack for ice for fishing boats.	Siting and powering of ice plants near fishing docks, meat processing facilities, and retail locations. One location identified is Guiuan but other fishing and agricultural product origination points should be considered.
	Preexisting shortages compounded by loss of equipment during storm and increased number of line crews.	Source and provide minimal safety equipment for line crews in the affected regions, (climbing gear, hot line tools, portable augers).
	Transformers have not all been replaced and are not properly labeled.	Initiate a community education program on the dangers of using oils from transformers for any use and advocating that Cooperative replace those with PCB's or at minimum label them as hazardous.
	Storm damage and lack of line crew staff.	Initiate a cash-for-work program to coordinate and fund crews to clear in advance of the line crews. Requires coordination with Cooperatives and specialized training for the cash-for-work crews on potential hazards.
	Excessive work load and stress of schedule.	Initiate a temporary staff supplementation program for line crews with the additional persons trained by line crew supervisors from those Cooperatives not affected by the storm.

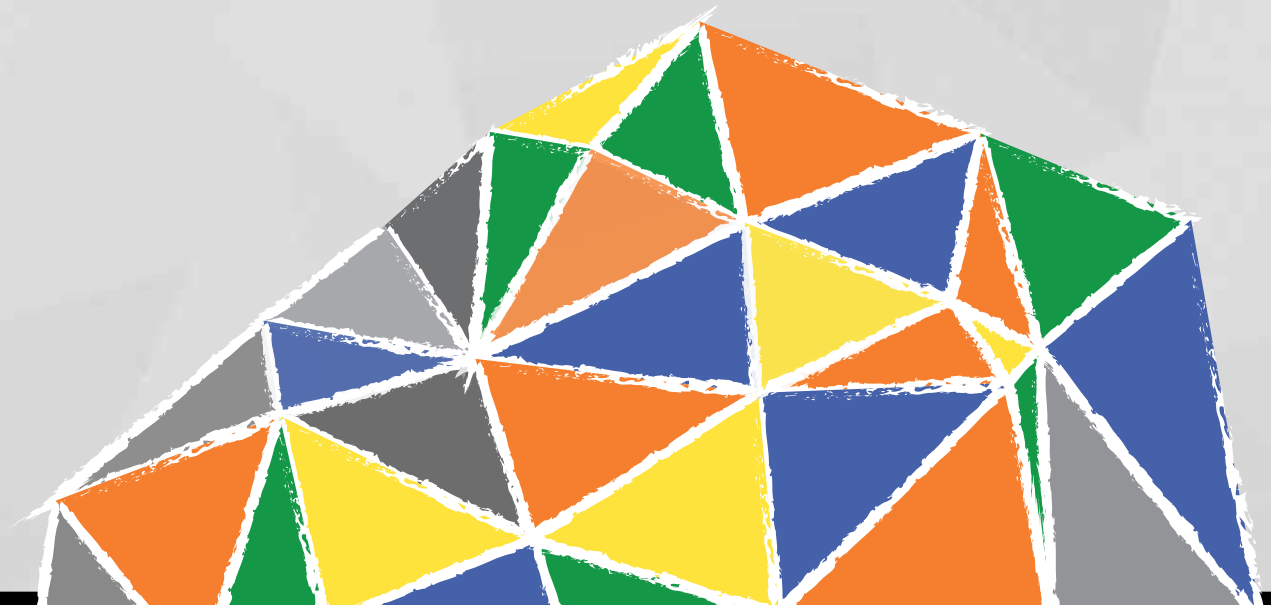
SHORT-TERM ACTIONS

Need	Vulnerability	
Lack of trained electric inspectors	Energizing structures with faulty wiring increases the likelihood of accidental electrocutions and fires.	
Lack of access to generating capacity for critical livelihood facilities	Delays the ability of citizens and communites to generate income and support recovery.	
Damaged high voltage transmission towers	Continued voltage instability and under power to Cooperative substations.	
Utility pole failure	Poles being rapidly installed will be susceptible to failure in future storms if not properly set.	
Communications for outlaying communities	Inability to relay timely critical information and requirements for assistance.	
Cooperative based generation	Transmission inadequacies and reliability present ongoing and post-event shortages	
Inland agriculture power shortages	Crops will not be planted or will be low yielding due to lack of irrigation and inland fisheries are experiencing die-offs due to lack of aeration.	

	Root causes	Recommendation
	Insufficient number of trained municipal staff.	Initiate a training program for existing and temporary electrical inspectors.
	Distribution system destruction combined with limited staff and supplies within the Electric Cooperatives.	Identify critical commercial facilities that if powered could stimulate commerce and provide these temporary generators that could later be moved to or hardened in place for emergency power.
	Long lead time for replacement towers.	Initiate conversations between transmission company and international vendors of towers to expedite delivery.
	Lack of proper tools to install and lack of understanding of the forces that cause a pole to fail.	Secure either auger trucks or portable powered augers for line crews and provide instruction on best practices for installing guywires and compacting the earth around an installed pole.
	Distance between cell towers often prohibits tower-to-tower communication thus reliant upon hard wire backhaul lines. Since these communications lines are on the utility poles that fail in a strong storm, there is lack of communication.	Secure backup generators and sat-phones for remote communities and islands sufficient to allow for early warning and post event communications
	Undersized transmission lines and load variability .	Install significantly sized generation capacity at substations capable of providing power to serially connected substations in the event of transmission interruption and to provide alternative peaking capacity. Identified locations include substation at Guiuan which could serve two other substations and the island of Bantayan, which could service its three communities and adjacent islands through future undersea cables.
	Low population density result in remote agriculture being low in scheduled priorities.	Install solar/wind power in these areas to provide power for pumps.

