



Executive Briefing

WHY ENERGY MANAGEMENT IS CRITICAL TO 5G SUCCESS

Operators' pursuit of growth through 5G is tied to meeting the challenge of lower, cleaner energy and practical guidance on how to achieve this



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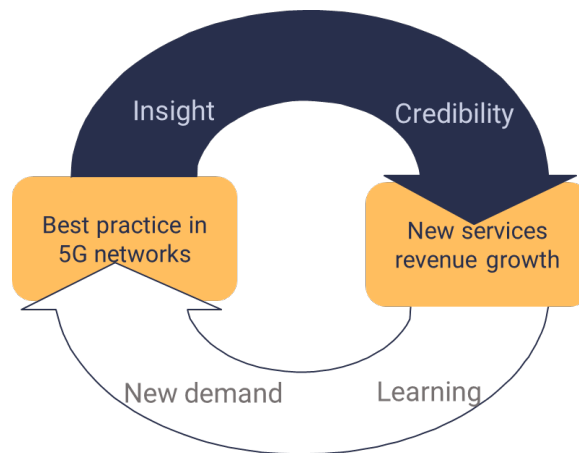
Executive Summary

Telecoms operators' business models are under pressure. They have seen their services commoditized over time: first voice and messaging, and now broadband connectivity. Increasingly, operators are looking for a new role. They need to build new growth and value by offering applications and services along with more tailored, integrated connectivity, all in a more automated, scalable way. 5G was conceived to support this ambition. However, it comes with some new challenges; new cloud-native technologies, new operating models, new skills, new partnerships, new competitors, new ecosystems, and a whole lot of investment.

Given this, operators can be forgiven for overlooking another big challenge relating to 5G and arising from the growth in traffic on 5G networks: energy and carbon emissions. If not approached correctly, 5G deployment could result in significantly increased energy use by operators. This comes at precisely the same time that key stakeholders and society are demanding greater transparency, accountability, and action on reducing energy use and greenhouse gas emissions. This presents operators with a dilemma:

How can telcos pursue growth through 5G and meet sustainability challenges?

In this report, we argue that rather than seeing energy and emissions as a challenge to overcome through mitigation, operators should see these as an opportunity to harness. By adopting energy management best practice, operators can address stakeholder demands and also build the credibility, insights and skills that they need to bring new integrated services to market.



Telcos can be credible in supporting their customers' and societies' transformation goals if they demonstrate leadership in driving changes which have a tangible impact on their own energy use and carbon emissions. This extends beyond the telcos' own direct energy use or emissions and includes supporting their customers and suppliers to do the same.

This report sets out both strategic and practical measures that can be adopted across all functions at all levels of telco organisations, evidenced by case studies from leading operators such as Telefonica. The research findings are supported by a survey of 500 enterprises globally which

highlights operators' opportunity to play a greater role in transforming their customers' operations and how they should address this opportunity.

Key findings

- Although airlines and energy companies have far greater carbon emissions, the telecoms industry is not far behind accounting for an estimated 250 MTCO₂ globally (c. 0.8% of global emissions)¹.
- STL Partners projects that global 5G traffic will overtake 4G/3G traffic by 2025 (even sooner under our fast roll-out scenario).
- In terms of energy required per unit of data transmitted, 5G networks are an order of magnitude more efficient than 4G networks².
- 5G networks will run on millions³ of generic servers, mostly located in smaller 'edge' datacentres. In addition to network functions, these distributed facilities will also support edge compute workloads for 5G-enabled applications such as AR/VR.
- These distributed edge sites need to be specified, equipped, commissioned, and operated differently than in the past (more detailed guidance is provided later in this report).
- 40% of the 500 enterprises we surveyed for this study thought that energy efficiency should be the first or second priority for telecoms operators when deploying 5G networks.⁴
- Energy costs already account for 5-7% of telco opex. Telcos also need to contain other operational costs linked to poor energy management: for example, maintenance, security and insurance.
- In our survey of 500 enterprises, only 37.2% of respondents stated that they currently saw telcos as credible partners in reducing carbon emissions. However, a further 56.1% said that they believed in the future telcos could become credible – it is up to the telcos to prove themselves.

Summary recommendations – from the field to the boardroom

1. **Adopt energy best practice in 5G design, procurement, deployment and operations.** There is plenty of room for improvement, much of it 'low hanging fruit'. We evidence this through detailed practical guidance and recommendations for functions across the organisation:

¹ <https://stlpartners.com/research/curtailing-carbon-emissions-can-5g-help/>

² [Nokia confirms 5G as 90 percent more energy efficient | Nokia](#)

³ We project 1m telco edge servers by 2024 - stlpartners.com/research/building-telco-edge-infrastructure-mec-private-lte-vran/

⁴ N=500, January 2021

infrastructure planners, technology architects, procurement and operations teams. Our research identified dozens of practical measures across 5 categories:

- Network technology: hardware and software designed and operated for efficiency
- Facilities infrastructure: including new edge data centres to support cloud native IT
- Infrastructure management: measure, monitor, manage, improve & automate
- Organisation and evaluation: taking holistic, full lifecycle view of costs & investments
- Working with others: Innovative commercial models, standards and collaboration

2. **Drive customers' transition to low emissions through 5G-enabled services.** If telcos lead effectively and with the right policies, then suppliers and customers should follow. By demonstrating best practice telcos position themselves as leaders. We have set out practical guidance for how telcos can adjust their proposition and go-to-market to do this. Our recommendations are as follows:

- Include a sustainability scorecard for 5G products
- Use internal pilots to demonstrate best practice to potential customers
- Provide granular energy and emissions reporting to customers
- Present the telco as a key partner for customers seeking a sustainable supply chain
- Build strategic partnerships for delivery

3. **Put the governance in place to ensure that company energy and sustainability targets are translated into practical action.** Setting bold goals of becoming carbon neutral by a given date is a good start. However, telco leadership needs to go much further to ensure that these goals turn into the practical actions and customer engagement set out in this report.

- Enforce better reporting of emissions and related energy KPIs
- Cascade top-down targets and accountabilities – all the way down, to everyone
- Add incentives based on energy and sustainability goals – set in bonuses
- Build credibility through strategic partnerships with suppliers

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Preface

The document has been prepared by independent research and consulting firm STL Partners. It is based on the output of an interview programme conducted by STL Partners with telecoms operators

globally, a survey of over 500 enterprises, as well as STL Partners' continuous research into the future telecoms operator and how to get there. The research programme has been commissioned by and contributed to by Vertiv.

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Introduction

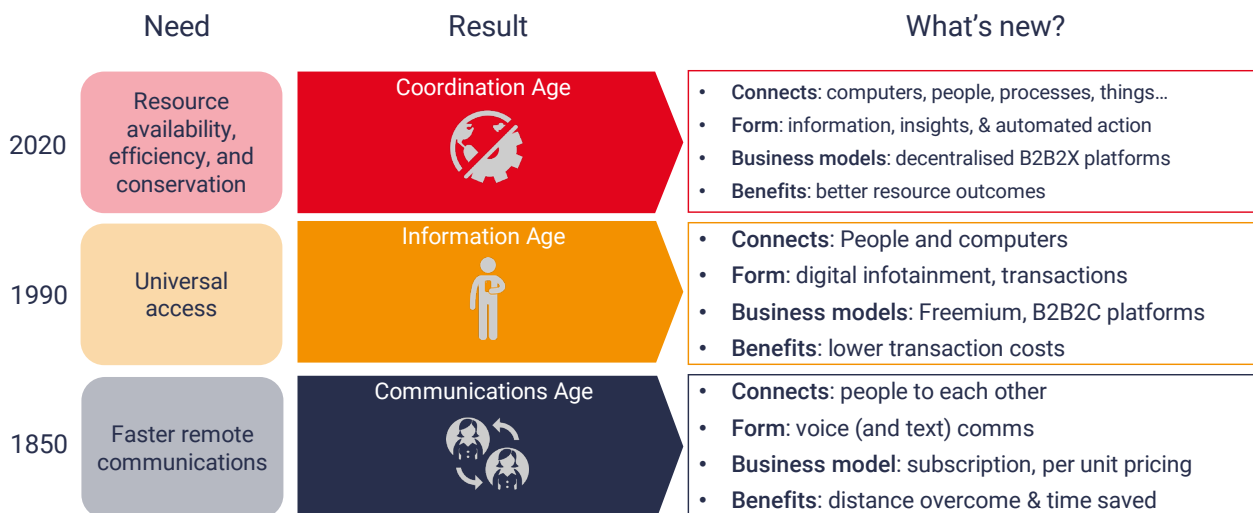
This paper explains why telco’s 5G roll-out, and their ability to monetise 5G, could be undermined by failing to address both the energy and wider sustainability issues that come with it. 5G must be deployed in an energy efficient manner to avoid spiralling costs and increased pressure from customers, investors and authorities. This report is aimed at the C-suite, but also at network operations and planners who are charged with deploying 5G, and the product and customer teams developing new 5G services that will create value and drive growth.

