



The fascinating world of the power supply industry

The overall market for AC/DC and DC/DC commercial switch mode power supplies (C-SMPS), which excludes consumers and uninterruptible power supplies (UPS), is estimated to be in a range of 22 to 25 billion US Dollars. This level has been stable for more than five years and from an outsider's point of view, could be perceived as a very static industry with very moderate growth index. This perception is amplified by a general feeling that the power supply industry reached such level of maturity, nothing will really happen, which in fact is not the case. Despite the steady top number, the C-SMPS industry is extremely dynamic, adjusting to market changes, new regulations, emerging new technologies and in permanent transformation, developing products and power solutions for early stage new technologies (e.g. 5G, Industry 4.0) or even not existing.

Segments transformation

It is not possible to go into details for every segment but there is one, which has had a major influence to all other, the Telecom/Datacom segment.

For decades, the Telecommunication segment has been predominant and one of the main technology driver for innovations within the power industry. We all remember the evolution in power distribution, moving from centralized-power to de-centralized power, which has been then adopted by other industries, becoming the worldwide power-architecture in all segments from Industrial to Defense. As well for the introduction of digital power technology, which is now used in many products operated in non-telecom segment.

All those technology evolutions have been driven by the need to make telecom equipment more energy efficient, to reduce energy consumption and carbon footprint, but as well possible to integrate, what used to be the size of building in the eighties, down to a chipset nowadays [Figure 01].

Integrating, what used to be a central telecom office down to a chipset has had a big impact on the volume of power modules consumed by this industry but as well how the power distributed and optimized. At the peak days in year 2000, the worldwide production of 5 to 20W board mounted DC/DC converters for the telecom industry was close to the 35 million units, which, for similar category of products consumed in the telecom industry is estimated to be below 6 million in 2017. We all know that the telecom market has reached a certain level of saturation but they are other reasons explaining this impressive decline in volume: Higher level of integration and increase use of discrete solution.

- **Higher level of integration** – Migrating from voice to data, the telecom industry rapidly reach a point of integration with the datacom industry to become the Information, Communication and Technology (ICT). At that point of time, both industry boosted the development of new generation of Signal Processors and other complex data-management ASICs requiring higher power DC/DC (e.g. Intermediate Bus Converters) with localized step down conversion achieved by Point-of-Load (POL). In few years radio base stations became smaller and smaller, backbone access shrunk to box size and the data centers became the heart of the ICT industry. This higher level of digitalization impacted on the low power DC/DC conversion market though contributed to the development of higher power density bricks, up to the 1KW mythic quarter brick.
- **Increase of discrete solution** – Considered by many as Nessie, the Loch Ness Monster, the transition from low power DC/DC power modules to discrete solution is a reality and, with the miniaturization of telecom equipment and higher level of integration a building practice that is now well established. This transition has been facilitated by the semiconductors manufacturers that developed-design support to a very advanced point, simplifying the implementation of low and mid power at board level and the development of highly integrated POL.

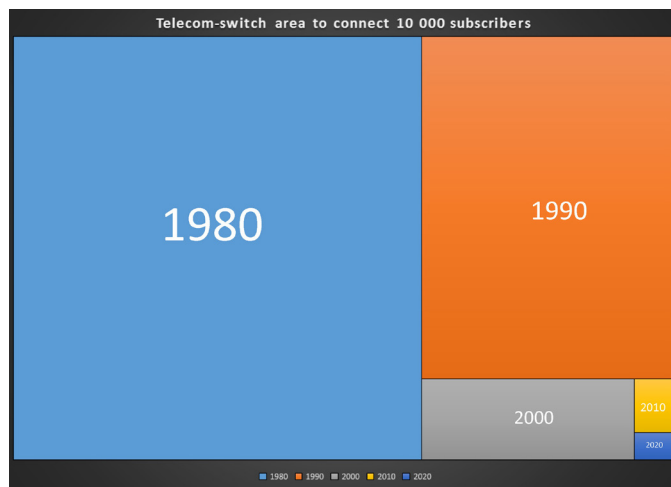


Figure 01 – Telecom-switch footprint for connecting 10 000 subscribers 1980 – 2020 (Source: Powerbox)

Despite number of market studies are frequently published about the growing volume of PWM, it is not simple to quantify the transition volume from conventional board mounted DC/DC converters in the telecommunication segment though; a rough number of 65% of the low/mid power conversion function is now achieved by discrete solution, compared to only 15% 10 years ago.

Combining lower market demand for conventional telecom equipment, higher integration and transition to discrete solution, the low and mid power DC/DC converters collapsed but at top level been compensated by the increase of higher power and other growing segments such as medical.

Growing areas full of innovations

- **Brut power** – It is obvious that radio base stations are getting smaller and, despite the expected number of 5G transmitters required by that new technology, the volume of low and medium power board mounted devices will never recover where they used to be during the peak days. That illustrates the impact of technology shift and challenges for power supplies manufacturers to always be ready for the next wave of innovations

With the booming of Internet, data traffic amazingly increased, requiring data centers to process more and

more, faster and faster, data than ever. More data/faster means more processors and more power supplies. Because of the extremely high level of integration, certain boards will soon require more than 3KW per board, which is not only a challenge to power but as well, how to keep such boards cooled enough.

Powering, with energy efficient solutions servers and other IP mass traffic routers requires from power designers to innovate in advanced topologies, use of new components such as Gallium Nitride or inventing efficient solutions to convert from the 400VDC distribution voltage to 1VDC required by the microprocessor. Within the data center power community the new motto is 400 to 1 @ 99, understanding 400VDC input, 1VDC output at 99% conversion ratio.

For sure a bit challenging but as we say within the power community: "Limits are made to be broken" and for the power pioneers, which I belong, we all remember the number of times we have been challenged to brake unbreakable limits!

