Greywale Management

The Greywale Service Provider Energy Strategy Taxonomy

Driving Discussion, Research and Investment

Greywale Service Provider Energy Strategy Taxonomy	Access, Outside Electronics (10,000s)	Central Office or Head-end (1,000s)	Metro POP (100s)	Core POP (10s)	Data Center
Sustainability 101					
System & Device Architectures					
Network Architectures and Protocols					
Systems/Software					

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Service Provider Energy Strategy

The energy consumption of telecommunication networks is emerging as a primary concern among network operators. The largest U.S. carriers each spend over $1 Billion per year on energy. One calculation shows that a savings of just 3% would translate in to **$0.01 per share** in net earnings. With this in mind, energy strategy has reached the board room!

Given the scope, variability and diversity of these networks Greywale Management proposes the Greywale Service Provider Energy Strategy Taxonomy® to **drive** future discussions, research and investments and to prevent random acts of green. Without a clear strategy map, the industry risk high levels of ambiguity and redundancy in these efforts and delays in implementing the much needed energy management techniques.

Equally important it will **prevent** "random acts of green". Good "green" ideas are everywhere. Each one may even have value. Yet, without an overriding energy strategy driven by the taxonomy, service providers will not maximize their investment and business potential. The use of scarce corporate resources, finances and management attention may produce an initial euphoria but will lead to long term disillusionment. Moreover, the taxonomy will ensure that these resources and efforts are spent on the right long term solution that also addresses the current needed energy savings for the business.

Why the Need for an Energy Strategy?

A long term strategy, complete with a vision and plausible tactical roadmap, will drive investments that solve real business issues. The five primary business issues an energy strategy should address are:

1. Traffic growth and network sprawl
2. OPEX reduction and improved operational efficiency
3. Brand enhancement
4. Regulatory preparedness
5. Availability, reliability and cost of energy

Traffic Growth and Network Sprawl

Traffic continues to grow exponentially due to the rise of mobile data, particularly video –accounting for 65% of mobile traffic, the move toward all-things cloud and the proliferation of internet connected devices and Internet of Things (IoT). At the same time energy efficiency creeps along with a linear improvement. Plus, existing equipment is being added to existing networks incrementally without any concern for energy consumption or longer term network complexities. As this occurs, the proliferation

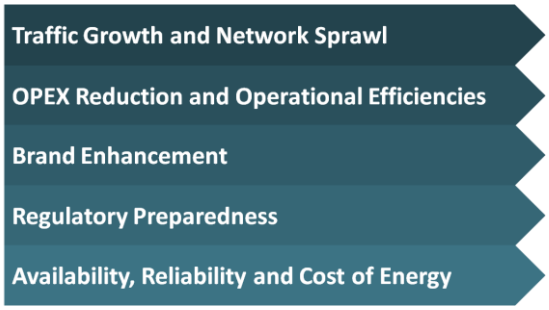
of small cells, wireless-cloud, and Content Deliver Networks (CDNs) are putting new types of network equipment in many available and convenient facilities that were not designed for them. Hence the term "network sprawl" to describe this move of more intelligent device to more parts of the network.

OPEX Reduction and Improved Operational Efficiency

Energy efficiency is a direct OPEX savings. It can range from any number of simple common sense activities such as turning off lights or tuning the HVAC system to more complex energy management techniques. As will be shown in the taxonomy, service providers are faced with a diverse set of facilities to address. Since energy impacts all aspects of the business, a focused energy strategy will, by its very nature, improve the overall operational efficiency of the service provider.

Brand Enhancement

In many countries competition for both wireless and residential subscribers is brutal. Give the truly "zero-sum" game of these markets it's expected that the "battle-of-the-brands" will be equally as brutal. Service providers spend heavily on consumer advertising offering better and less costly services. In many countries a substantial segment of the market is "eco-aware". By implementing a verifiable energy strategy service providers can attract these, often affluent, customers.



Regulatory Preparedness

Global regulators will only add new regulations. Energy consumption is an easy target as it's identifiable and measurable. We've seen this starting in the U.S. The Department of Energy (Not the F.C.C.) targeted set top boxes from an energy perspective. They claimed that two set-tops consumed the same amount of power as an EnergyStar refrigerator. To get ahead of the regulators, or at a minimum slow them down, the cable, telco and satellite users of set-top boxes got together and created a set-top box energy conservation agreement. This case-in-point illustrates that service providers with a comprehensive energy strategy can stay ahead of regulators and/or prevent new onerous and costly regulations.

