



ERICSSON

RETHINKING ENERGY PERFORMANCE

INCREASE APP COVERAGE, LOWER ENERGY

February 2015

RETHINKING ENERGY PERFORMANCE



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Technology is developing faster than ever, and with demands pulling at operators from all directions, it's vital that networks are streamlined and efficient.

With more subscribers wanting increasingly powerful connections, how can operators increase coverage and capacity, while reducing energy use?

For years, the focus of the telecom industry has been primarily on improving the energy performance of the 'box'. Now we need to evolve from this, and encompass all areas of the network.

A complete approach to energy performance means considering the whole network.

Operators need to remember three key actions: address the installed base; build with precision; optimize on site.

By addressing the installed base, the entire network's demands are taken into account. Building with precision ensures that a network has the capabilities to meet the traffic demand while using energy efficiently. Optimizing on site gives operators complete control over the energy consumption chain.

When energy is managed in a systematic way, it's possible to see capacity grow, while energy consumption is reduced.

We can provide operators with the tools to not only create a network that uses energy in an optimum way, but that delivers increased app coverage.



CONSIDER
the whole network

THE STATE OF THE INDUSTRY



It is essential that an operator plans for both present needs and future demands. Taking into account the state of the industry today is necessary when choosing an energy performance program, but failing to make this solution adaptable for future changes could be a costly mistake.

New technology and traffic growth will continue to push network evolution and expansion. Looking forward to 2020, it's predicted that all current radio technologies will continue to coexist, as well as the addition of 5G. Therefore, operators will need to use their entire network to provide the best user experience with app coverage.

Traffic growth is inevitable but ensuring opex doesn't increase with traffic is essential. Rethinking energy performance is vital to this.

Moving away from the box

The state of the industry, with its rapid traffic growth and multi-standard, multi-band, multi-layer complexity has meant box-to-box energy comparisons are no longer enough.

A product chosen for its low energy consumption, without considering its level of performance and capacity, will not be a sustainable choice. A box-to-box comparison will always source the low energy/low performance option as the best choice. However, in reality, the lower capability box will need to be replaced or added to. This is due to the need to keep up with expanding traffic, growth, and updates, incurring higher energy usage, and the attempt to lower energy usage will be unsuccessful. Only by looking at both current and future requirements and considering the entire network, can energy performance be achieved in a sustainable way.

WHAT IS APP COVERAGE?

App coverage brings together all aspects of the network, allowing a more comprehensive view of performance to be taken, meaning an operator can deliver a level of service that consistently meets user expectations everywhere in the network.





THE EFFECT OF ENERGY POLICIES

An operator's energy policy has a direct impact on the network's energy performance. If an operator considers every part of the business and the network when creating and implementing policies, it can lead to a tremendous reduction in energy opex. Operators that take a short-term, narrow approach to their policies will find that in the long run, their efforts will fall short.

Having one policy that incorporates information and goals from different parts of the organization will see a smooth transition occur in the journey to lower energy consumption. This one policy must cover every part of the value chain, for maximum savings and total control.

Most operators' organizations are not currently optimized for the reduction of energy on Radio Access Network (RAN) levels. This may be due to a lack of interest in deploying optimum radio system designs for different purposes, as well as not utilizing software features in a way that achieves energy savings.

We can help operators overcome these hurdles by sharing our experience and solutions.

RAPID FUTURE GROWTH

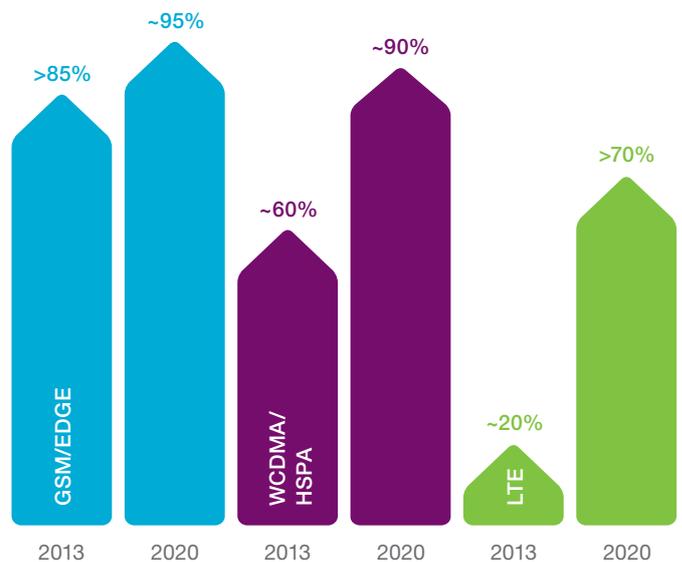
Rapid growth in smartphone usage has meant that operators need to start preparing for the future now. With rising forecasts, higher demands for better connectivity based on bandwidth-hungry applications, and ever-increasing subscriber numbers, networks need to be ready.