→ **1 and 0 are making the game** – There is another area where technology innovation contributed to boost power, efficiency and flexibility, which is the so called "Digital Power."

Considered as anecdotic when presented first, the digital power technology originally developed for ICT and high density data centers made its way through the

others industries becoming the preferred platform by power designers when addressing new challenges.

From a simple monitoring function to very advanced switching control, the number of power supplies using that technology grown exponentially and is even used in very advanced medical equipment such as Magnetic Resonance Imaging (MRI) where digital power combined with coreless technology make efficient power conversion possible in extreme condition (e.g. high magnetic field of 4 Tesla) [Figure 02].

Highly debated for almost a decade, the integration of a digital chain within power supplies opened a new range of applications, only few years ago, we couldn't even though they will exist.

From the Internet of Things (whatever it falls under that category) to unmanned ships crossing ocean, the future power supplies will not be as it is today and power engineers already working on intelligent power architectures able to self-control the way they operate. How far could that go? Hard to say but with projects to bring men to Mars, unmanned vehicles, Industry 4.0 and all other applications requiring extremely high reliability and full remote monitoring and control, it shouldn't be too far and 2020 might be a good target [Figure 03].

Power to medical and home healthcare

From 1.2 billion USD in 2016, the global market for medical power supplies is expected to expand at a

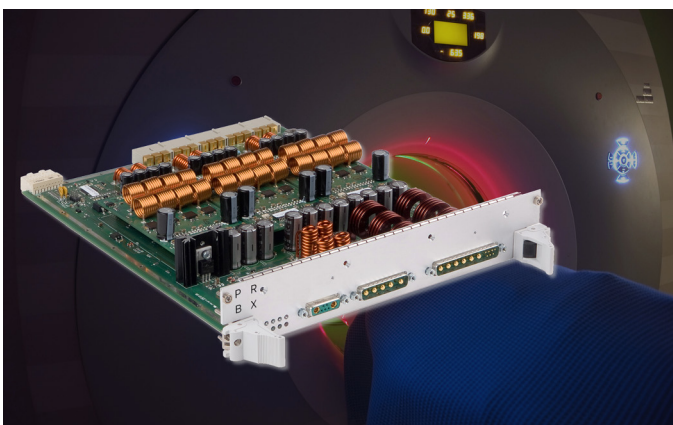


Figure 02 – Powerbox GB350 digitally controlled power supply for demanding applications operated under high electromagnetic field (Source: iStock.com/baranozdemir – Powerbox)



Figure 03 – Rolls-Royce oX Land-based control-center supervising unmanned ships (source: Rolls-Royce)

CAGR of 4.5% from 2017 to 2022. This growth results from a global population that is both living longer and experiencing an increasing rate of chronic disease, combined with economic factors that are driving the increased of healthcare in the home.

Beside conventional equipment for hospital and medicalized infrastructures, there is a growing demand for medical electrical equipment designed for use in home environment, requiring from power supplies manufacturers to not only consider standards and regulations but as well Patient Comfort and Patient Environment, for example by designing products for home environment such as the lenticular shape, eliminating hard shapes and avoiding wheelchair blocking [Figure 04].

Because of the nature of the medical segment and risk of electrical shock or malfunctioning equipment resulting from a faulty power source, power supply have to comply with stringent regulatory and certification systems. The implementation of the so called IEC 60601 4th edition is one example of safety regulation enforced in that industry but beside any regulation, power supplies manufacturers are taking own initiatives to develop processes integrating risk assessment far above what is required by the ISO 14971 and to push manufacturing facilities to comply with the ISO 13485. Designing a power supply for medical requires not only the best power technology but a very high level of knowledge in regulations and field of applications.

For power designers, Internal or external medical power supplies are full of challenges and designing a product, which has high efficiency, high isolation, ultra-low leakage current and able to guarantee critical systems to work flawlessly is not an easy task.

That what makes this segment very interesting, especially when home healthcare increasing the interaction between the patient and installed equipment, and considering many other aspects such as radio coexistence.

For power supplies designers the medical segment is probably one of the most demanding in terms of combined knowledge. Be a good power electronic designer is not enough anymore and it's a real team work combining many disciplines that must work together, which makes the job very interesting with full of rich learning.



Figure 04 – Powerbox EXM2205 – Medical certified lenticular shape external power supply for home healthcare applications. (Source: Powerbox)

Conclusion

It is difficult to cover all areas composing the 22-25 Billion envelop and it is for sure that a lot of things are also happening in other segments such as Industrial implementing Industry 4.0, Lighting growing exponentially and some considering to integrate built-in power on silicon inside the LED, the Transportation to integrate communication to power supplies for monitoring and preventing maintenance but it is easy to understand that, despite an overall number that seems to have been stable for more than five years, a lot of changes happened in the business composition.

I would like to conclude this article buy a quote from Kenneth Hildebrand: "Strong lives are motivated by dynamic purposes" which reflects very well, what we all, power supplies aficionados are aiming for. We like to brake unbreakable limits and the power industry is full of amazing challenges, which make it so exiting.

POWERBOX

The fascinating world of the power supply industry
White paper 011

About Powerbox

Founded in 1974, with headquarters in Sweden and operations in 15 countries across four continents, Powerbox serves customers all around the globe. The company focuses on four major markets - industrial, medical, transportation/railway and defense - for which it designs and markets premium quality power conversion systems for demanding applications. Powerbox's mission is to use its expertise to increase customers' competitiveness by meeting all of their power needs. Every aspect of the company's business is focused on that goal, from the design of advanced components that go into products, through to high levels of customer service. Powerbox is recognized for technical innovations that reduce energy consumption and its ability to manage full product lifecycles while minimizing environmental impact.



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