



# The Mid Cornwall Beacon and Repeater Group Sustainable Beacon Project

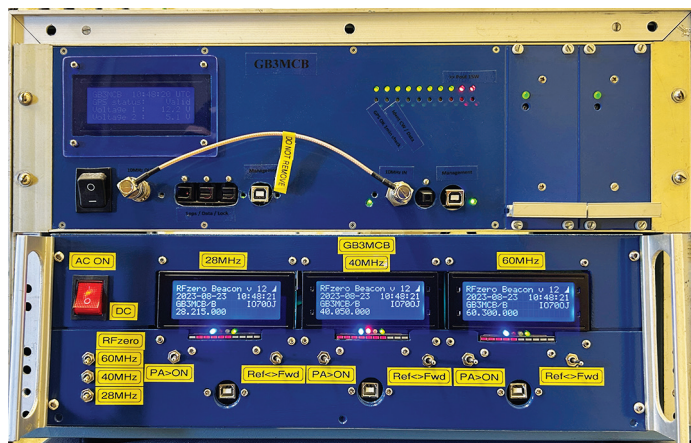


PHOTO 1: GB3MCB 50MHz SBP beacon and new 28-40-60MHz beacons.

In early 2022, following requests from the RSGB, the Mid Cornwall Beacon and Repeater Group (MCBARG) agreed in principle to the siting of three new beacons at its Hensbarrow Downs site near St Austell in Cornwall (IO70oj).

The proposed beacons on 28MHz, 60MHz and 40MHz were to replace those formerly sited at the Rutherford Appleton Laboratory at Chilton, Oxfordshire.

Peter, G8BCG funded and built the new units from scratch using RF-Zero modules and PA units supplied by Sergey, EX9T. After extensive testing the new beacons were brought into service in September 2022.

## More Power

Energy has always been by far the highest single cost to the group. In effect the local repeater group members were subsidising the international beacons. So, in parallel with the new beacon work, a decision was made to seek funding for a solar PV array to reduce or eliminate these costs and put MCBARG on a sustainable footing.

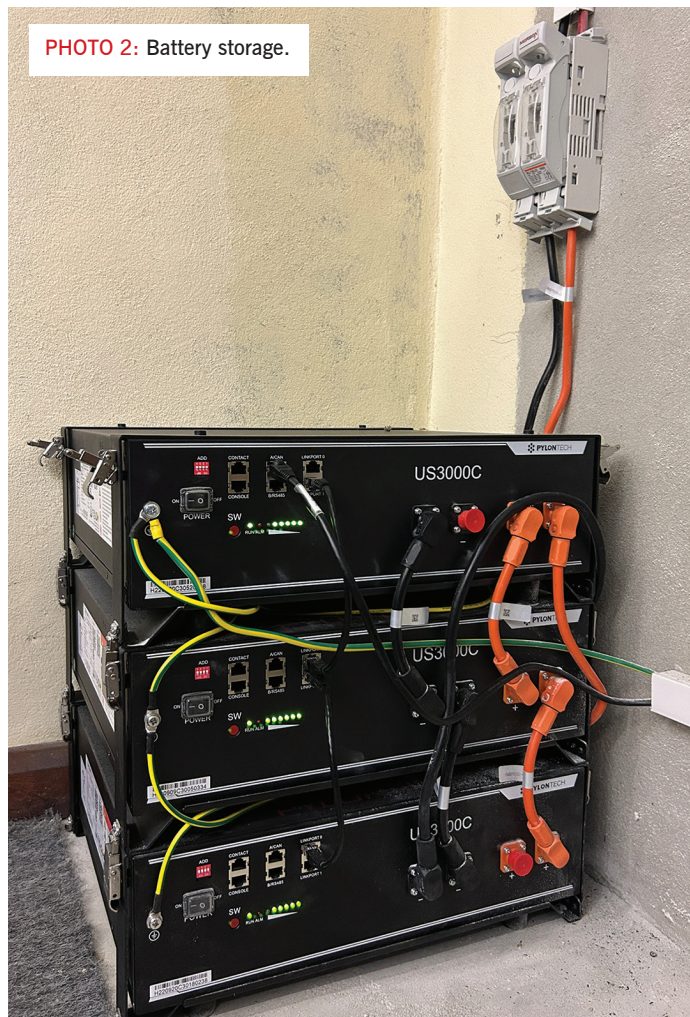
## The RSGB Legacy Fund

In March 2022, following discussion with several funding sources and supporters, Peter, G8BCG made an application to the RSGB Legacy Fund for The Mid Cornwall Beacon and Repeater Group Sustainable Beacon Project.

Over the following months, quotes were obtained and a more-detailed, fully-costed application was made. During the same period, electricity costs more than doubled, emphasising the need for this project more powerfully that we could have ever imagined!

On 19 March 2023 we received a short email from the RSGB stating "I am pleased to report that at yesterday's meeting the Board agreed the Legacy Committee's proposal to fund the PV array" (at a cost of almost £12k).

PHOTO 2: Battery storage.



## Solar PV Self Build

To obtain maximum value for money and to retain control of the design, the decision was taken to adopt a self-build approach, supervised, signed-off and certified by a local electrical contractor.

