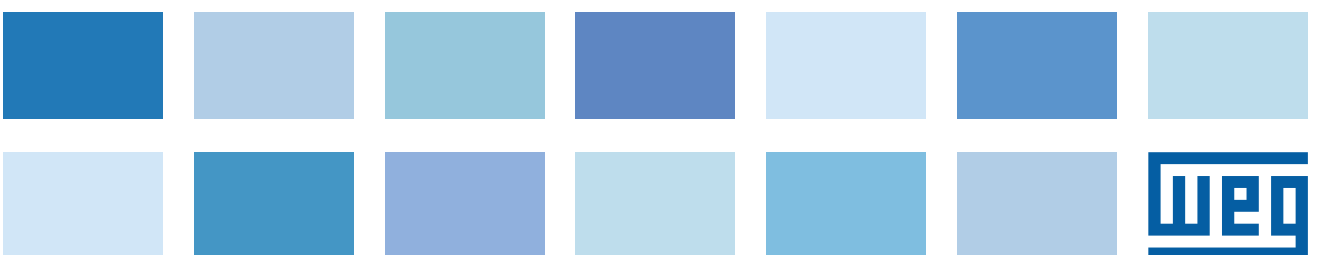




A history of innovation at Cragside continues with hydro-electric power from WEG





# A history of innovation at Cragside continues with hydro-electric power from WEG

**Built in the 1800s by Victorian Engineer and Inventor William Armstrong, Cragside is credited as being the first house to be lit with hydro-electricity - and over 100 years later it is generating green electricity again from water power thanks to a WEG W22 high efficiency electric AC motor / generator.**

William Armstrong was one the most prominent industrialists of his age, pioneering the use of pressurised water to power hydraulic equipment such as dockside cranes; after which he went on to introduce breach loading field artillery guns and many other engineering marvels. Towards the latter part of his career he showed a visionary attitude towards reducing dependency on fossil fuels and the need for developing renewable power sources.

Putting his money where his mouth was, he and his wife Margaret created

the Cragside estate, north of Newcastle in Northumberland, there they famously planted seven million trees over an area of over 1,700 acres, together with five artificial lakes that were used to generate hydro-electricity. This innovation made Cragside the first documented house in the world to have been lit by hydro-electricity, using incandescent lamps provided by fellow inventor Joseph Swan.

As the first engineer and scientist to join the House of Lords, William Armstrong left a career legacy as well as his spectacular house, now run by the National Trust. The house contains many gadgets that would have been revolutionary in their day, including hydraulically powered lifts, dishwashers and cooking spits. Re-introducing one of the most famous, the hydro-electric power generation, has been achieved thanks to a WEG motor/generator installed as part of the new Archimedes screw power installation.



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Visitor numbers are steady at Cragside during the day and the Archimedes screw generator is positioned on the main entrance drive, depending on rainfall and supplied by the lake it can run all day when visitors are there and the lake can refill during the night if required. Hydro-electricity is popular in some of the other mountainous properties managed by the national Trust where it is more viable as a green power source.



An Archimedes screw generator was chosen because the team was looking for a generator that would work efficiently with a low head of water. An Archimedes design is ideal because it does not require water pressure to operate, just water flow and a head – which is provided by one of the manmade lakes created for exactly this purpose. The lighting for the entire house can now be powered using the flange mounted high efficiency 18.5 kW rated WEG W22 IE3 electric motor.

Robin Wright, Cragside Engineer also shares a passion for all things mechanical, commenting on the installation he said, “I think he [Lord Armstrong] would be delighted with the new hydro-power installation, he was an innovative thinker and loved anything that used water to make power, he also made comments about coal lasting two hundred years and solar power being something for future generations to exploit, so a bit of a visionary.”

Phil Hall, Sales Engineer from WEG commented, “We have supplied motor / generator solutions for prominent hydro-power installations in the UK and around the world ranging from ratings of tens of kilowatts to megawatts. In most modern Archimedes screw generator applications there tends to be some inertia within the system – this can be due to the physical size of the screws or the use of a gear reduction stage. Employing a motor is helpful in this instance as the motor can be used to drive the screw until it reaches operational speed and the water flow takes over. Once the water is pushing the screw, then the motor is disconnected from operation as a motor and is mechanically driven over-speed, i.e. over its synchronous speed in order to generate power.

WEG is able to supply both gears and variable speed drives that are matched to each application, enabling similar projects to be fully supported by WEG equipment.

An Archimedes screw, although ancient in principle, is actually a very efficient way of generating power when you have a large volume or flow of water, but low head.



The lighting for the entire house can now be powered using the high efficiency WEG IE3 electric motor driven over-speed as a generator.

“The system, although ancient in principle, is actually a very efficient way of generating power when you have a larger volume, or flow of water, but not much space to create a pressure head to drive a mechanical system. The losses are mainly in the gearbox rather than in the motor or the bearings that support the screw, but we need that geared stage to increase the rpm enough to overspeed the motor.

“At Cragside the screw drives the 18.5 kW motor at over its 980 rpm synchronous speed via a gearbox, only when the system needs to start-up does the motor draw power to get going. The motor is rated at 93% efficiency so it maximises the available energy conversion from the screw when working as a motor, or a generator.

The W22 motor range from WEG represents affordable energy efficiency; the standard motor which reaches IE3 efficiency levels of 93% is far beyond many other manufacturers’ standard product offerings. The W22 range covers frame sizes from IEC 63 to 355A/B and can deliver between 0.12 and 500 kW. For more specialist applications, the W22 range can be supplied with increased levels of ingress protection, up to IP66, as well as being specified for operation in potentially explosive atmospheres.

WEG is unusual in that it also offers a full range of super-high efficiency IE4 motors from fractional kW ratings to megawatt powers. These IE3 and IE4 machines, whether used as motors or generators offer an unbeatable combination of high efficiency, range, availability and value.

When considering the total cost of ownership (TCO) for a W22 the cost of acquisition typically represents less than 5% of the total cost of ownership

over an average operational lifetime. In contrast, the associated energy savings provided by premium efficiency motors far outweigh this additional investment in purchase price, particularly in applications where the process operates on a frequent shift, or 24hr basis.



Electrical output from the motor is quoted in kVA when it is running in generation mode, so what is desirable here is a high power factor and high efficiency. The WEG W22 unit has both these with a power factor of 0.85 to 0.86 and an output of between 8 and 10 kVA (1kVA is a 1,000 volt amps) which ensures a high degree of the potential energy in the water pushing the screw around as it descends is converted into electricity.





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