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Driving down energy usage across telecoms networks: 5G RAN and beyond

Rupert Wood and Caroline Gabriel

About this report

This report is about energy consumption and cost across mobile and fixed networks and provides practical measures for bringing it down. It also outlines best- and worst-case scenarios for usage and cost.

The report provides recommendations for operators and policy makers.

It is based on several sources:

- Analysys Mason's internal research
- a review of the relevant literature.

GEOGRAPHICAL COVERAGE

- Worldwide, but with a specific focus on countries in which 5G networks have been deployed.

KEY QUESTIONS ANSWERED IN THIS REPORT

- How much energy is consumed by operators and by the whole value chain (from data centres to consumers)?
- What are the long-term trends in energy usage in telecoms networks?
- What technological and commercial levers can operators pull to reduce their energy usage and lower their energy costs?
- What should policy makers consider if they want to define green networks?

WHO SHOULD READ THIS REPORT

- Networks teams
- Investor relations and analyst relations departments
- Government policy makers
- Regulators

Executive summary

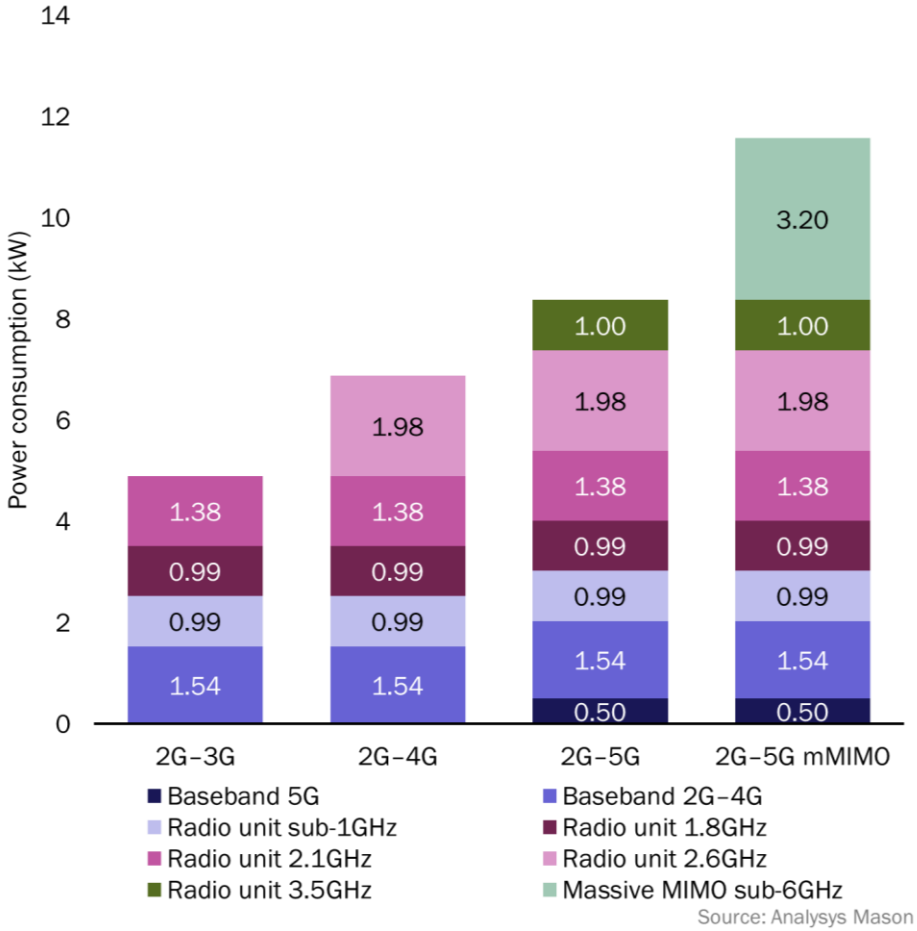
Commitments to sustainability and environmental, social and governance (ESG) goals and the recent steep energy price rises are forcing operators to give more attention to their energy usage and costs. However, nearly every operator is also deploying 5G, which will use more energy than previous generations. Operators must therefore take a holistic approach to energy efficiency to avoid huge increases in energy spend.

