N° 1 - 2019

INTERNATIONAL DISTRIBUTION OF ELECTRONICS ASSOCIATION

IDEA ELECTRONICS

Bulletin

# GO, EUROPE!

**GEORG STEINBERGER,** DMASS & IDEA

The EMEA Distribution market ended 2019 with a slight downturn of ~5%, after almost 3 years of consecutive growth. The consensus among market experts was that the decline was an inventory correction rather than an economic decline. All hopes of a fast turnaround are now on more favourable conditions - macro-economic as well as industry-internal. With the Brexit gone and an agreement between the US and China in sight, we should see **a recovery starting in Q2/2020**.

The bigger question is how strong and resilient the **European industry** is in a more aggressive global competition. I am considering the *"Roaring 20s"* of the 21st Century as a transformational period - any industry that will not plan de-carbonisation and green-tracking, will run into major trouble like consumer boycott. Europe needs to take the lead in innovating the **three big *"I's"* - Industry, Infrastructure, Information** - to stay relevant. Better and more relevant technology will be the key to it - and a sustainable supply chain, ensured by demand creators and logistic partners.

The future of distribution is not in box moving but in providing solutions and services that augment the use cases of our customers' customer.

**ADAM FLETCHER,** ECSN

*"Whilst the outcome for 2019 failed to meet the widely held expectations of the global electronic components industry, it will in my opinion be viewed as small bump along the road to increased growth in the market* - said Adam Fletcher, Chairman IDEA - *The article from Gartner in the following page neatly summarises why the electronic components industry is set on a trajectory for growth over the next decade, it's going to be an interesting journey"...*

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## ASSOCIATIONS

**AREI** - SOUTH AFRICA
Association of Representatives for Electronics Industry

**ASPEC** - RUSSIA
Association of Suppliers of Electronic Components

**ASSODEL** - ITALY
Associazione Nazionale Fornitori Elettronica

**CEDA** - CHINA
China Electronics Distributor Alliance

**ECAANZ** - AUSTRALIA
Electronic Components Association Australia and New Zealand

**ECIA** - UNITED STATES
Electronic Components Industry Association

**ECSN** - UNITED KINGDOM
Electronic Components Supply Network

**ELCINA** - INDIA
Electronic Industries Association of India

**FBDI** - GERMANY
Fachverband der Bauelemente Distribution

**FEDELEC** - TUNISIA
Tunisian Federation of Electric and Electronic Industries

**SE** - SWEDEN
Svensk Elektronik Trade Associations

**SPDEI** - FRANCE
Syndicat Professionnel de la Distribution en Electronique Industrielle

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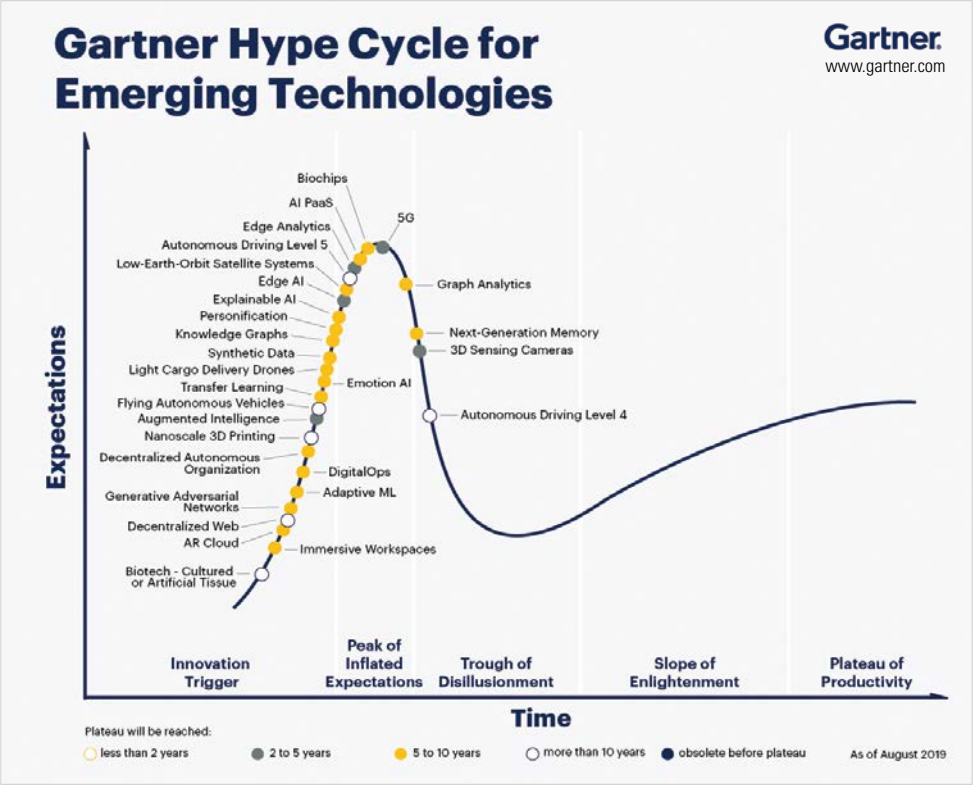
# 2020 Tech Trends according to Gartner

