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Small cell siting: regulatory and deployment considerations

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SMALL CELL FORUM
Solving the HetNet puzzle

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Small Cell Forum accelerates small cell adoption to drive the wide-scale adoption of small cells and accelerate the delivery of integrated HetNets.

We are not a standards organization but partner with organizations that inform and determine standards development. We are a carrier-led organization. This means our operator members establish requirements that drive the activities and outputs of our technical groups.

We have driven the standardization of key elements of small cell technology including Iuh, FAPI/SCAPI, SON, the small cell services API, TR 069 evolution and the enhancement of the X2 interface.

Today our members are driving solutions that include small cell/Wi-Fi integration, SON evolution, virtualization of the small cell layer; driving mass adoption via multi-operator neutral host; ensuring a common approach to service APIs to drive commercialisation and the integration of small cells into 5G standards evolution.

The Small Cell Forum Release Program has now established business cases and market drivers for all the main use cases, clarifying market needs and addressing barriers to deployment for residential, enterprise and urban small cells. Our most recent release focused on how to accelerate the commercial adoption of virtualization in small cell HetNets. It examines the business drivers and barriers to adoption, provides the nFAPI specification for a transportable MAC/PHY split for LTE small cells, addresses networking aspects such as architectures and x-haul bandwidth and latency requirement, as well as important aspects such as synchronization, orchestration and virtualized workload placement.

The Small Cell Forum Release Program website can be found here: www.scf.io

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About 5G Americas: The Voice of 5G and LTE for the Americas

5G Americas is an industry trade organization composed of leading telecommunications service providers and manufacturers. The organization's mission is to advocate for and foster the advancement and full capabilities of LTE wireless technology and its evolution beyond to 5G, throughout the ecosystem's networks, services, applications and wirelessly connected devices in the Americas. 5G Americas is invested in developing a connected wireless community while leading 5G development for all the Americas. 5G Americas is headquartered in Bellevue, Washington and officially announced the change of the organization's name from 4G Americas on February 12, 2016. More information is available at www.5gamericas.org.

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Scope

The successful delivery of dense HetNets depends on the collaboration of a large number of stakeholders – regulators, administrations, municipal authorities, site owners, operators and vendors. This document aims to outline the ways in which these stakeholders can cooperate to fulfil the maximum potential of small cells. It also aims to raise awareness among the stakeholders, ranging from equipment producers, operators, integrators, policy makers, and local administrations, that are involved in the approval, acceptance and roll out of the small cells layers of the mobile networks.

Executive summary

Ubiquitous, high speed mobile broadband is proven to have a significant impact on a country's economic competitiveness and social prosperity. For instance, a 10 per cent expansion in mobile penetration increases productivity by 4.2 percentage points, according to one report [1].

As traffic levels rise, and as more industries and cities become always-connected, the mobile networks will have to be designed in a new way. Notably, they will involve very large numbers of small cell base stations, which can deliver massive broadband capacity in urban areas and reach every corner of the country too.

Small cells, then, can achieve the mobile broadband objectives set by governments and cities round the world more effectively than traditional networks alone. They are a critical enabler of 4G densification and of 5G, and therefore of many services which governments are targeting to drive socio-economic change, whether those are for consumers, enterprises or the Internet of Things (IoT).

However, to achieve this potential, significant new approaches are needed in the regulatory and administrative processes which govern mobile deployments. Getting huge numbers of small cells into the right sites timely and affordably is essential, but to date, such programs have often been held back by cumbersome and outmoded processes at several levels:

- Approvals and certification for small cell equipment
- Approvals for site usage and deployment
- Infrastructure and spectrum sharing rules
- Health and safety rules

The small cell industry has made a great deal of progress in easing deployment and the SCF Release Program provides operators with a template to roll out dense networks in a scalable, repeatable way. However, the goals above will only be met in full with a combined effort by regulators, administrations, municipal authorities, site owners, operators and vendors.

This document aims to outline the ways in which these stakeholders can cooperate to fulfil the maximum potential of small cells. It also aims to raise awareness among the stakeholders, ranging from equipment producers, operators, integrators, policy makers, and local administrations, that are involved in the approval, acceptance and roll out of the small cells layers of the mobile networks.

Regulators and administrations have a major role to play in enabling frameworks which will ease deployment now and for 5G, driving significant socio-economic benefits. As the commercial and socio-economic need for dense mobile capacity and universal coverage becomes urgent in many areas, authorities around the world are starting to respond. Some innovative new approaches to small cell deployment and regulation are emerging, which will help create best practice examples.

One of the most critical steps is to support a universal set of classifications for equipment and promote it internationally when defining regulation and administrative rules, including exemption or lighter approval rules.

Other common issues underpin every deployment, but Small Cell Forum and 5G Americas believe that consensus could be reached with sufficient discussion and openness.

The checklist below highlights those core issues and potential solutions, which will be detailed in full in the report:

Key challenge	SCF Recommended solutions
Streamlining the regulatory approval for small cell equipment	Standard industry classifications of equipment with common documentation of compliance and conformity to be used when defining related policies; some of these classes can be subject to be exempt from approval process or to light regulatory regime.
Scaling the planning application process to support large numbers of cells	Common rules on which equipment classes can be exempt or subject to fast track approval; batch process for groups of cells, to decrease the approval time and reduce workload of local administrations.
Securing sufficient suitable sites with power and backhaul	Simplified common frameworks to ease the opening up the access to street furniture and other existing assets. Census of available assets per municipality. Open access to administrative buildings. Eliminate zoning approval for small cell installation
Cost of installation	Adopt simplified rules of installation that would enable non-skilled workers to deploy (based on classes of equipment and complexity of installation). Reduce fees and taxes (e.g. application and right of way rental fees, installation, operation, periodical revision taxes).
Public health concerns	Mandated use of pre-certified equipment with international kitemarks to alleviate fears
Administrative complexity	Single executive to coordinate all approvals (e.g., in a smart city program) Streamlined paperwork and filing to minimize the approval processes and reduce the workload of the administration.

What about rental cost expectations? Far from a macro level income?

In order to facilitate large-scale small cell deployments, the following recommendations, based on evolving best practice round the world, are proposed for consideration by regulators, administrations and municipalities in the Americas. These will be the focus of the report:

- Simplified procedures to optimize administrative flows of documentation processing
- Generic declaration of equipment at national/regional/local level
- Generic certification of equipment: internationally standardised accepted classes of equipment with installation rules/manuals => avoid additional documentation
- Generic permits for installation and operation
- Generic installation permissions (vs. site-by-site) and franchises for installation
- Building permits & access to public domain rights of ways: generic authorizations to access administration facilities, single applicable documentation form at national/state level

- Exemptions based installation based on generic criteria: antenna height, power levels, combination of power and height, on a regional-based level
- Environmental considerations: restriction of installation of equipment in sensitive areas
- Fees regime proportionate with the size of the small cells and the installation volumes tied to direct costs of managing the right of way

- Incentives for deployment of greener and environmental friendly equipment
- Lower/exempt taxation and local fees to encourage deployments -> alignment of rental fees with those of other 'essential' infrastructure (water, electricity, gas)
- New roles at the local level: new entities to handle the entire process, authorizations, certifications (operators' third parties, administrative staff)

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Mobile broadband has a significant impact on a country's economic performance and social inclusion. It can boost competitiveness for cities or whole nations, which is why so many governments have put ubiquitous, fast mobile connectivity at the heart of their digital policies, moving to open up more spectrum and initiate national broadband plans.

Broadband speeds and availability have been shown, in study after study, to drive digital inclusion, GDP and economic growth. In many cases, mobile broadband can be deployed more cheaply and flexibly, and supports a wider range of use cases than fixed-only.

A report by the GSMA, Deloitte and Cisco [2], concluded that:

- A doubling of mobile data use leads to an increase of 0.5 percentage points in GDP per capita growth rates
- Countries characterized by a higher level of data usage per connection have seen an increase in their GDP per capita growth of up to 1.4 percentage points;
- In developing markets, a 10 per cent expansion in mobile penetration increases productivity by 4.2 percentage points.

As an example, a report by Australian regulator ACMA in 2013 [3] (see Figure 1–1) found that:

- productivity growth from the mobile communications sector that led to an increase of $7.3 billion in Australia's economic activity (GDP)
- time savings for businesses as a result of mobile broadband use that led to a further $26.5 billion increase in Australia's economic activity.

