

SPECIAL STUDY

Power Rectifier Reliability: Telco Carriers' Perspective in Asia/Pacific Excluding Japan

Sponsored by Emerson Network Power

Harish N. Taori

Marc Chin

February 2010

IDC OPINION

The telecom industry, especially in Asia/Pacific's emerging economies, is undergoing phenomenal growth, both in terms of voice and data. In this highly competitive market, leading telco carriers usually rely on quality of service (QoS) to differentiate themselves from their competition. QoS, however, cannot be achieved without highly reliable and efficient network operations. Power rectifiers, through DC power systems, play a pivotal role in enabling high-quality network operations.

This IDC special study was designed to understand, from the telco carrier's perspective, the overall power rectifier ecosystem, the importance placed on the reliability of power rectifiers, and their perception of key power rectifier brands in the market. The respondents who participated in the survey are directly involved in decision-making or have some influence over the power rectifier purchase decisions. IDC surveyed a mix of respondents across a range of job functions (such as network, operations, procurement, service delivery, project management, facilities management), and job responsibilities (purchase, performance or operations) to get a holistic view for the purpose of this survey.

The study revealed several interesting findings, insights into industry best practices, and areas where telecom carriers and original equipment manufacturers (OEMs) can collaborate and benefit from the relationship. IDC feels that the expanded partnership between these two entities will benefit the telecommunications industry as a whole in a number of ways including:

- Building a consensus for a consistent definition of "reliability", as it varies with job function and level of exposure to the field operations
- Promoting best practices for monitoring power rectifier failures as well as preventive maintenance of power rectifiers to maintain its efficiency and reliability
- Reducing environmental hazards by appropriately disposing power rectifiers at the end of life as well as increasing the adoption of environmentally safe power rectifiers

IN THIS STUDY

In this custom study sponsored by Emerson, IDC interviewed 16 leading telco carriers across seven Asia/Pacific countries – Australia, India, Indonesia, Malaysia, Singapore, Thailand and Hong Kong. The objective was to get their perspective on:

- Their power rectifier ecosystem and best practices deployed to maintain reliability
- The Importance, definition and measures of power rectifier "reliability"
- The perception on reliability of key power rectifier brands
- Drivers for Infrastructure sharing and investments in alternative sources of energy

The survey was targeted at respondents in various job functions with purchasing and/or performance and/or operational responsibilities. The findings in this document reflect the aggregated views of the survey respondents who provided clear perspectives on their organization's experience with their power rectifier ecosystem and the brands that they currently own.

METHODOLOGY

IDC conducted face-to-face or telephonic interviews with professionals from 16 leading telco carriers:

- 6 fixed-line operators, 9 wireless, and 1 broadband provider
- 7 Asia/Pacific countries:
 - Australia – 2
 - Hong Kong –1
 - India – 3
 - Indonesia –2
 - Malaysia – 4
 - Singapore – 2
 - Thailand – 2

The respondents are directly involved in decision making or have some influence over the power rectifier purchase decisions. IDC surveyed respondents across a broad range of job functions (such as network, operations, procurement, service delivery, project management, facilities management), and job responsibilities (purchase, performance or operations) to get a holistic view on this subject.

SITUATION OVERVIEW

Introduction

Telco carriers are evolving as information communications and technology (ICT) players by providing comprehensive managed services and launching software as a service (SaaS) through a cloud services platform. The entry of MNC players has further intensified the competition.

QoS, often used by leading telco carriers to differentiate from their competition, cannot be achieved without highly reliable and efficient network operations. Power rectifiers, through DC power systems, play a pivotal role in enabling high-quality network operations.

Power rectifiers are electrical devices that convert alternating current (AC) to direct current (DC). In the telecommunications industry, power rectifiers are an integral part of telecom rectifier systems. They are also used in battery chargers, DC drives, DC power systems, and other power system devices. Power rectifiers usually have one or more diodes, electronic components that conduct current in only one direction. Single-diode power rectifiers omit the negative portion of the AC waveform, whereas multi-diode power rectifiers reverse the negative portion of the AC waveform, allowing it to merge with the positive part to produce an entirely positive current.