Every year, the **Gartner Hype Cycle** highlights the emerging technologies that companies should experiment over the following year.
*"The 2019 Hype Cycle highlights the emerging technologies with significant impact on business, society and people over the next five to 10 years* - says Brian Burke, Research Vice President, Gartner - *Technology innovation is the key to competitive differentiation and is transforming many industries."*




This year's emerging technologies fall into **five major trends**: Sensing and mobility, augmented human, postclassical compute and comms, digital ecosystems, and advanced AI and analytics.

## 1. SENSING AND MOBILITY

This trend features technologies with increasingly enabled mobility and the ability to manipulate objects around them, including **3D sensing cameras** and more **advanced autonomous driving.** This is possible thanks to sensors and AI evolution. As sensing technology continues to evolve, it will aid more advanced technologies like the Internet of Things (IoT). These sensors also collect abundant data, which can lead to insights that are applicable across a range of scenarios and industries. Technologies in this trend include: **AR cloud, autonomous driving levels 4 and 5** and **flying autonomous vehicles**.

## 2. AUGMENTED HUMAN

Augmented human technologies improve both the cognitive and physical parts of the human body by including technologies such as **biochips** and **emotion AI**. Some will provide "superhuman capabilities" while others will create robotic skin that is as sensitive to touch as human skin.
Technologies in this trend include: **Personification, augmented intelligence, immersive workspace** and **biotech** (cultured or artificial tissue.)

## 3. POSTCLASSICAL COMPUTE AND COMMS

Classical or binary computing, which uses binary bits, evolved by making changes to existing, traditional architectures. These changes resulted in **faster CPUs**, **denser memory** and increasing throughput.
Post-classical computations and communications are using entirely new architectures and this includes 5G. Technologies in this trend include: **Next-generation memory** and **nanoscale 3D printing**.

## 4. DIGITAL ECOSYSTEMS

Digital ecosystems are web-like connections between actors (enterprises, people and things) sharing a digital platform. Digital ecosystems are constantly evolving and connecting, resulting in new products and opportunities.
Technologies in this trend include: **DigitalOps, knowledge graphs, synthetic data** and **decentralized web**.

## 5. ADVANCED AI AND ANALYTICS

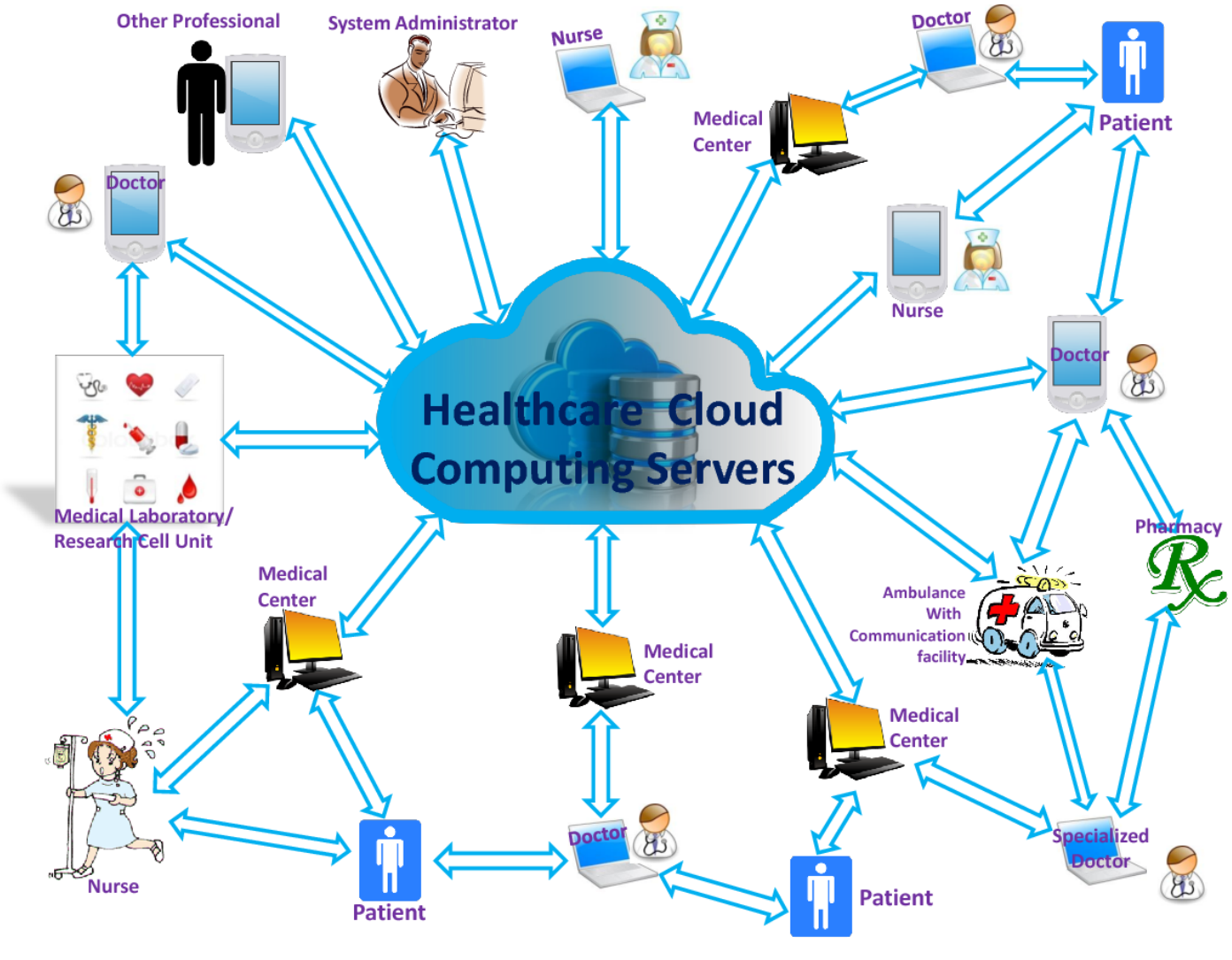
Advanced analytics is the autonomous or semi-autonomous examination of data or content using sophisticated tools beyond those of traditional business insights.
Advanced analytics enables deeper insights, predictions and recommendations.
Technologies in this trend include: **Adaptive machine learning, edge AI, edge analytics**, **explainable AI, AI PaaS, generative adversarial networks** and graph analytics.

