

Solar PV pump

Supplying mains or borehole water for field grazed livestock at remote sites isn't always a practical option. Alternative watering systems are available, depending on the site and stock requirements.

This leaflet looks at the installation of two types of solar PV powered systems to provide drinking water for field grazed livestock. The work was carried out as part of a Scottish Government funded trial to investigate alternative watering options.

What is a Solar Photovoltaic (PV) pump ?

Using solar energy as a power source, a battery can be charged which will then be used to power an electric pump system. Alternatively, larger capacity panels can be used to directly power an electrical pump.

Significant water storage capacity within large trough(s) can provide a 'buffer' for varying demands during drinking and possible periods of reduced available 'solar charging' during periods of limited light level. Water can also be pumped to an intermediate storage container to supply a number of troughs as part of a gravity fed system.



Points to consider when choosing a solar system

- What is the water requirement of livestock (both overall and to satisfy peak drinking demands)?
- What is the distance and height (head) required to allow a drinking trough at a location **to remove risk** of poaching, erosion and faecal contamination of watercourse being protected? This will determine the pump duty specification for any site and in turn effects the power supply equipment and arrangement.
- What is the overall energy/power availability to satisfy the pump equipment requirement, taking into account specific regard to possible variations in light levels?



Protecting water quality

Under Diffuse Pollution General Binding Rules, significant **poaching within 5m of a water-course is no longer acceptable.**

Where livestock frequently enter water for drinking or crossing and cause significant poaching, alternatives need to be considered. The following hierarchy is recommended when considering livestock watering options :

- Extension of mains supply
- Extension of existing spring or bore supply
- In-field bowsers
- Off-line gravity feed trough
- Alternative watering system, e.g. pasture pump, solar PV or ram pump.

Solar pumps

Pros

- Standalone system: easy to site, install and maintain
- Authorisation for abstraction falls under [GBR2](#) so no paperwork or CAR application needed
- Option to power a battery operated electric fence

Cons:

- Installed systems were prototypes; no off the shelf complete systems
- May need to design system and purchase components separately
- Both systems trialled cost around £2,000 (ex VAT) but price expected to fall as demand increases
- Risk of theft/vandalism on some sites

Solar charged battery operating an electrical pump

System components included:

- Abstraction point
- Submersible low voltage pump located within the abstraction sump.
- Medium capacity troughs
- Mast mounted integral (low voltage) solar panel
- Voltage regulation and charging system probe control of pump
- Battery
- Fencing to protect rear of pump and cabling (battery could run electric fence).

'Battery free' system

Components included:

- Abstraction point
- Submersible pump located within the abstraction sump
- High capacity troughs
- 2x 195w solar panels (mast mounted)
- Electronic power management and pump controller
- Fencing to protect panel mast and controller.

Funding

Funding is available towards **alternative watering for field grazed livestock**. See options under Scottish Governments [Agri-environment Climate Scheme](#) for details.

Battery operated electrical pump (solar charged)

As part of the trial, solar energy charged a battery, powering an electric pump system. A 'low voltage' submersible pump supplied water on demand to a trough; the pump was supplied by a low voltage, high capacity battery, voltage regulator and solar panel to provide a charge current to the battery.

The submersible pump was located in an abstraction sump chamber (see leaflet on abstraction design for mechanical/electrical pump systems). Water entered the abstraction point and was directed to the pump chamber/sump. As livestock drink, level probes in the drinking trough indicated a low level in the trough to switch 'on' the pump. The pump operated by transferring water from the chamber to the trough. Once the water reached a high level in the trough, the pump was automatically switched off.

Pump protection (low water) was provided by integral 'low level' sensing and switching off the pump to protect the pump in the event of water shortage within the abstraction sump. The pump was powered from a deep cycle battery which was charged by the solar panel and charge regulator.

Solar operated electric pump

In this system, the solar panel(s) alone provided significant power for operation of a submersible pump. Using a larger solar panel area to increase available energy/power during lower light levels **and** with electronic control of the pump, this allowed continuous operation during lower panel 'output' (lower level light) periods.

The pump was located in an abstraction chamber. As with the other system, a low level in the trough switches the pump 'on' and a high level in the trough will switch the pump off. The pump and controller were both configured to allow a variable output range from the solar panel to maintain operation of the pump over a range of light levels. At very low light conditions the pump would not operate. At this time, and at times of low flow, the high capacity troughs act as temporary water storage.

Further information:

- Alternative Watering for field grazed livestock 1 - Abstraction Systems. SRUC Technical Note TN665 www.farmingandwaterscotland.org/
- Alternative Watering for field grazed livestock 2 - Pumping Systems. SRUC Technical Note TN666 www.farmingandwaterscotland.org/
- CAR Practical Guide; includes requirements for authorisation under CAR www.sepa.org.uk/water/water_regulation/reqimes.aspx
- Controlled Activities Regulations (CAR) - The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2013 www.sepa.org.uk/water/water_regulation/car_application_forms.aspx
- Grazing Animals Project (2007). Watering stock on sites – Information leaflet 13 www.grazinganimalsproject.org.uk/stock_management.html
- Sniffer (2002). Off-stream water provision for livestock. Report number SR(02)01F www.fwr.org/snifpr.htm

Also in this series:

- Abstraction design for water powered (ram) pumping systems
- Abstraction design for electrical/mechanical pumped systems
- Ram pump systems
- Pasture pump systems

For further details see www.farmingandwaterscotland.org or speak to your local agricultural adviser.

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