Need	Vulnerability	
Procurement of critical materials	Delays in procurement and delivery of critical materials will delay reconstruction of distribution systems.	
Lack of commercial refrigeration	Agricultural products such as meat, fish, eggs and poultry cannot be brought to market or this is done so in an unhealthy manner.	
Electric, communications and local government coordination	Interactions between tree communities is resulting in unnecessary delays and potential elevated risks to individual's health and the livelihood recovery effort.	
Prioritization of generating capacity	Limited supplies of generating capacity is not placed to provide the best response to the needs of the communities and to advance the recovery.	

	Root causes	Recommendation
	Lack of capital funds resulted in low inventory of spares combined with the extent of damage requiring very large numbers of items that are in short supply worldwide.	Facilitate connections between Cooperative Engineer and General Managers and vendors of distribution system components to speed procurement process. Possibly work with Asian Development Bank and World Bank to provide letters of credit in advance of Philippine national funding.
	Lack of refrigerated storage near the origination points.	Identify these centers and located sufficient refrigerated storage to allow for collection of sufficient quantities to allow affordable transport to market centers.
	There is no culture of coordination between the three communities.	Advocate and support coordination between these groups at the municipality level and document and exchange lessons learned to other communities.
	A process for evaluating beyond hospitals and command centers does not exist.	Create a prioritization framework based upon the Yolanda experience and publish it for use in future events.



MEDIUM-TERM ACTIONS

Need	Vulnerability	
Excessive cables on utility poles	Delays in removing debris that interfere with the installation of new electric lines and if the pattern carried forward on to new utility poles will increase their potential to fail in next storm.	
University coordination	Not making the best use of potentially invaluable expertise.	

LONG-TERM ACTIONS

Need	Vulnerability	
Cash flow shortages at Electric Cooperatives	Delay in providing power to cities	
Utility pole failure	Excessive number of utility pole failures result in recurring power outages in frequent storms.	
Power planning and trading capabilities	Increased electric prices and lowered reliability.	

	Root causes	Recommendation
	Lack of coordination between Electric Cooperatives and communication companies and lack of regulatory guidelines.	Initiate consultations between companies and local government units to create locally-owned solutions.
	Lack of culture of including universities in recovery and reconstruction efforts.	Engage universities in collecting and analysis of lessons learned from Yolanda in a manner that allows for the transfer to future community leaders.

	Root causes	Recommendation
	Structure of Cooperatives set in law.	Advocate for review by Central Government.
	Lack of understanding by the Cooperative of best practices for placement and securing utility poles.	Initiate a study of the loading of utility poles in high winds and develop procedures for line crews on their best placement.
	Lack of trained staff at the Electric Cooperatives.	Advocate inter-Cooperative outreach to train staff in each Cooperative on the philosophy and practice of planning and trading.

ABOUT TRANSGAS

In Brazil, a country whose electricity demand has doubled in the last decade, TransGas is forging collaboration with PETROBRAS-funded Afro Brazilian Business Incubator, an innovative social project that supports small business development in the favelas by building the entrepreneurship skills of their residents. It has already supported the establishment of over 2000 new businesses. Picture taken by TransGas staff from the balcony of the award-winning restaurant of Incubator participant Mrs. Jurema in Morro da Providência, Rio de Janeiro.

TransGas Development Systems, LLC, is a New York-based firm that specializes in project development and technical management of energy and infrastructure. It builds on over 30 years of engineering and development expertise to harness efficiency in design, construction and operation of innovative energy production solutions.

TransGas' predecessor, Gas Alternative Systems, Inc. was established in 1981, when it developed, financed, constructed and operated a cogeneration facility in New York that supplied electricity and steam to two large universities and three hospitals for two decades.
That project was the first US cogeneration facility to: (i) Purchase its own 20-year fuel supply in the ground; (ii) Receive Canadian National Energy Board's permission to export natural gas to the US; (iii) Receive US government's approval to import Canadian gas; and (iv) Build its own dedicated natural gas pipeline to bypass existing utilities and directly interconnect with the natural gas transmission lines.

Crisis Response and Management

TransGas is expanding the provision of technical advice and project implementation in the areas of energy and infrastructure to countries that have been impacted by natural disasters or political and social unrest.

TransGas' work in crisis response and management harnesses the company's three-decade global experience to support local authorities devise and implement infrastructure plans while building long-term resilience. TransGas provides immediate on-site analysis and undertakes feasibility studies to help determine optimal solutions.

TransGas aims at strengthening capacities to deliver better and more modern infrastructure that helps people withstand natural disasters and incentivizes sustained and sustainable economic growth.

TransGas' portfolio in crisis response and management includes the following:

Fast response to power outages and recovery of grid voltage:
a. Immediate provision and installation of skid-mounted generators.
b. Procurement of electricity and power generation, distribution and transmission equipment.

Strategic planning:
a. Technical assistance and training in building or re-building infrastructure that supports resilient economic growth.
b. Feasibility studies and technical assessments in collaboration with local authorities.

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