There were initial concerns that the solar PV system might generate excessive noise and impact on the repeater receivers. It was critical to reduce this risk from the outset. To achieve highest efficiency, many designs make use of optimisers – DC/DC switching converters mounted directly behind each

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PHOTO 3: GB3HB Fusion repeater.



PHOTO 4: GB3NQ ATV repeater.

solar panel. So, with a 12-panel array, that would mean 12 DC/DC switching converters, all mounted in the open, each with the potential to generate and radiate noise. This seemed like asking for trouble. Investigations revealed that, for locations where all of the panels receive similar solar illumination, a simpler arrangement where DC is fed from the solar panels to a single ground-mounted, indoor, fully-screened, DC/AC inverter drastically reduces the risk of radiated noise whilst also reducing design complexity and capital cost. Decision made!

After a huge amount of procurement research and site planning by Paul, G6MNJ followed by intensive MCBARG volunteer site works, the solar array, batteries and inverter system were brought into service on 5 June 2023. This really was an amazing team effort!

## System Description

The solar PV system comprises 12 x 410W solar panels giving a maximum potential output of just under 5kW. For ease of installation and optimum sighting, the panels are ground mounted in weighted tubs. The inverter is a 3.6kW Solis unit to which 10kW of Pylontech batteries are attached. The consideration of having many more potential watts than the inverter can process is that on overcast days, and also as the days shorten towards the winter, we achieve higher outputs than an array of panels totalling only 3.6kW. We are observing this in practice from the data already collected on the Home Assistant software running on a Raspberry Pi.

Indications to date are that it is rare that the batteries are not fully charged by sunset and so the entire site can be run on stored solar power until sunrise the next day.

Full, secure, remote access is available via a second Raspberry Pi which provides monitoring data and system control, as required. This also provides a 'live' solar status bar for display on the group website: [gb3mcb.org.uk](http://gb3mcb.org.uk) (see also QR code to the right).



## Solar PV in action

It is early days but the system is certainly working very well indeed and our electricity consumption from the grid has been reduced to virtually zero.

By mid-August the system had generated approximately 1300kWh of power from 'go-live' on 4 June – an average of 16kWh/day. The site consumes 14kWh/day of which roughly 66% continuously powers beacons, and 33% is used by repeaters and other systems. Excess power will of course reduce as the days get shorter but the massive reduction in the annual energy costs has already returned the group to a sustainable footing.

## Mission accomplished

Of course there will be times when the Sun does not provide us with sufficient energy

to power everything *and* recharge the batteries. So, we still need our grid supply. As for the total energy bill saving? We will only know this after a full year of operation.

## Project summary

- Capital costs were sponsored by the RSGB.
- Installation costs were covered by the hard work of MCBARG members/volunteers.
- Ongoing operation is now sponsored by the Sun!

## Our sustainable future

MCBARG operates a unique cluster of nine beacons and three repeaters at IO7Ooj. The site, buildings and mast are leased for a token sum and, as a non-profit organisation, we do not have to pay commercial rates.

In support of the wider local community we house communications systems for Cornwall Search and Rescue and the local Air Training Corp.

Our entire operation is funded by membership, donations, sponsorship and grants. We have been fortunate to receive considerable help from special interest groups such as the UK Six Metre Group, UK Microwave Group and British Amateur Television Club.

With solar now powering all our systems, we can target future funding and expenditure on radio projects rather than utilities bills.



PHOTO 5: Solis DC/AC inverter.

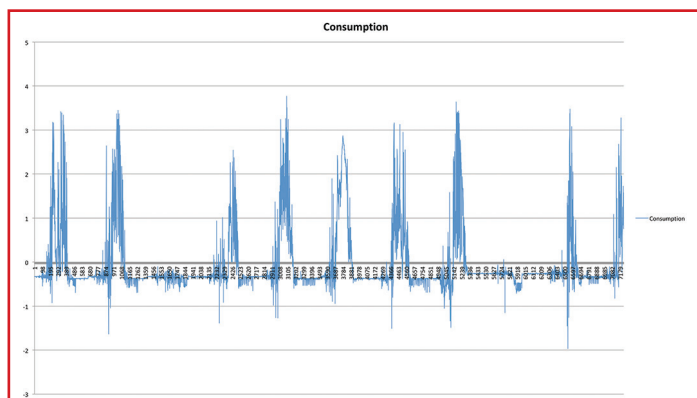


FIGURE 1: Consumption.

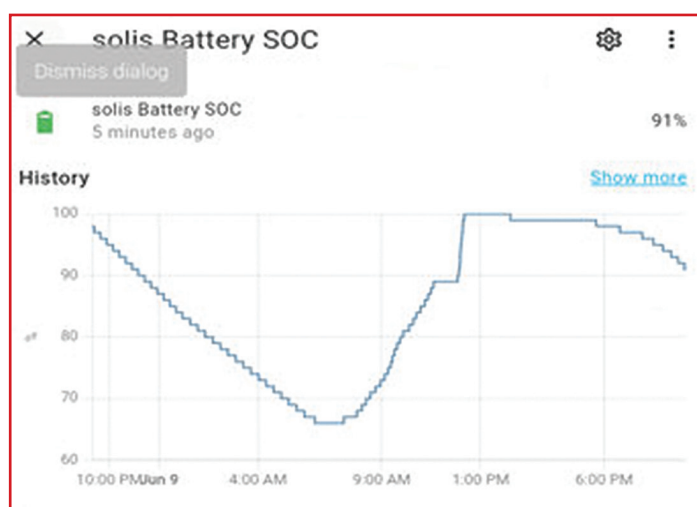


FIGURE 3: Typical 24-hour battery state of charge.