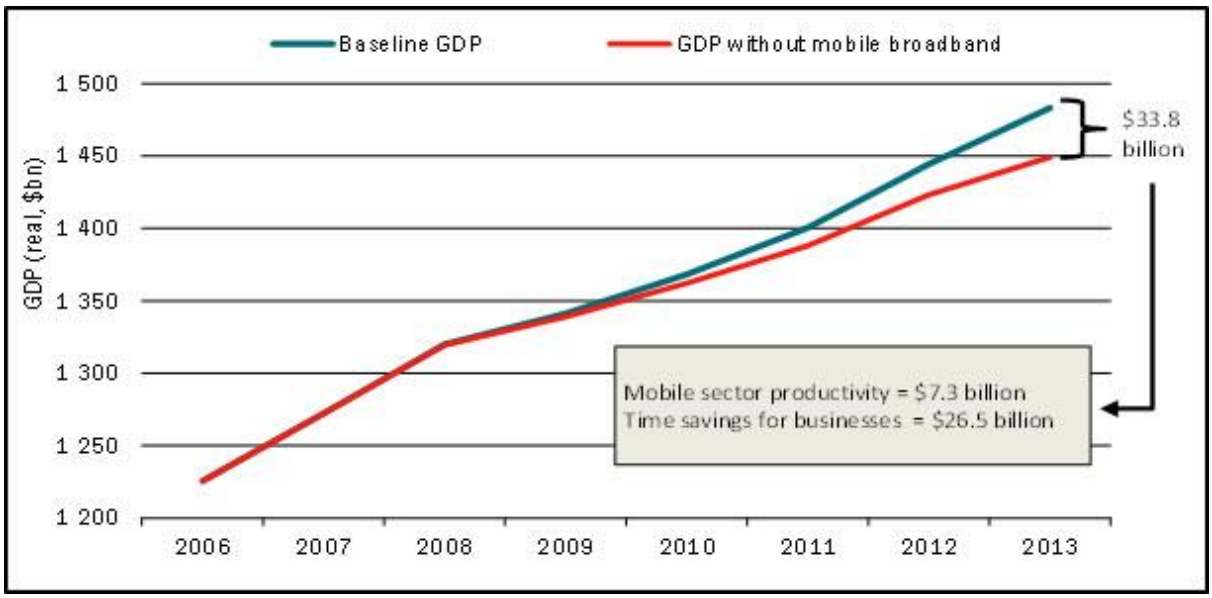

Figure 1–1 The impact of mobile broadband on Australia's GDP in 2013. Source: ACMA

2. The role of small cells in improving the socio-economic case

To deliver and enhance reliable connectivity for citizens and businesses, mobile broadband needs to continuously get faster and more reliable, meaning that network architectures are constantly evolving, densifying, and becoming increasingly focused on small cells. This is because:

- Levels of mobile data traffic are rising at an accelerating rate. This is pushing mobile network operators (MNOs) to adopt new network architectures better suited to handling high volumes of traffic at affordable cost. One of the most important elements is densification – adding to network capacity by building out large numbers of low cost, low power access points or small cells. Because of their large numbers, small cells present new challenges for equipment and site approvals and installation.
- User expectation of the quality of the mobile connection is rising too, as connectivity is becoming essential facility rather than a luxury. Many businesses have adopted mobile-first approaches, while many consumers consider their smartphone as their primary communications tool. This puts additional pressure on regulators to require and operators to build out ubiquitous, reliable networks, often necessitating large numbers of new sites.
- The mobile network will need to support a far wider range of use cases, each with different patterns of traffic and usage, as it evolves towards 5G. In particular, many vertical markets are entrusting key processes to mobile networks as part of their digital transformation, and the Internet of Things (IoT) is envisaged to connect billions of devices within a decade, many of them over mobile connections. Some of these applications will require mobile coverage in every corner of a country, supporting more demanding levels of latency and reliability than have been necessary in 3G and 4G.

Small cells represent a more practical and affordable solution to the request of making high capacity mobile connections truly ubiquitous and reliable. The higher the speed and availability of mobile broadband, the more the economic effect is magnified, as Figure 2–1, from a study by A.D. Little illustrates.

Figure 2–1 Economic impact of increasing speed and availability of broadband

Source: Ericsson/AD Little [4]

For any authority willing to enable universal broadband and all the socio-economic benefits that brings, small cells can provide a far lower cost alternative to macrocells-only, whether to private operators or state infrastructure programs.

Small cells can contribute to regulatory and policy objectives in several important ways, such as depicted in the Table 2–1 below:

Policy or initiative	Role of small cells
Smart city	Bring the ubiquitous coverage required for services like public safety, traffic management, etc. as they can be deployed in hard-to-reach locations such as underground car parks or even in pavements.
Smart digital community	A blanket of small cells can quickly and cost effectively bring broadband and cloud access to more (small) businesses, stimulating new economic activities.
Bridge digital divide	Provide a more affordable, flexible way to extend coverage to remote and rural areas, and to hard-to-reach urban areas, to enable universal broadband access
Maximize use of spectrum	Increase the spectrum efficiency by reusing the existing mobile operator spectrum for indoor operation, both the currently unused frequencies and those already used by outdoor sites. They can make use of high frequency spectrum as well.
Stimulate new consumer services	The location- and presence-awareness inherent in small cells can support and accelerate new commercial applications such as mobile shopping and context aware marketing, enabling new services.
Emergency response	Small cells can play an important role in providing vital communications for emergency teams. Their localized and dynamic nature helps to meet regulatory requirements placed on national carriers in such circumstances.
City aesthetics	Minimised impact on the environment, due to their relatively small and unobtrusive form factor. The visual impact on the surroundings can be further minimised if mounted on existing structures such as lampposts, walls, etc.

Table 2–1 The ways in which small cells can support common policy objectives of governments and cities

3. Increasing density makes a new approach urgent

To achieve the coverage and capacity levels required to deliver a fully connected society, small cells need to be deployed in a dense or even hyperdense manner, with some operators planning to roll out 200 or even more cells per square kilometer for high traffic environments like urban city centers and stadiums in the next few years. With 5G, that density will increase further; 5G is envisaged to support one million connections per square kilometer, which could involve 1,000 small cells in some scenarios.

Figure 3–1, from the European Commission's METIS 5G project, provides a high level view of the numbers of different types of cells involved in a next generation dense network.

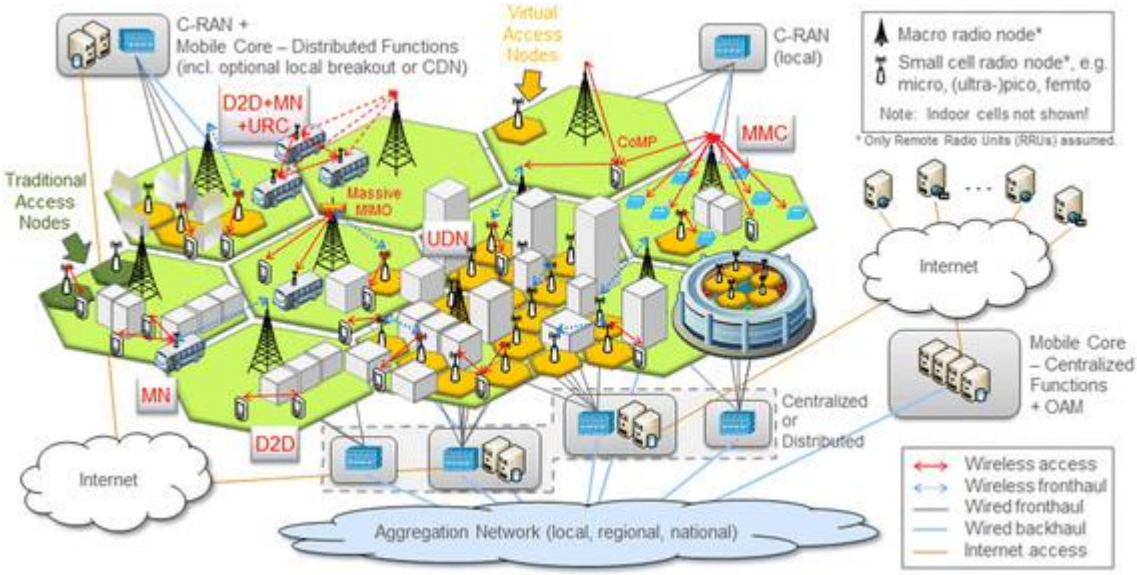

Figure 3–1 A conceptual 5G network. Source: European Commission 5G PPP METIS

Clearly, this will be a very different logistical proposition from deploying a macro cell on a tower or roof. Some of the new approaches relate to the planning and optimization of the network, particularly the increased automation of processes in view of the increasing number of equipment that will need to be installed and put in use. Figure 3–2 indicates the rising percentage of urban or enterprise small cells which will be deployed in dense environments.

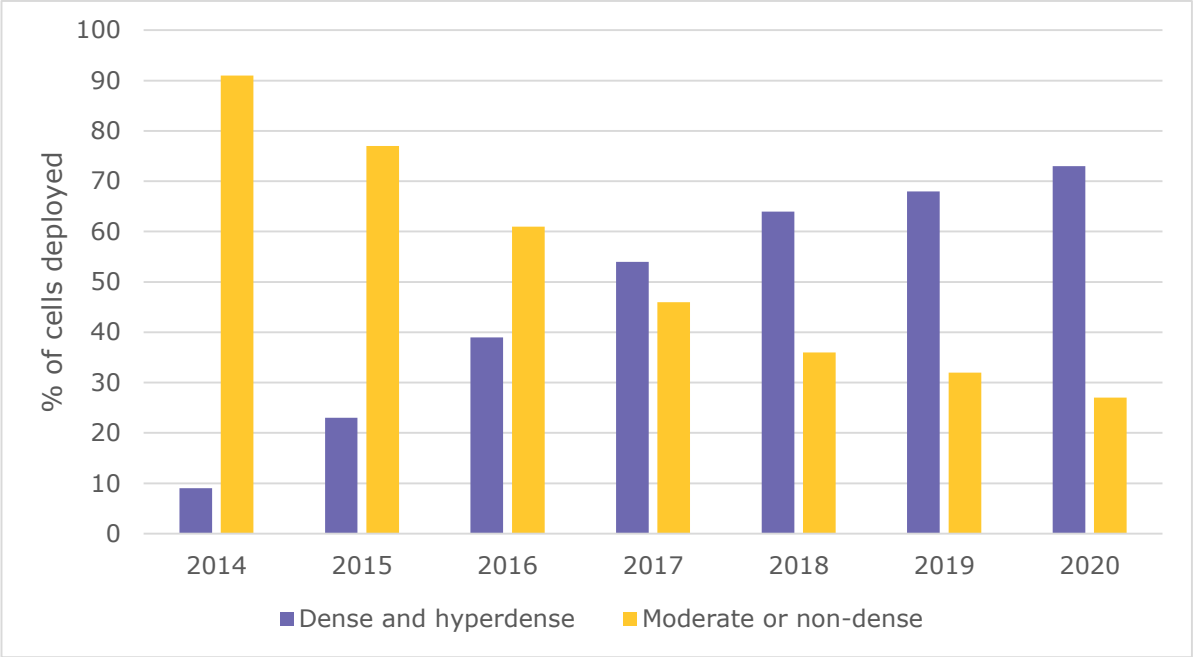

Figure 3–2 Distribution (%) of new small cells deployed by density

*Source: Rethink Technology Research forecast [**5**]*

- Low density small cells <20 per square km
- Medium density 20-75 per square km
- Dense 75-200 per square km
- Hyperdense >200 per square km