# Security data is
## a must for medical devices

**M. DI PAOLO EMILIO,** EETIMES JOURNALIST

IoT technology has changed the work of healthcare professionals seeking to reduce costs and improve patient care. Progress is promising, and the medical IoT market expects to reach **137 billion dollars worldwide by 2021**. IoT device manufacturers are organizing to meet demand while also introducing cybersecurity solutions for the protection of sensitive data. There will be almost **650 million IoMT** *(Internet of Medical Things)* devices in use by 2020. It is easy to imagine the large amount of personal and sensitive information that all these devices store every day, and this makes healthcare organizations one of the main cyber targets criminals.

**HEALTHCARE CLOUD COMPUTING SERVERS** Chart 1



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## DATA THREATS

The threats range from the appropriation of data sensitive to tampering of fundamental or even vital functions. In recent years, many patient data have been compromised. These violations have necessitated better security through the use of cloud computing that is changing data storage with some technology giants like Microsoft that control the market. **Cloud storage** makes sharing much more convenient and reduces the impact of data loss. Scientists and medical professionals need to look for HIPAA compliant cloud hosts and collaborate with cloud data companies to ensure security needs are met *(chart 1)*.
The connected health devices can represent a new, more economical way to health, with a strong (and positive) impact on health. With all these advantages, devices are strongly at risk of hacker attacks, such as compromising information and customization.

An always-connected healthcare system allows health care to evolve, gradually abandoning the traditional analog model. These digital devices are used for monitoring, preventive care, data collection, and chronic and long-term care. The connected devices are, in fact, capable of collecting and sending biometric data in real-time, making the various phases of therapy much simpler.

The **medical IoT** is not intended to replace healthcare professionals, but to provide them with data collected from devices to improve diagnosis and treatment plans, as well as to reduce inefficiencies and waste in the system. Many data storage and transit systems use end-to-end cryptographic solutions that can provide greater security for data exchange. The cryptographic algorithms, already widely used to protect the traditional transactions that take place on the Internet, such as online payments, provide a valid way to verify the source of the data and prevent interceptions of the information contained.
Performance and safety requirements vary significantly from one application to another. The success of any medical application depends on the trust of users through robust solutions, but with security features to offer reliable protection.

## SECURITY FEATURES

The security features are mainly based on some fundamental elements, including stable **cryptographic encryptions**, such as **Advanced Encryption Standard (AES), Secure Hash Algorithm (SHA**), and the key public figures RSA and ECC. There are two classes of algorithms in the world of cryptography. For hashing algorithms, SHA-1 is an example, as is SHA-2, SHA-3.
The choice of a connection protocol and circuit solutions with an adequate cryptographic technique make the medical device (wearable) perfectly valid for use in the health field.

