Broadband Community Node

Solar powered emergency tent

Introduction:

This paper proposes a Basic Emergency Earthquake Communications Node (BEECN) which provides broadband to a neighborhood. It uses a small Starlink terminal for broadband (which requires no operational infrastructure on the ground).

The objective is to provide communities in stress with full broadband communications capability, even if they have no power, no cellular or cable service. After a 9.0 earthquake, that could be the scenario for dozens, if not hundreds of neighborhoods.

Because the broadband is supplied by satellite, feeding a local WiFi node, individuals can use their own phones to access the internet. It is expected that the Basic Broadband Community Node (BBCN) will become a community hub, where people can gather, communicate with each other and loved ones, watch news or even entertainment programs. When set up, it resembles a well-equipped glamping camp-out.

Objective:
The Basic Broadband Communications Node (BBCN) is designed to be portable, cost/effective, and easily installed in community parks. It provides all the broadband a typical resident has come to expect. It enables isolated communities and individuals to access the internet. Anywhere. Anytime.

We estimate the cost for a complete BBCN to be about $20K, about one tenth the cost of a cellular “COW”, while providing faster, better, broadband service to stricken communities.

A total of 1200 watts can charge the 10,000 watt/hour lithium battery pack from a combination of solar and small wind turbines in about 8 hours. The battery powers a community WiFi node, a dozen phones and laptops, a video projector, and misc devices as well as chargers for phones, radios, lights and other devices. It consists of a pop-up tent, church tables, folding chairs, a video projector, and chargers for personal devices.

It would take 2-3 people about 4 hours to assemble and can easily be transported in the back of a van or pickup.

Functional Description:

1. **Battery:**

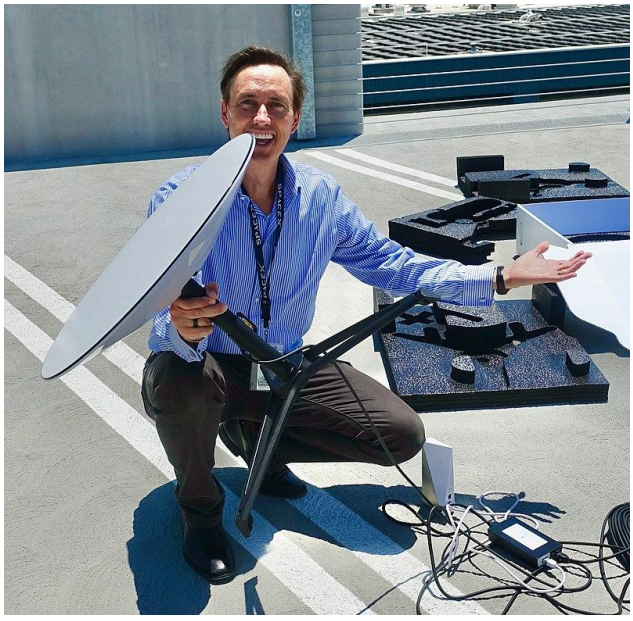
The key element in this proposal is not the satellite terminal, it’s the battery. The BLUETTI EP500 Pro delivers 5,100 Watt hours and 3000 watts of pure sine wave AC using a LiFePO4 battery pack. It could power a whole house for a day or two. Two units can even be ganged together.

Up to 15 outlets allow you to power anything from laptops and air conditioners.

It can be charged up from empty in 4 hours using a 2kW gas generator, but combined with solar and wind generators the need for a gas generator may be eliminated.

	BLUETTI EP500 US Plug Version	BLUETTI EP500Pro US Plug Version	Goalzero Yeti 6000X	Point Zero Titan
Product				
Pack Capacity	5100Wh		6071Wh	2000Wh
Battery Type	$LiFePO_4$		Li-ion NMC	Li-ion NMC
Life Cycles	6000+		500 Cycles to 80% capacity	2000
AC Inverter	2000W	3000W	2000W	3000W
	4800W Surge	6000W Surge	3500W Surge	6000W Surge
Output Ports	4×100V~120V AC 3×12V DC 1×12V/30A RV 2×USB-A 2×USB-A(Quick Charge) 1×100W USB-C 2×Wireless Charging Pad	4×120V/20A 1×120V/30A (NEMA L14-30) 3×12V DC 1×12V/30A RV 2×USB-A 2×USB-A(Quick Charge) 2×100W USB-C 2×Wireless Charging Pad	2×120V AC 2×USB-A 1×USB-C 1×60W PD	6×120V AC 4×12V DC 6×USB-A 2×USB-C 1×30A RV
External Charge	**Wall Outlets (600W):** 9~9.5Hrs **Solar (1200W):** 4.7~5.25Hrs	**Wall Outlets:** (depend on the grid voltage) 3.5~3.8Hrs (US 1800W) 3.9~4.4Hrs (JP 1500W) 2.2~2.7Hrs (EU/UK 3000W) **Solar (2400W):** 2.6~3.1Hrs	**Wall Outlets:** 12Hrs **Solar:** 18~36Hrs **Car Charge:** 40Hrs	**Wall Outlets:** 4Hrs **Solar:** 2Hrs **Car Charge:** 11hrs

2. **Satellite Terminal:**



The Starlink satellite terminal, with 100 Mbps now available in the Portland-Metro area, provides broadband even when ALL cellular and landline communications is down. It delivers broadband anywhere, anytime. Even when FirstNet's generators run out of gas.

The small terminal actively scans the sky for overhead satellites. Because the first 1,500 satellites were launched with a 53 degree inclination, most of their satellites go directly overhead for ideal reception. The service is available now in Portland. The satellite terminal costs $500 and the service fee is $99/month. It draws about 100 watts. Figure a power draw of 100 watts times 24 hours or 2400 watt/hours. A newer, lower-cost terminal that uses less power is anticipated in the next few weeks.