However, it should be noted that making it easier to deploy small cells is not simply about driving connectivity in an urban context. Easing the regulatory and practical barriers matter just as much in rural and remote contexts. For example, Small Cell Forum commissioned independent experts Real Wireless to assess the business drivers for small cells in rural and remote environments. Real Wireless found that small cells have the potential to deliver affordable mobile broadband coverage to an extra 650 million users worldwide with GDP benefits close to $1 trillion or an estimated operator benefit of $163 billion. [SCF150] [**6**]

The small cell industry has made significant progress in many phases of optimising and automating the deployment process, creating tools and frameworks which simplify the network design, construction, provisioning and optimization activities (for instance, see Small Cell Forum [SCF096] [**7**]. However, they are representing only the technical solutions developed to facilitate installation and reduce deployment time, while diminishing the on-the-spot human intervention to solve operational and maintenance activities.

4. Barriers to fulfilling the potential of small cell networks

Additional significant barriers to achieving the goals set in the national and societal policy objectives are to be considered; some relate to cost, whether networks are state-funded or built by private operators, others to technical or commercial factors. But a number of issues are of regulatory nature, arising from the rules and processes governing many aspects of mobile network deployment, from spectrum licensing and usage, to health impacts, to site planning and access to right-of-way and property, and taxation.

Enhanced deployment processes and resulting cost reduction would enable even denser networks to be deployed, with even greater impact. Currently, in many cases, even low levels of density are hard to achieve within reasonable timescales and budgets because regulation has not kept pace with the change in network architecture.

Consequently, improvements in operator's tools and approach to deployment and operations cannot overcome all challenges; a supportive planning and regulatory environment is equally important for the desired outcome.

The pressures on regulatory and planning agencies are certainly mounting, as large numbers of sites need to be identified and approved, planning permissions secured and other requirements, such as aesthetics and power limits, satisfied. The complexity may vary considerably in different regions.

The smoother and more streamlined these processes can be, the easier it becomes to deploy small cells to a scale at which they will deliver the maximum benefits, within optimal time and cost limits. There is still considerable work to be done to achieve this scalable, repeatable, streamlined approach to planning and approval.

Figure 4–1 shows a simplified deployment process for a public small cell project, from initiation phase to network build-out and optimization.

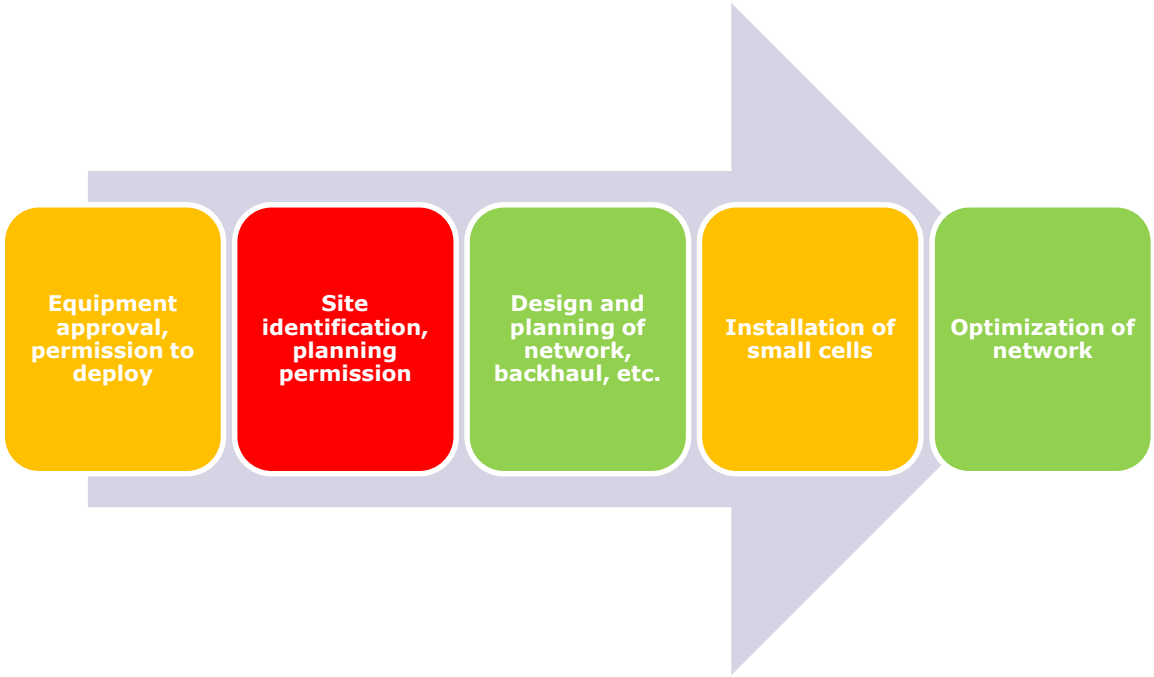

Figure 4–1 Simplified view of the phases of public small cell deployment

Each phase has a colour rating - based on operators' feedback - related to how robust and supportive the tools and processes are to facilitate each respective phase of the process (green = significant; amber = little; red = very little impact). This provides a clear indication that, while permissions to deploy and installation procedures are problematic, the operators feel reasonably optimistic about their ability to design, plan and optimize the networks. The greatest bottlenecks are perceived in the area of siting.

Despite the clear drivers for operators to densify their networks to respond to the increasing connectivity and service quality expectations, progress has often been disappointing because of challenges in some stages of the deployment process, which limit scalability and repeatability of the tasks. The key areas where operators report problems which either make deployment difficult or uneconomic, are:

- Gaining permissions to deploy including equipment approval
- Identifying and acquiring sites with backhaul and power
- Rolling out the cells in a repeatable, affordable way
- Addressing health concerns
- Supporting neutral host or multi-operator platforms

5. Solutions and best practice

In light of the rising need for dense HetNets to achieve their own national and regional broadband goals, many regulators around the world are devising creative approaches which can provide templates for others.

Further on, this document examines several of the main areas holding back dense small cell deployment, and suggests solutions based on best practice in certain markets, or on ideas coming out of the stakeholders - operator, vendor and regulatory - communities. This, it is hoped, to facilitate a greater dialog between the stakeholders in order to lower barriers, enable scalability, and unleash the social and economic benefits of ubiquitous high capacity mobile broadband.

Based on emerging best practice around the world, the checklist below indicates the main areas where regulatory and administrative authorities can work with operators to create a strong environment to deploy small cells at scale:

- Simplified procedures to optimize administrative flows of documentation processing
- Generic declaration of equipment at national / regional/local level
- Generic certification of equipment: internationally standardised accepted classes of equipment with installation rules/manuals, aimed at avoiding additional documentation
- Exemptions based installation based on generic criteria (e.g.: equipment size, location, street furniture used, antenna height
- Generic permits for installation and operation
- Generic per batch installation permissions (vs. site-by-site) and agreements for installation
- Eased access to the public domain: building permits & rights of ways – generic national authorisation form to access administration facilities, single applicable documentation form at national/state level
- Environmental considerations: reasonable restriction of installation of equipment in sensitive areas
- Proportionate taxation and fees regime for equipment and sites
- Incentives for deployment of greener and environmental friendly equipment
- Lower/exempt taxation and local fees to encourage deployments, alignment of rental fees with those of other 'essential' infrastructure (water, electricity, gas)
- New roles at the local level: new entities to handle the entire administrative process, including authorizations, certifications (operators' third parties, administrative staff)

While these proposals would require significant changes, in some cases, to the established processes of regulatory and planning authorities, the onus is not all on those agencies to change their ways. There is also the need for the small cell industry to work on areas like standard documentation and equipment definitions, and certification, and to share that work internationally, and with standards bodies and regulators.

In collaboration with industry groups, service providers, and manufacturers, the national and local authorities can work together to facilitate the deployment and adoption of small cells as part of the mobile networks that respond to the growing demand for wireless data connectivity.

6. The stakeholders in the small cells deployment process

One of the factors which adds complexity to the small cell planning, approval and deployment process is the large number of bodies which are potentially involved.

Stakeholders other than network operators, equipment supplier and radio frequency regulator may have a strong interest and a far greater role than in most macrocell installations because of the location of small cells[1]. These include the municipal planning authorities but also other interested parties such as landlords, transport operators or property developers.

However, the most significant stakeholders remain the administrative ones: the radio frequency (RF)/telecoms regulators, for spectrum usage and equipment, and the local planning authorities, for sites.

Figure 6–1 summarizes the role of each of these two groups, and the primary challenges associated:

- In the case of the regulators, many are using a framework which was devised for macro radio sites and is not well suited to small cells.
- In the case of the planning authorities, they often have to apply fragmented rules and processes, which were not devised with radio equipment or with huge numbers of units in mind.