The Coordination Age – a new role and purpose for telcos

STL Partners believes that the telecoms industry and wider society is on the cusp of a new age. From the 1850s until around 1990, the **Communications Age** was dominant. The telegraph and then telephony enabled people to communicate instantly over long distances and overcome geographic boundaries. In the 1990s the Internet emerged. This heralded the **Information Age**. The Internet has also allowed information and entertainment to be accessed instantly – first via a PC and, increasingly, from mobile devices anywhere.

In the **Coordination Age**⁵ ‘things’ are increasingly connecting with each other as IoT and cloud-based applications become ubiquitous. This is creating an exponential increase in the volume of data available to drive development of advanced analytics and artificial intelligence, which combined with automation, can improve productivity and resource efficiency. Telco’s have seen commoditization of voice and messaging in the communication age and then basic connectivity in the information age. They now need to define a new role and purpose in the Coordination Age.

Figure 1: The Coordination Age



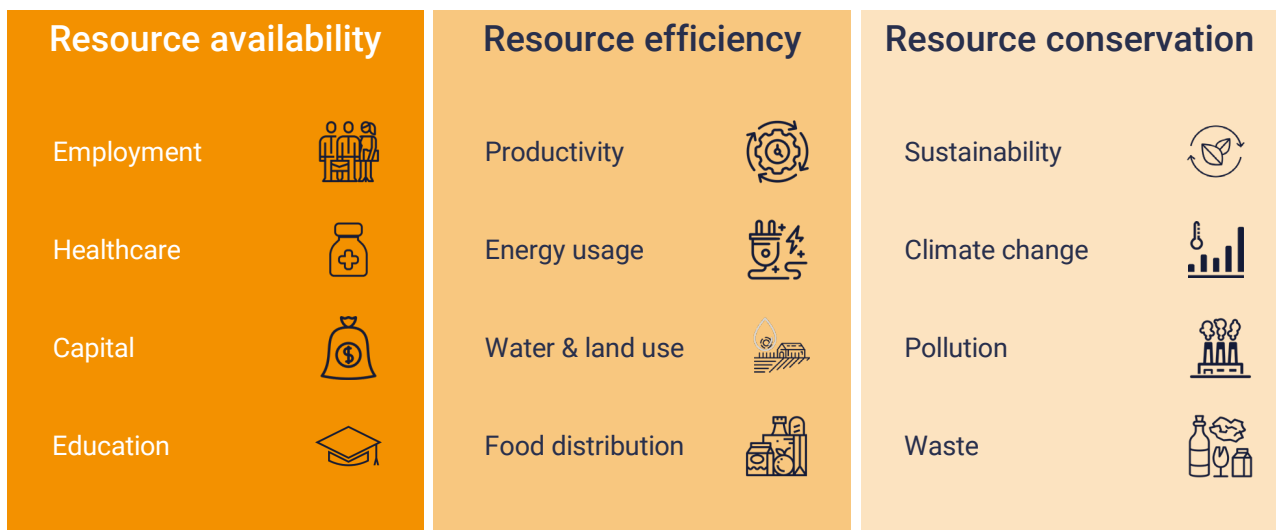
Source: STL Partners

⁵ In more detail in our report [The Coordination Age: A third age of telecoms](#)

Resource efficiency and the Coordination Age

The Coordination Age is driven by growing needs for resource efficiency and will be enabled by new technologies, at the core of which is 5G. To create sizeable new value from these technologies, in the wider context of stagnant connectivity revenues, telcos must endeavour to play a role in solving the problems that the world faces as a whole: climate change, the availability of human and physical resources, automated processes replacing humans, etc. To do this they must seek to create new partnerships with other economic players and play a role in the wider global economy.

Figure 2: Improving the coordination of our resources



Note: Non-exhaustive list

These are issues for governments, enterprises, & consumers. Solutions must come from all constituents.

Source: STL Partners

Telcos can be credible players in the Coordination Age if they demonstrate leadership in driving changes which have a tangible impact on their own energy use and carbon emissions, as well as driving their customers and suppliers to do the same.

5G: Designed to spur innovation and drive growth

Much has been written (not least by STL) about 5G technology being different – both in what it does and how it does it – from previous ‘Gs’. Among other things, 5G has been conceived:

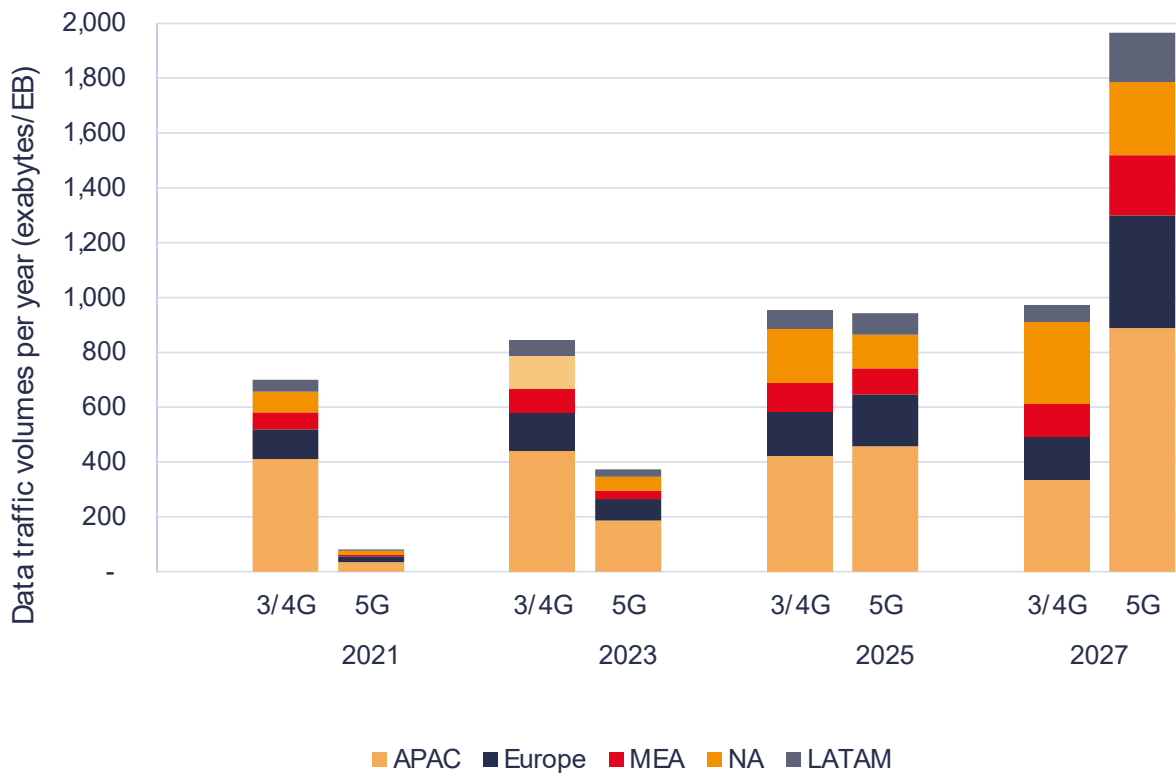
- To enable new operating models, spur innovation and introduce an explosion of tailored connectivity and tightly coupled applications (e.g. low latency, high reliability, IoT)
- To sustain the growth in data traffic that we have already seen with 3G and then 4G

Although many operators globally have yet to launch 5G, the roll-out is gathering pace and expected to achieve significant global coverage by 2025.