Power rectifiers vary in terms of AC inputs and DC outputs. Common AC input voltages vary from 115 ~ 480 VAC whereas Common AC input frequencies vary from 50 ~ 400 Hz. There are several mounting styles for power rectifiers. Some devices mount on a standard DIN rail or can be attached to a wall, cabinet, or chassis. Others feature an open frame or enclose the input and output connections. Important rectifier specifications such as DC output voltage, DC output current, power, reliability and efficiency are usually looked at while evaluating the power rectifiers.

Key Survey Findings

- ☒ Respondents concurred that both power rectifier “reliability” and “efficiency” are key considerations for power rectifier purchase. “Rectifier cost” and “support services” from the vendor are also among the top five considerations.
- ☒ Frequency of rectifier failures and Mean Time Between Failures (MTBF) are usually the measures used by the respondents to assess rectifier reliability. Both the measures are co-related and are interchangeably used by both power rectifier vendors as well as the telco carriers.
- ☒ A higher number of respondents owned ENP power rectifiers and rated ENP slightly higher (4&5) on the reliability scale compared to their peers.
- ☒ To detect the power rectifier failures, a higher proportion of respondents prefer to use a centralized monitoring system (CMS), whereas a few others either outsourced to a third party or relied on in-house resources. Irrespective of detection mode, the respondents agreed that they prefer to replace the failed rectifiers within 24-48 hours. In general, the OEM is responsible for repairing the failed power rectifiers.

- ☒ Telco carriers are either currently having or considering infrastructure-sharing contracts with other telco carriers to reduce their operational costs.
- ☒ “Unavailability of the grid due to physical remoteness of the sites”, and “high energy costs” were some of the key reasons for considering investments in alternate sources of energy.

To maintain high reliability and efficiency of power rectifiers, preventive regular maintenance is generally relied on as best practice.

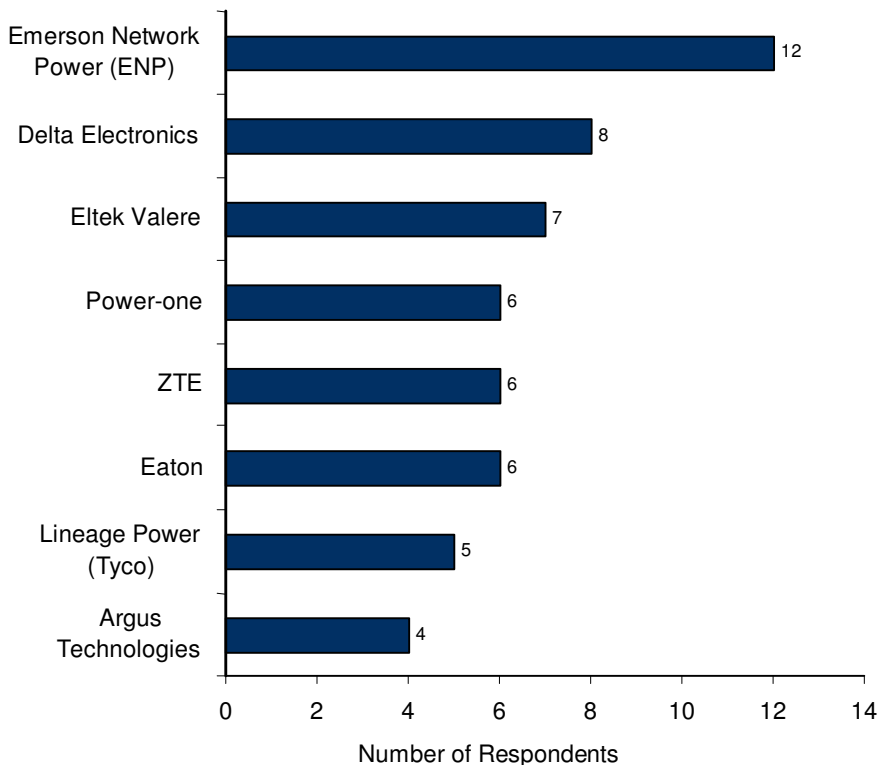
Assess Current Situation

Power rectifiers are the heart of DC power systems. The bigger the reach of the telco, the higher the number of DC power systems or power rectifiers in one network ecosystem. The number of power rectifiers owned by the telco carriers who participated in the survey varied in size and scale of their operations. In general, the majority owned more than 25,000 power rectifiers but about two-fifths of the organizations owned less than 10,000 power rectifiers.