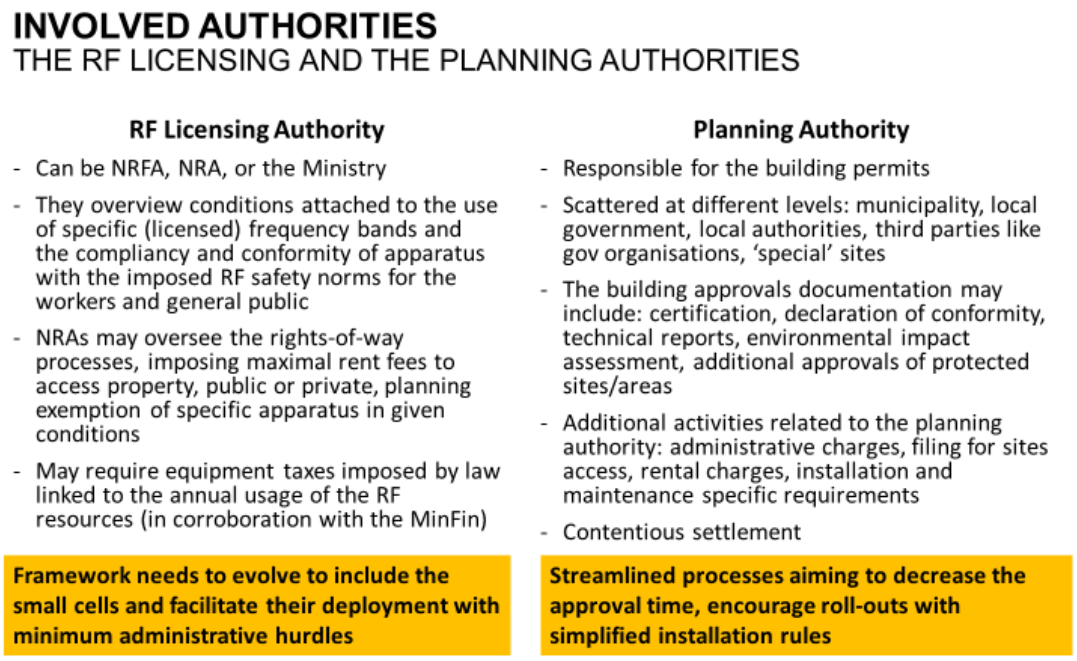

Figure 6–1 The roles of the RF licensing authority and the planning authority in small cell deployment

For both groups, a streamlined framework would make their jobs easier as well as improving small cell deployment at scale, so there is considerable mutual motivation on all sides to examine best practice and evolve new approaches. The next sections

[1] Small cells are deployed in the heart of the town or village, and often very close to people and streets; they may use publicly owned infrastructure such as street lights, but also be installed indoors within enterprise locations or shopping malls.

suggest some possible approaches, based on discussions and developments in real world situations in some parts of the world.

7. Solutions – Certification and approval of equipment (RF regulators)

Before an operator can start planning sites, the equipment must be approved and certified, a process which can vary significantly in different countries. The approval processes may differ in terms of complexity and length in each market; this, added to the cost and time to market, can make difficult the deployment of small cells at scale.

When large numbers of items are involved, as in a dense small cell deployment, the roll-out would be greatly facilitated by a system under which all cells of a certain category could be certified for RF compliance and generic approval. This would help achieve the repeatability and standard procedures which enable mass scalability.

In some areas, such regulatory provisions are already in place at national level. In particular, some jurisdictions, based on specific criteria, allow for:

- no specific planning permission requirements for roll-out of certain apparatus
- simple/no declaration regime
- simplified installation rules bases on equipment size/installation height

To deploy the forecasted volumes of small cells successfully worldwide, lighter administrative rules would be a significant boost. In markets where categories of equipment can be declared and certified generically at national or even regional[2] level, there has been a significant impact on ease and cost of deployment.

EXAMPLE 1

In the European Union, responsibility for compliance with regulations (power limits, interference protection, etc.) in low power networks such as Wi-Fi rests with the manufacturer, not with a third-party authority.

In general, the combination of Wi-Fi Alliance certification, unlicensed spectrum and a relaxed approval regime in many areas has enhanced the ability to deploy public WLANs quickly and inexpensively.

Many lessons could be learned for the cellular community. Small cells need to be considered similar to Wi-Fi access points (based on their size and RF power) and thereby:

- Be exempted from planning permissions
- Benefit from simplified local infrastructure policies and design guidelines for installation.

In particular, the small cell community would welcome:

- Simplified procedures to optimize the administrative flow of documentation during approval processes.
- Generic declaration of equipment at national, regional or local level. High volumes of individual equipment declarations can be a timely process for both applicants and administration.
- Where declarations are required, a single form available at national level would ease the filing process; if installing several small cells in a defined

[2] Regional meaning pan-national level, as in the case of the EU region

area, the declaration by batches should be also standardized and generically available.
- Generic certification of equipment based on standardized classes of equipment with harmonized characteristics (e.g. power output, weight limits) would ease the documenting processes; additional documentation could be avoided with standardized manuals and installation rules for each category of equipment.
- Generic criteria for exemption from the approval process – for instance, there could be national or even international agreement on the maximum antenna height, power levels etc. at which a unit could be exempt from full approval process.
- Reduced mitigation time in case of disputes (shorter timing and faster settlement than for macro base stations).

7.1 Common classifications of small cell equipment

Many of the above proposals could centre on an internationally harmonised classification of equipment that come with specific requirements, such as exemption of declaration, exempt or light level of permissions required for deployment, etc.

Criteria for simplified installation processes have been addressed in different ways through current standards and regulations. Most of them are using Effective Isotropic Radiation Power (EIRP) as the key criterion as well as installation height.

Some authorities have already made considerable progress on standardizing requirements and making some categories of equipment exempt. Mechanisms to avoid delays related to bureaucratic inefficiencies have been implemented, including exemptions for small installations or certain site upgrades, 'one stop shop' licensing procedures, and tacit approval if local authorities do not oppose an authorization request within a certain number of days. [8]

These provide some best practice examples which may make it easier for other jurisdictions to adopt similar frameworks.

Examples of existing applicable criteria for exemption or a simplified procedure:

- Antenna height: Canada (15 m), Germany (10 m), the Netherlands (5 m), or United Kingdom (4 m/15 m)
- Power level: Chile (low power), France (up to 5 W), Japan (low power type approved, 20 mW), and Malaysia (EIRP of 2 W), Germany (10W)
- A combination of height and power: United States
- Regional-based simplified procedures: Spain

However, there are many regional variations in what limits are acceptable for exemption.

International standards update – ITU-T KT.100 and IEC 62232 Ed 2.0

International standardisation is making progress to provide common criteria, valid worldwide. The two main emerging standards regulating human exposure to base station RF – and therefore governing the height, power limits, etc. of cells – are ITU-T KT.100 and IEC 62232. Both provide simplified criteria in their latest iterations, which could help ease the regulatory burden wherever they are adopted. There should also be increased alignment between the two during 2017, a great aid to standard product classes.

Over the past three years, IEC 62232 has been undergoing a complete refresh in order to clarify the evaluation processes. One of the key evolution of IEC 62232 Ed.2.0 is that it clarifies the simplified rules that can be used for product and product installation inherent compliance evaluation. These processes are particularly relevant for small cells. The new revision is set to be fully adopted by the first quarter of 2017.

Where small cell installations comply with the power and installation parameters defined for each class shown in Table 7–1, they should be deemed to comply with the exposure limits without further requirements.

Class	EIRP[a] (W)	EIRP (dBm)	Product installation criteria
E0	n/a	n/a	The product complies with IEC 62479 or the product compliance boundary dimensions are zero. No specific requirement for product installation.
E2	≤2	≤33	The product is installed according to instructions from the manufacturer and/or entity putting into service. Compliance with the exposure limits is generally obtained at zero distance or within a few centimetres.
E10	≤10	≤40	The product is installed according to instructions from the manufacturer and/or entity putting into service and the lowest radiating part of the antenna(s) is at a minimum height of 2.2 meters above the general public walkway.
E100	≤ 100	≤50	The product is installed according to instructions from the manufacturer and/or entity putting into service and : (a) the lowest radiating part of the antenna(s) is at a minimum height of 2.5 meters above the general public walkway, (b) the minimum distance to areas accessible to the general public in the main lobe direction is Dm[b] and (c) there is no pre-existing RF sources with EIRP above 10 W installed within a distance of 5Dm meters in the main lobe direction (as determined by considering the half power beam width) and within Dm meters in other directions. If Dm is not available, a value of 2 meters can be used or 1 meter if all product transmit frequencies are equal to or above 1500 MHz.[c]
E+	>100	>50	The product installed according to instructions from the manufacturer and/or entity putting into service and: (a) the lowest radiating part of the antenna(s) is at a minimum height of Hm meters above the general public walkway, (b) the minimum distance to areas accessible to the general public in the main lobe direction is Dm b meters, (c) there is no pre-existing RF source with EIRP above 100 W installed within a distance of 5Dm meters in the main lobe direction and within Dm meters in other directions. Dm is the compliance distance in the main lobe assessed according to Clause 6.1 and Hm is given by Equations (6.1), (6.2) or (6.3) of IEC 62232.[d]

a. EIRP (equivalent isotropic radiated power) transmitted by the single antenna including all its active bands.
b. Dm is the compliance distance in the main lobe of the antenna (from Clause 6.2 of IEC 62232).
c. When such condition is not fulfilled the installation is still compliant if the sum of the EIRPs of the product and nearby sources is less than 100 W. If the total EIRP is above 100 W then the product is still compliant if it is installed at a minimum height of Hm meters above the general public walkway and at a minimum distance from areas accessible to the general public in the main lobe direction of Dm meters, where Hm and Dm are obtained using Equations (6.1), (6.2) or (6.3) of IEC62232 for the sum of the EIRPs including those of nearby sources.
d. When such condition is not fulfilled the installation is still exempted from evaluations if the product is installed at a minimum height of Hm meters above the general public walkway and at a minimum distance from areas accessible to the general public in the main lobe direction of Dm meters, where Hm and Dm are obtained using Equations (6.1), (6.2) or (6.3) of IEC 62232 for the sum of the EIRPs including those of nearby sources

Table 7–1 Simplified installation requirements for base stations (from IEC 62232 Ed.2.0)

In Europe, IEC 62232 will replace the existing standard EN 50400 (EMF compliance assessment methodology for RBS installations) and will ease network operators to provide compliance with EU EMF requirements, which will improve operational aspects of deployment, especially for small cells (corresponding to classes EO – E10).