Actual data traffic volumes will move to 5G networks faster than coverage or subscriber adoption. This is due to take up of new 5G services, the nature of consumer adoption cycles (earlier adopters are heavier users) and coverage concentration in more populous areas. For example, in South Korea 5G accounted for over 30% of all mobile traffic by the end of 2020⁶, although only 15% of subscribers were on 5G and much of the country is still not covered.

STL Partners project that global 5G traffic may overtake 4G traffic as soon as 2026.

Figure 3: Projected 5G traffic volumes by region



Source: STL Partners

Challenge 1: The 5G energy challenge

5G networks, done right, can limit carbon emissions and even reduce the overall energy consumption of telecoms operators, but given the number of factors at play, things will not fall into place on their own.

⁶ <https://www.mobileworldlive.com/blog/intelligence-brief-how-is-5g-faring-in-south-korea>

Figure 4: 5G can curb excess energy use.... if done right

5G can curb excess energy use... but challenges remain
<ul style="list-style-type: none"> + 90% more energy efficient (energy to transmit same amount of data) than 4G + Greater 'energy elasticity' means that 5G can be turned down during off-peak times + Virtualisation means faster, cheaper renewal cycles and continuous improved performance in software and hardware + Greater opportunity for resource sharing + Decommissioning 2G/3G/4G networks 	<ul style="list-style-type: none"> - Growth in traffic due to more, higher-performance services and reduced perGB cost to users - Up to twice as many cell sites to achieve same levels of coverage - Cloud native infrastructure (COTs hardware) that require data centre environment (cooling, UPS) - Many more edge data-centres, including brownfield conversions

Source: STL Partners

In terms of energy required per unit of data transmitted, 5G networks are an order of magnitude more efficient than 4G networks⁷ (much of this due to the air interface, particularly MIMO arrays packing in a greater number of antennae). 5G networks can also be more 'energy elastic', with energy consumption more closely tracking network use: high at peak times, largely dormant at quieter times. Cloud-native 5G standalone core and virtualised RAN will make it far easier and cheaper to adopt performance improvements in hardware and software. Open RAN will spawn new commercial and operating models in RAN sharing / wholesale / neutral hosts.

However, as the higher performance and lower cost (per GB) of 5G services will result in increased use and accelerate traffic growth, this will negate some of the efficiency gains. Furthermore, to achieve coverage, 5G networks will initially represent another overlay network requiring additional equipment and energy. Due to the higher frequencies, 5G will need more cells than 4G networks and 5G cells will typically have peak power requirements higher than 4G sites. Initially at least, this power will be additional to that supporting existing networks.

Another complication is the cloud-native nature of 5G networks which means that these will run on commercial-of-the-shelf (COTS) servers. Although potentially cheaper to buy and more efficient to run than traditional telco equipment, such servers are designed to run in 'data-centre' technical facilities: with more specialised cooling and power requirements. Due to the nature of networks, these servers will be distributed across many, smaller 'edge' facilities as well as a few big ones. And, in addition to housing servers for network functions these distributed facilities may also support edge compute resources for telco customers' 5G-enabled applications such as AR/VR.

These distributed edge sites need to be specified, equipped, commissioned, and operated differently than in the past (more detailed guidance is provided later in this report). Failure to do so risks inefficiencies and a jump in both embedded and ongoing emissions. To compound things, these

⁷ [Nokia confirms 5G as 90 percent more energy efficient | Nokia](#)

sites will not all be greenfield ones. In many instances, they will be collocated with existing equipment, or use refurbished space in central offices, branch exchanges or older self-contained technical enclosures delivered by truck.

To reduce energy consumption and OPEX at telco sites and across the telco networks, one answer would be to begin to de-commission previous generations of mobile technology. De-commissioning 2G, 3G and 4G mobile networks would have a net beneficial effect on the carbon emissions from all the networks.

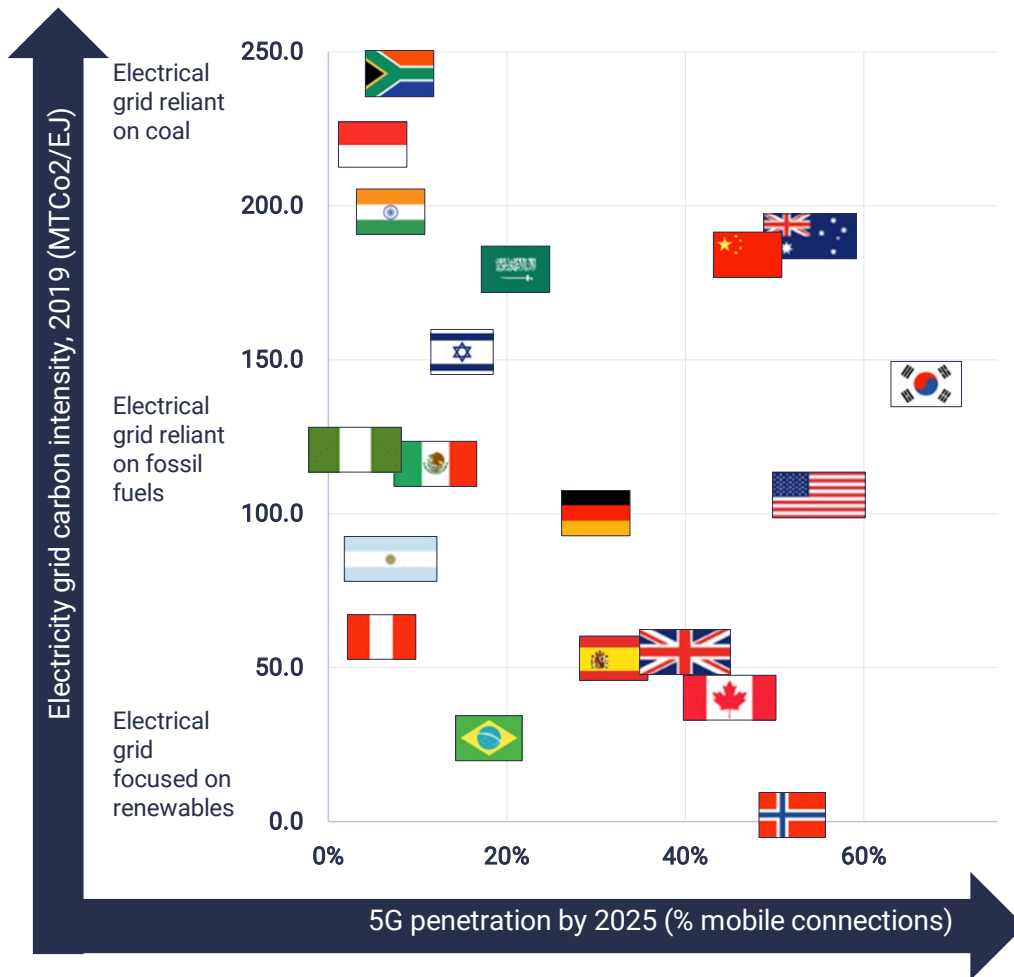
However, there are issues with de-commissioning, given that customers and applications rely on 2G and 3G even in advanced economies, smart meters being a key use for 2G, for example. There are also regional divergences: while many Asian countries have fully de-commissioned 2G and countries such as Germany aims to have fully de-commissioned 3G by 2022⁸, by the end of 2019F 46% of consumers of mobile connectivity in Africa still used 2G⁹.

This attests to a wider challenge when evaluating how telcos can reduce their carbon emissions in the Coordination Age: different regions are at very different stages of 5G deployment and face different challenges and solutions with regards to energy management as a whole.