Telecoms is an enabler of energy savings, but operators still have to 'do their homework'. 5G is more energy-efficient than 4G but adding 5G to existing networks will increase operators' energy usage. The most effective strategy is to decommission legacy mobile and fixed networks. Sleep modes and intelligent power management can help, but are only half-way measures. Operators, vendors and policy makers should co-operate to eliminate less-energy-efficient networks, thereby saving energy costs and helping to achieve ESG goals.

KEY RECOMMENDATIONS

- Operators should swiftly build new networks and decommission legacy networks to make substantial reductions in their energy usage.
- Operators should implement energy-saving measures that go beyond the natural implementation of more-modern networks.
- Integrated operators and policy makers should take a holistic view of where their traffic is carried in the most energy-efficient manner.

Figure 1: Maximum power consumption of a base station that supports multiple mobile generations, by component



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Challenge: energy costs are rising rapidly, and energy usage is set to increase as networks become more complex

The green agenda is becoming increasingly important to operators, and global conflict has resulted in steep energy price rises. At the same time, 5G threatens a sharp increase in energy intensity for operators.

Telecoms networks (excluding data centres (DCs)) account for 1.5–2% of the total electricity consumption in developed markets. Operators can decouple energy usage from greenhouse gas (GHG) emissions to some extent, but most energy will continue to be bought in, either from renewable or non-renewable sources. The cost of power is rising quickly, partly as a result of demand post-pandemic, but also, more recently, because of global conflict. It is set to continue to rise steeply in 2022.

Mobile RAN already accounts for over half of operators' energy consumption. 5G requires additional active powered elements, especially if massive MIMO (mMIMO) is deployed. In many cases, it will also require additional cells. This will cause operators' energy consumption to rise if there are no mitigating technologies or savings elsewhere.

It may not be enough for operators to point to their 'enabling' role at a time of green recovery programmes and when the benefits of digitalisation have been seen. They have homework to do; they can make energy savings across their networks and can make them a higher priority than previously. Policy makers need to understand how great operators' room for manoeuvre is and what trade-offs are involved in greening networks in order to achieve the desired outcomes.

Figure 2: Wholesale and retail non-residential cost of electricity, Germany and Italy, December 2020– February 2022

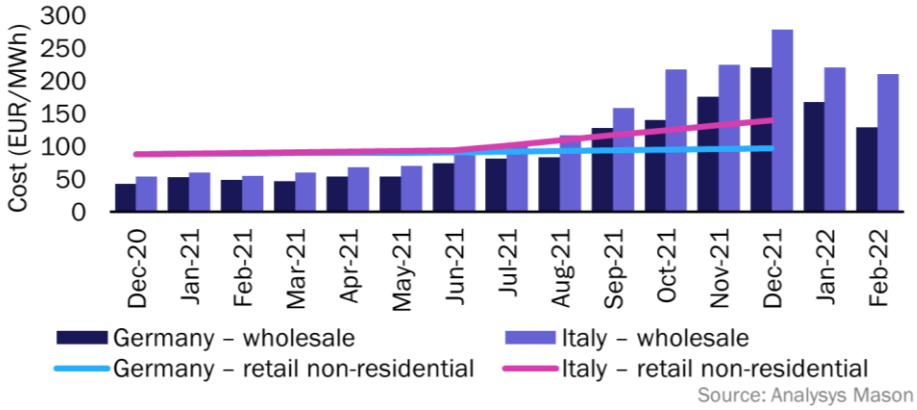

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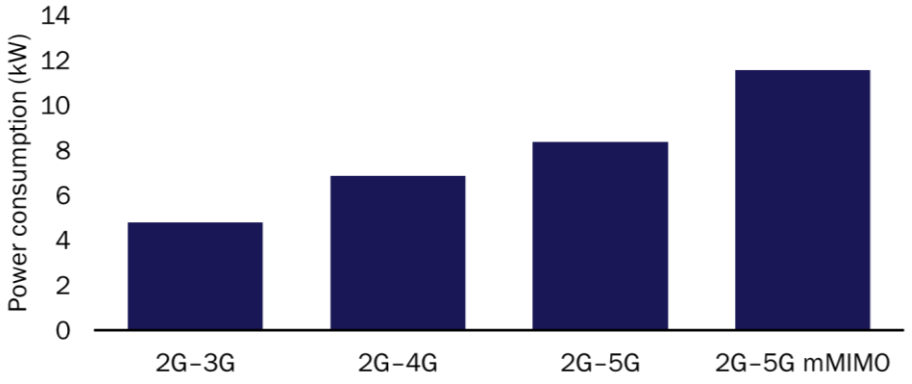
Figure 3: Maximum power consumption of a base station that supports multiple mobile generations