# WEARABLES: A BOOMING Q3 2019

Global shipments of wearable devices totaled **84.5 million units** in the third quarter of 2019 (3Q19), a year-over-year increase of 94.6% and a new record for shipments in a single quarter, according to IDC. Most of the growth in demand for wearables was driven by new products in the hearables market. Hearables alone accounted for almost half the market in 3Q19, followed by wrist bands and smartwatches.
*"Hearables have become the new go-to product for the wearables market* - pointed out the analyst **Ramon T. Llamas** - *This began with multiple vendors removing the headphone jack from their smartphones, driving the move toward wireless headphones. It continued with hearables incorporating additional features that either augment or expand the audio experience."*

**Top 5 Wearables Companies by Shipment Volume, Market Share, and Year-Over-Year Growth, Q3 2019** (shipments in millions)

| Company | 3Q19 Shipments | 3Q19Market Share | 3Q18 Shipments | 3Q18 Market share | Year-over-year growth |
|---|---|---|---|---|---|
| 1. Apple | 29.5 | 35.0% | 10.0 | 23.0% | 195.5% |
| 2. Xiaomi | 12.4 | 14.6% | 7.4 | 17.1% | 66.1% |
| 3. Samsung | 8.3 | 9.8% | 3.2 | 7.4% | 156.4% |
| 4. Huawei | 7.1 | 8.4% | 2.3 | 5.4% | 202.6% |
| 5. Fitbit | 3.5 | 4.1% | 3.5 | 8.0% | 0.5% |
| Others | 23.8 | 28.1% | 16.9 | 39.0% | 40.4% |
| **Total** | **84.5** | **100.0%** | **43.4** | **100.0%** | **94.6%** |

*Source: IDC Worldwide Quarterly Wearables Tracker, December 5, 2019*

**Worldwide Wearables Market by Product Category Shipment Volume, Market Share, and Year-Over-Year Growth, Q3 2019** (shipments in millions)

| Product category | 3Q19 Shipments | 3Q19Market Share | 3Q18 Shipments | 3Q18 Market share | Year-over-year growth |
|---|---|---|---|---|---|
| Earwear | 40.7 | 48.1% | 11.9 | 27.4% | 242.4% |
| Wristband | 19.2 | 22.7% | 12.9 | 29.7% | 48.6% |
| Smartwatch | 17.6 | 20.9% | 11.9 | 27.4% | 48.0% |
| Others | 7.1 | 8.4% | 6.7 | 15.5% | 4.7% |
| **Total** | **84.5** | **100.0%** | **43.4** | **100.0%** | **94.6%** |

*Source: IDC Worldwide Quarterly Wearables Tracker, December 5, 2019*

# Lithium Ion batteries: the future of e-mobility

**FRANCO MUSIARI**, ASSODEL

**Lithium ion batteries can present a different composition with different characteristics in terms of safety, performances, costs and lifetime. Here is a short overlook on the various technologies.**

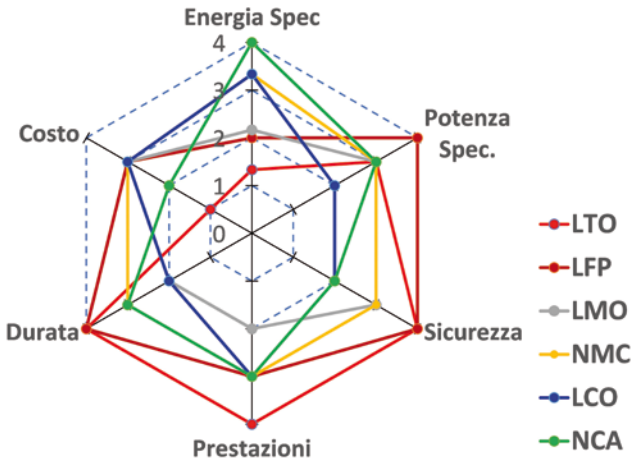
The era of electric vehicles is coming and batteries will become the preferred energy source for future mobility. **Lithium ion batteries** are currently market leaders and seem to have no competitors yet. However, among the lithium ion batteries, there are different combinations of the materials that make up the anode and the cathode: cobalt, manganese, nickel, aluminum, phosphorus. Each combination has different characteristics and offers advantages and disadvantages in terms of safety, performance, costs and other parameters.

The technologies that are competing for the e-mobility market and are different in the composition of the materials are:

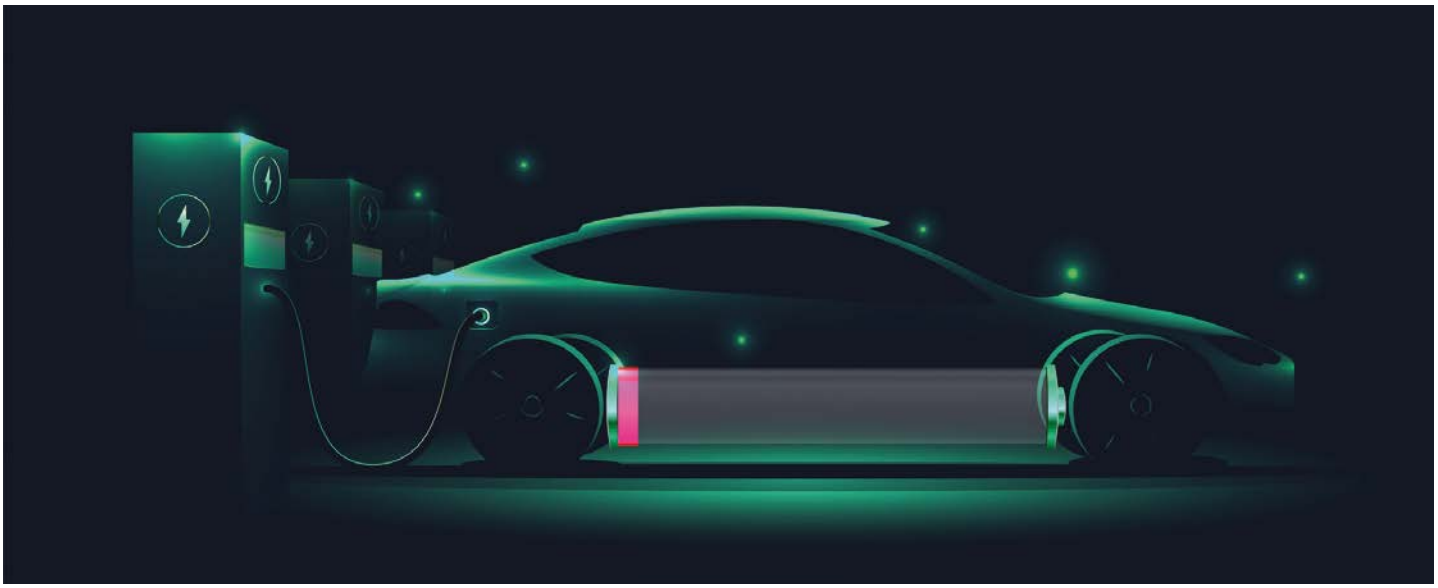
- Lithium Cobalt Oxide (LiCoO2) - **LCO**.
- Lithium Manganese Oxide (LiMn2O4) - **LMO**.
- Lithium Nickel Manganese Cobalt Oxide (LiNiMnCoO2) - **NMC**.
- Lithium Iron Phosphate (LiFePO4) - **LFP**.
- Lithium Nickel Cobalt Aluminum Oxide (LiNiCoAlO2) - **NCA**.
- Lithium Titanate (Li2TiO3) - **LTO.**

**COMPARISON OF DIFFERENT TECHNOLOGIES FOR LITHION ION BATTERIES**

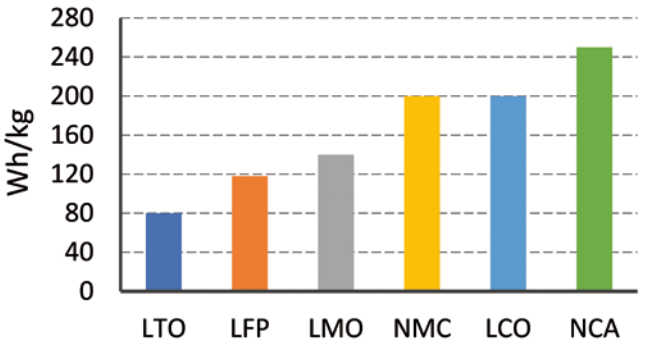
Chart 1




*Source: Baylor University*



**SPECIFIC ENERGY OF A LITHIUM ION BATTERY** Chart 2




*Source: Battery Univeristy*

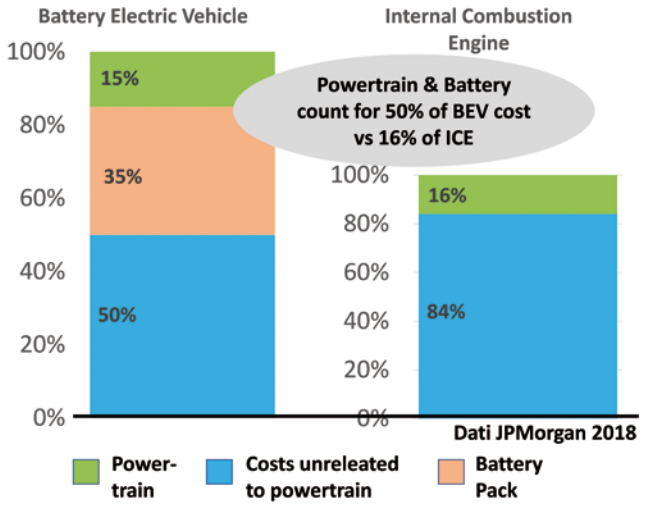
The prevalent technology in consumer applications - smartphones, tablets etc. - it is the lithium-cobalt oxide (LCO) which, however, is considered not suitable in the automotive sector for safety reasons.