FIGURE 1

Power Rectifier Brands Currently Owned by Telco Carriers

Q. Does your organization currently own power rectifiers from any of the following vendors/brands? [Multiple Choice]



n = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

As shown in Figure 1, the telco carriers who participated in survey own multiple power rectifier brands, but about 12 out of 16 currently own ENP power rectifiers and 8 out of 16 own Delta Electronics. The other brands present in the respondents' ecosystem

are Eltek Valere, Power-one, ZTE, Eaton, Lineage Power, Argus Technologies, Siemens, Rectifier Technologies, International Rectifier, Benning, Switchtec and Alcatel.

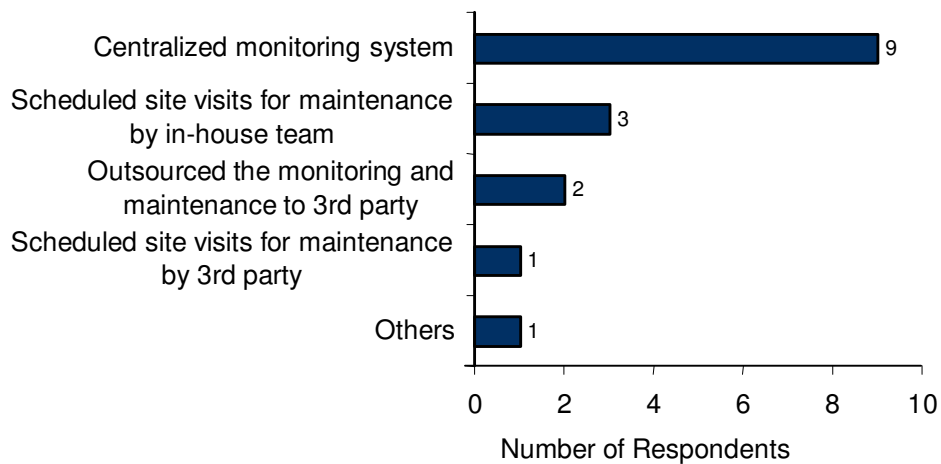
During the discussion on rectifier failures, the majority concurred that they witness less than nine power rectifier failures within a given DC power system, but of these respondents, a greater number witness less than four power rectifier failures in a year. As expected, performance of DC power systems deteriorates as devices age. In the survey, only one respondent said the telco experienced frequent rectifier failures when the system was less than 5 years old but majority said that the average age of their systems, when frequent failures occurred, was between 5 and 10 years. Respondents, who experienced high failures were having DC power systems between 10 and 15 years old, after which age they eventually replace the system.

In Figure 2 below, more than half of the telco carriers surveyed said they preferred to use a centralized monitoring system (CMS) to detect rectifier failures, whereas the remaining either outsourced or managed in-house; but in both cases, they conduct a health check on the systems when they make a site visit, which is "once a month". Usually, telco carriers use CMS to monitor failure detection but rely on preventive maintenance visits to service the equipment. A range of activities are conducted during servicing, including checking the battery, cleaning the model, recalibrating, and resetting the stabs on the plug.

