

SPECTRUM NEEDS FOR THE NEXT GENERATION

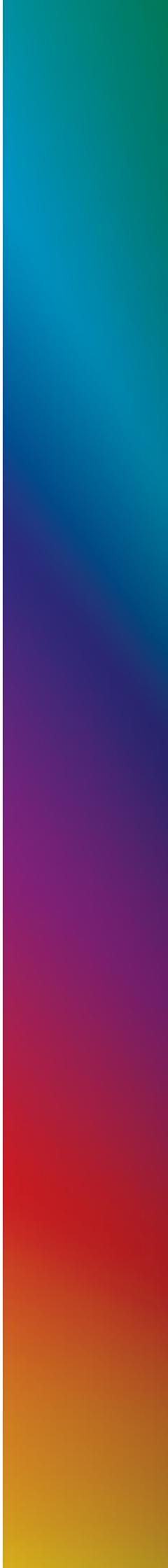
THE INAUGURAL CIS SPECTRUM MANAGEMENT CONFERENCE

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Spectrum auctions must be designed with clear policy goals in mind to avoid undesirable outcomes



SAMER MOURAD
Principal, Consulting

“ Failure to follow this process can result in a range of outcomes that might be considered undesirable to some stakeholders. ”



Auctions have become the most popular means of assigning spectrum licences, especially for spectrum that is used for services with high economic and societal value, such as those in the mobile sector. However, a badly designed auction can lead to undesirable outcomes, either from the perspective of governments or national regulatory authorities (NRAs), or for one or more winners of spectrum licences (for example, mobile operators). To avoid these pitfalls, spectrum auctions need to be carefully designed.

NRAs must establish clear policy objectives as a starting point for designing a successful auction

Several auction mechanisms have commonly been used to assign spectrum, ranging from simple, single-round auctions to more complicated multiple-round auctions. Well-designed auctions are considered to be allocatively efficient if they incentivise bidders to bid according to their true valuation. Auctions can also help NRAs to achieve varying policy objectives and tend to be more-transparent than alternative options when assigning high-value spectrum, and therefore less open to post-award dispute.

When designing an auction, NRAs should begin by establishing policy objectives that relate to the award. These could include the following goals.

- achieve allocative efficiency of assignment (ensuring that those with the highest value for the spectrum can use it)

- achieve efficient use of spectrum
- preserve or enhance the competitiveness of the telecoms market (for example, through low barriers to entry and by avoiding excessive spectrum concentration)
- create investment incentives
- ensure service continuity
- achieve universal service considerations and/or increase service coverage
- facilitate transparency and fairness (all potential parties should have an equal opportunity to acquire spectrum)
- avoid complexity and costs associated with the award mechanism
- ensure a fair price is paid for public assets.

Various spectrum management considerations will also need to be built into each spectrum auction, including technology-neutral licensing and management of interference. Each NRA will need to undertake market analysis, spectrum valuation and auction design work (sometimes involving technical considerations relating to assigning spectrum rights of use to avoid interference). Auction design parameters that need to be specified include, for example, the detailed auction format, lot structure, bidding and closing rules, reserve prices, spectrum caps and floors. It is usually the case that the NRA will hold at least one consultation with industry on its proposals prior to publishing the final auction rules.



Auctions must be carefully designed to avoid undesirable post-award outcomes for some stakeholders

Failure to follow this process can result in a range of outcomes that might be considered undesirable to some stakeholders, or that may conflict with policy objectives, including the following effects.

- **Unbalanced spectrum assignments.** Exceptionally asymmetric spectrum assignments may leave some operators struggling to compete effectively, or at least not able to improve the quality of their services as quickly as other players can. Concerns about this type of spectrum assignment need to be balanced against the potential consumer benefits associated with some operators holding large amounts of (contiguous) spectrum.
- **Unsold spectrum.** This may arise, for example, when reserve prices are set above the market value of the spectrum. Where it does arise, this can result in an inefficiency because scarce resources are not fully utilised, which potentially hinders market development and ultimately harming consumers.
- **Excessively low prices.** Low prices (relative to the value that an independent assessment of business case valuations might indicate) may not provide value-for-money for the taxpayer, and may potentially go hand-in-hand with an inefficient assignment (for instance, where demand has been strategically reduced).
- **Spectrum loss.** Auctions that result in an operator failing to secure renewed licences for spectrum may put service continuity at risk, as well as the stability of the operator, with the likely result in both cases being a negative short-term impact on end users.
- **Long or complex process.** This may result in both operators and NRAs dedicating resources to the auction for a long period, which incurs substantial costs, whilst also delaying service deployment and using that spectrum in a way that harms consumers and potentially some operators.
- **Spectrum awarded inefficiently.** Some auctions have resulted in spectrum being awarded to companies that are not yet in a position to make efficient use of it, leading either to spectrum being handed back to the NRA or causing a considerable delay in rolling out networks and launching services.

prepare for spectrum awards. Our advice encompasses technical, regulatory, market and economic aspects of spectrum management and spectrum valuation, which sets us apart from our competitors.