## "BATTERIES HAVE TO BE CHOSEN LOOKING TO 6 PARAMETERS ACCORDING TO EACH APPLICATION'S NEEDS„

The technologies listed above, which are often referred to by the corresponding symbol, can be compared on six parameters:

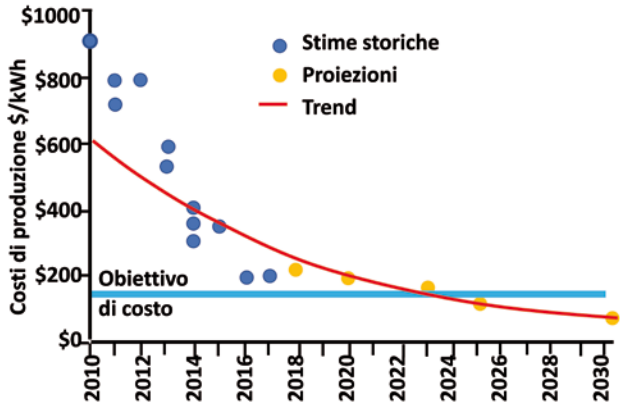
1. **Safety** - Lithium batteries are very sensitive to temperature and the main concern on this front is to avoid a thermal runaway. The technologies must be used together with a battery management system (BMS) that monitors all the cells. The safest of all, from this point of view, are those with lithium titanate (LTO) followed by LFPs with a trigger temperature of 270° C.
2. **Life time** - measured both in number of charge and discharge cycles and in life time
3. **Performance** - peak power especially at low temperatures
4. **Specific energy and specific power** - The specific energy measures the capacity of the battery to accumulate energy in relation to its weight: watt hour per kilogram, Wh / kg. Today the Lithium Nickel Cobalt Aluminum Oxide (NCA) batteries can reach a specific energy of 240/250 Wh / kg inside.
1. **Recharge times**
2. **Cost**.

**COMPARISON OF COSTS BETWEEN ELECTRIC VEHICLES (BEV) AND TRADITIONAL VEHICLES (ICE)** Chart 3




*Source: JP Morgan 2018*

**TRENDS AND FORECASTS OF BATTERIES' COSTS** Chart 4




As we can see from *Chart 1* there is no technology capable of winning on all six judging parameters.

Choosing the best technology along an axis inevitably means having to accept a compromise on the other parameters.
For example, the NCA technology has an optimal specific energy, absolutely the best, and a performance in capacity to deliver good power, as well as good performance and durability.
But on the other hand he suffers from security problems and decidedly high costs. LFP technology offers the best level of safety and specific power but is lacking in terms of specific energy and has higher costs than other technologies.

## Equipping smart systems with situational awareness

# The new paradigm for sensor design

Human operators of systems monitor their environment the whole time, often in ways that we're not aware of. The feeling of the breeze on our face, movements in our peripheral vision, small changes of pressure in our ears and in the soles of our feet. In order to match this awareness, smart systems need a well-designed and configured array of sensors, providing them with all the data that they need not only to directly perform their function, but also to give them situational awareness.

**Smart buildings** not only need data to perform their function directly, but also require background information about their environment to guarantee safe operation in all circumstances including exceptional events like earthquakes. **Consumer applications** like pedometers, drones and smartphones have a growing need for sensor solutions of their own, as their functions multiply and they become more autonomous.

> "THREE MAJOR TRENDS ARE EMERGING IN SENSOR DEVELOPMENT"

In response, I can see three major trends emerging in sensor development. First is for **multiple sensors to be integrated together onto a common platform** with a single interface to simplify system design. Second is the enhancement of **sensors with algorithms to provide interpretation of the data collected**. Finally, the evolution of **new classes of devices designed for ultra-low power battery systems like drones**.

## MULTI-PURPOSE SENSORS

Truly multi-purpose environmental sensors make it very easy for the designer to deliver a wide range of measurement functions from just one small sensor. This will save development time by providing numerous options that can be tailored to the user's needs. Whether it's a question of simply making sure the office environment is kept at the optimum working temperature or ensuring that say a museum has the correct humidity and lighting to protect the exhibits, these sensors offer easy to interpret data that can then be analysed, stored on the cloud and used to set parameters and make real-time adjustment.

There are probably seven core parameters that any environmental sensor for building and industrial automation systems should be able to monitor: **temperature, humidity, light, UVI, barometric pressure, noise** and **acceleration**. Additional requirements include integral memory, allowing data to be retained on a chip for a period of time. **Sensors need to be cloud compatible** with no need for additional hardware.
Bespoke threshold values can be set to provide alerts that notify the user of any abnormal sensor readings. This new breed of sensors also requires flexibility in terms of interfacing, allowing connection not only to the building automation infrastructure but also to mobile devices etc. **Power consumption** is another key issue. Potential applications include monitoring and controlling both industrial and office environments to improve the work space. It is also suitable for home and outdoor applications.
Sensors like the Omron 2JCIE Sensor provides the capability to monitor all of these, and provides data via popular wireless and wired data interfaces like USB and Bluetooth. Despite its compact size, 2JCIE features its own embedded memory for data logging to keep track of the surroundings.