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Solution: expedited decommissioning and intelligent usage-sensitive networks reduce costs, but a holistic approach to energy efficiency is also needed

Adding 5G without mitigating steps adds significantly to energy usage. Operators should look at the entire network to maximise energy efficiency, not just at the steps related to 5G deployment. The seriousness of energy costs and ESG goals requires a more holistic approach to energy than current approaches that leave these decisions to individual operating units.

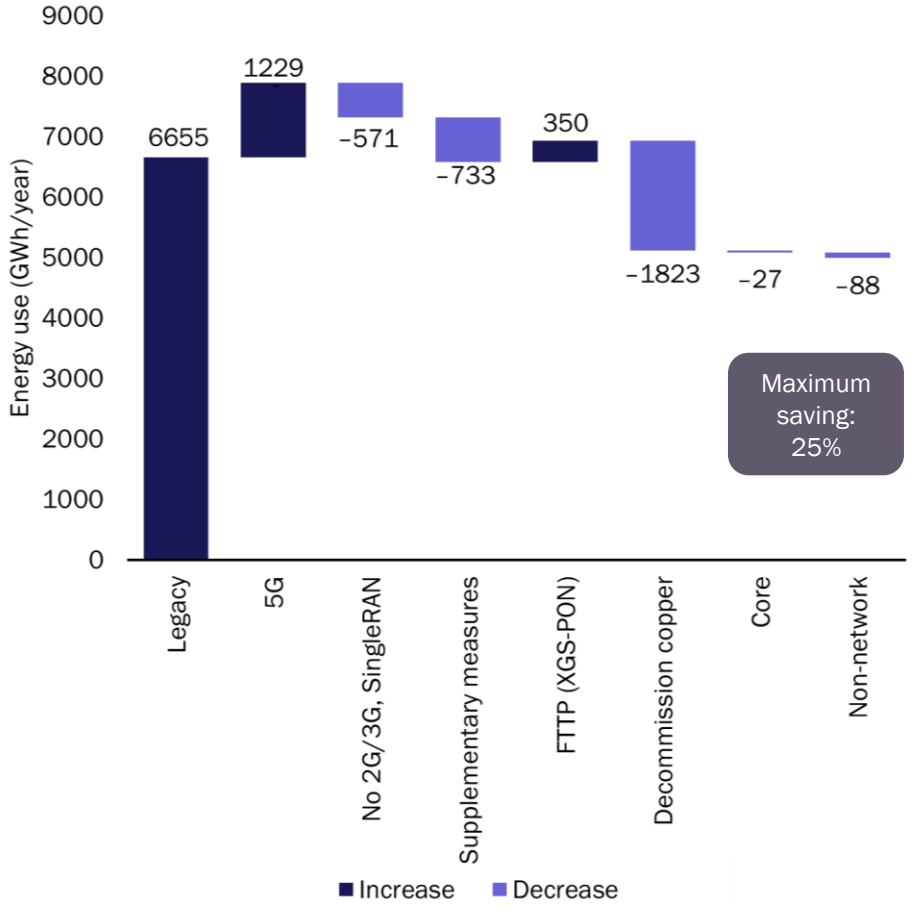
Decommissioning copper is the biggest step that most operators can take to reduce their energy usage. Indeed, FTTP is much more energy efficient than copper. Moving to a 4G/5G SingleRAN deployment that eliminates the need for a separate 2G/3G RAN also provides a significant direct reduction in energy use.