Questions?

Please feel free to contact Samer Mourad, Principal, at samer.mourad@analysismason.com

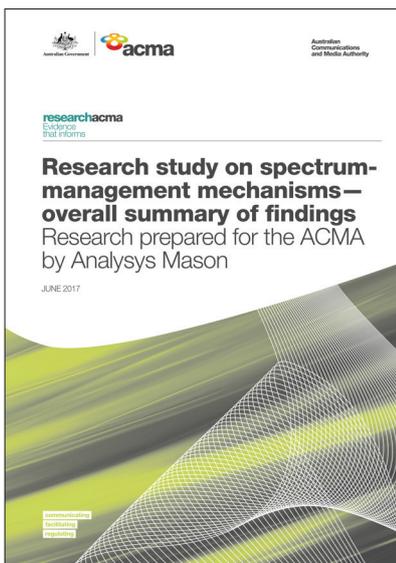
Spectrum auctions need to be carefully designed to avoid these undesirable outcomes to the greatest extent possible. Analysys Mason works for both operators and regulators on all major spectrum management topics, including licence awards and renewals, auctions, spectrum valuation, pricing and spectrum trading. Analysys Mason has been instrumental in shaping spectrum policy around the world through our wide-ranging studies that help regulators and operators to develop spectrum strategy, determine spectrum policy, formulate spectrum licence conditions, value spectrum and

Greater flexibility in spectrum use: do the benefits outweigh the risks?



JANETTE STEWART
Principal, Consulting

“A key feature of a new spectrum-management legislation is migration to a single licensing system.”



Many spectrum regulators are aiming to achieve greater flexibility in spectrum use, both to encourage innovation and to find more-novel ways to enable new services to be launched without the need to reassign frequencies from their current use.

Analysys Mason was commissioned by the Australian Communications and Media Authority (ACMA) in 2017 to assess the market opportunities – and the risks – associated with more-flexible, market-based management approaches for spectrum. This article summarises some of the key questions and concerns addressed in this study.

An overview of Analysys Mason's ACMA study

Trends such as the growing demand for spectrum, advances in wireless technologies and changing worldwide supply chains (with expectations of rapid growth of the Internet of Things (IoT)) have emerged, prompting a need to consider changes to the spectrum-management framework. In Australia, the government has proposed a programme of spectrum reform, and new spectrum-management legislation is now being implemented to replace previous legislation. The new legislation gives the ACMA new powers aimed at responding to rapid changes in market demand and the latest developments in wireless technology, including trends towards more-dynamic operation of wireless systems.

A key feature of the new legislation is migration to a single licensing system. The overall aim of this legislation is to give the ACMA greater flexibility to adapt

the issuing of licences and licence conditions to meet the demands of new technologies, and to improve the scope for changes of spectrum use to occur. The inclusion of a 'spectrum authorisations' option within the new framework could potentially create opportunities for different applications, with different requirements for spectrum access to coexist in the same spectrum. This might also facilitate emergence of the latest international wireless technological advances in dynamic spectrum access (DSA) in the Australian market, such as use of database systems that will determine operating parameters for concurrent use of spectrum, by reference to existing spectrum use and sharing conditions (for example, geo-location systems).

As input to its strategy for spectrum management reform under the new legislation, the ACMA asked Analysys Mason to assess best international practice in spectrum management, and to consider how best practice, market-based approaches to spectrum management might be extended in Australia towards achieving more flexibility in use as a means of meeting future spectrum demands. The study was completed in June 2017 and is intended to form an input to the ACMA's policy thinking in relation to prioritising new spectrum management approaches under the new legislation.

Within the study, we considered the appropriateness of applying flexible management approaches to different types of spectrum. Where market trends are clearly pointing towards re-assignment of key spectrum bands (for instance, due to under-utilisation), we also considered how regulators might weigh up the trade-offs between re-assignment, compared with moving to a position where more bands might be shared.