## INTEGRATED ALGORITHMS - THE EARTHQUAKE SENSOR

Whilst it is useful to be able to record a value for example for the acceleration experienced by a sensor, this data often requires


**G. FULCO,** OMRON
EUROPEAN PRODUCT MARKETING MANAGER

interpretation to be useful. Is a building shaking because a train has just come by or is the movement caused by something more sinister like an earthquake. The first can be ignored, the second may require specific action. Earthquakes are extremely common around the world so this is a major issue.
On average, 50 earthquakes strike each day, or about 20,000 a year. A system designer is unlikely to have the expertise to program the sensor to make the distinction, and won't want valuable system resources tied up monitoring movement in the background.

> "DATA OFTEN REQUIRES INTERPRETATION TO BE USEFUL"

**Earthquake sensors** like Omron D7S provide high precision measurement of spectral intensity, allowing it to reject impulse vibration noise and only respond to genuine seismic activity. When an earthquake strikes, the D7S uses a unique spectral intensity (SI) value calculation algorithm to distinguish between seismic activity and other movement.
The sensor includes a 3-axis accelerometer, and on the basis of the resulting measurements, calculates the SI value to assess the magnitude of the earthquake. Despite its compact size, D7S features its own internal memory and I2C interface, allowing it to be readily integrated into IoT devices. Potential applications include smart electricity and gas meters, wireless sensors, industrial control panels, electricity distribution panels, fire-prevention systems, home appliances such as heaters and gas stoves, chemical plants, expressways, bridges, tunnels, roads and many more.

## MEASUREMENT ON THE MOVE

Drones, pedometers, smartphones and other "must-have" consumer gadgets are creating the need for a further class of sensors. This requirement can only increase as their functions multiply. One of the parameters that each of these applications needs to accurately monitor is height, which can be measured through pressure.

> "DRONES, PEDOMETERS, SMARTPHONES ETC NEED A FURTHER CLASS OF SENSORS"

Blood pressure has been measured for some time, and sensor manufacturers like Omron are able to evolve the technology used in this application to provide stable and reliable height and pressure measurements, allowing changes in elevation of as little as 2m to be reliably recorded. The new designs leverage the low noise 24bit ADC and other features of the original sensor and feature digital control and output via I2C / SPI interfaces. In order to address the limited power budget, sensors designed for this environment automatically power down non-working circuits to minimise the power consumption.
Individual calibration parameters are stored in One Time Programmable-ROM (OTP), and are retained when the system is powered down. An integrated temperature compensation circuit helps ensure accurate absolute pressure measurements. New waterproof versions will help further simplify system design.

## CONCLUSION

Sensor technology is evolving rapidly in the face of an explosion of new opportunities. Smart buildings and drones are very much emerging, whilst fitness trackers, smart phones and other applications continue to evolve new functions which usually require new sensors.
Sensor manufacturers are rising to the challenge by continually developing the solutions they offer, and packaging them to make the life of the system designer easier.

# Trade Compliance Guidance
## for exporters in the Electronics Sector

**ANDREW SKINNER**, ECSN MEMBER

**This contribution to IDEA Bulletin was kindly submitted by Andrew Skinner, proprietor of AM Skinner Solicitors, a recent and welcome new ecsn associate member. Andrew is a recognised trade compliance expert with extensive operational experience in the development and implementation of end-to-end trade compliance programmes, as well as the management of regulatory investigations and enforcement.**

Trade Compliance is the broad term given to the process by which the import and export of goods, is controlled by various national (and international) regulations and laws, but for the purposes of this *IDEA Bulletin* I will look at **export laws affecting technology goods and software** only. Export laws are complex, and a single international shipment may have to conform with the requirements of multi jurisdictions. US law for instance has an extraterritorial effect and exporters of goods of US, origin in any non-US locations will need to juggle the requirements of their own country with those of the US law and any other applicable export laws (possibly through contract) when exporting goods.

> "ESPORT LAWS ARE COMPLEX, AND A SINGLE SHIPMENT MAY HAVE TO CONFORM WITH THE REQUIREMENTS OF MULTI JURISDICTIONS„

Goods are controlled for various reasons but the really important ones are…

- If they are specifically designed or modified for **military use**.
- If a product is **dual-purpose**. For instance, it was initially designed for civil applications, but could also be use by the military and it meets the technical specification laid down in the applicable dual-use control list. For example, a microcontroller operating over the full temperature range of -55°C to 125°C. is considered dual-purpose and would be subject to export control. Many countries maintain such lists including among others the UK/EU, U.S., Singapore and Australia.