FIGURE 2

Power rectifier failure detection process

Q. How do you detect power rectifier failures in DC Power Systems?



n = 16

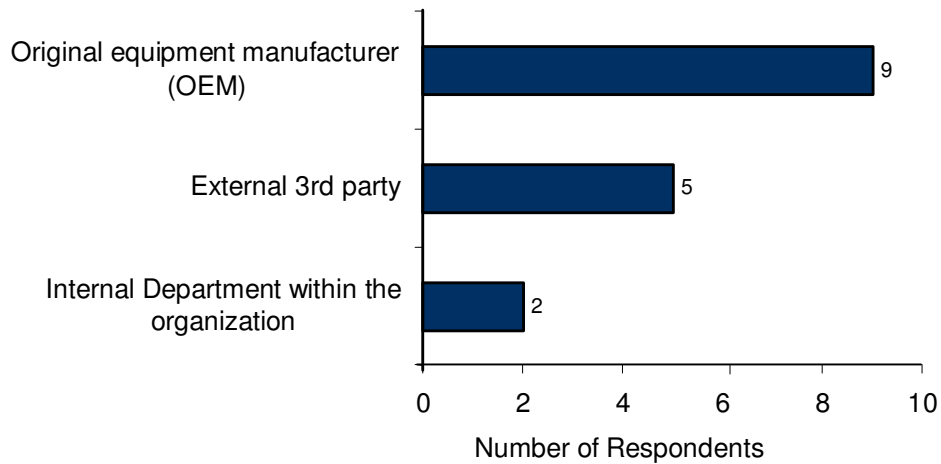
Source: IDC - ENP Power Rectifier Reliability Study, 2009

More respondents confirmed that they prefer to replace the failed power rectifiers within 24-48 hours of failure detection, irrespective of the mode of failure detection, as shown in Figure 3. In a few cases, they replace the failed power rectifiers as early as 4-12 hours after the failure is detected. The OEMs have the primary responsibility of repairing the power rectifiers. However, it is worth mentioning that there are few telco carriers who prefer to outsource the repair to a third party or manage the repairs in-house.

FIGURE 3

Responsibility for repairing failed power rectifiers

Q. Who is responsible for repair of failed rectifiers?



n = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

It is very unlikely for a single instance of power rectifier failure to result in the complete failure of a DC power system in the event of a complete shutdown of the service, as there are built-in redundancies in the DC power system. In general, the rectifier mean time between failures (MTBF) ranges from 6-12 months to 10 years, however in some instances multiple power rectifier failures occurred in a short time span resulted into temporary site shutdown, whereas mean time to repair (MTTR) ranges from 12 hours to 3 days. In certain cases, however, the MTTR could even go up to 3 weeks. Telco carriers use "duration of time the service is down" as the primary key performance indicator (KPI) to measure the impact of power rectifier failures on the organization's business. They monitor power rectifier failures against the usage and the load capacity to track the costs associated with fixing a given power rectifier failure. Interestingly, a higher proportion of these telco carriers do not have any end-of-life policy for retiring their DC power systems; however, one-quarter of them did mention that they do have some kind of end-of-life policy, which is either to resell or auction these power rectifiers in the secondary market.

Preventive regular maintenance program is the best practice generally used by the majority of telco carriers who participated in the study to maintain high reliability and efficiency of their power rectifiers.

