

IoT Security: Enabling Global Sustainability

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The next big thing is just around the corner! At least it always feels that way with IoT security. As quickly as you might catch up with the latest and greatest gadget, the next version is already announced. When it comes to traditional infrastructure, it is too costly to replace every time technology advances. But this doesn't mean technology has no impact. The IoT plays a significant role in the digital transformation by embedding infrastructure with sensors to reduce the amount of physical movement by moving data. As you might suspect, this has a significant impact on building a more sustainable global ecosystem. Today, we are faced with a huge energy crisis that is driving the need for more sustainable global ecosystems and a reduction of our carbon footprint. According to Lawrence Livermore National Laboratory (LLNL), there were 67.5 quads of energy being rejected or not utilized in 2019.¹ This means well over half of the total energy being generated is lost as unutilized heat. For reference, 1 quad of energy is equal to 1.055×10^{18} joules. This metric points to a significant issue in our ability to utilize generated energy on a massive scale. The IoT provides the means for addressing the challenges around energy efficiency through the accumulation and utilization of data. Being able to measure how energy is utilized through more advanced sensing techniques is the first step toward improving efficiency and sustainability.



urce: LNL March, 2020. Data is based on DOX/EIA MER (2019). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory of the Department of Energy, under whose auguies the work was performed. Distributed electricity represents only restal electricity selections and deso not include self-generation. El aports consumption of remewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The ficiency of electricity production is a calculated as the total restal leatricity delivered divided by the primary energy input into electricity and efficiency of electricity relations. End was efficiency of electricity and the solar solar divide by the primary energy input into electricity and the solar divide by the primary energy input into electricity and the solar divide and solar of a restal escore, 21% for the transportation sector and 4% for the industrial sector, which was updated in 2017 to reflect the source of the solar total escore and as not ename and on a not ename and on to industrial restore for and the source of the industrial sector.

Figure 1. Estimated U.S. energy consumption and flow in 2019.



Many people, organizations, and governments are striving to better understand our effect on ecosystems and participate in transforming our world to build a better future. IoT devices are used to reduce demand and more productively use existing resources. The fast pace of innovation and the quick release of new technology is aiding in developing more sustainable energy, minimizing our carbon footprint, and improving our social impact.

Paving the Way for a Better Future

Making an impact on sustainability can take place in three ways. First, there is the opportunity to reduce demand. This is done through virtualization and smart solutions. Another way is to increase efficiency by improving the way we do things. For example, replacing a combustion engine with an electronic motor or generating energy through renewables like wind instead of burning coal are environmentally efficient ways to produce energy. The third way is to manage pollution, which is done through monitoring and sequestration. All three methods require innovation and technological development.



Figure 2. The impact to sustainability can take place in three ways.

Electronics have transitioned several times in efforts to keep up with the need for efficiency. With the IoT, we are now seeing the greatest opportunity to positively impact sustainability.

The implementation of IoT and edge computing is a paradigm shift that transfers the use of energy from moving physical objects to moving data. This shift takes place in two ways. The IoT can be used to optimize current processes resulting in improved efficiency—or it can be the adoption of new processes. Both are needed to meaningfully impact sustainability, but introducing new processes is transformational.



It Takes Far Less Energy to Transmit Information than to Move Physical Entities

Figure 3. The paradigm shift that transfers the use of energy from moving physical objects to moving data.

Major Megatrends

IoT solutions are taking hold in every industry. Although the consumer industry might have some of the most interesting gadgets to outfit your home or even outfit your outfit, the IoT is making a considerable impact on sustainability and social impact with today's major megatrends.

5G as a technology is fundamentally transforming the way critical infrastructure will operate. Besides enabling new technology, such as autonomous vehicles, it allows for more traditional infrastructure to be connected without laying copper wire for connectivity. On both accounts, there is a significant reduction of waste. Additionally, it will be easier to deploy infrastructure to places in the world that have traditionally gone without, building a means for societies to flourish.

In a post-pandemic environment, there is an acceleration of new digital health solutions being launched and an increased access to telemedicine. Everything from wearables to at-home, clinical-grade medical devices are being launched to help people better manage their health. With the rising costs of healthcare, there is a significant need to proactively monitor and manage health, reducing the need for clinical care. Keeping people out of hospitals through prevention or at-home care is one of the most impactful methods to reduce rising costs and improve quality of life.

Electrification and autonomous vehicles are directly attacking one of the largest contributors to carbon emissions. Reducing overall demand for fossil fuel is one of the quickest ways to cut emissions. For example, being able to launch a widescale autonomous rideshare program will give people access to on-demand transportation, reducing overall traffic and vehicle ownership. In addition, utilizing renewable energy sources and electric motors will further cut carbon output.

The fourth major megatrend is automation and smart supply chains. Leveraging automation significantly improves worker safety by augmenting tasks that would either place undue strain on the human body or put someone in a dangerous environment. Additionally, using data to improve supply chain accuracy and precision reduces overall energy consumption and waste.



These megatrends are being enabled by data through IoT devices and edge computing. However, this is not without its challenges. The market is continuing to need faster and more dynamic design cycles to keep up with digital demand. As the demand grows, traditional markets benefit through opening the aperture of closed ecosystems to allow more contribution into design solutions with existing and new partners. This need is traditionally answered by industry consortiums and alliances defining open architectures.