In other countries and markets, it is more uncertain whether K.100 or IEC 62232 will be adopted in regulations, e.g. USA and Canada will probably not adopt the criteria without modifications. [9]

EXAMPLE 2

Simplified regulation and compliance - Progress round the world

While regulation is still scattered and very national-centric, some examples of progress in simplifying regulation and compliance include:

- **EU** Sep2016 – Proposal for regulation to ease small cells deployment under the new European Electronic Communication Code (art.2(24) definition, art.56 deployment)
- **France** Based on EIRP – no declaration below 1W, light declaration for 1-5W. Since Mar2016 – annual site tax divided by 10 for BS installation subject to the declaration regime (1-5 W EIRP).
- **India** Adopted the simplified product criteria of ITU K.100 (with some modifications due to the lower EMF limits compared to the international ICNIRP limits).
- **Italy** Simplified procedure for implementing new small antennas sites taking into account a combination of radiating surface (< 0.5 m²) and power (<7 W at the antenna connector) – simple communication to Municipality and Regional Environmental Authority.
- **Germany** No RF approvals in case of EIRP<10 W; no building permit for installation height below 10m
- **Malaysia** Transmitters with EIRP ≤ 2 W are classified as inherently compliant. No permit requirement for low-impact facilities.
- **The Netherlands** There are exemptions or simplified procedures for small antenna masts up to 5 m, all license-free.
- **UK** Simplified procedures for small cell installation (simple declaration 56 days prior to installation). Small installations do not require an application for prior approval or full planning if they meet certain criteria. The mobile operators notify the local authority.

USA regulation is continuously evolving with regard to simplified procedures for small antennas, as depicted below. However, local regulatory and administrative law and rules at federal state, county and municipal level add complexity in dealing with small cells deployments.

EXAMPLE 3

USA – simplifying procedures for small antennas

In the USA, several provisions of FCC under the '*47 CFR 1.1307* - Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared' aim at exemptions/simplified procedures for small antennas (Table 1 of 47 CFR 1.1307), and for exemptions/simplified procedures for changes to existing sites (some provisions under 47 CFR 1.1307(b), 1.1307(b)(1) and 1.1307(b)(3)).

In August 2016, FCC signed an agreement with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers to exempt small cells from historic preservation review if they do not have a negative impact on the site.

A proposal of law *Mobile NOW Act [**10**]* (Making Opportunities for Broadband Investment and Limiting Excessive and Needless Obstacles to Wireless Act) is being considered by Congress. If passed, it will provide some additional relief from restrictive local siting laws that could apply to small cells. Its proposals on siting include:

- Expands the types of services covered by federal zoning rules and creates a new standard for 'unreasonable discrimination' by government officials. The current standard requires non-discrimination among providers of 'functionally equivalent services,' and the proposed new standard requires non-discrimination among providers of 'personal wireless services' as opposed to just functionally equivalent services.
- Pre-empts local governments' ability to require removal or replacement due to 'passage of time' or 'the availability of alternative technology or design.'
- Prohibits local governments from requiring information to evaluate an applicant's claim that there is a 'gap in coverage.'
- Bars local governments from governing the size or placement of emergency backup power systems and from taking any steps to ensure that such facilities comply with federal and state environmental regulations.
- Imposes for the first time limitations on fees a locality can assess on permits.
- Imposes the most conservative interpretation of the FCC's shot clock to include all proceedings required for the approval of an application.

Note: A full update on the legal changes round the world with regard to small cell regulation, since 2008, can be found in Small Cell Forum's document [SCF076] [**11**].

8. Solutions – site identification and planning permission (local authorities)

In the view of many operators (see Chapter 4, Figure 5), the greatest bottlenecks to large-scale deployment of small cells are linked to site identification and achievement of the planning permission. These areas require the greatest efforts - from both the industry and the administrations - to evolve towards a simplified, standardized and repeatable set of processes to support the massive build-out, timely and where required, as well as the objectives of the national or municipal administrations.

While macro base stations can often be placed conveniently, and only a few are required per area, small cells and HetNets must be positioned to support targeted coverage, for instance in urban canyons, shopping areas, etc.

Streamlined, standardized processes are ideal for scale purposes, but real sensitivities about base stations to be placed in the heart of the city and close to users, range from aesthetics to health fears. Communication between stakeholders, from early stages, to discuss and alleviate concerns of all sides, is essential; examination of best practice round the world would build regulator confidence.

Concerns linked to the roll-out may span over several densification issues, such as:

- Precision of location: Large-scale deployments of outdoor small cells in the 5G HetNets can demand for precise siting. As greater density of the small cells drives the size down of the equipment, which will call for greater precision in cell position near the location where the services are being consumed.
- Handling of siting approvals: Large-scale deployment of cells in a hyper-dense HetNet environment will call for a large number of siting approvals.
- Heterogeneity of planning processes: Planning policies fall under the responsibility of local public entities and can differ widely, depending of the local situations and peculiarities.

The above considerations can lead not only to a vast number of precise locations to handle, but also the increasing number and complexity of applications for operators, and evaluation and approval on the administrations' side. Such situations will virtually lengthen the administrative processes in the disinterest of the availability of services.

Across the globe, there is a wide range of legal and waiting periods for the approval process of RF sites, with a best practice of 20 days in New Zealand, but 3-6 months being more common in many other countries such as the US, UK and Italy. Figure 8–1 offers a synthesis of the similar procedures in the EU.

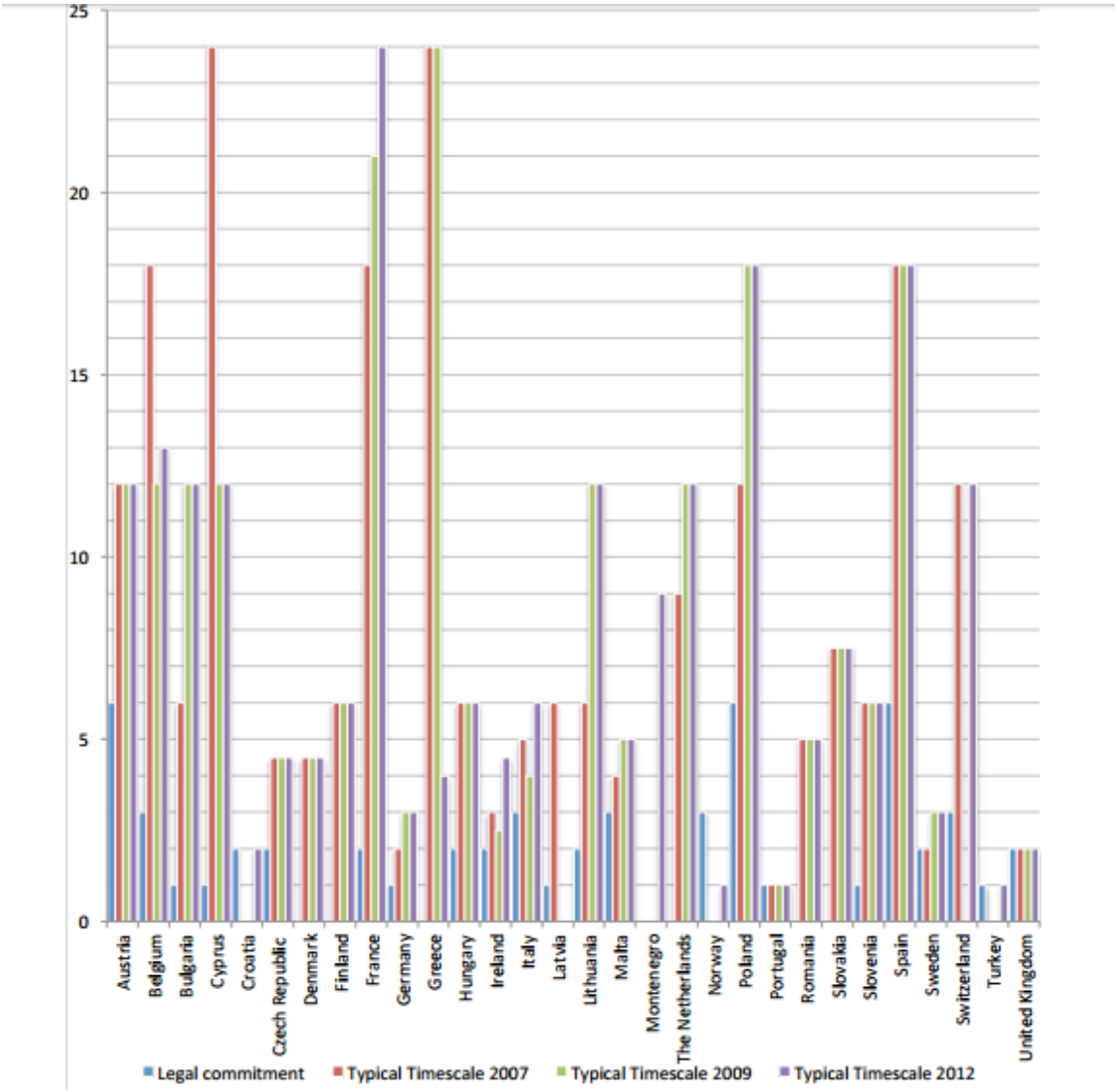

Figure 8–1 Legal requirements and typical timescales for permission to deploy base stations in Europe (in months)

Source: GSMA

In Latin America, the municipal-level permitting stands as the biggest challenge for the deployment of new wireless tower infrastructure [12]. In recent years, governments in Brazil, Colombia and Peru have approved and sanctioned new regulations that seek to standardize and simplify wireless infrastructure permitting procedures, and eliminate bureaucratic obstacles for the timely deployment of wireless infrastructure, including wireless towers.