International best practice for spectrum management

As part of our study, we surveyed the approaches to spectrum management used in eight jurisdictions worldwide. From this survey, we selected examples of markets where regulators are implementing market-based mechanisms for spectrum assignment, and have evolved these towards more-sophisticated market-based spectrum assignment and sharing approaches. We focused primarily on sharing and flexible use that might potentially be facilitated by technological co-ordination techniques, such as DSA.

We found that current international trends highlight the importance of achieving more-flexible and dynamic use of spectrum as one mechanism of meeting future spectrum demand. However, the costs and timescales involved in adopting new market-based mechanisms facilitated by technological solutions (for example, the use of geo-location databases to manage the use of spectral gaps in real time, and to control the operating parameters of systems to avoid interference with other spectrum users in the same location) should not be underestimated, and represent a key barrier to wider adoption.

We also considered the risk that the potential for interference will rise with increased numbers of users sharing the same spectrum. The extent to which this risk becomes unmanageable by the market is dependent on the approach to

sharing (for example, via shared-use licences that the regulator enforces, or via a class licence or licence exemption, where many devices and systems are operating in an uncoordinated way). An important conclusion from our assessment was that the innovation goals that regulators are seeking to achieve from flexible spectrum use will be compromised if the risk of radio interference cannot be managed by the market. In addition, there is likely to be less willingness to invest in deploying services where predictability of high-quality spectrum access is absent.

We noted that the success of more-sophisticated market mechanisms for spectrum sharing will rely on the availability of real-time information on spectrum management and the interference environment, to facilitate frequency co-ordination and interference avoidance. The means of providing and maintaining this information in real-time are still being developed.

Finding the right balance for developing new spectrum management frameworks

We found that finding the right balance – between providing flexibility for new market players and ensuring predictability (including a stable competitive environment) for traditional mobile and wireless operators – is one of the challenges that the ACMA and other regulators potentially face in developing new management frameworks for spectrum. Where large-scale investment in new nationwide networks is required (for instance, within the mobile market), there may still be a need for operators to have individual licences that provide exclusive use of spectrum, to avoid undermining investment certainty through a lack of guarantee concerning spectrum quality.

We have also noted that, although flexibility in spectrum use is a useful general attribute, it is less important in periods when market developments are clearly pointing towards reassignment of

key spectrum (for example, towards mobile communications), as often seems to be the case today. Notwithstanding this, it is likely that, without sharing, finding sufficient amounts of contiguous spectrum as desired for 5G 'new radio' radio access networks (5G RAN) (for example, in multiples of 100MHz) will be challenging to achieve. Given that the frequency bands being considered internationally for 5G are in use by various satellite services where substantial investment in new satellite technology has been made (for example, 3.3–4.2GHz, 26GHz and 28GHz), there will be a need to implement appropriate sharing provisions between 5G and the existing services in those bands.

To address these complex trade-offs, best practice in established spectrum management techniques will be relevant into the future, to enable regulators to prioritise their choices of management approach from the range of mechanisms that might be considered. This best practice includes establishing demand for spectrum, assessing alternative bands/ bandwidths of interest for new uses, and identifying options for making spectrum available (as well as potentially consulting on these options with industry). This best practice can be facilitated by open decision making, including publishing materials online, consulting with industry and conducting cost-benefit assessments.

Analysys Mason provides a range of spectrum consulting services, including assessing trends in spectrum usage, meeting future demands, spectrum valuation, strategy and auction advice.

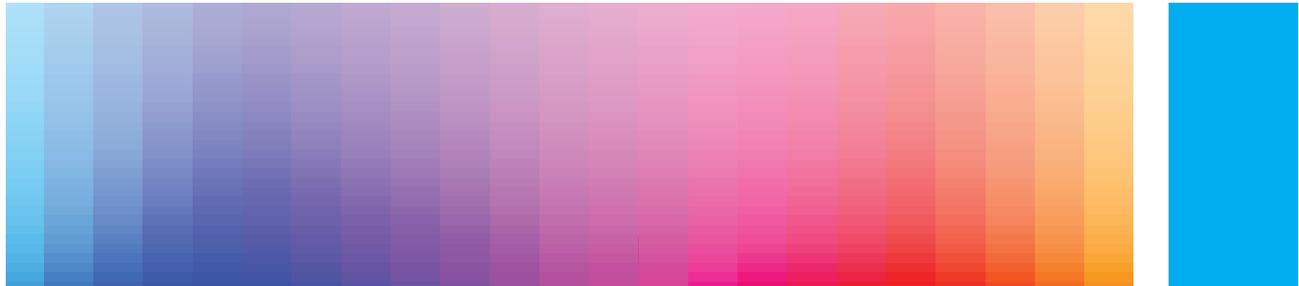
Questions?