⁸<https://www.lightreading.com/4g3gwifi/telekom-deutschland-plans-3g-sunset-in-summer-2021>

⁹ GSMA Intelligence, <https://data.gsmaintelligence.com/api-web/v2/research-file-download?id=45121572&file=2796-160719-5G-Africa.pdf>

Figure 5: Regions with different 5G take-up face different energy challenges



Source: STL Partners analysis, IEA¹⁰, GSMA¹¹

An added challenge with deploying 5G in a sustainable manner is that telcos cannot lose sight of resiliency and cost. Energy performance and sustainability goals need to be aligned with financial and operational objectives and incentives, not competing with them. We set out how this can be achieved in this study.

Challenge 2: A rapidly changing business climate

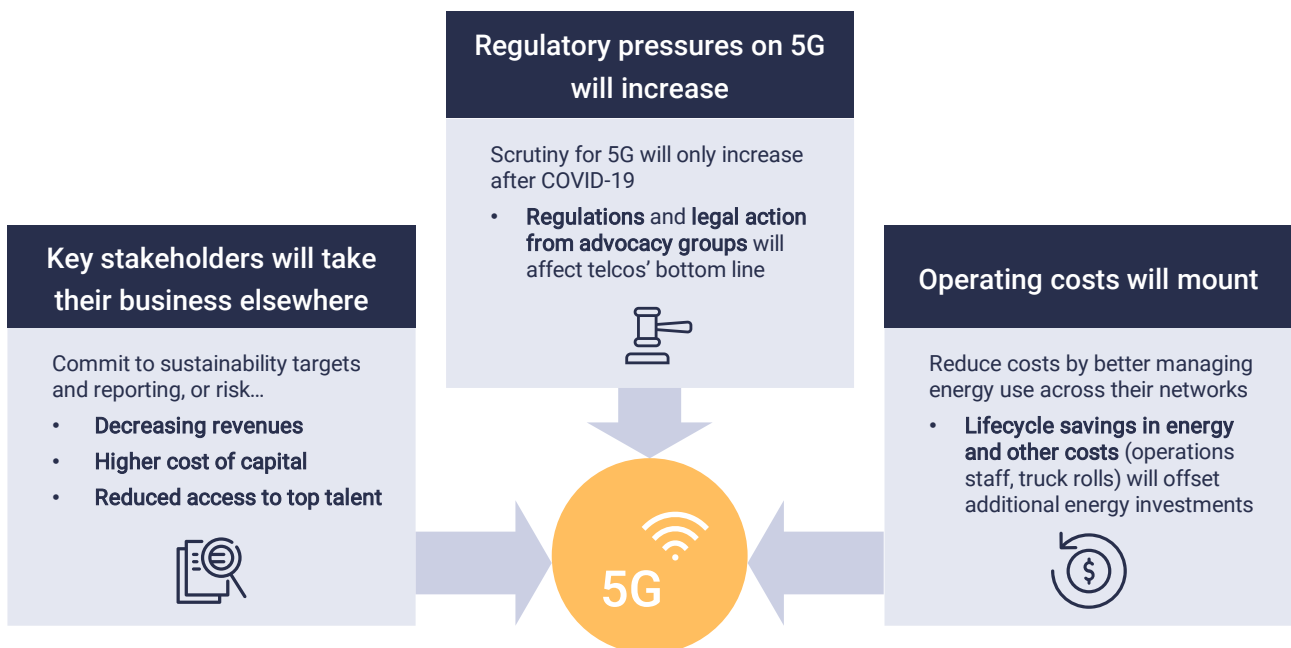
5G is where operators will be devoting most resources over the next decade. The massive investment required for deploying 5G plus the energy challenges associated with running 5G will ensure that 5G dominates operators' carbon footprint. Retrofitting or replacing legacy operations is harder to justify (both economically and environmentally) than adopting best practice with new 5G and 5G-ready networks.

¹⁰ IEA, [Energy Data and Statistics](#).

¹¹ GSMA, [The Mobile Economy Report](#).

Although airlines and energy companies are bigger contributors in terms of carbon emissions, the telecoms industry is not far behind accounting for an estimated 250 MTCO₂ globally (c. 0.8% of global emissions). There will be increasing stakeholder pressure for 5G networks to be demonstrably sustainable by-design and in-operation. Well-intentioned best-efforts and token initiatives in annual reports will not impress increasingly savvy investors, government, regulators, advocacy groups, customers and employees. Evidenced action and detailed disclosure will. This is no longer a question of social and corporate responsibility; it is becoming a business imperative with financial consequences.

Figure 6: Take pro-active action or fall foul of mounting pressures



Source: STL Partners

- **Governmental and regulatory pressure will mount:** 5G is a technology already under scrutiny, and this will only increase as wider environmental concerns move to the fore in the wake of the coronavirus crisis. While in some countries the sustainability ambitions of the government have lagged those of the multinational telcos who operate there, this is changing with the new US administration and greater global multilateral action. One example of this is the new EU rules on sustainable investing¹² which is imposing increased reporting requirements on sustainability-focused asset managers. Another example is the new obligations on all companies under the Non-Financial Reporting Directive¹³ due in 2022.
- **Advocacy groups are targeting big emitters with legal action:** In an ongoing legal case a group of climate activists are suing Shell, citing the 'great danger for humanity' that the company poses. They are demanding that the oil company cut its total carbon dioxide emissions by 45%

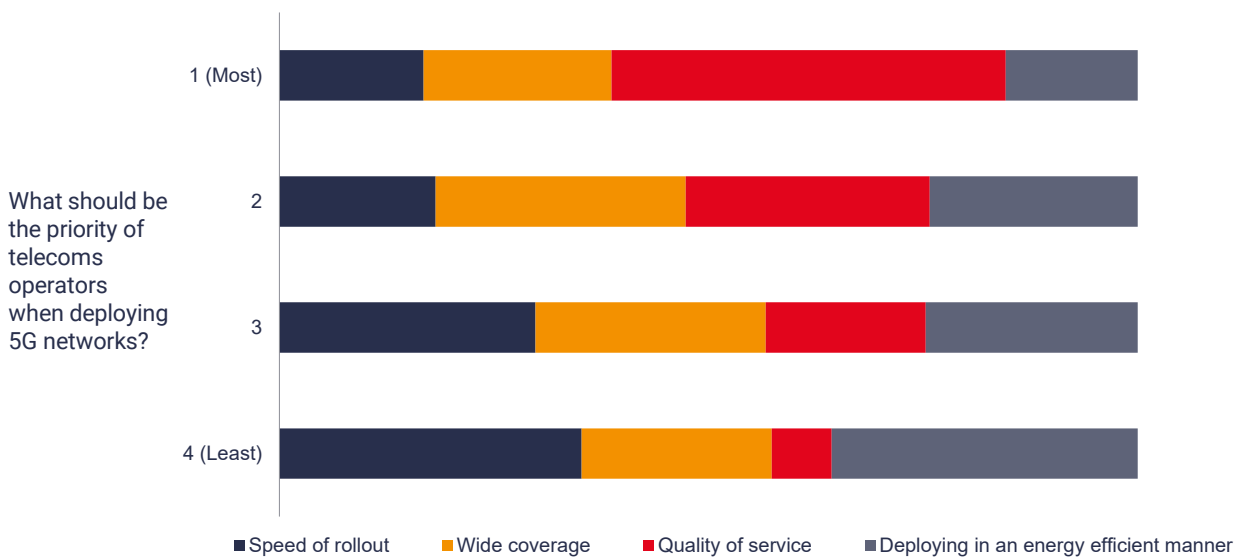
¹² EU rules promise to reshape opaque world of sustainable investment – The Finance Info

¹³ Non-financial reporting | European Commission (europa.eu)

by 2030. This type of action will become more frequent as firms and industries that are complacent become increasingly targeted.

- **Stakeholders will take their business elsewhere:** employees, customers and investors now all expect telcos to set ambitious sustainability targets and report on progress on meeting these. There are growing expectations not just from younger generations but from all demographics. People want to work for and buy services from companies with a clear purpose that includes meeting climate commitments. Investors will want to earn a risk premium from assets seen as underperforming on emissions. These all carry very real financial consequences.