EXAMPLE 4

BRAZIL - A complex and incomplete legislation

Amid the economic situation, Brazil is taking steps significant steps to contribute to the proper development of the telecommunications infrastructure in the country, in order to facilitate and encourage their implementation, expansion and modernization.

Several actions have been taken in the last years in this direction: in December 2014, the Senate approved the small cell tax break bill, followed later in April 2015 by the endorsement of the Law of Antennas (Law 13,116 / 2015) that streamlines the license for the telecommunications antenna installations.

The 2014 Small cell tax break bill extends the range of small cells equipment entitled to exemption from the Fistel telecommunications fee, for equipment with transmission power up to 5W. Previously, only equipment below 1W were exempt from Fistel, the fee charged by the telecom regulator Anatel to operators per transmission units installed. Equally the equipment transmitting between 5-10W will see their Fistel fee reduced.

Additionally, the General Law of Antennas of 2015 proposes a simplification of the process and establishes a maximum period of 60 days for licensing, equally recommending that the upgrade of municipal legislation to address specific deadlines to streamline the licensing process. The granting of authorization is handled by a single body, without prejudice to other municipal administrative bodies that may occur during the processing period. Without the manifestation of charge during the 60-day period, the license shall be considered approved (tacit licensing approval). Under the current law Anatel has to define the technical parameters for installation, maintenance and removal of the towers, and the supporting infrastructure.

Despite the lineaments of the antennas Law, the main challenge remains the difficulty of harmonizing the Union's competences with the performance of states and municipalities, with regard to the laws and urban policies associated with the installation of telecommunications networks in the country.

While the overall context is rather complex – a survey conducted by the National Union of Telephone and Mobile and Personal Service Companies (SindiTelebrasil) revealed the existence in Brazil, more than 250 laws that restrict the installation of towers and antennas, each with its own requirements and obligations imposed providers and holders – Brazil is paving its way towards establishing a better legal framework of the telecommunications infrastructure.

The situation can be also complex when targeting city deployments of small cells – as in the case of the city of New York. Several generic rules spanning from national to state and local level are applicable, and operators planning small cell deployments need to consider and comply with all these requirements. For example:

- Under the national/federal laws, the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) are dealing with environmental assessments and historic sites preservation. Section 106 of the NHPA requires that the FCC take into account the effect that issuing a license will have on historic properties. This involves review by State Historic Preservation Officers (SHPOs) and Federally recognized tribes.
- At state level, New York's Environmental Conservation Law and State Environmental Quality Review Act ('SEQRA') could potentially apply to the placement of small cells in New York City. SEQRA can apply any time a local

government permit or approval is needed to make an installation or perform construction. However, New York City has its own sub-process, called City Environmental Quality Review ('CEQR'), that governs New York City's obligations under SEQRA.

- The local level includes zoning, code, and permitting requirements; the NY City Zoning Code and City Code are to be considered when deploying metro cells as well as prior approvals from the Department of Buildings.

EXAMPLE 5

A New York Tale – complying with obligations for placing small cells

A study commissioned to evaluate special considerations existing in New York City identified six generic classes of addressable properties for which a number of different permits might be required by city, municipal, metropolitan, federal, and/or state entities. As such, a number of documents, fees, and/or contracts can be envisioned at the local level.

The typical obligations an operator would have to follow for placement of small cells include:

- Zoning. The New York City zoning code contains several provisions that relate to the placement of wireless communications equipment in the city. The permitting process generally involves the filing of an application describing the proposed structure and why it is necessary; an examination of the site by a city employee; a public hearing; and the issuance of a decision by the City Zoning Board.
- City code requirements. Various provisions of the New York City code will apply to the deployment of small cells equipment, including:
  - Building Code – construction, alteration and use of a radio tower. This code includes provisions governing tower location and accessibility, materials used in constructing towers, and the permissible weight of towers.
  - Landmarks and Historic Preservation. This code contains special regulations to govern construction or alterations on property classified as a landmark or located in a historic district.
- Permits. Before installing wireless facilities, the customer must obtain appropriate permits from the New York City Department of Buildings. An application for a permit is submitted on a form furnished by the Department and must be accompanied by the proper fee.
- The local obligations above are additional to the existing federal and state level laws. However, they should not be obstacles to small cell deployment. The generic applicable legislation includes the National Environmental Policy Act, the National Historic Preservation Act, and other state environmental laws.

The obligations differ from city to city, adding complexity in operators' processes and handling of authorisations and permits. As authorisations must be gathered from various entities, a streamed process, replicable at scale in metropoles and metropolitan areas are challenging and hard to achieve. A local approach is the actual solution that is location specific and time consuming.

In many cases operators deal with these administrative issues through local partners and, for the small cells, the role of the subcontractors can evolve in different models. One specific example is the 'acquisition, design, and construct' model in UK, where local agents control 'under one roof' issues like site selection, local planning consultations, and application submissions. The role of such entities is to establish relationship with the local administrations and continue working with them on regular

/ yearly basis. However, national applicable policies would help harmonizing working patterns between operators and/or their third parties and the local administrations.

The following list summarizes the various administrative requests that may apply:

- Equipment/system RF exposure limit certification, and eventual installation and services authorization, although some exemptions may apply
- Applicable national, regional, and local permits for installation and service operations
- Sectoral regulatory consideration
- Environmental, historical, and tribal considerations: planning restrictions for sensitive areas like schools, hospitals, historical buildings and preserved areas, or national parks
- Building permits: owner property authorization, public domain rights of ways, and other eventual mutualisation requirements. For instance, strand mounted Wi-Fi has been successful in the US because cable operators have the right of way.
- Applicable taxes and fees: national and/or local taxes and fees may be applicable under the form of equipment installation taxes, administrative fees, one-off and/or annual fees

Key elements to scaling small cells deployment are streamlined requirements and supportive regulation and rules at national and local level. Yet this list indicates the wide range of considerations and stakeholders which are involved. Given the number of entities that might be involved at the national and local level, the amount of paperwork required, along with the length of some processes, creates severe delays.

8.1 Recommendations for streamlined processes

A generic scope for planning with streamlined processes can assure the scalability required when deploying hyper-dense networks. Recommendations include:

- Installation procedures for small cells should be developed and established based on internationally accepted equipment classes, referenced similarly by the national administrations. The internationally accepted reference would enable generic permits for installation and operation.
- Scaled-down administrative processes applicable to small cells will speed up the administrative flow of documents for local planning approval and will allow faster roll-out.
- Streamlined process for small cells siting should consider, whenever possible, easy access to public and governmental properties for installation of such equipment.
- National-based rules regarding the rights-of-way for the deployment of small cells need to be considered for both the access to the property and administrative paperwork. Applying same policies on national basis will simplify and incentivize the roll out of denser network.
- Grant access to administrative buildings with a preferred regime will encourage, where possible, the use of these facilities vs. private locations.
- Ideally, a municipality could conduct a census of all available locations suitable for installation (to ease the classification based on power, fibre facilities, etc.)
- Put in place specific rules only for sensitive areas (military, historical sites, preserved natural spots), where installation might reasonably be restricted.

9. Solution - Using different types of sites

The massive scale of hyperdense small cell networks will require large numbers of qualified sites, plus more precise locations than macrocells, which results in less flexibility in choosing and gaining access to the appropriate site.

The challenges of precise siting requirements can be mitigated by various new approaches, which may also help to reduce administrative overhead:

- Mounting on a widening variety of existing structures (buildings, rooftops, street furniture)
- Mounting on new poles in some instances
- Use of alternative indoor locations
- Sharing of sites or a neutral host platform

It will be important for all stakeholders to take a creative approach to new types of sites, since in hyperdense situations, even solutions like roofs or light poles may be insufficient in number, at least in the right locations. The availability of qualified sites will therefore become a rising concern.

Despite efforts to streamline the regulatory and policy frameworks, the deployments encounter hurdles as the rules at local level are not yet completely coordinated with the national/federal ones, and access to sites is in some situations difficult.

EXAMPLE 6

USA – Access to municipal and cooperatively owned poles

Section 224 of the Communications Act, which provides wireless carriers with reasonable access at fair and reasonable rate to utility poles, does not apply to municipal and cooperatively owned utility poles. Until the Congress changes Section 224 to include those poles, the FCC should consider issuing guidance or best practices recommendations to municipalities and coops to promote wireless broadband deployment, particularly in dense urban areas where hundreds of nodes may be needed. Such guidance could make clear that prohibition on use of municipal owned light poles, excessive fees for attachments, unreasonable distance limitations for zoning in rights of ways, exclusive access agreements with a single carrier, and not allowing batch filings impede the small cell deployments.

Alternative developments will be valuable, especially if a generic planning permission process can be established for an entire category of sites, such as traffic lights. As such, engaging with the owners of many types of street furniture are important, as they can open up alternative locations: light poles, street signs, billboards, bus stops etc. Generic processes relate therefore to both publicly owned infrastructure and some private assets.