Please feel free to contact
Janette Stewart, Principal, at
janette.stewart@analysismason.com

The full report is available at:

<http://www.acma.gov.au/theACMA/international-best-practice-for-spectrum-management>

Analysys Mason's consulting expertise on spectrum



We offer a range of spectrum management advice to our clients

- Assess spectrum needs
- Support to regulatory consultation process
- Value spectrum
- Support spectrum licence acquisition
- Offer technical spectrum advice
- AIP and spectrum pricing policy

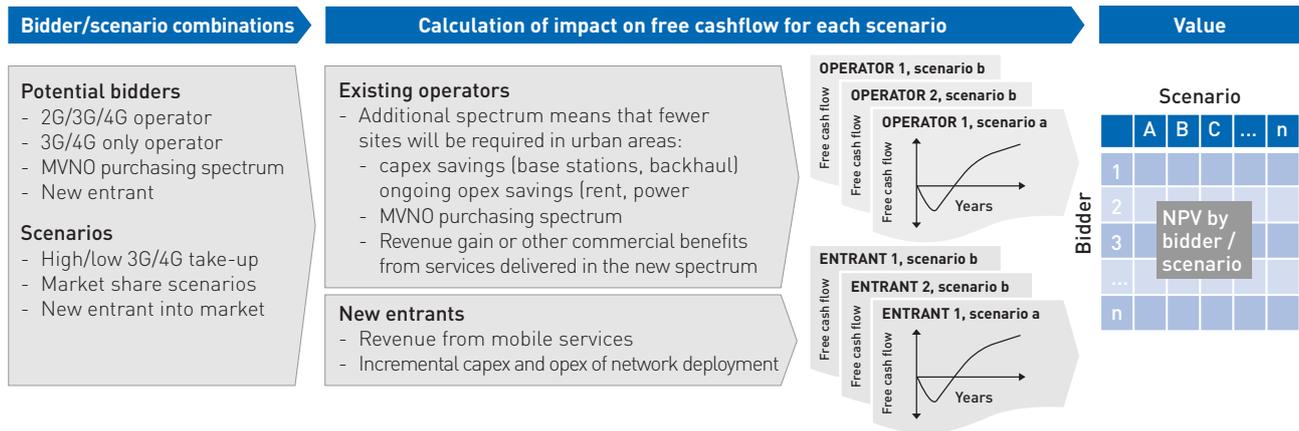
We have extensive experience of assessing spectrum requirements

Future spectrum demand	Map requirements against spectrum supply
<ul style="list-style-type: none">- Forecast future spectrum requirements, including:<ul style="list-style-type: none">- future service demand (e.g. mobile broadband/4G/5G)- impact of future technologies and performance- resulting spectrum demand	<ul style="list-style-type: none">- Understand wider technological and market developments, and their implications for spectrum usage- Review alternative spectrum acquisition strategies, including:<ul style="list-style-type: none">- spectrum trading and liberalisation- licence-exempt spectrum- Strategy implementation<ul style="list-style-type: none">- develop processes and roadmaps

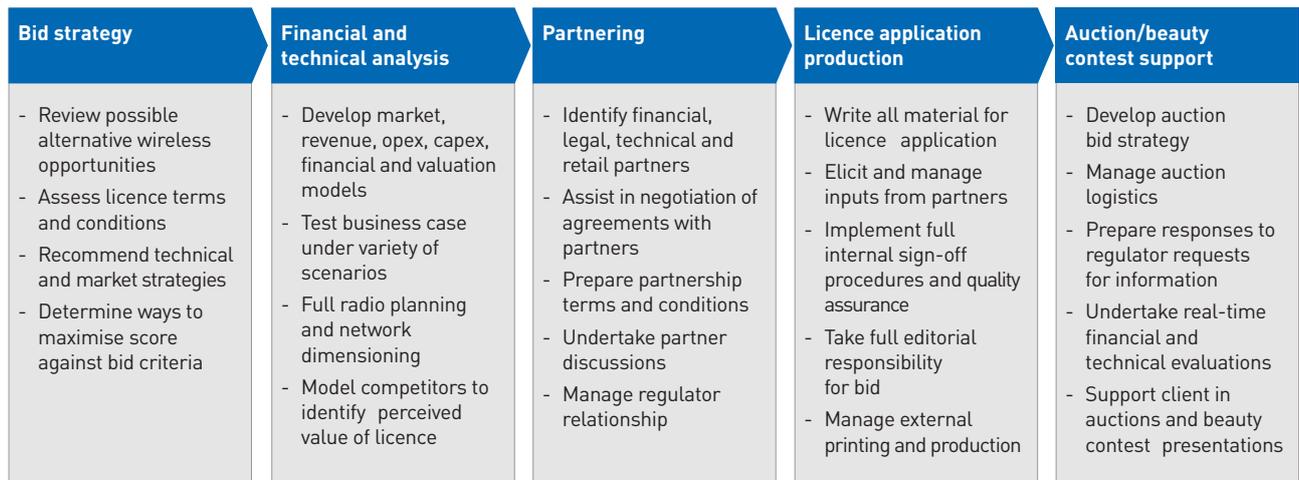
We have supported many responses to public consultations

