ASH

CREATIVE WIRELESS ELECTRONICS

Approaching the challenge of battery life

The challenge

Modern smart devices and wireless networks are now offering services that were once considered the preserve of science fiction like Star Trek. However, boldly going where nobody has gone before can bring its own challenges. One of the key concerns is balancing performance and battery usage – it's very easy to be in a position where despite having the technology, some systems suffer from 'We don't have the power Captain!'

Customers' vigorous demands on technology add to this challenge. Users often want lots of features, simple interfaces, small devices, as well as a responsive network. This reliance on wireless networks to cater for their needs means there are greater demands on the infrastructure than ever before. Wireless sensor network devices typically require a 10-20 year single-cell battery life whilst also delivering high performance in terms of complexity, protocol and radio range. These demanding customer expectations often conflict with what is possible, so designing wireless devices and networks that perform is becoming far more challenging.

Overview

The resources to meet the challenge

Engineering economics

Key approaches to maximising battery life

The resources to meet the challenge

There are many factors involved in designing wireless systems and they all need to be considered when trying to maximise battery life. Some key ones include:

Complexity

To produce wireless systems that cater for all the demands placed on them can lead to immensely complex designs. Customer demands for features are increasing and accommodating this means adding further levels of complexity. Equally, ensuring wireless systems can accommodate a variety of devices requires high degrees of standardisation – which is a complex undertaking in itself.

Utilizing the latest components for the appropriate solution

Inevitably, electronic components are improving all the time. Modern silicon processes and architectures mean that many parts of a wireless system can now offer improved low-power operations and improved power use sleep modes. These enable energy to be managed more effectively. Microcontrollers, for example, offer a low voltage operation ideal for single-cell batteries and operating currents in the region of 1mA – 20mA. Likewise, transceivers offer good performance but the trade-off is that they are complex to integrate and use higher currents in the region of 10mA – 40mA.

Battery Technology

Developments in battery technology are fuelled by advances interest areas such as handheld devices and electric vehicles. Despite the increases in battery density over the last 40 years, battery technology is developing less rapidly than other technology areas. Battery technology is still a restriction on many system designs, so efficiency measures across the network are essential in improving the user-experience.

Engineering economies

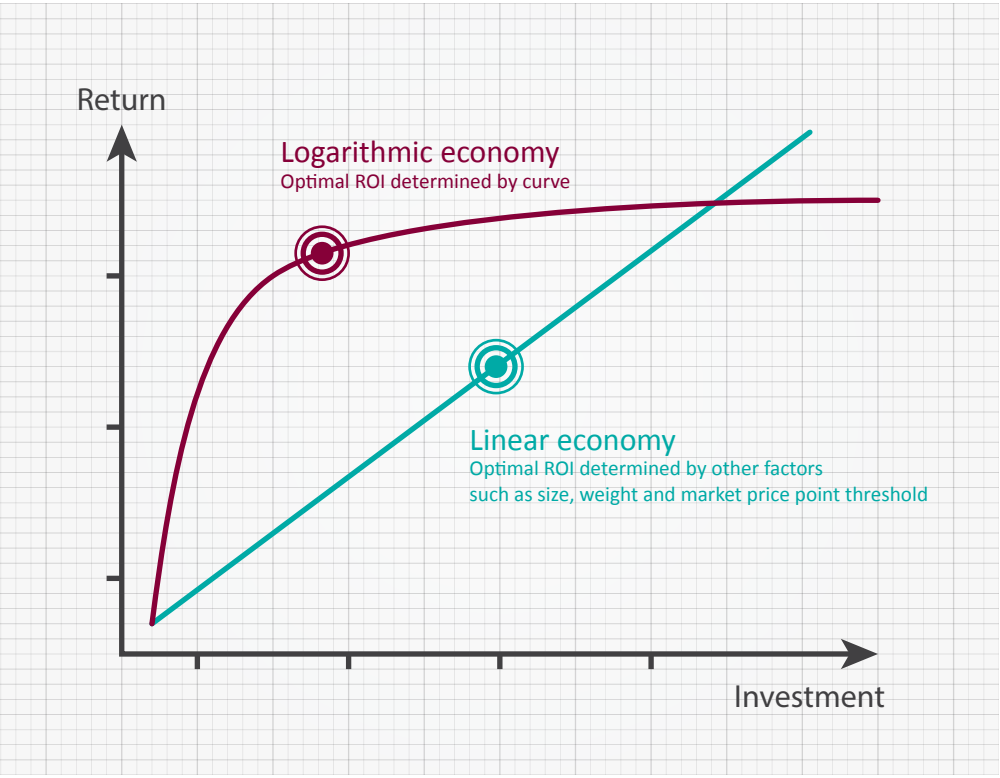
Electronic engineers engineer in two economies; Linear and Logarithmic. It's vital to remember the effect of both economies on wireless system design.

The development of technology is very often dictated by the Logarithmic economy. For example, when transmitting a radio signal, the benefits gained diminish rapidly beyond a given power input. The optimal amount of power to use is that which results in a signal strength just above the 'knuckle' in the curve shown in the graph.

The Linear economy features in many other aspects of electronic engineering. For instance the price of material commodities or labour costs for manufacture will generally rise in proportion with requirements of a project.

Battery capacity follows a Linear economy. By paying more you can achieve a higher battery capacity. This might indicate that it is effective to do so but there are other factors involved that determine optimal battery capacity for a device. Price, size and weight are three significant factors that consumers are often not very willing to compromise on. Therefore, despite the linear economy, battery capacity for any given device will have a natural ceiling.

In order to improve battery life without simply increasing the battery capacity requires a smarter approach.



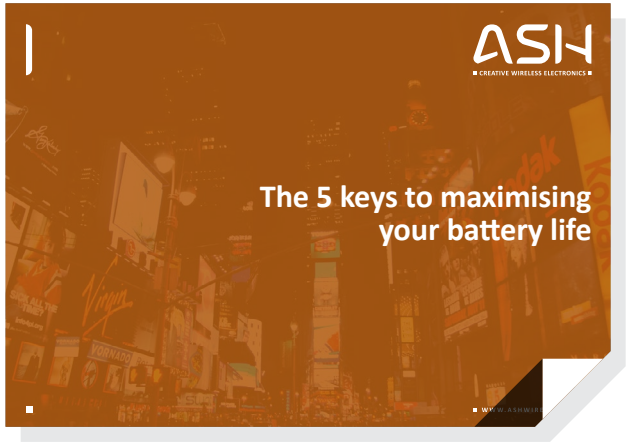
Key approaches to maximising battery life

There are a number of innovative approaches that designers utilise to ensure battery life is extended without the prohibitive cost of higher capacity batteries:

1. **A duty cycle** - can save energy whilst maintaining performance levels
2. **Micro-scheduling** - can add flexibility to achieve better energy saving
3. **Sleep-Mode current** - can be tweaked to find optimum performance
4. **Low-power support circuits** - can ensure energy is reserved for core systems
5. **Battery choice** - is vital and should be scrutinised for each application

What to know more?

Check out our accompanying resource at:
www.ashwireless.com/resources



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+44 (0)2380 551 044

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