Accelerating Innovation and Overcoming Challenges

There are two main catalysts driving the creation of industry standards and alliances. Markets require faster and shorter design cycles with more ecosystem partners able to drive timely competitive solutions. And the nature of embedding IoT devices in physical infrastructure requires open architectures to scale. The response to both needs is the formation of industry standards, consortiums, and alliances.

The O-RAN (Open Radio Access Network) Alliance is a great example use case. It is an alliance launched by operators in the telecom industry to give them a voice in what is possible. Their objective is to provide intelligent, open, virtualized, and fully interoperable mobile networks. Both members and contributors are participating to develop and encourage a white box ecosystem for 56 infrastructure. Traditionally, this market has been dominated by large telecom companies deploying proprietary black box solutions. The O-RAN Alliance will deliver interface standards and white box reference designs that will enable widescale participation, accelerating the pace and diversity of innovation in 56.

An essential role of industry standards and consortiums is to ensure reliability and development for maintainability, as well as safeguard for future requirement volatility. The same needs that exist in the 5G ecosystems exist in other markets, which are responding similarly. Standards and consortiums also define requirements for security, which safeguard our future from inadvertent and malicious attacks. The security component to these working groups should assess security risks and define interoperability.

Security's Impact on Sustainability

One of the fundamental principles to security is applying the right security to the right places within the system according to the risk and value of the asset. As we continue to develop connected solutions that reside in physical devices, traditional or new, the threat surface continues to expand. This places security as one of the foundational elements to enabling the IoT and making a meaning-ful impact on social and environmental causes.

Playing a role in consortiums, alliances, and standards bodies is a primary opportunity to influence good security practices. There are three ways that taking a conscious approach to security can directly impact sustainability.

The first is around the reduction of electronic waste. Electronic waste doesn't often get highlighted as a significant environmental concern, but it is an area of great opportunity. Today, it is very costly to recycle electronic waste, even when it is disposed of properly. Finding better ways to recycle e-waste is needed, but the right security solution can help reduce the overall amount of waste generated. This can be done by extending the usable life of products and developing hardware platforms that allow for software-defined solutions. Incorporating security subsystems that enable both approaches can result in the reduction of electronic waste by lengthening hardware life cycles and providing methods to leverage second life solutions.

The reduction of operational waste is another way security can impact sustainability. Defining security standards for IoT applications that are light in size can reduce the overall size and power of the device. It is common to take a data center approach to defining edge device interfaces by specifying the security requirements to include more than the necessary algorithms and additional interfaces. There is an opportunity to specify only the minimal number of interfaces and cryptographic processes to reduce the overall product size.

Security also has a big social impact by ensuring safe operation, safeguarding user privacy, and making security intuitive and easy, both for the end user and development teams. Most people are not security experts and do not understand the implication of security configurations and settings. Finding ways to seamlessly incorporate security from a user perspective has a significant impact on their general well-being.



Figure 5. Three unexpected areas where IoT security could enable global sustainability.

With today's fast pace of innovation, ADI is making significant contributions to technology in the area of sustainability. ADI's wireless battery management system is transforming the automotive sector by driving down material costs while increasing design flexibility, which enables more efficient scaling of electric vehicle fleets. Our energy storage systems (ESS) are facilitating the integration of renewable energy with mainstream energy by mitigating intermittency issues inherent to renewable power sources such as wind and solar. And the ADI EagleEye[™] occupancy monitoring solution unlocks insights and analytics to manage buildings more efficiently. These are just a few of the many applications utilizing ADI solutions to improve efficiency and mitigate environmental impact by deriving meaningful insights.

Our security approach is intended to enable our technology to produce a more sustainable global ecosystem through practices that allow for the fast pace of innovation and the reduction of waste. These practices are rooted in conformance to industry standards while helping shape new standards to enable secure and sustainable edge solutions. Our security solutions are intended to have high reuse across many different applications to ensure teams can quickly innovate and have confidence that the security solution is certified to standards and robust in architectural design. As we continue to look forward, our security architectures enable dynamic life cycles, with abilities to enhance software features as industries continue to uncover latent needs. ADI is committed to helping our customers introduce new, transformational solutions.

Reference

¹ "Estimated U.S. Energy Consumption in 2019: 100.2 Quads." Lawrence Livermore National Laboratory, March 2020.

About the Author

Erik Halthen is a product marketing manager for Analog Devices' cybersecurity center of excellence. He leverages his background to facilitate industry adoption of solutions that will enable an autonomous future by understanding customers' most challenging cybersecurity needs and guiding the development of new IP. With a rich history in addressing cybersecurity threats, he helps companies bridge the gap between information technology security and operational technology solutions. Erik is internationally recognized for his published articles and for regularly speaking at major trade shows. He also serves on the advisory committee for University of South Florida's Cybersecurity for Executives certificate program. Erik advocates for the awareness of cyber threats to connected infrastructure and uses his voice to align advancements with environmental and social initiatives to safeguard the future. He can be reached at erik.halthen@analog.com.

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