Operators can reduce energy demand by using an AI-based approach to managing chips in network devices

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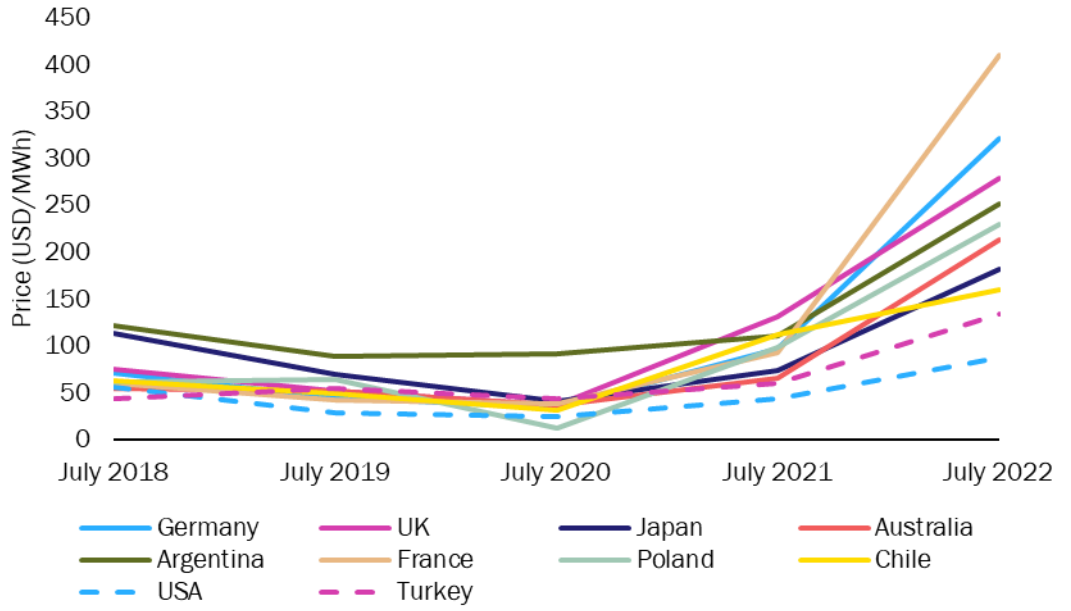
Managing power in mobile networks has become increasingly important for telecoms operators in the past few years. However, the recent surge in the cost of electricity, particularly in Europe (Figure 1), has brought power consumption and management to the top of operators' agendas.

Figure 1: Wholesale electricity prices, selected countries worldwide, July 2018–July 2022[1]



Source: Analysys Mason

Managing power usage is already possible (for example, operators can reduce radio transmission power using set timers), but power management now needs to become more dynamic and precise. The ability to expose an increased level of detail of power consumption will require operators to invest more in the power management process and device manufacturers to develop new capabilities either in their element management systems (EMSs) or by embedding automated intelligence capabilities in the devices. If operators and manufacturers can achieve these things, operators could reduce energy costs and address some of their sustainability goals. However, operators will need to balance the need to reduce energy consumption with competing goals, such as improving network performance and coverage, and reducing latency.

1 IEA (2022), *Real-time Electricity Tracker*. The prices are the average wholesale spot prices of each July of the represented year.

Operators need to reduce power consumption but traditional static solutions are insufficient

Power consumption is unavoidable, but mobile networks waste energy because of heat loss, poor power amplifiers and unused network elements. Mobile networks consume approximately 0.6% of electricity worldwide, and consumers and governments are applying pressure on operators to reduce their energy consumption.[2] Legislation, such as the Paris Agreement, is pushing network operators towards more-sustainable management of their companies by mandating disclosure of carbon emissions and energy-saving strategies.

Operators have an additional financial motivation to reduce their energy consumption; electricity costs are rising sharply and account for 7.5% of the operating expenses of mobile operators.[3] Energy prices are predicted to continue to increase due to global conflict and increased demand following the pandemic.

Past solutions to this problem have relied on predictable and static rules, but operators need to have better energy management solutions now that they are under pressure to prove they are seeking to be more sustainable and the cost of power is rising steeply.

Device manufacturers are increasingly developing AI-based and other solutions to improve network energy efficiency

It has been possible to turn network devices on and off for years, but device manufacturers are developing more-dynamic technologies to address this.

AI, in particular, is being used to make power on/off mechanisms more dynamic. By using configuration and performance statistics, AI can dynamically predict traffic load and adjust shutdowns, and can therefore help to save more energy compared to static schedules, while also ensuring that user experience is not compromised. AI analyses energy-saving scenarios and pre-evaluates energy-saving benefits, then it tests the baseline impact of the solution on KPIs and energy-saving benefits. Supervised learning makes the predictions based on the latest network load and performance feedback permanent.

The following are examples of AI-based solutions that are designed to help network operators to reduce power consumption.

- **Ericsson's Micro-Sleep TX** uses integrated architecture to switch off power amplifiers when no transmission is required and can switch the power on again within microseconds. Ericsson claims that this software can reduce 70% of energy consumption during low-traffic hours.
- **Huawei's Powerstar 2.0** uses hardware to shut down base stations and networks within milliseconds based on service load.
- **Nokia AVA** uses AI to shut down mechanisms to address the energy loss in mobile networks and Nokia claims that it can deliver "between two and five times more power savings than non-AI systems that perform temporary shutdowns based on fixed schedules".

2 Ericsson (16 December 2021), *A holistic approach to address RAN energy efficiency*.

3 See Analysys Mason's *Opex efficiency strategies for operators*.

- **American Tower** is deploying AI-based solutions to predict traffic patterns and automate wake-up and sleep systems.

Excessive internal temperatures can lead to power loss and component failure, and companies are finding new ways to address this.

- **Huawei's NetEngine routers** no longer use the traditional heat dissipation methods of copper heat sinks and silicone grease but now use carbon nano thermal pads and a vapour chamber (VC) liquid-gas phase change heat sinks. According to Huawei, doing this has improved heat dissipation by up to four times and reduced chipset temperature by 19 degrees Celsius. This has improved the reliability of the routers and reduced heat build-up in the motherboard, but it is not yet clear by how much this reduces power consumption.

- **Ericsson's Silicon** range of systems on a chip (SoC) can improve energy efficiency by reducing heat generation and energy consumption, and Ericsson claims that the energy efficiency of the Silicon solution itself increased "by a factor of seven from 2016 to 2021".

- Nokia claims that **Nokia AVA's** liquid cooling systems can reduce power by 70% and opex by 30%.

Using AI can help network providers to achieve cost-saving and sustainability goals

The ability to reduce power consumption requires access to systems, devices and components to monitor it. New technologies and solutions can manage the network in a more dynamic way to reduce power usage.

Power on/off mechanisms use AI for dynamic shutdown schedules based on traffic load and improve on static schedules that do not use periods of low traffic load efficiently. The use of AI for power on/off has been tested by American Tower, Ericsson, Huawei and Nokia. Ericsson has shown promising results with a 70% reduction in energy during low energy hours and so has Nokia with a two to five times increase in energy savings compared to static non-AI systems.

Finally, although heat dissipation is not a specifically dynamic method, it is a significant part of reducing power consumption. Ericsson's purpose-built Silicon and Nokia AVA's liquid cooling have shown to reduce power consumption.

This is just a start. More innovative methods are needed to reduce power consumption and make sure every part of the system functions more efficiently.