Auction rules analysis	Economic assessment	Response preparation
<ul style="list-style-type: none">- Analysis of parameters of the consultations and auction rules, including:<ul style="list-style-type: none">- number of licences- spectrum packaging- usage rights- licence obligations	<ul style="list-style-type: none">- Development of economic arguments for responses- Detailed modelling of the value of the spectrum across a range of scenarios- Calculation of the economic benefits	<ul style="list-style-type: none">- Preparation of responses to regulator requests for information/attendance at information sessions- Real-time financial and technical evaluations during process- Support in auctions and beauty contest presentations

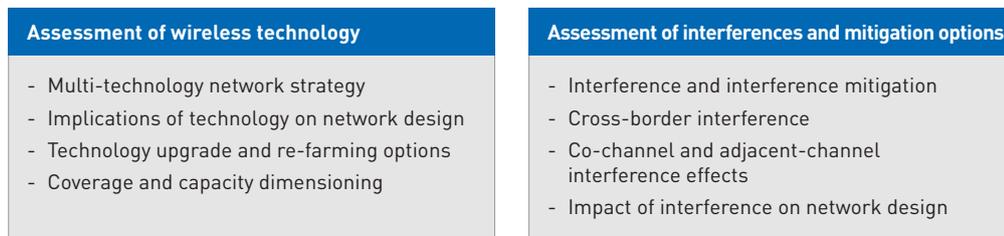
We have a proven methodology for valuing spectrum



We can manage the entire licence acquisition process



We have specialist technical spectrum expertise



Analysys Mason's consulting and research are uniquely positioned



Analysys Mason is a global consulting and research firm, specialising in telecoms, media and technology (TMT). Since 1985, Analysys Mason has played an influential role in key industry milestones and has helped clients through major shifts in the market. We continue to be at the forefront of developments in the digital economy and are advising clients on new business strategies to address disruptive technologies.

See what clients have to say about working with us: www.analysismason.com/client-testimonials

ABOUT OUR SERVICES

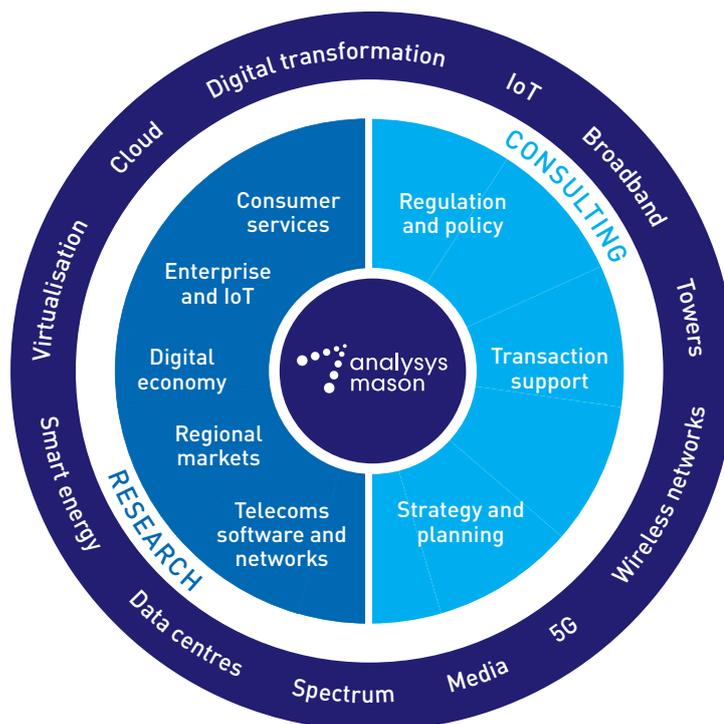
At Analysys Mason, we understand that clients in the TMT industry operate in dynamic markets where change is constant. Our consulting and research has helped shape clients' understanding of the future so that they can thrive in these demanding conditions.