3. **Solar and Wind Generation.**

Because the power grid may be non-existant or down for weeks after a large earthquake, getting gasoline and diesel fuel to remote sites may be difficult if not impossible. Solar and wind don't need the grid.

Solar is cheap and efficient, but wind can work all night. Combined, they might deliver an average of 1000-2000 watts an hour during the day, perhaps 500-600 watts at night (wind only).

Solar is commonly available at $1-$3 per watt. So 1200 watts of (portable) solar might cost around $2500. No installation cost.

Small wind turbines that generate 600-1200 watts are commonly available on Amazon. Their cost per watt tends to be higher than solar but wind can generate electricity at night. Solar can't. It's dependent on the environment. Sometimes the wind blows and the sun shines. Sometimes it doesn't. That's what the generator is for.

Small wind turbines commonly are divided into two types, the common horizontal axis turbine, mounted on a swivel to face the wind. The less common vertical axis turbines generate electricity without swiveling. They rotate like a carousel on top of a pole. Either type would work. We are proposing a vertical axis turbine because it promises easier mounting and the top-heavy swivel is eliminated.

Requirements:

The prime objective is to generate enough power to operate a broadband node 24/7 (anywhere) without a gas-powered generator. So we need to estimate our total average power draw over 24 hours. If we are using a 10 kilowatt/hr battery (two ganged 5kw batteries), then we need to deliver approximately 12kw from wind and solar every day to charge the thing. We need to draw LESS than 10 Kwatts a day to keep the system operating 24/7. If we used an average of 500 watts an hour, times 20 hours, that's 10 Kilowatts. Can we meet that requirement? Let's add up our estimated power draw:

POWER DRAW:

1. Starlink Terminal. ~100 watts x 24 hours = 2400 watts
2. Eight, 60 watt, USB-C power outlets: ~ 500 watts x 8 hours = 4000 watts
3. Four, 12 volt chargers (30 watts each) ~ 120 watts x 8 hours = 1000 watts
4. Two, 110 volt AC (300 watts each) ~ 600 watts x 4 hours = 2400 watts
5. **TOTAL ..... ~ 10,000 watts**

Is this a realistic power estimate? No. This is a draft pape. A more accurate power draw and power generator estimate would be needed.

	BLUETTI EP500	BLUETTI EP500 Pro	Goal Zero Yeti 6000X	Point Zero Titan
Pack Capacity	5100Wh		6071 Wh	2000Wh
Battery Type	LiFePO4		Li-ion NMC	Li-ion NMC
Life Cycles	6000+		500 (80%)	2000
AC Inverter	2000W 4800W Surge	3000W 6000W Surge	2000W 3500W Surge	3000W 6000W Surge
Output Ports	4×120V AC 3×12V/10A DC 2×USB-A 2×USB-A(Quick Charge) 2×Wireless Charging Pad 1×100W USB-C 1×12V/30A RV	5×120V AC 3×12V/10A DC 2×USB-A 2×USB-A(Quick Charge) 2×Wireless Charging Pad 2×100W USB-C 1×12V/30A RV	2×120V AC 2×USB-A 2×USB-C	6×120V AC 4×12V DC 6×USB-A 2×USB-C 1×30A RV
Input Time	Wall Outlets(600W) 9~9.5Hrs Solar (1200W) 4.7~5.25Hrs	Wall Outlets (depend on the grid voltage) 3.5~3.8Hrs (US 1800W) 2.2~2.7Hrs (EU/UK/AU 3000W) Solar (2400W) 2.6~3.1Hrs Car Charge (24V) 13Hrs	Wall Outlets 12Hrs Solar (200W) 18~36Hrs Car Charge 40Hrs	Wall Outlets 4Hrs Solar 2Hrs Car Charge 11Hrs
Max Solar Power Input	1200W	2400W (2X1200W, dual solar input)	360W	1000W One Battery Pack
Wireless Charging	√	√	X	X
Split Phase	√	√	X	X
MPPT Charge Controller	√	√	√	√
App Control	√	√	√	X
UPS Mode	√	√	√	X
PV + AC Dual Charge	√	√	X	√
Peak Load Shifting	√	√	X	X
Price	$2,799	$3,799	$4999.95	$2,995

Budget:

Here is a (very) rough cost estimate of a BBCN Broadband Community Node:

1. Two, 5100 watt/hr, Bluetti EP500 pro lithium batteries .. $8,000
2. One Starlink satellite terminal with 1 yr service ..…….$1,800
3. WiFi 6e community hotspot ……..$ 500
4. 1200 watts solar panels ……..…$2,000
5. 600 watts vertical axis wind turbine with moun……$2,000
6. Video projector and screen ……..$ 700
7. Three USB powered laptops ……..$1,500
8. Canopy, chairs, tables, carry cases ……..$ 500
9. Misc power adapters, tools, and other costs ……...$2,000

   TOTAL ESTIMATED COST…….**~$19,000**

Partners:
Partners might include; PBEM, Neighborhood Associations, HOAs, Transition Projects, tech firms, Tri-Met, O-DOT, etc.

Conclusion:
This proposal would provide broadband for the people. In an emergency, the satellite and wind/solar power could be life savers. But the technology may be applied for more routine use in parks or city kiosks. The cost and risk of exploring these options is low.

Related Links:
https://www.bluetti.com/pages/ep500-p
https://www.kickstarter.com/projects/bluetti/bluetti-ep500-and-ep500pro-the-new-era-of-home-backup-power
https://www.starlink.com/faq
https://en.wikipedia.org/wiki/Starlink
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https://www.amazon.com/NINILADY-Permanent-Generator-Controller-Efficiency/dp/B08MPT4D15/ref=asc_df_B08MPT4D15

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