This exponential rise in traffic will have big consequences for operators, who will need to provide high quality connections for subscribers, regardless of their location.

Operators need to improve the efficiency of GSM, in order to release the spectrum to WCDMA and LTE. Furthermore, WCDMA (low-band) needs to be built out on every GSM site, and LTE is needed in high-traffic areas to meet demands using new spectrum bands.

However, operators may be hindered by energy and power allowances at existing sites. Being limited by the amount of power that can be used at a certain site will prohibit operators from expanding their capacity, and may put them at a competitive disadvantage.

Figure 1: World population coverage by technology



Source: Ericsson Mobility Report, November 2014

THE SYSTEMATIC APPROACH

Ericsson has a system-wide approach for energy performance, designing solutions that will reduce energy consumption while increasing app coverage. By addressing the installed base, building with precision and optimizing on site, operators will see a difference in their energy use and resulting performance levels.

We can offer alternatives to the box-to-box comparison route. We have a host of solutions, created to help operators of any size, on any technology, improve their energy performance. Developed to cause as little disruption as possible, and with operators' installed bases in mind, we have created a series of solutions to approach energy performance in the best way.

Networks will evolve: traffic growth is driving RAN expansion, with more sites needing to use multi-radio technologies.

Future RAN will need all technologies in order to compete and be the best performing network.

GSM will have to be made more efficient, with a wider rollout of WCDMA and LTE. The number of LTE rollouts is predicted to be huge – and that's only the growth forecast up until 2020, and then 5G will be introduced.

Energy challenges will arise when available energy budgets become too tight. Added to the challenges of reducing energy consumption is the need to abide by organization and government policies.

Operators need to address the installed base, choosing a solution that covers all generations. There is a need to build with precision: using the right amount of energy, at the right time. On-site challenges need to be taken into account, such as volume, size and power constraints.

ADDRESS THE INSTALLED BASE

Energy performance solutions need to address current and future technologies in any operator's network. Whenever new radio technology is added, the existing generations typically remain. Solutions therefore need to address the complete installed base. These solutions include:

- > Enabling RAN specific energy saving features for 2G, 3G and 4G. This will give operators the potential to reduce energy consumption in existing radio equipment
- > Prolonging capacity lifecycle. An energy efficient network is one that can deliver the needed capacity for an extended period of time, based on flexible capacity growth, rather than hardware upgrades. Network capacity can be increased by staying current on the latest software releases, without adding new hardware
- > Using capable hardware everywhere. New hardware platforms that support multi-standard with a reduced footprint are much more energy efficient



Increase network capacity without adding hardware

Figure 2: An example of WCDMA software to remove capacity bottlenecks

Bottleneck	Traditional solutions	Unique Ericsson software solutions
Uplink channel elements	<ul style="list-style-type: none"> > Add additional baseband capacity 	<ul style="list-style-type: none"> > Features reduce the impact of uplink channel elements consumption
Downlink power	<ul style="list-style-type: none"> > Add new carrier or increase transmitted power 	<ul style="list-style-type: none"> > Features reduce the impact of power limitation
Downlink HSDPA codes	<ul style="list-style-type: none"> > Increase baseband capacity > Add new carrier 	<ul style="list-style-type: none"> > Features reduce the impact of code limitation
Uplink interference	<ul style="list-style-type: none"> > Add new carrier 	<ul style="list-style-type: none"> > Features reduce the impact of uplink interference or reduce the device power utilization

Boost performance with RAN software

Ericsson offers RAN-specific energy saving software functions that adapt energy consumption to traffic: operators can ensure they are delivering the right amount of performance when it is needed. Typically, design philosophy is either to reduce the output power of the carrier, or enable discontinuous transmission when possible.