Most operators are now integrated fixed–mobile players and can take a more holistic approach to balancing traffic across their networks. This reduces the pressure to build out mMIMO or additional cells, which require yet more energy, as shown in Figure 3. It is here that potential energy savings run counter to short-term commercial imperatives; policy could drive change.

Some energy-saving technologies are more discretionary: advanced cooling, usage-sensitive networks (assisted by AI) and self-powering units. Operators may invest in their own renewable power generation or take out power purchase agreements.

The solution is not just one for operators; regulators and policy makers must also take it into consideration. They must support ESG policies and make it easier for operators to remove old technologies and switch users to more-energy-efficient options.

Figure 4: Best-case scenario for energy reduction, generic developed country that is similar in size to the UK



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Recommendations

1

Operators should swiftly build new networks and decommission legacy networks to make substantial reductions in their energy usage.

Without SingleRANs or the straightforward sunsetting of legacy networks, 5G simply adds to energy consumption. Operators should therefore accelerate the timetable for decommissioning 2G and 3G. Fixed networks provide even greater opportunities for cuts; FTTP is vastly more energy efficient than copper or HFC, but will take a long time to implement. Green-minded policy makers should pay attention to the benefits of faster phase-outs.

2

Operators should implement energy-saving measures that go beyond the natural implementation of more-modern networks.

It is possible to further reduce mobile network energy consumption in three main ways. First, operators can deploy more-energy-efficient cooling equipment. Second, they can implement ever-more-targeted usage-sensitive systems that enable them to power down networks when underutilised. Third, there is a growing range of options for the self-generation of energy. These will not be deployed everywhere, but real savings can be made.

3

Integrated operators and policy makers should take a holistic view of where their traffic is carried in the most energy-efficient manner.

Fixed networks (FTTP/Wi-Fi in particular) are vastly more energy-efficient than mobile networks, including 5G. Minimising the use of fixed-wireless access (FWA) and steering substitutable mobile traffic to Wi-Fi should reduce the rate of energy-costly upgrades to RANs. This may run counter to current monetisation models, but green-minded policy makers should not actively encourage substitutable traffic to be carried on less-efficient networks.

Contents

About the authors

Rupert Wood (Research Director) is the lead analyst for our *Fibre Infrastructure Strategies* and *Wireless Infrastructure Strategies* research programmes. His research covers the following areas: the evolution of operators' investment priorities; operator business structures; business models for FTTP and convergence; fixed broadband technologies; the economic impact of digital transformation; capex forecasting; and network traffic forecasting. He has extensive experience of advising senior management on strategic issues. Rupert has a PhD from the University of Cambridge, where he was a Lecturer before joining Analysys Mason.

Caroline Gabriel (Research Director) leads Analysys Mason's *Networks* research practice, as well as leading many 5G-related research activities across multiple programmes. She is responsible for building and running Analysys Mason's unique research base of mobile and converged operators worldwide. She works directly with Analysys Mason's research clients to advise them on wireless network trends and market developments. She has been engaged in technology analysis, research and consulting for 30 years, and has focused entirely on mobile and wireless since 2002. Her focus is on critical issues and trends related to mobile and wireless infrastructure, particularly operator deployment intentions for 4G, 5G, cloud-RAN and other technologies.