In addition to ongoing systems maintenance, major upcoming projects include:

- tower fall arrest system upgrade/re-certification
- multiple antennas maintenance/replacements
- upgrade/replacement of older beacons for better stability/ident.

## Thank you

The MCBARG committee and members are truly grateful to the RSGB, and in particular to the Legacy Fund, for their vision and generosity in supporting our sustainability project.

We hope that this article will inspire you to:

- join / support the RSGB
- join MCBARG – knowing that your membership dues will go to supporting propagation research beacons and rather than power companies.
- think of ways that *you* might contribute to make our amateur radio hobby more sustainable.

## RSBG Legacy Fund

For more information about the RSGB legacy fund visit [rsgb.org/legacy](http://rsgb.org/legacy)

## References

- [1] <http://gb3mcb.org.uk/>
- [2] <http://gb3nc.org.uk/>
- [3] <https://rfzero.net/>

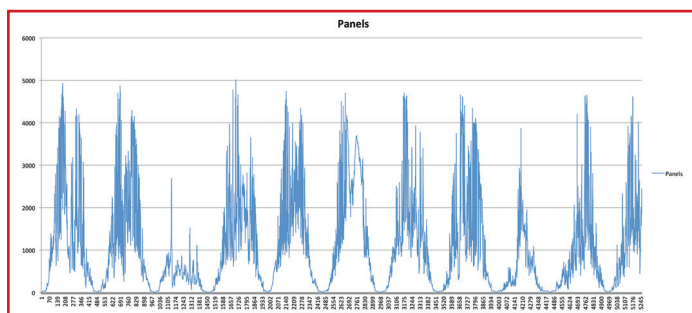


FIGURE 2: Output of panels.

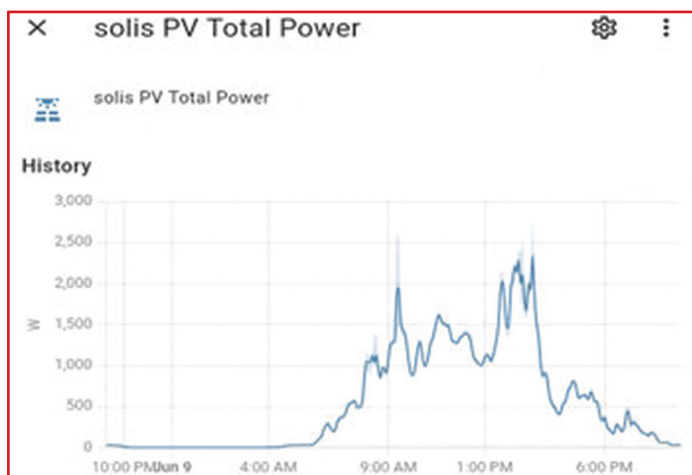


FIGURE 4: Typical 24-hour solar output.

### GB3NQ ATV Repeater

The repeater transmits on 1316MHz 2000kS/s FEC 4/5 DVBS-2.

The input frequencies are 146.5MHz, 437MHz and 1249MHz.

GB3NQ runs in beacon mode between midday and 9pm when it plays out a video for 30 minutes. When running between 10am and 10pm, it may be accessed at any time with a valid digital television signal on the 2m, 70cm or 23cm bands. This would be a symbol rate of 333k symbols/s on 2m or 70cm, and 23cm symbol rates of 333, 1000 or 2000kS/s.

GB3NQ can be HD live-streamed by using the link:

<https://batc.org.uk/live/gb3nq>

### The GB3MCB Beacon Cluster IO70oj:

28.215MHz, 40.050MHz, 50.005/50.443MHz(SBP), 60.300MHz 70.025MHz, 144.469MHz, 432.470MHz, 1296.860MHz and 10368.980MHz.

The VHF, UHF and SHF beacons are all on North East beam headings from our far SW location. Our 2m beacon is unique in that it has two antennas. One to the North East and the other to the South for French, Spanish and further afield propagation reports. For the HF and low VHF beacons more omnidirectional antenna systems are used to provide better global coverage.

### GB3NC Service area covers most of Mid Cornwall

Band: 2m (RV58) output: 145.7250MHz Receive: 145.1250MHz

FM analogue voice - CTCSS tone of 77Hz or 1750Hz tone burst.

Echolink node number is 282184.

GB3HB service area covers most of Mid Cornwall

Band: 70cm (RB15) output: 433.3750MHz Receive: 434.9750MHz

This is a Dual Mode repeater with access for either C4FM/FUSION or F3E but not cross mode. The CTCSS tone is 77Hz.