Figure 7: 40% of enterprises we surveyed thought that energy efficiency should be the first or second priority for telecoms operators when deploying 5G networks



Source: Survey conducted by STL Partners Jan 2021, n=501

- **Operating costs will mount, putting further pressure on margins:** Energy costs already account for 5-7% of telco opex. Telcos will need to contain other operational costs linked to poor energy management: for example, reduced maintenance, security and insurance.

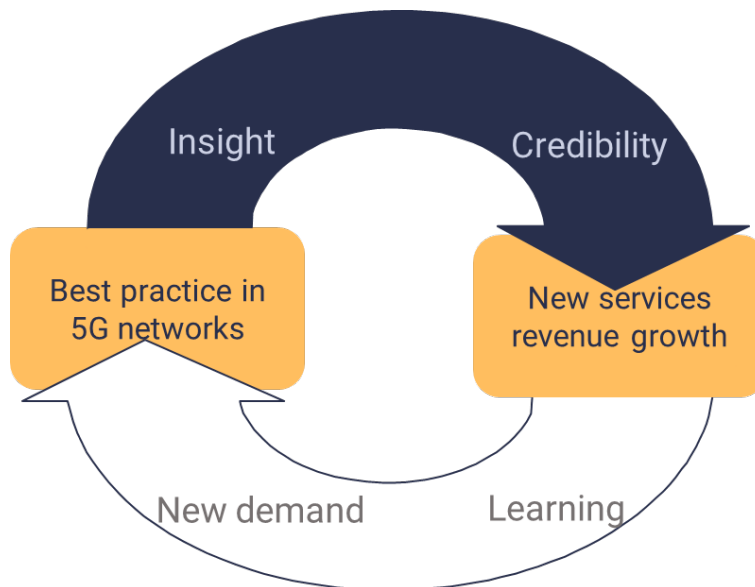
How can telcos pursue growth through 5G and meet the challenges of the changing business climate?

We argue that operators must reconcile their 5G aspirations through a two-step approach.

1. **Adopt energy and emissions best practice in 5G design, procurement, deployment, and operations**
2. **Drive and inspire customers to deploy 5G-enabled services that support their transformation**

As set out above, 5G presents telcos with energy challenges. Because of this, telcos must do all they can to ensure that 5G has a limited (and ideally positive) impact on carbon emissions. The first step is ensuring that their 5G energy use and carbon emissions are minimised, and the second step is ensuring that their customers do the same. In this way, even if the telcos' own energy use and carbon emissions due to 5G remain substantial, these can be balanced out by reductions made by customers enabled by 5G. In summary, when it comes to energy and sustainability, telcos need to practice what they preach... and then should also preach what they practice. The rest of this paper will run through both prongs of the answer in more detail.

Figure 8: Cycle of growth through efficiency



Source: STL Partners

1. Adopt energy best practice in 5G design, procurement, deployment, and operations

Most operators are not systematically adopting best practice in deploying 5G. There is plenty of room for improvement, much of it 'low hanging fruit'. We evidence this through detailed practical guidance and recommendations for functions across the organisation: infrastructure planners, technology architects, procurement and operations teams.

Best practice operates at multiple levels...and across them

In the following section, we set out some of the ways that telcos can adopt energy and emissions best practice in 5G design, deployment and operation. Many of these are not specific to 5G but also apply to 4G expansion, which in any case will be increasingly '5G-ready'.

Figure 9: Best practice in 5G network design, deployment and management





Source: STL Partners



Identify and prioritise efficiency in key technology components

A good starting point is to identify all the 5G technology components that have an impact on energy and emissions. In the table below, we list some of these, essentially as a checklist.

Figure 10: Components to prioritise high-efficiency

 Active components: Network hardware and software	 Passive components: Facilities and indirect (passive) infrastructure
<ul style="list-style-type: none"> • Efficient hardware (silicon, servers, switches, radio) • Hardware energy orchestration • Virtualisation and network functions • Shared/Multi-mode RAN • RAN sleep modes (Micro Sleep Tx, MIMO SM, Massive MIMO SM, Cell SM) • Optimised scheduler (downlink) • Self-Optimising Networks (SON) • AI/ML traffic prediction for augmented sleep modes 	<ul style="list-style-type: none"> • Energy-optimised UPS (Uninterrupted power supply) • On-site generation / renewables • Lithium-Ion battery storage • Avoid multiple AC<->DC steps • High-efficiency rectifiers • Precision cooling and ventilation • AI/ML energy demand prediction for UPS and battery storage optimisation



Measure, monitor, manage, improve, iterate, and automate

Surprisingly, telco remote monitoring of indirect (passive) infrastructure is often limited to simple alarms. Granular monitoring is needed across telco infrastructure to improve energy efficiency. By monitoring variables such as temperature and humidity, the heating, ventilation, and air conditioning (HVAC) of telco sites can be energy-optimised. More data means that infrastructure can be managed more efficiently and central systems can automate these processes. Remote monitoring means that operators can better target (and reduce) routine maintenance. When field technicians are required for repairs, they should have a better idea of what the problem is before setting out and hence reduce the number of additional trips that need to be taken.

Better monitoring combined with predictive analytics may take the form of reducing artificial cooling when outside temperatures are lower than usual, or it may pick up cabinet doors that have been left open. Marginal gains can be substantial when aggregated across 30,000+ sites.



Take a 'full' lifecycle perspective

The business case for adopting more efficient solutions must be evaluated across the whole lifecycle of the solution. High-performance rectifiers, for example, may be shunned by specifiers and procurement teams in favour of less efficient, cheaper alternatives, if procurement is purely on a lowest-cost basis. To emphasise efficiency over short-term capex, operators should compare alternatives:

- by projecting the total cost of ownership across a longer timeframe (e.g. extend analysis from 3 years to 5) and/or
- by capturing (and giving greater value) to 'inefficiency' cost factors that are generally overlooked or understated (e.g. apply higher energy cost and PUE multipliers) or
- where a full lifecycle analysis is not practical, attach a theoretical value 'penalty' to lower-efficiency options. These penalties can be pre-defined company-wide.



Take a more holistic approach across the organisation

A holistic approach is needed to bring together disparate departments across a telco organisation. When operations, energy procurement, and sustainability teams all work independently they can overlook instances where a cross-functional lens would result in better commercial and energy outcomes.

An example of this is when domestic consumer air-conditioning units are used for cooling in remote technical sites rather than purpose-built precision cooling systems, which happens in many markets across Asia, Africa and the Americas. Although domestic air-conditioning units are easier to source and support through local suppliers, they consume at least 20% more energy (partly as they add back humidity which is a requirement for human comfort but not for the IT equipment it is cooling). Installing more appropriate equipment from the outset will significantly lower energy bills and reduce carbon emissions, while advanced remote monitoring can reduce the need for unscheduled repairs and better meet the objectives of local operations teams. A more holistic approach can capture inefficiencies such as this.