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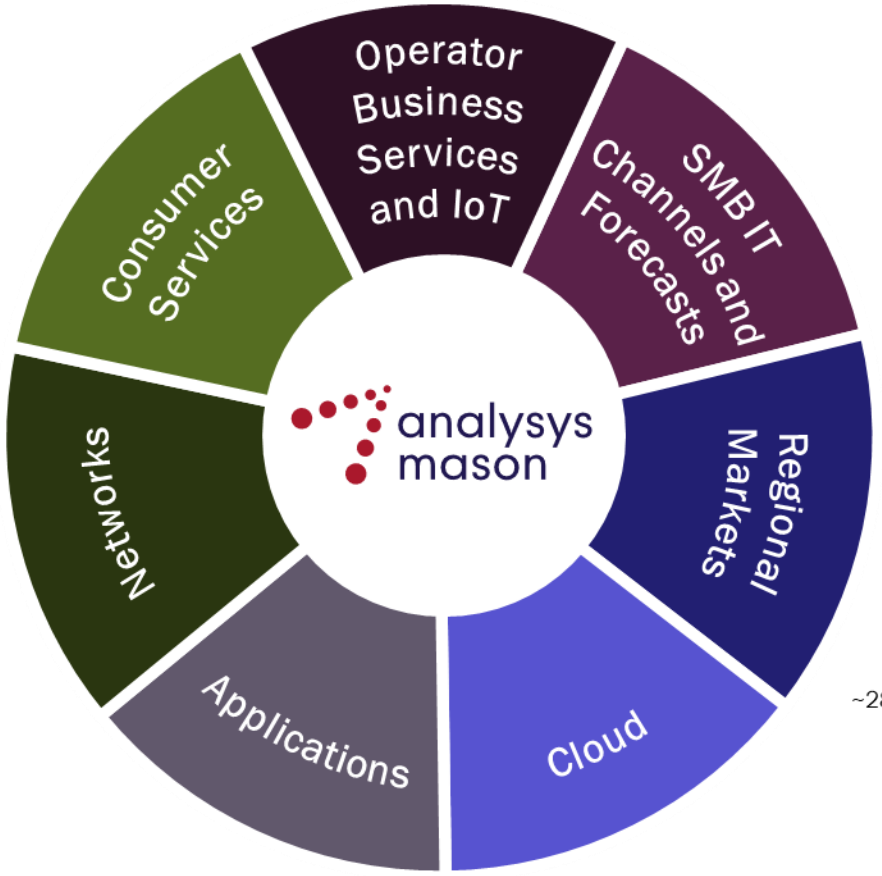

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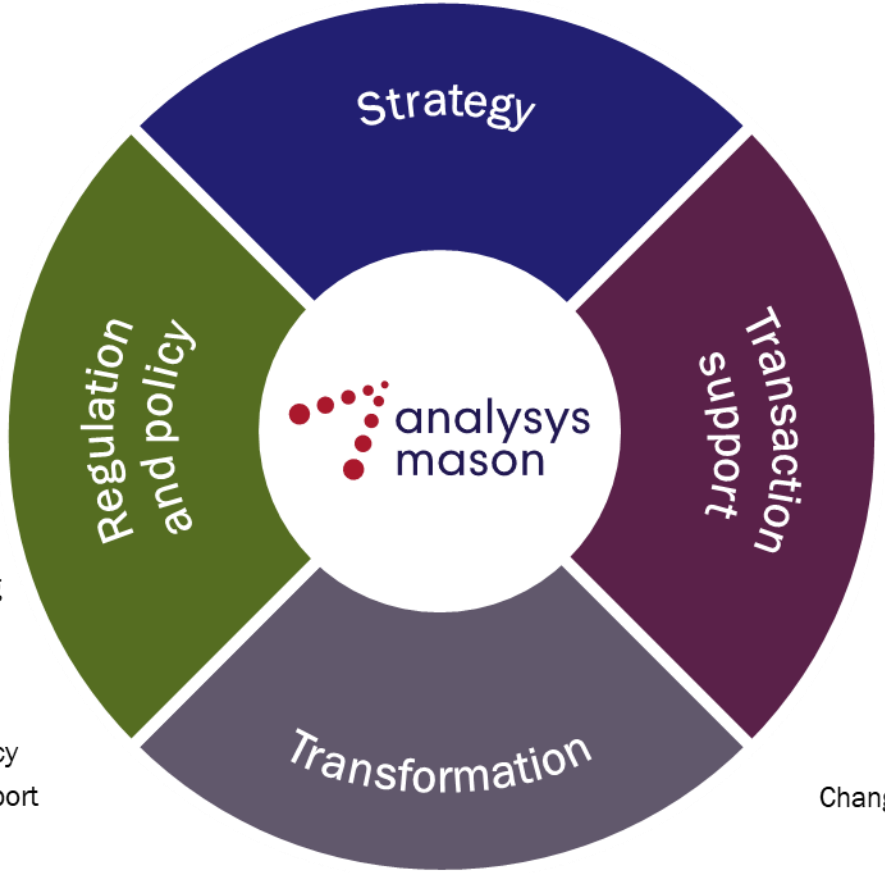

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