Goods that are not considered dual-purpose may still be controlled on end use grounds. For example, low tech goods such as capacitors, resistors, light emitting diodes will be subject to controlls if they are used for certain nuclear or military end-use applications.

Furthermore, U.S. controls laws also apply to certain exports, re-exports and in-country transfers of additional end-use applications, including exports in support of UAVs.

The **US Export Administration Regulations** (EAR) also contains denied party lists and exporters are required to carry out due diligence checks prior to exporting their goods to ensure that their goods are not re-exported to, for example, Iran through resellers in the UAE's Sharjah free zone or to China through Hong Kong.
Sanctions also apply to certain countries, Russia for example is currently subject to sanctions imposed by both the U.S. and European Union. Exporters should always monitor denied-party watchlists maintained by the UK Treasury, the *Entity List* (EAR), *Unverified List* (EAR) and the **US's Office of Foreign Assets Control (OFAC)** and consider their obligations under all applicable laws before exporting goods because compliance with these lists is strictly monitored and enforced through a variety of regulatory agencies including the UK's *HMRC and Border Force*, *US's Office of Export Enforcement* and *FBI*.

## WHEN IS US LAW APPLICABLE?

An item is subject to United States export control law if an item for export...

a) was produced in the U.S.
b) wasn't produced in the U.S. (e.g. made in the UK) but it contains more than a specified percentage of content of U.S. origin that is subject to U.S. controls.

*Note:* encryption technology (ECCN 5E002) is subject to U.S. controls if the U.S. content is above 0% and the same rule applies to certain encryption and cryptanalytic items and software (ECCN 5A002, 5A004, 5B002, 5D002). Interestingly publicly available encryption source code that has met the U.S. notification requirements does not have to be counted as controlled U.S. content for the percentage calculation rule.

c) is a non-U.S. made product but is based on technology or software that did originate in the U.S. and is intended for export from a non-U.S. location to regulated destinations; or…..
d) was made in a facility or a major sub-facility located outside the U.S., and if the product is dependent on certain U.S. technology or software, and intended for export from a non-U.S. location to specified destinations

"THE US EXPORT ADMINISTRATION REGULATIONS (EAR) IS A POINT OF REFERENCE FOR MANUFACTURERS„

Non-compliance with export control laws and sanctions may lead to criminal prosecution, seizure of goods, severe financial penalties (up to one million USD per violation), breach of commercial contracts and significant reputational damage.

# WSTS: the market will recover in 2020

The **World Semiconductor Trade Statistics (WSTS)** has released its new semiconductor market forecast generated in November 2019. WSTS expects the world semiconductor market to be down in 2019 to US$ 409 billion. This represents decrease of 12.8%. This reflects expected decrease in almost all major categories, with an extraordinary decrease from Memory at 33% followed by Analog with 7.9% and Logic with 4.3%. In 2019, all geographical regions are expected to decrease.

Worldwide Semiconductor Market is expected to recover in 2020
For 2020, all regions are forecasted to grow with the overall market up 5.9%, with Optoelectronics contributing the highest growth followed by Logic.

## WSTS Forecast Summary

From the fall 2019 Forecast Meeting, held November 19 to 21, 2019:

| Fall 2019 | Amounts in US$M | | | Year on Year Growth in % | | |
|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| Americas | 102,997 | 75,469 | 80,775 | 16.4 | -26.7 | 7.0 |
| Europe | 42,957 | 40,008 | 40,913 | 12.1 | -6.9 | 2.3 |
| Japan | 39,961 | 35,536 | 36,654 | 9.2 | -11.1 | 3.1 |
| Asia Pacific | 282,863 | 257,974 | 274,686 | 13.7 | -8.8 | 6.5 |
| Total World - $M | 468,778 | 408,988 | 433,027 | 13.7 | -12.8 | 5.9 |
| Discrete Semiconductors | 24,102 | 23,960 | 24,874 | 11.3 | -0.6 | 3.8 |
| Optoelectronics | 38,032 | 41,056 | 46,168 | 9.2 | 7.9 | 12.5 |
| Sensors | 13,356 | 13,623 | 14,355 | 6.2 | 2.0 | 5.4 |
| Integrated Circuits | 393,288 | 330,350 | 347,630 | 14.6 | -16.0 | 5.2 |
| Analog | 58,785 | 54,151 | 57,002 | 10.8 | -7.9 | 5.3 |
| Micro | 67,233 | 65,674 | 68,879 | 5.2 | -2.3 | 4.9 |
| Logic | 109,303 | 104,617 | 111,463 | 6.9 | -4.3 | 6.5 |
| Memory | 157,967 | 105,907 | 110,286 | 27.4 | -33.0 | 4.1 |
| Total Products - $M | 468,778 | 408,988 | 433,027 | 13.7 | -12.8 | 5.9 |

Note: Numbers in the table are rounded to whole millions of dollars, which may cause totals by region and totals by product group to differ slightly.