These savings are in the range of 20–120 W per cell, which adds up to an impressive amount, due to the total of small savings on many cells. For example, BCCH power saving is a GSM feature that provides 40 W savings per cell. If this is applied over 10,000 sites with 3 cells, savings in the region of 10.5 GWh and EUR 1.6 million could be achieved over the course of a year for a typical GSM network.

Figure 2 shows some examples of how our WCDMA solutions of rethinking energy performance can help operators solve capacity bottlenecks with software, instead of having to add new hardware. This ensures that capacity growth can be managed. Operators will be able to deliver the needed capacity over time, prolonging the hardware capacity lifecycle, resulting directly in increased network energy performance.



Use capable hardware

Despite the ever increasing power of software, existing hardware will need to be replaced at some point. New hardware platforms should provide multi-standard support, a reduced footprint and the best energy performance.

The Evo Controller 8000 is a vital component of the RAN evolution strategy. It combines the functions of the GSM Base Station Controller (BSC) and the WCDMA Radio Network Controller (RNC) in one common network controller.

It is also possible to have up to three Wi-Fi controllers (WIC 8030) configured in a single RNC. The Evo Controller 8200/BCS, with support for more than 12,000 TRXs in one single cabinet, brings capacity density to the next level. One Evo Controller can consolidate up to 40 BSC and RNC cabinets into one, reducing power by 90 percent.

INDUSTRY
BEST

radio energy
performance

50%

improvement
in energy
efficiency

ERICSSON RADIO SYSTEM

With the Ericsson Radio System, we have established a generational shift in mobile networks for the 5G future.

The system enables radio system transformation to address the constantly increasing demands for app coverage from consumers, businesses and industries.

It ensures efficient and sustainable performance from the industry's smallest radio units and offers the lowest power consumption. While doing so, it reduces energy consumption and optimizes spectrum resources.

The Ericsson Radio System lowers capex and opex through its high-performance and flexible site configurations, with innovations like one-bolt installation.

The new radio unit has the industry's best energy performance, and provides a 50 percent improvement in energy efficiency. This is due to highly integrated electronics and advanced power amplifier architecture. While the weight and size of the radio has also been reduced significantly, it can support three times as many as radios in the same volume. Together with the extreme modularity and flexible site deployment, it changes the building practice for high-density sites.

The Ericsson Radio System also comes with the most powerful baseband ever. On one board, it is able to handle twice as many cells as existing baseband units: it supports both LTE TDD and FDD modes simultaneously.



Figure 3: The Ericsson Radio System's Radio Unit

BUILD WITH PRECISION

Using the right equipment in the right location at the right time is a key part of improving energy performance – and an area where many operators fall short. Ericsson offers insights into traffic and network reality, enabling operators to understand how traffic is distributed, and therefore dimension the network effectively (Figure 4).

Figure 4 shows that mobile traffic distribution is highly uneven. Our observations concluded that half of a network’s sites carry only 15 percent of the total traffic, while 5 percent of the sites carry 20 percent of the traffic. The Ericsson Radio System’s modular and flexible architecture provides solutions suitable for the complete range of site requirements, from extreme density to those with lower traffic. Our insights reveal that low-load sites, typically comprising 50 percent of an operator’s network, are often over-dimensioned.

Having more control over the equipment and the way it is used is an integral part of reducing energy consumption. Over-dimensioning, a commonly used yet incorrect solution, does not always result in performance gain. Instead, it more often leads to increased opex, higher energy consumption and inflated capex – all of which impact the TCO.

Operators may be concerned by rapid traffic growth, and therefore believe it is safer to have powerful equipment everywhere. We also found that traffic growth is not uniform – it tends to increase at times and in locations where it is already high, while growth is much slower in the places where loads are low.