Availability, Reliability and Cost of Energy

Many of us take for granted that when we flip a switch the lights will go on and will stay on. However, not everywhere around the globe can be assured of this. In advanced economies availability and reliability of energy, while better, is not 100% across the board. Given the deployment of more cell towers and associated electronics, whether macro-cell or small cell and the push for more rural broadband, energy availability and reliability is not as clear cut. Additionally, outages due to weather and brown-outs due to demand are common occurrences. To protect their business, and their brand, service providers need to create a strategy to address these real, albeit rare, events.

Likewise, the cost of energy can fluctuate greatly from region to region (including state to state in the U.S) and over time. For example, diesel fuel will vary at the whims of the global oil markets. A comprehensive energy strategy should also address these issues to mitigate supply risk and price fluctuations.

In addition, the cost of energy and its availability is a major hurdle in developing economies such as China, India, Middle East and Africa. The telecom and internet services are usually needed in urban and off-grid areas and reliance on diesel generators and batteries are high. In such scenarios, a comprehensive energy strategy should mitigate the rising costs of fuel while introduce new hybrid powering solutions.

The Greywale Service Provider Energy Strategy Taxonomy®

The proposed taxonomy, shown in Figure 1, addresses the different physical facilities and the different types of solutions required. It should be clear, that no one solution or one solution type will be successful in all areas. Yet, given the amount and cost of energy involved in large telecommunication networks an array of solutions is required such that each network operator can adapt those that meet their specific and local requirements.

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Figure 1 The Greywale Service Provider Energy Strategy Taxonomy®

The remainder of this paper introduces the taxonomy and defines the categories of **Solutions** (Rows) and **Service Provider Facilities** (Columns). The taxonomy will act as the framework for operators to reference and to direct their efforts towards a more energy efficient network operations and service

delivery. This will set the agenda for a holistic view on energy efficiency and energy management for telecom operators and address the limitations of taking a one sided view to the energy challenge.

Definitions: Solutions

Sustainability 101

This refers to the well document array of technologies and procedures in the market today that are being adopted across the globe. It can be as basic as installing better light bulbs and tuning up the HVAC system in all facilities, including retail stores. Or it could be installing a renewable energy source (e.g., solar or wind) to augment existing power to the facilities. The main point is that current solutions can be adopted "as-is" without any material changes that would be service provider specific. In the future, telecom specific solutions that address the unique needs of networks may be developed.

New Systems and Device Architectures

Networks are comprised on numerous types of equipment and the equipment is comprised of numerous semiconductor devices. New energy-aware and more efficient devices and systems will be developed as part of normal upgrades and enhancements. Energy savings with new equipment benefits by Moore's law by default. Moore's law states that the performance of semiconductor devices doubles every 18-24 months. Thus, SPs can deploy more energy efficient devices and equipment with zero impact on current network architectures and operations. Here, the legacy device (e.g. switch or router) can be physically removed from the network and a new one can be installed, cables connected and powered on. Existing OAM&P (Operations, Administration, Maintenance and Provisioning) and M&Ps (Methods and Procedures) will be largely unchanged.

New Network Architectures and Protocols

As energy use continues to rise network operators will look at modifying the underlying end-to-end network architecture to become more energy efficient. This could include new protocols that are energy-aware and adapt to current, or historic, energy use patterns. It could also include re-locating certain facilities closer to renewable energy sources. Unlike the first two categories this one is likely to impact network operations. For example, new facilities may be required and new energy management systems would be installed in the Network Operations Center (NOC).

Systems and Software

This category includes any software system whose primary purpose is related to service provider energy. These include systems that augment current BSS/OSS/NMS/EMS systems as well as new software-based systems that **do not** require service provider specific or custom hardware.

Definition: Service Provider Facilities

RAN/Access/Outside Plant

Certain functions of the telecom network are located in remote or outside locations. Examples include; the RAN, base stations & Antenna's, Digital Loop Carriers, CATV Amplifiers, and Controlled Environmental Vaults (Underground). In many cases the choice of location is limited due to issues such as right-of-ways and local regulations. The exact location and access to energy will impact specific energy strategies.

Central Office/Head End

These locations are purpose built to terminate the local loop or the "last mile". They typically service a single municipality. In advanced economies many of these facilities are decades old, locate in prime city center locations[1] and can terminate over 100,000 individual copper pairs for POTS and DSL. Some are manned facilities and some are unmanned facilities. It should be noted that due to regulations these facilities contain large arrays of batteries to provide emergency services during power outages. Due to the chemical makeup of batteries there's a plethora of regulations and environmental issues associated with them should be noted here.