Importance of Power Rectifier Reliability and Evaluation Criteria

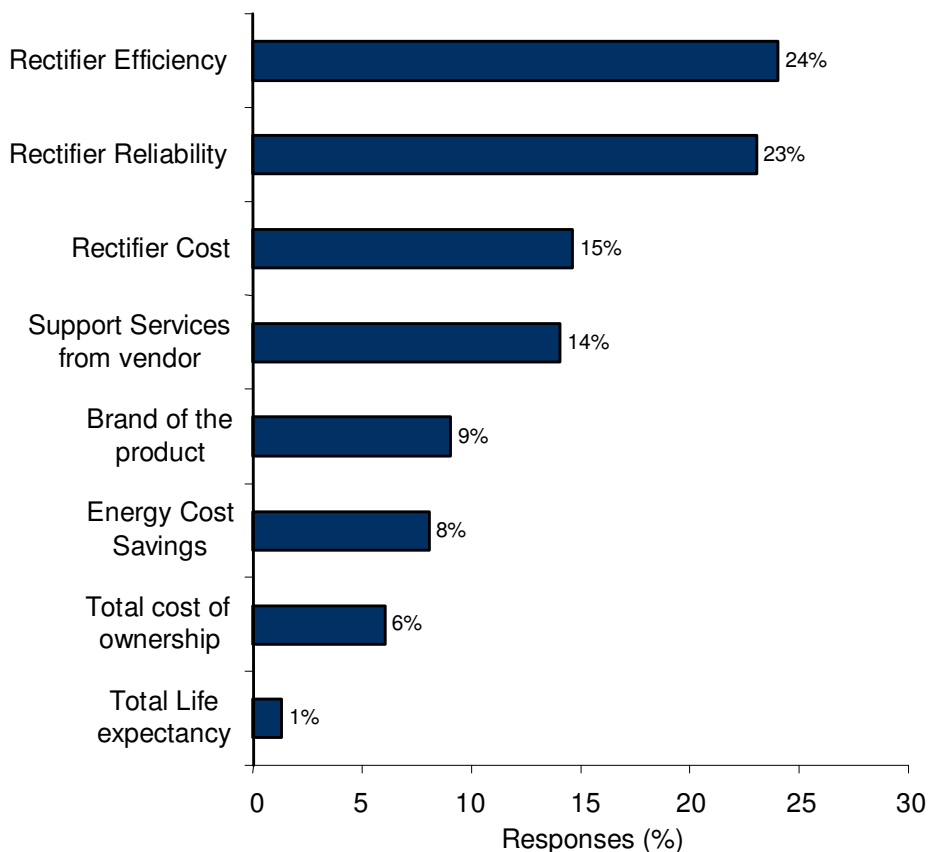
Reliability and efficiency are the primary considerations for purchasing power rectifiers. As shown in Figure 4 below, the key considerations are interlinked, as rectifiers with good reliability and high efficiency will reduce the total cost of ownership. Due to the budget constraints, rectifier cost is also an important consideration as the telco carriers prefer to choose the brand that offers best value for money but meets at least one of the top two considerations. It is observed that the top two considerations are almost the same for both operations and procurement personnel who participated in the survey. It is not unusual to see "support services

from the vendor" among the top five criteria, as this attribute is very critical to telco carriers for providing high-quality reliable services to its end customers. It is interesting to see that "energy cost savings" came out as one of the leading considerations, probably because telecom providers across the globe are facing higher cost and environmental challenges due to increased power consumption.

FIGURE 4

Top 5 considerations for Power Rectifier Purchase (Weighted Average - Top 5)

Q. What are the top five criteria that your organization considers most important before purchasing power rectifiers?



n = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

Different definitions emerged when respondents were asked to define power rectifier reliability. However, the general consensus is that rectifier reliability is defined as the failure rate per rectifier per year. "Failure rate" is defined as frequency of rectifier failures per year.

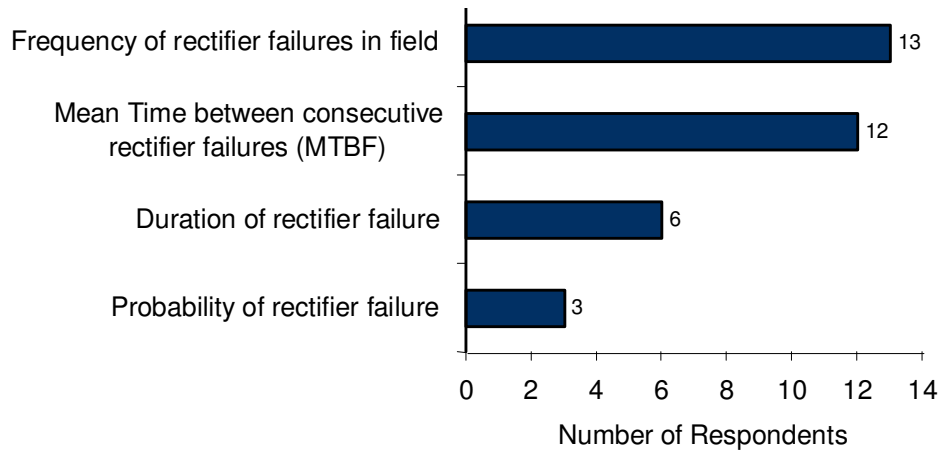
As shown in Figure 5, telco carriers interviewed in the study used both "frequency of rectifier failures in the field" and "mean time between consecutive rectifier failures (MTBF)" to measure reliability of power rectifiers. These measures are co-related and are used interchangeably in the industry, both by power rectifier vendors and telco carriers. However, from a practical perspective, "frequency of rectifier failures" is more tangible and actionable as compared to "MTBF". As far as frequency of rectifier failures in the field is concerned, by and large, respondents affirmed that they expect

the failure rates to be lower than 1% or less than 4-5 failures per year for the rectifiers to be considered reliable.