Virgin Media UK and Swisscom in Switzerland have even deployed small cells in pavements or under manholes, where they are invisible and can support ubiquitous coverage and specific applications such as smart parking.

JCDecaux integrates small cells into its billboards, which has several advantages, as:

- The billboards are plentiful, close to centers of population, and already installed and powered
- The small cells are almost invisibly installed

- JCDecaux is accustomed to negotiate with cities for a large portfolio of locations for its billboards, and has its own streamlined frameworks for agreeing large numbers of site approvals. As such, a large part of the approval process is already achieved.

Other examples of owners of site portfolios include:

- transport operators (railside or roadside sites, backhaul and infrastructure)
- existing mobile towercos which are amassing portfolios of smaller sites under standard agreements (e.g. Arqiva in the UK, Crown Castle in the US)
- public utilities which control light poles, powerlines and other infrastructure.

Any owner of a large portfolio of sites is well positioned to negotiate a blanket agreement, with standardized terms and conditions, with an operator. This is beneficial to operators as much of the administrative burdens can be passed to the sites owner. These entities often have the advantage of existing streamlined frameworks for agreement with local authorities and other stakeholders.

9.1 The role of neutral host/multi-operator deployments

One way to ease the approval and deployment process involves spectrum sharing. Operators spend a lot of money on spectrum, and are often unwilling at first exposure to let their competitors have access to it. But this reluctance fades for two reasons – the reduced cost of the infrastructure, where up to six networks can be served for the price of one, and where the spectrum is underused anyway, and the owner can earn revenue they would otherwise miss, by carrying traffic on behalf of a competitor, by measuring it and charging for it.

Historically, spectrum sharing has not always found favour with regulators, since it has often been viewed as a potential threat to healthy competition between national operators. However, the research undertaken during the production of this report indicates that several countries around the world have already authorized the use of active network infrastructure sharing including RAN/spectrum sharing in certain special circumstances such as underserved areas. This has been allowed, or even encouraged, in some countries where regulators have had strong policy objectives to extend mobile broadband coverage to areas of low population not likely to be served by multiple competing networks. The regulatory mechanisms by which this has been achieved are not always clear and vary from one country to another although some broad themes emerge.

Alternatively, in countries where a fully liberalized regime is in place, spectrum trades have occurred subsequent to the original award process, to enable transfers of spectrum rights from existing licence holders to a new JV. Both these approaches do, however, pose the risk that regulators and competition authorities may bar such applications or trades if distortion of competition is judged to be a significant risk.

Nevertheless, there are several examples whereby such deals have been accepted and this is especially likely to be the case in developing countries or regions where policy objectives to extend broadband coverage may outweigh competition concerns.

Newly emerging regulatory frameworks may bring additional opportunities for multi-operator small cell operation in spectrum currently occupied by military and other incumbent applications. The licensed shared access (LSA) concept developed within the European regulatory framework is one approach which may enable shared spectrum authorizations to be applied for. A similar approach called authorized

spectrum access (ASA) has been adopted in the United States which is primarily targeted at small cells. This is exemplified by the new CBRS service in 3.5 GHz (see below).

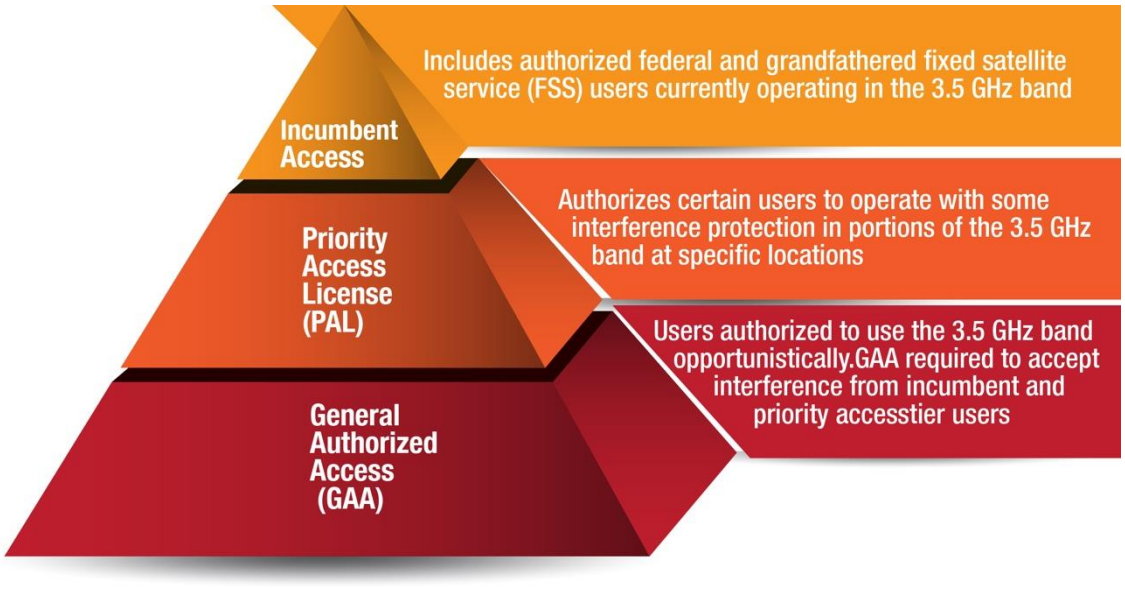

Figure 9–1 The 3.5 GHz ASA sharing scheme (CBRS) in the United States

The neutral host concept can take various models depending on the underlining regulation and its success needs proven. However, as networks evolve towards 5G and the access to high mmWave frequencies, sharing concepts may evolve to accommodate neutral host in dense urban environments, whether indoor or outdoor. Spectrum management for high bands, combined with a thoroughly developed operational model will highly influence adoption of such models like neutral host, SCaaS or MSA.

10. Solutions – installation

When regulatory and site permissions have been obtained, the next challenge is to install the cells in an efficient, quick and affordable way. The ability to do this may also depend on negotiation and cooperation with local authorities, especially when using publicly owned sites.

Physical cell installation in large scale HetNet deployments can be a challenge due to permits needed, equipment transport and installation, and large numbers of cells requiring set-up/ configuration. In some countries, it may be required to use workers employed by the local authority, or qualified by it.

Solutions, which involve new processes both for operators and municipalities, include:

- Lean cell site approaches, in which there is considerable advance base station set-up/provisioning in order to avoid site disruption and minimize time to perform installation.
- The use of standard classes of equipment and their installation rules can ease the installation, operations, and maintenance burden and alleviate concerns on perceived risk for workers. The installation rules attached to the equipment class indicate the level of knowledge and skills the workers require to make the respective installations. Such provisions open up the installation of certain classes to a larger community of generic workers, with an easy guide of installation, while reserving the more powerful equipment installations to trained personnel.
- Per-class deployment recommendations can reduce the complexity of O&M as well, and so decrease part of the costs of deployment and maintenance associated.

With intensification of the HetNet deployments new local level roles and dedicated activities can emerge, such as a 'street manager' directing a workforce which is proficient in rapid, high volume, street-level roll-outs, treating small cells as urban furniture.

11. Other regulatory issues

Sites and installation are not the only areas where regulatory and municipal authorities intersect with operators over small cells. Other important examples include:

- Health and safety
- Taxation and fees
- Smart city initiatives

11.1 Health issues

Along with aesthetic issues (addressed in Chapter 3), the main topic which creates community concern around small cells is the fear of health risks from radiation. These concerns may spark intervention or even obstruction by local councils, but operators can help by providing clear information and by taking decisions such as avoiding deployment in heritage areas.

The concern about health risks is in contrast to a number of independent expert reviews that have concluded that there is no convincing scientific evidence of a link between public exposure to low level radio signals generated by small cells. This is an area where local and central government can work with the industry to address community concerns.

A transparent exchange of information between authorities and operators is in place in most of the countries, as RF authorities require operator declarations of network infrastructure compliance with relevant national or international guidelines, issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and other relevant agencies. Such certifications should suffice for local authorities to allow deployments.

The operator's responsibility is to ensure that, once deployed and brought into operation, the small cell emissions fall within any additional limits specified by the national regulator as a condition of their spectrum authorization and comply with the existing rules in force. Declarations of compliance should be the de facto usage and post-installation measurement rather the exception, done by RF authorities as compliance verification mean.

Internationally accepted classes of products, pre-certified – based on the IEC 62232 Ed2.0 classification, as proposed earlier in the document – can also alleviate health concerns with the local authorities that would need afterwards to refer to standards rather than empirical explanations when communicating with the locals.

11.2 Taxation and fees

Another area where some local authorities could consider changing their rules to ease the path of small cells is in taxation and fees. As shown in some earlier examples, several taxes and fees are scattered with different entities involved in the siting and deployment processes.

For harmonizing and lower the taxation and fees burden, recommendations include:

- Apply proportionate taxes for small and their respective sites rental fees. As volume deployments are foreseen for small cells in the ultra-dense networks,

the actual roll-out will depend on the financial robustness of the business case. For site rentals, a two-pronged goal should target:

  - proportionate fees for small cells vs. macro base stations, and
  - alignment of telecom rental fees with those of 'essential' infrastructure utilities like gas, water and electricity.