CONSULTING

- We deliver tangible benefits to clients across the telecoms industry, including communications and digital service providers, vendors, financial and strategic investors, private equity and infrastructure funds, governments, regulators, broadcasters and service and content providers.
- Our sector specialists understand the distinct local challenges facing clients, in addition to the wider effects of global forces.
- We are future-focused and help clients understand the challenges and opportunities that new technology brings.

RESEARCH

- Our dedicated analyst team tracks and forecasts the fixed and mobile services accessed by consumers and enterprises.
- We offer detailed insight into the software, infrastructure and technology that deliver those services.
- Clients benefit from regular and timely intelligence, and direct access to analysts.



“Analysys Mason is a global consulting and research firm, specialising in telecoms, media and technology (TMT). Since 1985, Analysys Mason has played an influential role in key industry milestones and has helped clients through major shifts in the market. We continue to be at the forefront of developments in the digital economy and are advising clients on new business strategies to address disruptive technologies.”

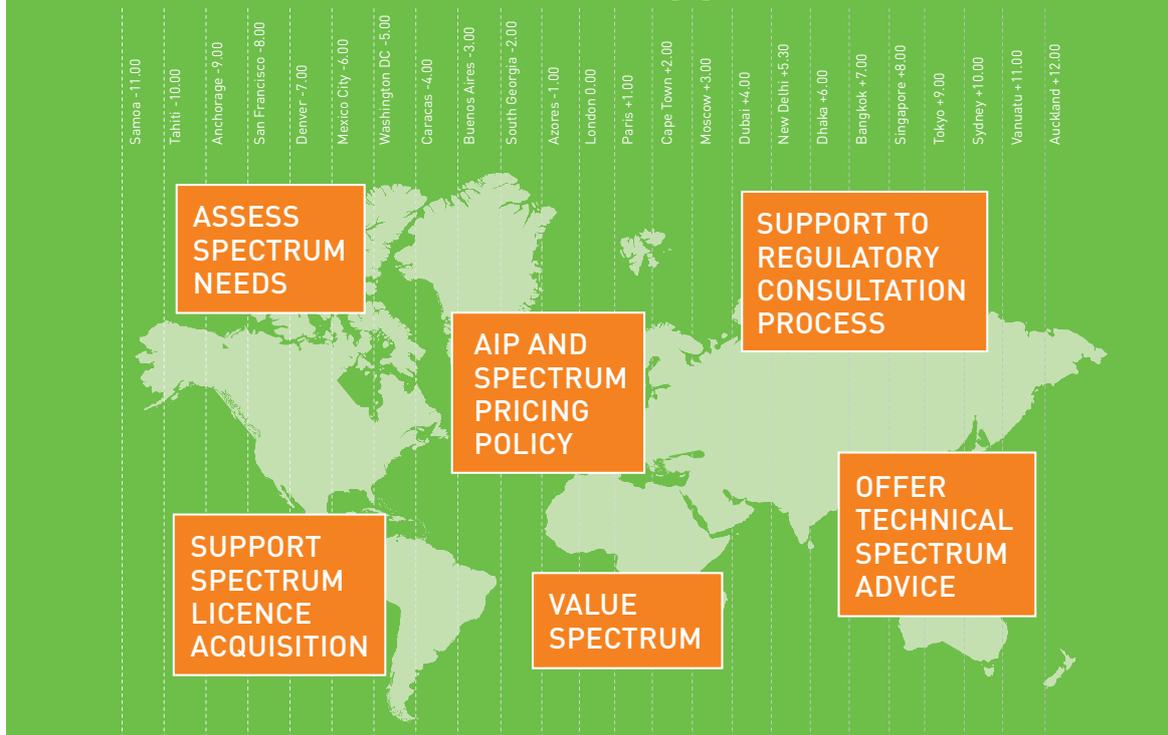
Analysys Mason assists clients around the world in all aspects of spectrum management

Over the last 5 years we have carried out

113 spectrum focused projects

in **42** countries for **67** organisations

Enabling clients around the world to make the most of their opportunities



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Consulting and research specialists in telecoms, media and technology (TMT)





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