FIGURE 5

Measures used by Telco Carriers to Evaluate Power Rectifier's Reliability

Q. Which of the following measures does your organization use to evaluate or assess reliability of the power rectifiers in DC power systems? [Multiple Choice]



N = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

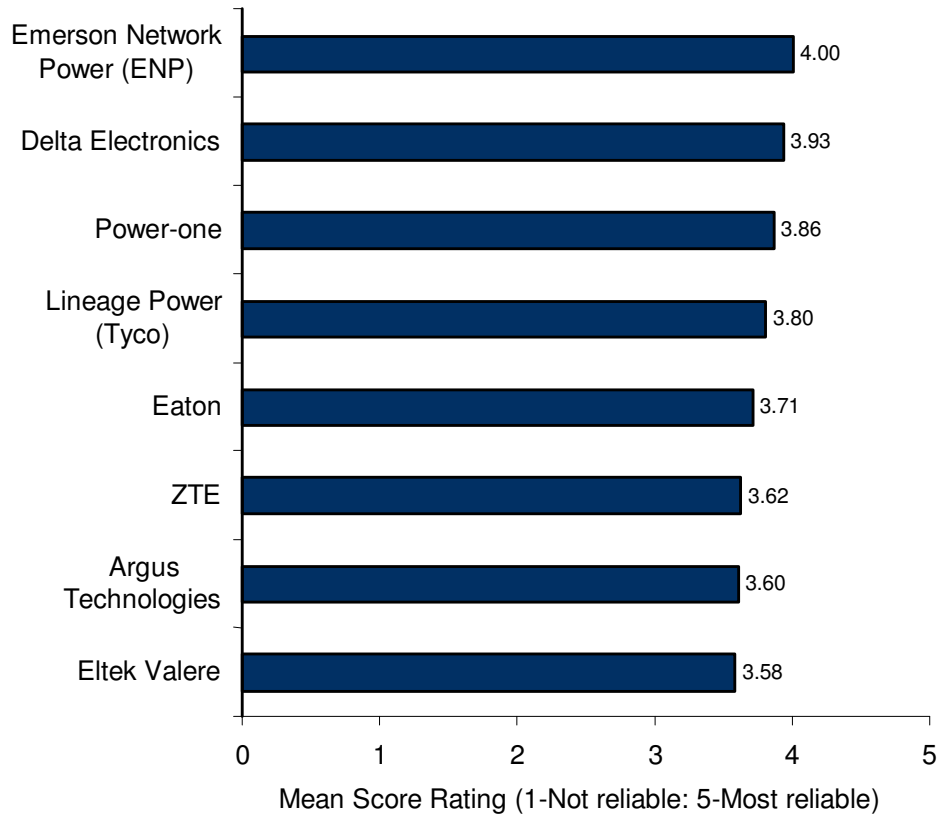
Perception on Reliability of Power Rectifier Brands

More respondents not only own ENP power rectifiers but also perceive that ENP power rectifiers are slightly more reliable than its competition. This is also true for Delta Electronics to a certain extent. Power-one, Lineage power (Tyco) and Eaton are some of competing brands that are closest to ENP both in terms of mean score and rating frequency. In terms of mean score that is consolidated across all the brands and respondents, it is evident from Figure 6 that the gap between the leading and trailing brand is quite small, however, it seems ENP is perceived to be more reliable brand both by Operations and Procurement personnel participated in the survey. It is also true that there seems to be some disparity in the opinions between Operations and Procurement personnel, suggesting rectifier reliability of brands is perceived differently within the same organization.

FIGURE 6

Perception of Power Rectifier's Reliability by Brands (Mean Score)

Q. From your experience and perception, please rate "Reliability" on the scale of 1-5, where 1 is "Not Reliable" and 5 is "Most Reliable" for each of the following brands of power rectifiers in DC power systems?



N = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

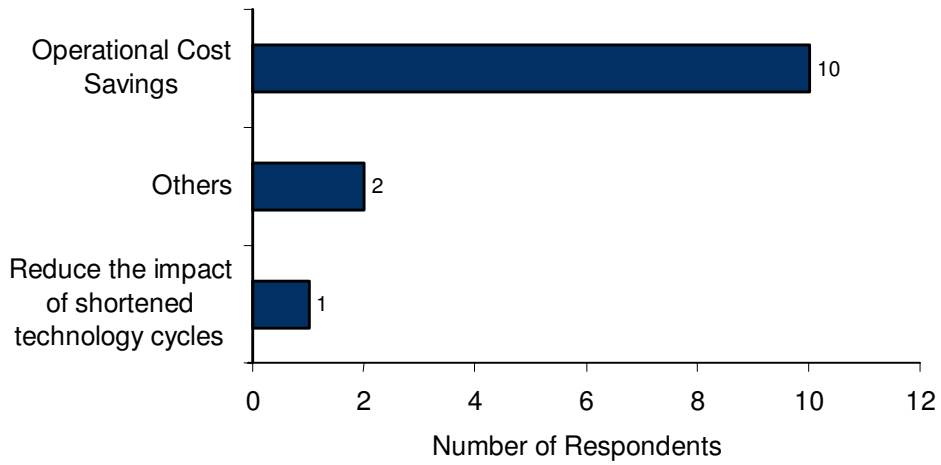
Drivers for Infrastructure Sharing and Investments in Alternative Sources of Energy

Respondents said that they are either considering or currently having infrastructure-sharing contracts with other telco carriers to reduce operational costs. One of the key drivers for considering investments in alternative sources of energy is "unavailability of the grid due to physical remoteness of the sites", as stated by the respondents in the interview.

FIGURE 7

Drivers for Infrastructure Sharing

Q. In your perspective, what would be the primary reason for infrastructure sharing?



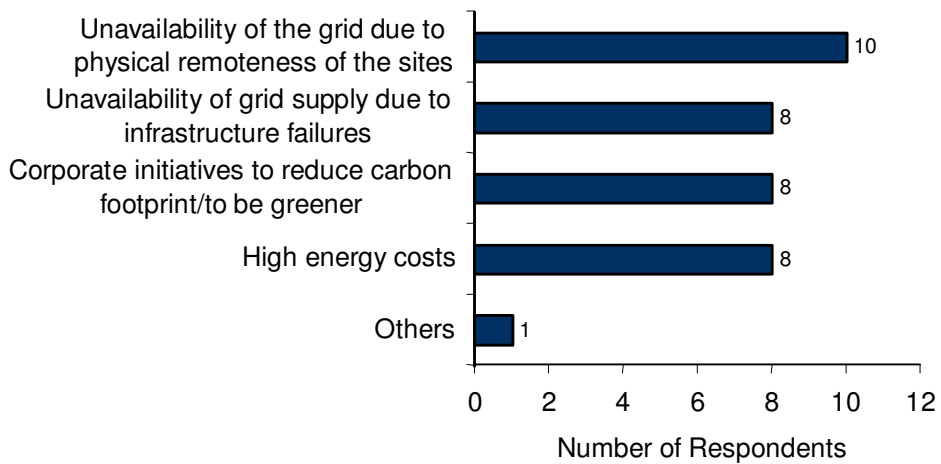
N = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

FIGURE 8

Drivers for Investment in Alternative Source of Energy

Q. Which of the following do you think would be the strongest drivers for your organization to invest in alternate sources of energy?



N = 16

Source: IDC - ENP Power Rectifier Reliability Study, 2009

ESSENTIAL GUIDANCE

- Building consistent industrywide definition of power rectifier reliability: The definition of power rectifier reliability varies with the job function and level of

exposure to the actual maintenance of power rectifiers in the field. Personnel from procurement tend to use "mean time between failures" (MTBF) numbers to define reliability whereas personnel from operations use "failure rate" to define reliability within the same organization. For practical purposes, it is important to have a consistent definition across the industry.

