Powering the watch

The environmental and design benefits of solar-powered watches

Since 1858, the British Horological Institute has been supporting the horological industry, or to you and I, the clock and watch makers. Mechanical watches were the norm for many decades until the advent of the quartz watch by Seiko in the 1960's, following which the digital watch emerged in the 1970's and in the mid 1990's the first solar powered watches were launched onto the market. The latest development was the smart watch which has gained in popularity since being introduced in the early 2000's.

Creative design is at the heart of many watch makers, arguably none more than Ressence who state "the user is at the core of what we do. Mechanical fine-watchmaking is the vector to express our concept as we design our watches from the exterior to the interior." The digital watch replaced 'hands' with a segmented liquid crystal display, the creativity and innovation of Ressence has made it possible to have a watch with rotating sub-dials mimicking the motion of the planets thereby enabling intuitive reading of time. A unique design concept.

So how has the evolution of watch design and technology impacted the sustainability and environmental impact of the watch?

This is an interesting question, the original manual watch could be classed as very sustainable and environmentally friendly, especially as it was powered by manually winding the spring and with good care would last many years. In fact, the Swiss watch industry is recognised as a global leader in the design and manufacture of the precision mechanical watch.

With the advent of mass-produced battery powered quartz watches the market has grown and an accurate timepiece is now affordable to everyone. However, there is the need to replace the battery at regular intervals, and this comes at an environmental cost. One alternative is the use of ambient light, whether indoor or outdoor, to charge a battery and provide the necessary power to drive the watch mechanism.

Seiko LCD Solar Alarm Chronograph A156-5000, 1978: Seiko's first solar-powered watch

The Japanese companies Seiko and Citizen have been the pioneers of this technology; the use of amorphous silicon solar cells has been a success and they are utilised in a number of watches today.

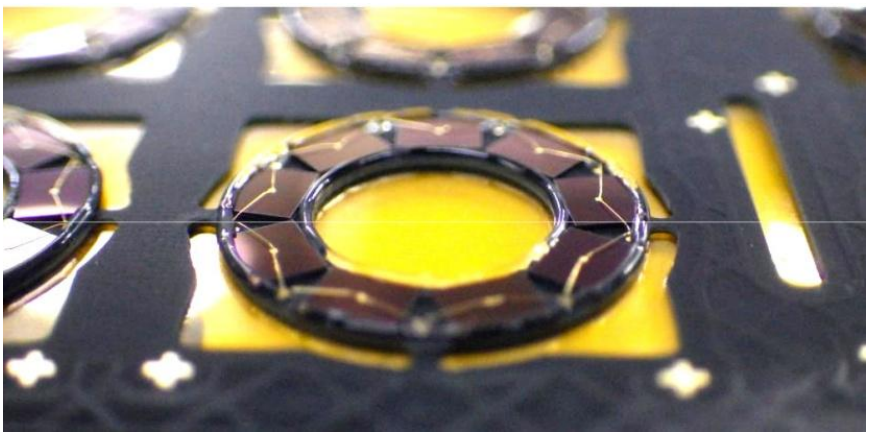
More recently, several luxury and designer brands have launched solar-powered watches, exemplifying how they are now part of modern luxury watchmaking: “Luxury watchmakers embrace solar: Timepieces powered by sunlight were once seen as the antithesis to high-end Swiss watches. But no longer”, FT.com, Financial Times.

So, what of the future?

With an ever-increasing appetite for new functionality and connectivity, especially with the advent of the smart watch, there is increasing demand for power, whilst this must be balanced with the drive for sustainability. Watches and wearables that monitor your health and wellbeing (heart rate, temperature, motion), link the user to their emails, finances (credit and bank cards), social media and offer location services via GPS all require greater power and serve to reduce battery life, meaning more frequent charging or more battery changes.

Solar power is an alternative source of power, however, one of the limitations of the solar powered watch is that the power generated is directly proportional to the surface area of the solar cell visible to the light source. Clearly it is impractical to design very large watch dials, just to enable the incorporation of larger solar cells. Hence there is a requirement for the development of more efficient solar cells.

If the efficiency of solar cells could be improved that would enable greater functionality. The state-of-the-art was arguably amorphous silicon solar cells. However, there are new material systems entering commercialisation enabling a significant improvement in performance compared to amorphous silicon. One such technology is utilised by Antwerp based watch designer, Ressence, who use advanced solar cells in their prestigious and novel designs. The cells Ressence use have evolved out of the space and satellite sector, and utilise different materials offering up to 6 times more power than the best performing amorphous silicon. The benefit being



a significant reduction in the size of the cells or enhanced energy generation. Furthermore, the cells can be miniaturised and using a connected mosaic configuration novel structures can be designed and manufactured in volume.

Ressence selected Lightricity as their supplier of choice for advanced solar cells for their Type 2 eCrown® due to the capability to collaborate on a custom designed device with space technology performance. The unique horse-shoe cell device enabled Ressence to offer connectivity, that would not have been possible using any other cell technology. Ressence stated "*SELF SUFFICIENT TECHNOLOGY; eCrown® first uses photovoltaic energy to run. When required, photovoltaic cells, some hidden behind 10 micro-shutters on the dial, will use the outside light as energy source. The eCrown® technology is therefore self-sufficient. A fundamental quality in the nomad world of today."*

Accurately measuring solar cells for watches and for other applications

With the growing adoption of photovoltaic cells for watches and the different light energy harvester technologies available there is an increasing demand for an accurate method to compare the performance of cells using different materials systems or from different suppliers. To meet this demand Lightricity has developed and is selling a desktop indoor light simulator, designed specifically for the characterisation and performance measurement of indoor light cells. As recently reported by PV Magazine International, Oxford based, Lightricity has recently launched the benchtop "LightBox Indoor Light Simulator", coming in two sizes, it enables the accurate and reproduceable characterisation of indoor cells under a range of light levels from below 10 lux to 50,000 lux. The light uniformity of the LightBox has been measured by the UK's National Physical Laboratory (NPL) as part of an A4i grant from Innovate UK. The LightBox STD and LightBox XL are available now. For more details follow this link: https://lightricity.co.uk/indoor-light-simulators

The Lightbox is available in two different sizes: 110 mm x 110 mm x 80 mm incorporating a 5 x 5 array of white LED lights and a larger version 185 mm x 185 mm x 85 mm incorporating an 11 x 11 array of white LED lights.

Lightricity LightBox

Contact Information:

For further information, product enquiries and order information please visit:
www.lightricity.co.uk

Lightricity PV technology

Lightricity offer the world's most efficient indoor PV technology (though it works outdoors, too). The patented technology converts indoor light sources to energy with approximately 30% efficiency – a more than six-fold improvement on conventional PV, as validated by the UK's National Physical Laboratory.

A panel the size of your fingertip will power your wearable for the next 20 years. Even in extremely low indoor light. Our technology can be sealed in the device and operate at temperatures from -40 to +200 degrees, beyond the conditions a wearable will ever be exposed to.

We offer customisable PV devices that can be designed to meet the watch designer and manufacturer requirements.