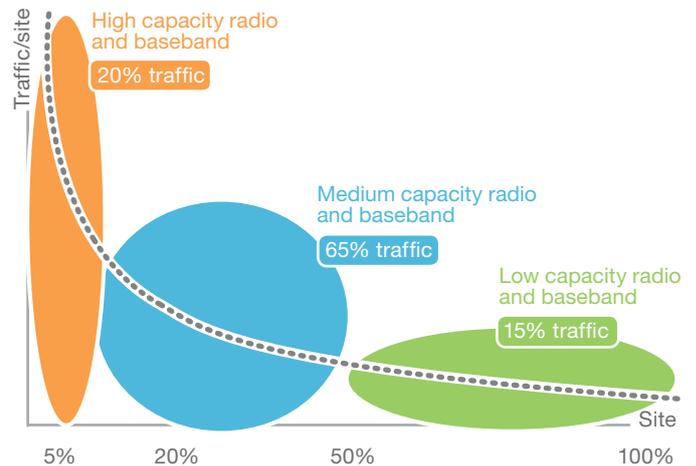
It is also important to highlight that site diversity with both low and high loads exist across the entire network. Some sites in dense urban areas experience little traffic, while some rural sites cover large geographical areas and carry a comparably high traffic load.

Precise dimensioning with the right radio and baseband for each traffic segment will not only significantly reduce energy consumption, but also sufficiently support future growth.

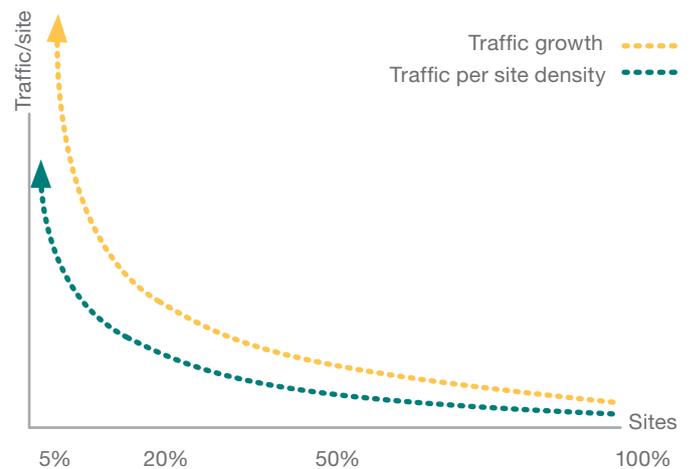
In one trial, energy consumption of a deployment with traditional, large, capable equipment was compared to one with precisely matched solutions. The latter’s choice to precisely match its demands resulted in a 40 percent reduction in energy use.

Figure 4: Dimensioning a network efficiently and effectively

a. Traffic distribution



b. Traffic growth



c. Network reality



ENERGY PERFORMANCE VARIES

depending on radio system architectures



Energy performance also varies depending on different Radio System architectures. The careful selection of optimal Radio System alternatives can easily reduce energy consumption.

It is commonly understood that the placing of radio transmitters close to the antenna improves the quality of the radio link. Due to this, Remote Radio Units (RRUs) have become a well-established industry deployment.

Using RRUs eliminates energy losses in feeders and jumper cables, as well as reducing cooling needs.

We have a unique solution to provide app coverage in low density areas. Our Psi-Coverage solution uses a single radio unit to provide the same

coverage as an ordinary 3-sector base station equipped with three radio units. Using less hardware reduces energy consumption by more than 40 percent, while maintaining the same performance. Psi-Coverage has also evolved to support multi-standard – both LTE and WCDMA, and dual-carrier HSDPA, which provides a down-link peak rate at 42Mbps. This enables operators to deliver superior app coverage in the 50 percent of their sites with relatively low traffic.

By building in line with the demands, operators can improve app coverage and network performance, while optimally reducing energy consumption.

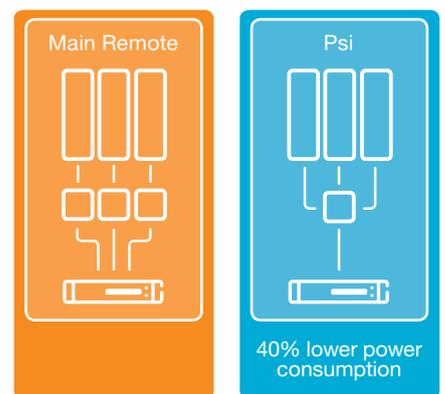


Figure 5: Psi power consumption vs. a traditional 3-sector deployment

OPTIMIZE ON SITE

Radio and transmission equipment needs to be placed onsite, where operators will usually have size and power limitations.

We have developed several solutions to help operators solve on-site challenges. We offer cost-optimized solutions for different energy sources, intelligently controlled site expansions to keep energy consumption down, smart solutions for different business models, and the combination of transmission and RAN on site.