The Headend are the CableTV equivalent facilities with many similarities. Primary differences include the presence of large satellite antenna arrays and less centralized locations.

Metro POP

These locations are logically in larger metropolitan cities. Metro POPs aggregate traffic from a number of local CO's and serve as a CO for the local municipality. In addition to the central office equipment, located here is additional equipment including optical transmission (SONET, DWDM) and higher capacity routing and switching equipment. Metro POPs also act as an interconnect or peering facility with other service providers. In this case the third party provider may or may not have co-located equipment. Given the capabilities of these facilities they are a likely candidate for the network sprawl noted above.

Core POP

The core POPs are located in few large cities or strategic centralized locations. They aggregate a number of Metro POPs, function as a Metro POP for the geographic region and may act as a CO for the local population. This facility is a major peering and interconnect facility. The Physical location may also have a data center co-located.

Data Center

Data centers are large facilities that are purpose- built to house large amounts of computing and storage equipment. Given the nature of IP, data centers can be located anywhere. They are not geographically required to be located at or near customers.

Summary

This document introduces the Greywale Service Provider Energy Strategy Taxonomy. This taxonomy, or strategy map, presents a comprehensive view of the problem areas of solution development. The solution segments address two vectors. They are the type of solution (Sustainability 101, Systems and Devices, Network Architectures and Software Solutions and the type of facility (Access/Outside Plant, Central Offices/Headends, Metro POPs, Core POPs and Data Centers. The purpose of creating an Energy Strategy Taxonomy is to drive future discussions, research and investments throughout the industry and throughout the service providers themselves. It will also prevent "random acts of green" which misallocate scarce corporate resources.

It was also discussed that a service provider energy strategy needs to address primary business issues. The five primary business drivers are; Traffic growth and network sprawl, OPEX reduction and operational efficiency, Brand enhancement, Regulatory preparedness and the availability, reliability and cost of energy.

We strongly believe that services providers that approach energy issues in the comprehensive strategic framework introduced herein will be industry leaders in many pertinent metrics. For a more detailed discussion please contact Greywale Management.

Notes:

1. For an interest perspective on this see: http://greywhalemanagement.blogspot.com/2013/05/untapped-service-provider-real-estate.html

About Greywale Management

Greywale Management is an international consulting firm focusing on service provider energy strategy. It provides strategic marketing, market research and business development services for service providers, equipment vendors, energy solution providers and semiconductor vendors. It focuses on managing innovations in both large organizations and startup companies. www.greywale.com

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Greg Whelan is a principal at Greywale Management. He has over 20 years of international high technology marketing and business experience. He has worked in technical marketing roles for large technology firms including Cisco Systems (San Jose, CA) where he lead award winning global marketing campaigns in telecommunications and internet markets and Analog Devices (Norwood, MA) where he created and lead their entrance into the broadband telecommunication market. He's also spearheaded marketing for a number of early stage venture-backed start-ups in the Boston area, three of which were acquired by larger tech companies.

He's a pioneer in the broadband telecommunications area and drove the first global DSL standards and was a co-founder, and Vice President of the International Broadband Forum. He has participated in global technical standards at the ITU, T1E1 and SCTE. He has over two-dozen published papers and articles and has spoken at numerous conferences and forums in the US and in Europe.

He has a BS Electrical Engineering from Cornell University and a High Technology MBA, with honors from Northeastern University. He has also studied Digital Video Networking at the MIT MediaLab. He can be reached at gwhelan@greywale.com

Dr. Hassan Hamdoun is a senior analyst at Greywale Management. He received his Ph.D. in Wireless Communications from Swansea University, United Kingdom. He received his M.Sc. (ENG) in Electronics Engineering (distinction) from the University of Sheffield, UK, and the B.Sc. (Hons) in Electrical Engineering from the University of Khartoum, Sudan. He worked in setting up the first Sudanese Electronic Payment Network (SUDAPAN) with the Electronic Banking Services (EBS) and the central Bank of Sudan. He then joined the Sudanese mobile telephone company (Zain-Sudan) as a radio engineer and a regional team leader for EDGE and 3G integration and implementation projects.

Currently Dr Hamdoun is involved in projects and research in the area of ICT for sustainability, energy efficient network design and holistic approaches to addressing energy costs, OPEX and CAPEX in communications systems and networks from both technical and business perspectives. A Current project is researching sustainable solar powered broadband access with African universities and institutions. He can be reached at h.hamdoun@greywale.com