Invest in on-site generation and participate in a greener grid

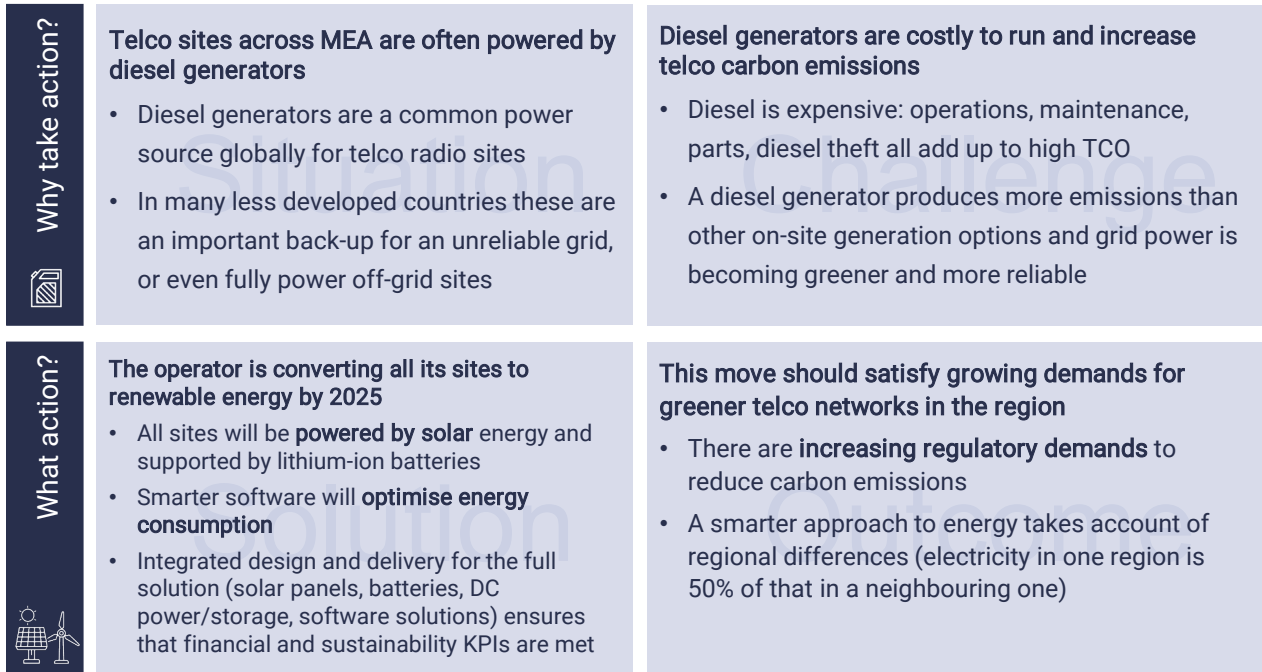
Greater use of renewable energy and hybrid solutions is needed across telco sites to replace and demote (to last resort) the diesel generators that are currently used as primary power and back-up for the grid. Diesel theft is a common problem across less wealthy regions; indeed, one African operator spends an estimated \$82m replacing stolen diesel and batteries each year. In countries across Africa, APAC and LATAM generators are used because grid supply is unreliable or simply unavailable. As well as expensive (capital, maintenance, fuel and theft), this is an inefficient source of fossil-fuel electricity.

Wider energy orchestration can take the form of on-site solar panels and lithium-ion batteries. A system can store the renewable energy when it is not needed and release it when it is. At on-grid sites further integration can occur, using the power from the solar panels whenever possible and only taking from the grid when necessary. This type of system requires initial investment but can be both cost and carbon efficient in the long run and hence must be evaluated over the full lifecycle.

A further step is for telcos to participate as producers: when they have excess energy generated by solar panels, to sell it back onto the grid. This is restricted currently in many countries by closed energy supply markets but where possible represents true participation in the grid and the Coordination Age. Utility energy suppliers often need additional power during high peak demands during the day, for example due to an increase in air conditioning on high temperature days. Renewable energy and battery storage with intelligent management software from the telco sites can be used to offset this high peak by taking excess power from the solar and batteries. Revenue

paid by the utility companies to the telco operator can make the ROI on the renewable investment very positive.

Figure 11: MEA converged operator case study



Source: Vertiv

Operators are amongst the largest and most distributed users of grid energy. As such, they can play an important role in driving changes in energy markets to accelerate the transition to lower-carbon grid power: lobbying authorities, using purchasing power and demonstrating smart grid / smart city capabilities. Furthermore, these changes will create opportunities for telco customers to adopt smart energy practices that 5G enables.

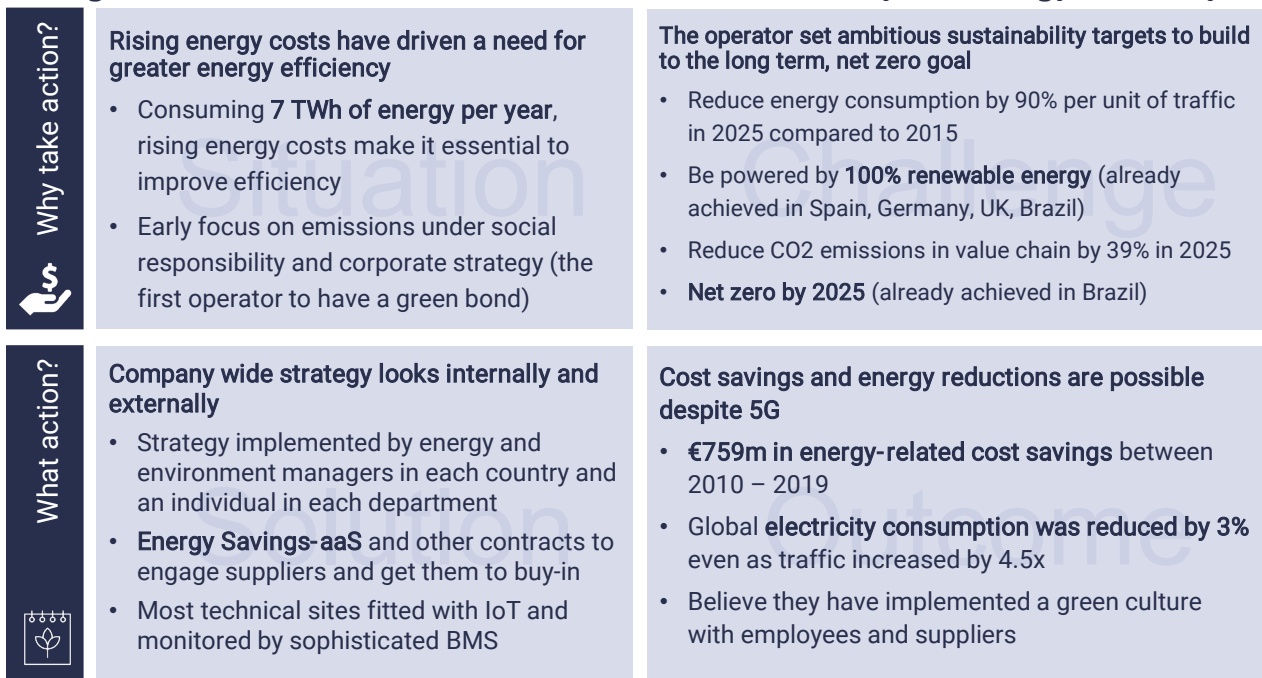


Pursue innovative commercial arrangements with suppliers

Securing green energy supply contracts through Power Purchasing Agreements (PPAs) is a clear mechanism for telcos to reduce their energy emissions. However, these are only possible in some countries and they have finance implications as they create a liability.

New commercial models that involve a risk/greater reward arrangement for all parties mean that emissions reduction becomes a common goal. ‘Energy savings-aaS’ models can be a way to do this, as Telefónica have demonstrated. The system vendor is partly (or even completely) compensated through a share of any cost savings that are made from reductions in energy consumption. Other (more supplier cash-flow friendly) models see vendors paid a % of these savings up front and the rest when further gains in energy savings are made a couple of years down the line. This incentivises vendors to play their part in the carbon reductions of the telco for the entire life of the system.

Figure 12: Telefónica has built a culture of sustainability and energy efficiency



Source: Telefónica



Drive ecosystem standardisation

Telcos should cooperate with the vendor community (also with towercos and each other) to optimise solutions and then standardise deployments. In driving consistency across sites, telcos will reduce complexity and make it easier to scale improvements as well as to maintain and service assets.




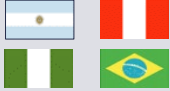


Participate in initiatives and inform the market

Participation in industry-level initiatives such as the Science-Based Target initiative (SBTi) signals intent on behalf of the telco, as well as encouraging participation from others. These initiatives can influence the ecosystem beyond telcos, technology vendors, software vendors, etc to act similarly. Operators should also cooperate at an industry level to educate the market. One operator we spoke to was reluctant to implement sleep modes as this might undermine perceived performance if independent speed tests were undertaken at 2am when the network was powered-down.

Focusing action for your operator

Every operator is different. As we set out in the previous section of this report, there are big differences in countries’ energy set-up and 5G roll-out. For example, on-site (mainly solar renewables) makes more sense in emerging markets such as Myanmar with limited grid infrastructure and the presence of tower companies to enable greater resource sharing between operators. On-site solar makes less sense in countries with well-established grids already delivering low-carbon power such as Norway (hydro), France (nuclear) or Denmark (Wind farms). We have attempted to identify which areas are of potential focus.