- Lower / exempt taxation and local fees to encourage deployments by aligning rental fees with those of other 'essential' infrastructure (water, electricity, gas). E.g. In December 2014 Brazil passed a law which extends the categories of small cells entitled to an exemption or reduction of the Fistel telecommunications fee. In UK, the government [13] is evaluating ways to align rights of access for telecom infrastructure rollout to those of utilities like water and electricity. Given the priority that the Government attaches to digital communications and investment, and the ever more vital role this plays in economic growth, productivity and social interaction, a more radical reform is appropriate to limit the value of consideration to rates that are more relevant to modern infrastructure rollout.
- Remove specific deployment or spectrum usage fees for small cells, as most deployments are meant to augment existing capacity of networks.
- Provide financial incentives for the deployment of environmentally friendly networks; this would impact on green initiatives while boosting small cells, which operate at low power. Additionally, (SON based) dormancy features [14] can further diminish the diminish energy consumption and save significant amounts of power.
- Adjust rental fees for private properties, by setting by law the maximum price

In some countries, for historical reasons, specific situations have to be handled in respect to the legacy tribal considerations, as in the case of New Zealand or USA. Whether it is about heritage and request for reservation of radio waves or access to property, these issues have to be addressed with respect to the situation but also in a manner that assures that quality of service and coverage of telecom networks is achieved. The national laws existing in such cases should be completed with detailed recommendations or procedures as to avoid lengthy administrative processes and eventual litigations.

EXAMPLE 7

USA – Access to tribal properties

The National Environmental Policy Act (NEPA), 47 C.F.R. §1.1307, requires proposed new and modified wireless facilities to be reviewed for impact on historical properties. The reviews must be conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA) and involves review by State Historic Preservation Officers (SHPOs) and Federally recognized tribes. The FCC has excluded many types of deployments from these Section 106 reviews, but gaps still exist and create barriers to small cell infrastructure deployment.

One issue lays with the fact that delays in the tribal review slow down broadband deployment.

Under existing FCC rules, if a tribe does not respond to a proposed new or modified facility request after a period of time, there is a process for a deemed approval. However, no formal process exists to obtain approval from tribes that have responded with interest in consulting on the proposed site, but never actually provide input. The

FCC should establish a timeline for tribal review and deem approved any review where a tribe fails to meet the timeline.

In such situations, the FCC should provide clarity on when tribal fees are appropriate and establish a standard fee schedule for those instances: fees should not be required for mere tribal consultation or the FCC should work with the tribes to set a fee schedule.

Equally, the FCC should consider excluding new and replacement pole placements in rights of way and commercial areas from Section 106 tribal review, as SHPO review is already excluded.

11.3 Smart cities

As the idea of smart cities develops, there will be increasingly close relationships between local government and small cell roll-outs, which may enable smart city services which require density, such as vehicle-to-infrastructure services or public safety.

The growth of smart cities is likely to be a catalyst for some local authorities to pursue innovative approaches to small cell siting, in order to support the services they require. This may also lead to greater sharing of resources, such as personnel, and of costs and revenues in some circumstances. There may even be cases where the local authority acts as a neutral host platform for a small cell network, with its own applications as the 'anchor tenant'.

That might encourage the idea which is put forward by some parties, of a coordinating role within the city which would place all the various approvals and processes associated with small cell deployment in the hands of a single executive and team. Smart city projects are already starting to lead inevitably to this kind of reorganization, and it will be important for small cells to be included in the 'smart city director' remit.

12. The role of the small cell industry and of the Small Cell Forum

As mentioned earlier, progress towards a simplified, unified and streamlined approach to facilitate large-scale small cell deployments will come from increased communication and cooperation between all the stakeholders. The onus is not all on authorities to change their ways – the operators and small cell vendors also have a significant responsibility and role to play.

Much of this is about communicating – providing regulators and municipalities with the information they need to make appropriate decisions and working to alleviate their concerns.

The GSMA, for instance, believes that 'the provision of technological information to regulatory and planning authorities is an effective means of raising awareness and understanding of the deployment issues confronting members' [**15**]. GSMA recommends:

- Improved dialog with local authorities and other key regulatory stakeholders will increase understanding of network infrastructure development requirements and the impacts of local planning frameworks.
- The consultation process should take into account planning, environmental and community issues.
- The GSMA's members should consider whether communication with regulatory and planning authorities could be improved

However, collaboration between authorities and industry must be continuously developed and encouraged, as much of the work on devising commonly agreed equipment specifications, certifications, documentation and installation instructions – agreed to be the starting point for simplified regulation – must come from the industry itself, acting in a collaborative way. These inputs will serve authorities to elaborate laws and regulation that take into account, reflect, and accommodate technological evolution and trends.

In addition, the small cell industry must actively engage with operators and local administrations, associations of mayors, and national regulators to establish or update codes of best practices, guides for the local communities, etc. For example, the French regulator ARCEP established a dedicated group for communities, GRACO (Groupe d'échange entre l'Arcep, les collectivités territoriales et les opérateurs), aiming to facilitate telecom related planned developments and their impact on local communities.

12.1 The role of the Small Cell Forum

Small Cell Forum plays a vital role, providing a central hub for communication between all the industry stakeholders and a unified voice to build trust and best practice with regulators, administrations and cities.

The Forum is supporting and drives the central goal of achieving a common small cells classification, to underpin and enable changes in regulatory practice with the benefits summarized in Figure 12–1.

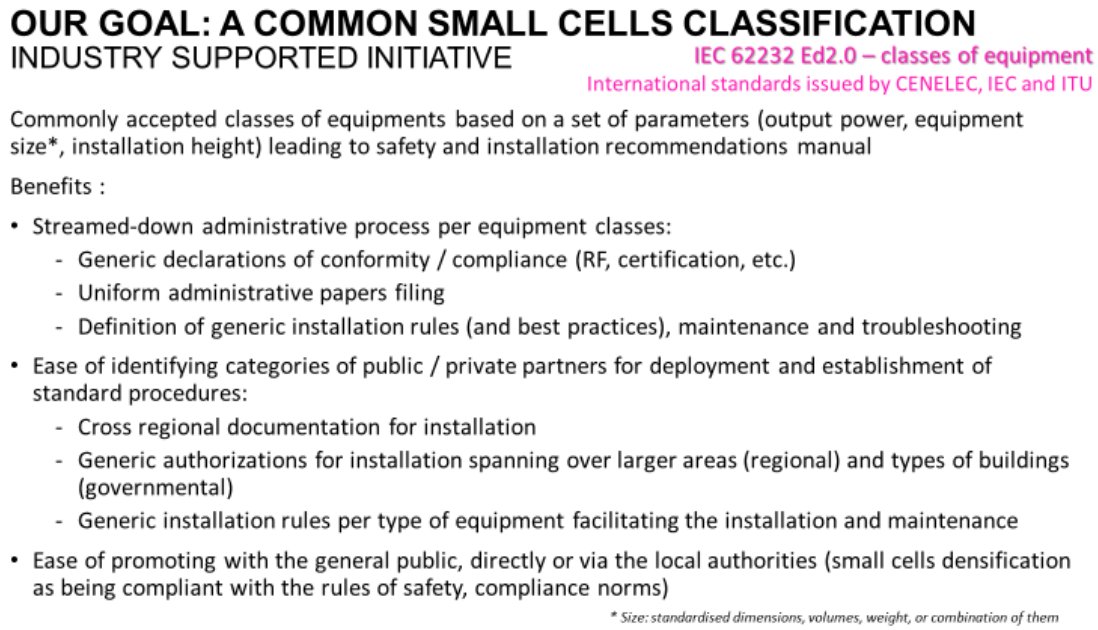

Figure 12–1 Summary of the benefits of the core goal of a common small cells classification

In addition, the Forum is developing best practice guidelines for states, regulators and municipalities in collaboration with 5G Americas in North America, GSMA in Latin America, and through working with leading carriers in the Middle East and Asia. In Europe, the Forum lately prepared its response to the UK Digital Economy Bill, and will follow closely the review of the European Council and Parliament of the European telecom framework, the Electronic Communication Code that contains regulatory proposals aimed to facilitate the deployment and operation of small cells. At the same time the Forum is continuing to urge national governments to strengthen deployment provision in support of the societal and commercial imperatives.

The Forum's regulatory objectives are:

- To encourage a consistent regulatory environment in a wide range of administrations, giving operators and vendors access to wider markets and thereby generating economies for providers and consumers alike.
- To assist national and local administrations in understanding the regulatory issues associated with small cells and, where necessary, to clarify regulations to enable their citizens to gain full access to small cell services.
- To ensure that any necessary clarification is identified and dealt with ahead of the time at which operators wish to provide services, permitting the benefits to be achieved in a timely fashion.
- To provide Small Cell Forum members with knowledge of the status of the regulatory environment for small cells across the world.

'While the air interface continues to dominate industry discussion, the biggest challenges in rolling out the dense networks associated with 5G lie in the underlying network architecture and fragmented and outdated national regulatory frameworks,' said David Orloff, Chair of the Small Cell Forum. 'We are actively engaged in defining operator and vendor priorities for bringing interoperability and consistency to the enabling technologies that will be the foundations for 5G networks. At the same time, it is critical that the industry works in conjunction with regulatory bodies to create an environment in which these networks can be swiftly and cost-effectively deployed.'

13. Conclusion

Densification and small cell initiatives which are starting now with LTE-Advanced will lay the foundations for migration to 5G as that emerges. In every aspect of the network, from radio to services to the logistics of sites and installation, the move to 5G will be easier if operators start now to introduce new approaches and processes.

In 5G, there will be a move to extremely dense networks, with heavier use of high frequency spectrum and the ubiquitous coverage required by many emerging IoT applications. That will increase the demands on sites and on streamlined, automated deployment processes. Technologies like SON [**16**] and virtualized RAN will become essential to enable the roll-out and management of huge numbers of cells and the rise of vertical market IoT networks will usher an even greater variety of stakeholders into the mobile ecosystem.

It is therefore essential for regulators and the industry to consider the best processes and rules now, at an early stage of densification, so they have a strong body of unified frameworks and best practice, before the even greater challenges of 5G kick-in.

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