- ☒ Power rectifier OEMs may need to change messaging on reliability: Currently, power rectifier OEMs widely use MTBF numbers to make a case that their rectifiers are more reliable compared to the competition. However, MTBF numbers change with the installed base and may not really provide any actionable insights to telco carriers. OEMs need to simplify their messaging to communicate their strengths on reliability to these telco carriers.
- ☒ Leveraging best practices to detect power rectifier failures: Telco Carriers in mature countries such as Australia, and India generally use a centralized monitoring system to detect the power rectifier failures and to reduce the site visits. Telco carriers in emerging economies can leverage this best practice to reduce the cost and improve operational efficiency in monitoring and detecting power rectifier failures.
- ☒ Telco carriers can collaborate with the OEMs: To optimize their investments in alternative sources of energy, to reduce the input costs of traditional energy resources, and to check the environment related challenges, telco carriers need to collaborate with the equipment providers to promote green products as well as dispose existing rectifiers, at the end of life, in an environmentally safe manner.

CONSIDERING EMERSON

Emerson Network Power, a business of Emerson, is a global leader in enabling business-critical continuity from grid to chip for telecommunication networks, datacenters, health care and industrial facilities. Emerson Network Power provides solutions and expertise in areas including AC and DC power and precision cooling systems, embedded computing and power, integrated racks and enclosures, power switching and controls, monitoring, and connectivity. All solutions are supported globally by local Emerson Network Power service technicians.

Emerson, based in St. Louis, Missouri (USA), combines technology and engineering together to provide solutions to customers through its network power, process management, industrial automation, climate technologies, and appliance and tools businesses. Emerson's sales in fiscal 2009 were US\$20.9 billion. The company is ranked 94th on the Fortune 500 list of America's largest companies.

Challenges / Opportunities

- ☒ Diverging interpretations on definitions and measures associated with reliability between telco operations and procurement staff is a current challenge faced by equipment vendors. MTBF is widely quoted with reference to reliability, but most often misapplied as a means to measure the same in an operational setting. MTBF remains an important reference point for operators to make equipment comparisons between brands that are new to their network; however, in light of QoS drivers, actual reliability performance needs to take precedence. This reflects Emerson's current approach towards further educating customers on how

a businesswide and coherent view of reliability will positively impact on network QoS.

- ☒ Interpretation and measurement of efficiency and reliability amongst most operators remains at the component level. Significant opportunity to increase both attributes are to be found as Emerson guides customers towards a more system-centric view of their infrastructure. The CommsConnect workshop program that Emerson deploys around Asia addresses challenges and opportunities throughout the entire operators infrastructure that looks at both of these dimensions but also taking into account: speed of network rollout, serviceability, optimization of AC power, air-conditioning infrastructure, as well as alternate sources of energy.
- ☒ Centralized monitoring is widely referenced among telcos as a means to delivering best cost and reliable infrastructure. As per the previous note, this tends to focus on the component level but misses the opportunity of a system-centric view of infrastructure. Benefits are not solely focused on an increase in reliability but also delivers on increased efficiency, lower operational costs and better utilization of support resources.
- ☒ As network complexities grow, telco operators will find the task of balancing network reliability and cost even tougher. The opportunity to leverage outside help for deploying best practices in reliability management will become increasingly attractive. With its global footprint and diverse solution portfolio for passive network infrastructure solutions, Emerson Network Power is a natural partner to help pollinate best practices for reliability management.

Copyright Notice

This IDC research document was published as part of an IDC continuous intelligence service, providing written research, analyst interactions, telebriefings, and conferences. Visit www.idc.com to learn more about IDC subscription and consulting services. To view a list of IDC offices worldwide, visit www.idc.com/offices. Please contact the IDC Hotline at 800.343.4952, ext. 7988 (or +1.508.988.7988) or sales@idc.com for information on applying the price of this document toward the purchase of an IDC service or for information on additional copies or Web rights.

Copyright 2010 IDC. Reproduction is forbidden unless authorized. All rights reserved.