Figure 13: Relative opportunity of initiatives by region

Area of initiative	Later 5G deployment		Earlier 5G deployment	
	Higher emission grid	Lower emission grid	Higher emission grid	Lower emission grid
				
Efficient network hardware	●	●	●	●
Efficient network software	●	●	●	●
HW energy orchestration	●	●	●	●
Multi-mode/shared RAN	● (4G too)	● (4G too)	●	●
RAN sleep modes	●	●	●	●
Optimised scheduler	●	●	●	●
High efficiency rectifiers	●	●	●	●
Self-Optimising Networks	●	●	●	●
AI/ML traffic prediction	●	●	●	●
Minimise AC <-> DC steps	●	●	●	●
Precision Cooling	●	●	●	●
Ventilation / free cooling	●	●	●	●
AI/ML energy prediction	●	●	●	●
On-site renewables (solar)	●	●	●	● (remote loc)
Measure, monitor, automate	●	●	●	●
Adopt a 'full' lifecycle view	●	●	●	●
Holistic across organisation	●	●	●	●
Decommission 2/3G network	●	●	●	●
Renewables feed-in	● (if permitted)	● (if permitted)	● (if permitted)	●
Innovative supplier deals	●	●	●	●
Industry level initiatives	●	●	●	●
Engage & inform the market	●	●	●	●

● Major
 ● Medium
 ● Minor

2. Drive customers' transition to low emissions through 5G-enabled services

The best case study you can have is yourself

Telcos can set an example – if they lead effectively and with the right policies then suppliers and customers will follow. By demonstrating best practice telcos position themselves as leaders – active players in the Coordination Age. To earn credibility as potential partners moving into the Coordination Age telcos must show that their own processes are efficient. In a survey conducted of 500 end enterprises by STL Partners, only 36.3% of respondents said that they currently saw telcos as credible partners in reducing carbon emissions. However, a further 57.5% said that they believed in the future telcos could become credible – it is up to the telcos to prove themselves.

“Telcos will be credible as partners only by demonstrating their commitment to carbon footprint reduction, coupled with performance and cost acceptable to our business

Logistics company surveyed by STL Partners, UK

Telcos can carve out a broader role for themselves in the Coordination Age by supporting their customers in pursuing their own transformational operational efficiency goals.

- In some cases, energy efficiency and emissions will be the customers' **primary objective**.
- However, in most cases this will be an **indirect benefit** derived in pursuit of other productivity, efficiency, growth and compliance objectives.

Who to target?

It makes sense to focus on industries where 5G will bring greatest benefits. STL Partners has examined several different industries and quantified the sizeable benefits that 5G will bring to them.

Manufacturing

In previous work by STL Partners, we estimated that 5G would bring \$730bn of benefits to the manufacturing sector in 2030¹⁴. By bringing more than connectivity, telcos can secure a bigger share of these benefits. The key use cases include advanced predictive maintenance, automated guided vehicles, and remote robot control.

Many of these benefits involve fewer errors, reduced waste, fewer on-site visits/trips and higher productivity all of which result in lower energy intensity of production (reducing the total energy and GHG emissions for each item produced).

When surveyed, 54.7% of manufacturers said they were aiming for net zero by 2030, with 28.5% aiming to achieve this by 2025. Moreover, over 1/3 of manufacturers said they strongly believed that private LTE/5G networks or Wi-Fi 6 would help them to achieve greater energy efficiency, and

“If telcos want to be seen as credible in reducing carbon emissions they have to be transparent with their own policies

Manufacturer surveyed by STL Partners, Australia

¹⁴ STL Partners, *October 2019, '5G's impact on manufacturing: \$740bn of benefits by 2030'*

43.9% strongly believed that this would be the case for 5G. There is a clear opportunity for telcos in this sector.

Transport and logistics

In transport and logistics, we estimated that \$280bn of benefits would be brought by 5G in 2030¹⁵. Some of the key use cases included advanced driver assistance, connected traffic infrastructure, and automated last 100 yards delivery.

These benefits involve higher asset utilisation, reduced waste, fewer trips and higher productivity all of which result in lower energy intensity of transport (reducing the total energy and GHG emissions for each item delivered). The emissions benefits will accelerate as transport itself transitions to electric power and electricity transitions to lower-carbon generation.

In the transport and logistics sector, 36.4% of logistics firms and 25.4% of transport firms hoped to achieve net zero by 2025. On average, 40% of respondents in the transport sector believed that each of 5G, private LTE/5G networks, and Wi-Fi 6 would help them to make energy efficiency improvements. In logistics, 54.5% of respondents strongly believed private LTE/5G networks would help them improve energy efficiency, and 48.5% for 5G. Again, there is a clear telco opportunity.

Figure 14: Corealis, Port of Livorno case study



Source: STL Partners

¹⁵ STL Partners, *September 2020*, ‘5G’s impact on transport and logistics: \$280bn of benefits by 2030’

Healthcare

In healthcare, we estimated that 5G would enable 1 billion patients to have improved access to healthcare in 2030¹⁶. The use cases include connected ambulance, remote patient monitoring, and virtual consultations.

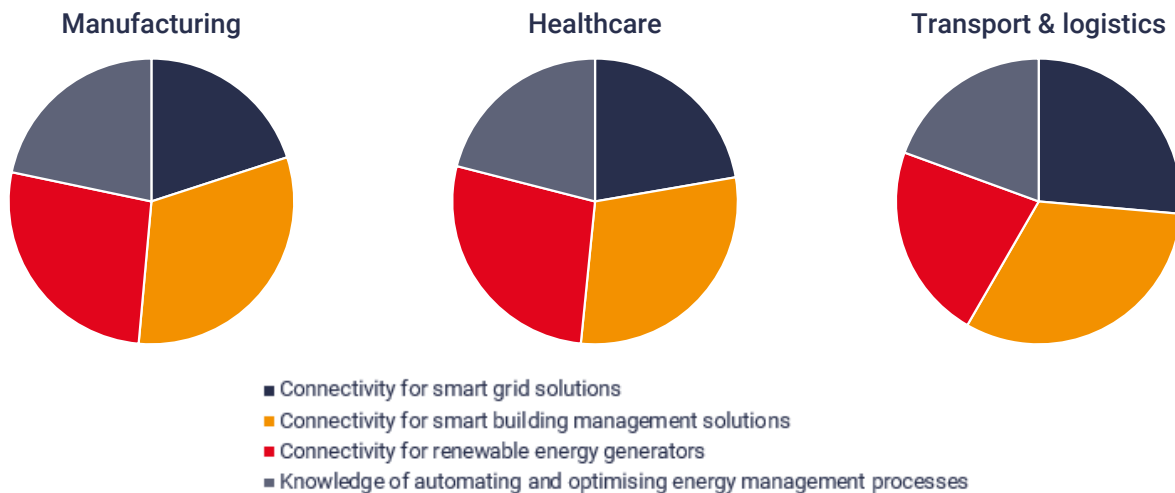
Unlike other industries, healthcare benefits cannot be easily measured in monetary terms. However, many of the 5G-enabled use cases we evaluated involved higher asset utilisation, reduced patient and clinician travel and higher clinician productivity, all of which result in less energy and emissions for the same or better patient outcomes. However, given the fixed nature of most healthcare budgets globally, more efficient healthcare translates in longer lives rather than cost savings.

In healthcare, 26.1% of respondents said they were aiming for net zero for 2025, and over a third were looking to reduce carbon emissions in at least some business units by 2025. Over one third of respondents strongly believed that each of private LTE/5G networks, 5G and Wi-Fi 6 could enable energy efficiency improvements.

“If telcos seriously work on reducing their own carbon emissions, then they can play an important role in helping us reduce our own

Healthcare provider surveyed by STL Partners, India

Figure 15: What role could telcos play in addressing your organisation’s energy management needs?