Our cost-optimized solutions for different energy sources include Remote Site Management (RSM), which contains a number of features to reduce energy costs and improve sustainability. Operators can control and compare their energy consumption at all sites, with real-time monitoring of energy source information.

Remote Hybrid Control Management ensures that the usage of diesel generators, batteries, solar powers, wind turbines, fuel cells and so forth, is cost-optimized. Battery Management ensures a substantial battery life extension, and optimal battery replacement planning, meaning fewer visits to the site are required.

Operators can intelligently control their site expansion within their energy limits with our solutions. Intelligent site recovery prioritizes between battery recharge and traffic after a power outage, and can be used across a multitude of standard sites. It also provides stepwise site recovery from the RSM for battery and all radio technologies.

We support multiple operator business models. Passive site sharing, in the case of tower companies for example, can utilize RSM multi-vendor support to control and optimize power usage on site.

Active network sharing lets operators use their full portfolio and solutions to optimize energy performance across the shared networks.

The benefits of having common site solutions for integrated MINI-LINK microwave with RAN are apparent throughout the entire site. One cabinet on-site that can share power, batteries, cabling and accessories can achieve great savings. Prefabricated cables reduce cable and connector related outages. Shared power and cooling saves a considerable amount per year and per site, while reducing two cabinets to one, cuts an energy footprint by 50 percent.

Our site controllers help make sites more intelligent, saving money and saving energy, without losing performance.



SETTING UP FOR A SUCCESSFUL FUTURE



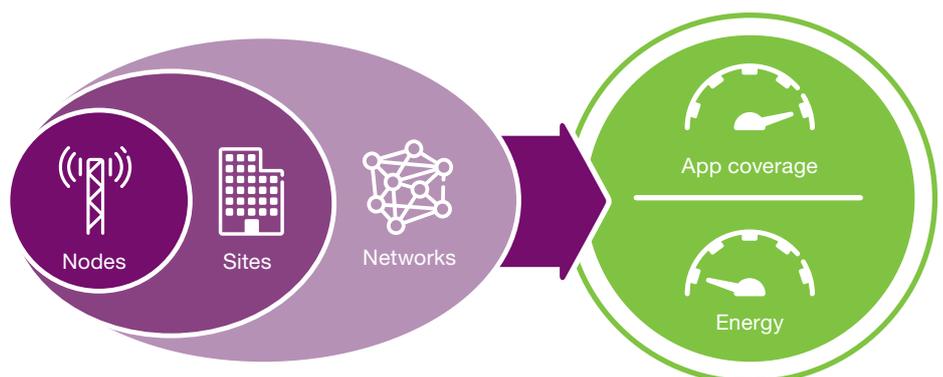
To provide the best performing network, operators have to ensure that traffic and capacity can increase, while energy consumption decreases. With our array of thoughtful solutions and intelligent use, this is possible, but operators have to be prepared to take a complete view of energy performance.

It is possible for operators to increase app coverage while improving their energy performance, by taking a systematic approach and thinking about energy in terms of the entire network. Operators can use app coverage to quantify this approach to energy: dividing this coverage by RAN network energy consumption will show exactly how much is being used to give consumers high quality coverage.

Approaching energy performance from the perspective of the whole network, means that operators are setting themselves up for a successful future – not one restricted by energy and an inability to expand. Mobile traffic is forecast to grow considerably in the future, and networks need to be sustainable on the road to 5G.

TAKE A SYSTEMATIC VIEW

of energy performance



Ericsson is the driving force behind the Networked Society – a world leader in communications technology and services. Our long-term relationships with every major telecom operator in the world allow people, business and society to fulfill their potential and create a more sustainable future.

Our services, software and infrastructure – especially in mobility, broadband and the cloud – are enabling the telecom industry and other sectors to do better business, increase efficiency, improve the user experience and capture new opportunities.

With approximately 115,000 professionals and customers in 180 countries, we combine global scale with technology and services leadership. We support networks that connect more than 2.5 billion subscribers. Forty percent of the world's mobile traffic is carried over Ericsson networks. And our investments in research and development ensure that our solutions – and our customers – stay in front.

Founded in 1876, Ericsson has its headquarters in Stockholm, Sweden. Net sales in 2014 were SEK 228.0 billion (USD 33.1 billion). Ericsson is listed on NASDAQ OMX stock exchange in Stockholm and the NASDAQ in New York.