Source: Survey conducted by STL Partners Jan 2021, n=501

Specific steps in driving customer efficiency through 5G

To target these industries effectively, telcos need to pursue initiatives that drive real action from their customers. Our recommendations are as follows:

- **Include a sustainability scorecard for 5G products:** this should be included alongside the economic benefits of products when selling to customers. This will encourage customers to

¹⁶ STL Partners, October 2019, '5G's healthcare impact: 1 billion patients with improved access in 2030'

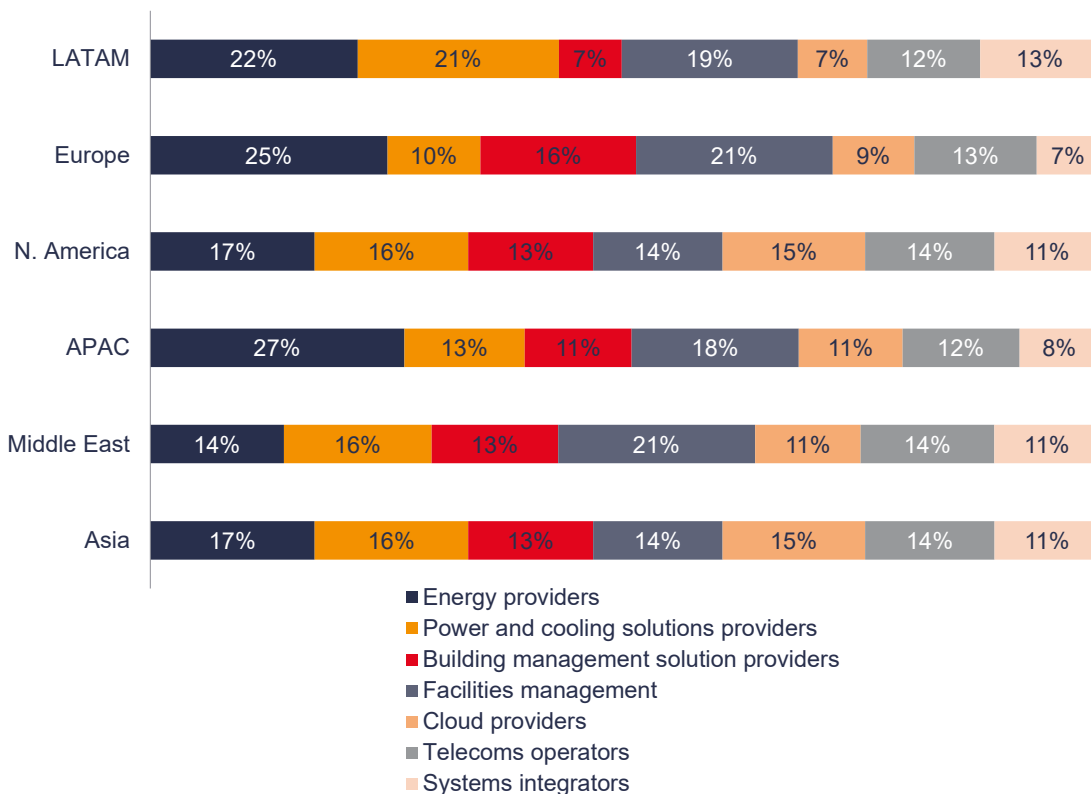
place financial and sustainability metrics on a more equal footing, as well as showing that you care. With better reporting this is an easy and low-cost step to take.

“ Sometimes it seems telcos are only trying to promote their products or services, I want to see them demonstrate the environmental benefits they can bring

Healthcare provider surveyed by STL Partners, Argentina

- **Use internal pilots to demonstrate best practice to potential customers:** better monitoring and automation of HVAC can be applied across many industries. If these are enabled by connectivity, then telcos can use case studies of their own processes to promote their services as well.
- **Provide granular energy and emissions reporting to customers and ask them to report this back:** this helps to provide an end-to-end efficiency picture. Stakeholders care that a telco’s products are being used in a carbon efficient manner as well, more transparency from customers helps to prove this. This plays back into best practice for the telco themselves as it enables better reporting of emissions.
- **Communicate the telco as a key partner for customers seeking a sustainable supply chain:** it is important to market the progress made and the best practice being exhibited by the telco. Telcos can market themselves as a ‘green leader’ in their market, it can be a USP.



Figure 16: Who do you currently see as key partners for improving your organisation’s energy efficiency?



Source: Survey conducted by STL Partners Jan 2021, n=501

- **Build strategic partnerships for delivery:** telcos need to partner with companies that share the same sustainability goals. This maintains the end-to-end attention to sustainability and lends more credibility to the efforts of the telco.

Figure 17: Longreach Airport case study

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Why take action?</p> 	<p>The regional airport in Longreach, Queensland faces extreme environmental challenges</p> <ul style="list-style-type: none"> • Temperatures fluctuating from 0°C to 45°C demanded daily reboots and energy-intensive terminal air-conditioning • Insect plagues mean that technical staff had to sweep server rooms for bugs or risk outages and flight delays 	<p>Longreach Airport needed a quick, cost-effective solution to solve these challenges and address energy efficiency goals</p> <ul style="list-style-type: none"> • In 2016, the airport offset 95% of its daytime electricity (205,000kWh annually) by installing 396 solar panels, but... • Even with considerable annual energy savings of \$40,000, it would take years to recoup the 6-figure installation cost
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">What action?</p> 	<p>In 2019, the airport upgraded its IT infrastructure with Vertiv's SmartCabinet™ solution</p> <ul style="list-style-type: none"> • This provides an enclosed and secure mobile data centre that prevents bugs from creeping into the IT systems, and its built-in cooling system protects against extreme heat • Remote central monitoring and IoT runs essential services for the airport, including CCTV and access control 	<p>Free from heat or insect related outages, the airport increased its focus on operational efficiency and energy monitoring</p> <ul style="list-style-type: none"> • Reduced technical staff by leveraging cloud-based IoT data to remotely monitor critical infrastructure in real time • Opened IoT data to universities and industry partners to develop a video analytics platform that shares results with the local community

Source: Vertiv

Conclusions and recommendations

Preach what you practice...

By defining a clear purpose and adopting best practice, operators can bring practical expertise, insights and credibility to their customers' energy transformation plans. Inspiring customers' ambitions, building confidence that these can be achieved and demonstrating practical know-how are key to being an effective (and commercially successful) partner.

... as well as practice what you preach

As set out at the start of this paper, the time for well-intended, best-efforts has passed. Stakeholders and customers in particular want to see tangible action backed by credible reporting on results.

Recommendations for telco leadership

The initiatives outlined above offer a non-exhaustive list of ways that telcos are already reducing their energy use and carbon emissions. The question for telco management is how they put the governance in place to ensure that company energy and sustainability targets are translated into practical action. Our recommendations are as follows:

- **Enforce better reporting of emissions and related energy KPIs:** this is needed throughout the organisation to track where improvements need to be made as well as for transparency. Reporting energy and emissions information along with financial KPIs further ensures that it is viewed as a similar priority.
- **Cascade top-down targets and accountabilities:** energy and sustainability must be treated as core objectives for the whole business to bring together disparate internal teams. In practice this means having these broken down and reported throughout all levels of the organisation. It can also mean having company-wide strategies implemented by dedicated energy and environment managers in each department. Telefonica is a great case study on this.
- **Add incentives based on energy and sustainability goals:** from the C-level and cascaded downwards this means that employees are invested in the goals. Telefonica for example, has linked 20% of its employees' variable pay to sustainability targets such as energy and emissions targets. Putting sustainability on par with direct financial objectives ensures it is prioritised. However departmental budgets should reflect these new goals.
- **Build credibility through strategic partnerships with suppliers:** As well as the examples of innovative supplier arrangements in the report, operators should include credible carbon footprint reporting on scope 3 emissions (all indirect embedded emissions in a company's supply chain). Stakeholders want a full picture of a company's end-to-end emissions and you need efficient and transparent partners to do this effectively. Telcos can request emissions reporting in the tender process and have targets for emissions from their suppliers (one interviewed telco have targeted reducing supply chain emissions by 40%).

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