DC POWER: IS IT TIME TO SWITCH?

As operators move from the realm of being video-only providers to serving up data and telephony, they should consider the option of DC powering for multiple services.

There was a time when cable was simple. Operators had virtual monopolies, so competition was not an issue. They delivered a single programming feed, leaving any sorting out to be done at the set-top. And powering headend or hub equipment was nearly as simple as plugging a toaster into an AC outlet.

A WHOLE NEW WORLD

That was then. Today, competition is intense and becoming ferocious. Cable companies are expected to deliver advanced video services, voice and data, just to stay competitive. And if subscribers aren't satisfied with what one provider offers, they can turn to overbuilders, satellite broadcasters or a phone company for what they want. Not surprisingly, power requirements are changing, along with everything else.

Operators have some complex choices to make. But there's one area where there is no choice: powering telephony equipment. Telephony has never used AC. It uses -48 VDC, and chances are, it always will. In other words, operators planning to offer the telephony services that subscribers demand will have to power equipment with -48 VDC.

WHY NOT THE WORKS?

Most electronic equipment is already DC. Even if it plugs into an AC outlet, it uses an internal power supply to convert AC to the DC it needs. The change taking place today is in where that conversion takes place.

There are good reasons to convert headends and hubs to DC power, and in spite of the conversion cost, some savvy operators are doing just that.

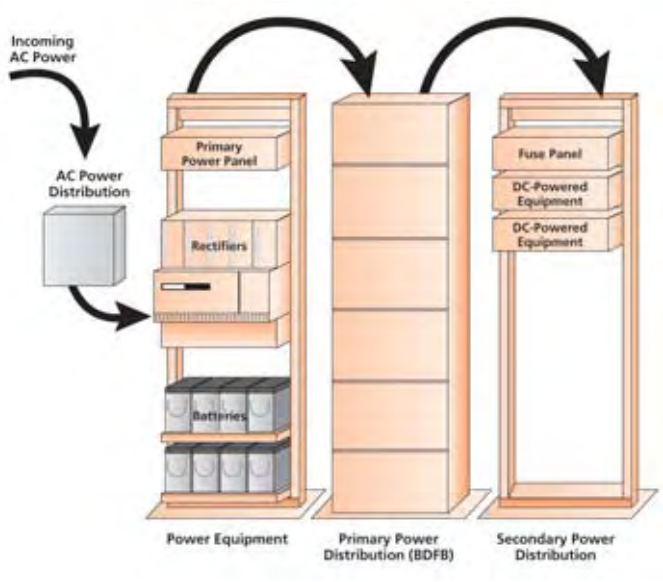
Although many operators continue to rely mostly on AC, the future clearly favors DC power in headend and hub facilities. DC powering for nontelephony equipment only began appearing in the mid-1990s. It takes some getting used to, but because it fits so well with the direction of today's markets, operators should at least consider the DC power option.

THE COST OF CHANGE

Network operators should know the following about DC power in multi-service operations:

- It involves a significant initial capital outlay – more than traditional AC, but still only a small fraction of the cost of building a headend or hub.
- A DC plant uses somewhat more "real estate" than an AC system, much of it for the required battery banks.
- Though it isn't really complicated to use, there is a learning curve for a staff that's used to AC.
- Initial installation of the primary DC system should probably be left to experts.
- There are still a few kinds of equipment that do not offer a DC power option.

So why are some of the fastest-growing operators in the world making the change to DC? The answer is simple: Reliability.



Power distribution scenarios

RELIABILITY RULES

As important as video service can be to subscribers, it's not a matter of life and death. Telephony, on the other hand, is a "lifeline" service, with legal liabilities to match. Subscribers may not know about Telcordia's 99.999 percent telephony-uptime standard, but they take that level of service – mere minutes of lost service each year – for granted.

Data, too, is becoming a critical service.

At the same time, as competition grows, attitudes toward traditional video are changing as well. In today's post-deregulation markets, subscribers increasingly have a choice of video suppliers, and are as likely to disconnect over poor service as over price or programming.

RELIABLE POWER FOR RELIABLE SYSTEMS

In a world of super-reliable integrated circuits, power problems remain a leading cause of service interruption at the headend or hub. The problem can be as small as a bumped AC plug or blown fuse, or as large as a neighborhood outage. It can be as intentional as a rack powered down for repair or as hidden as a faulty connector. Whatever or wherever it is, it will probably affect subscribers.

In today's competitive multi-service market, that means lost revenue.

It also means expense in tracking down and correcting the problem. As systems get larger and more intricate, even small failures can be costly to locate and repair, especially with experienced technical staff getting harder to find and more expen-

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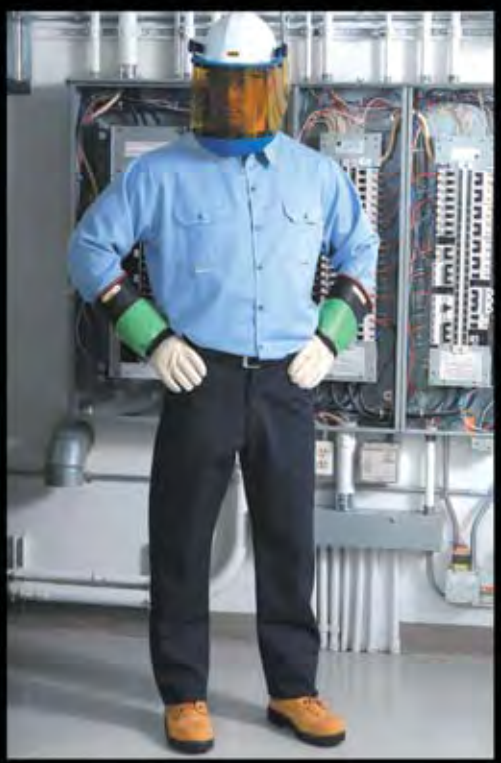
5 to 10 arc flash explosions occur in electric equipment every day in the US*

Are YOU protected?



Everyday, workers in the electrical maintenance and utility industry work in environments that may expose them to hazards that could cause severe or fatal burn injuries. In the event of a momentary electric arc, everyday non-flame resistant work clothes can ignite and will continue to burn. Untreated fabrics continue to burn until the fabric is totally consumed and non-flame resistant synthetic fabrics will burn with melting and dripping causing severe contact burns to skin. The use of flame resistant clothing will provide a level of thermal protection, and after the source of ignition has been removed flame resistant garments will self-extinguish.

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DC Power

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sive to keep. In that kind of environment, any investment that eliminates causes of failure or speeds repair will pay for itself. DC power is exactly that kind of investment.

THE DC DIFFERENCE

Incoming AC power from the local power plant is converted at the headend facility. The AC is converted to DC through the use of rectifiers. The rectifiers feed DC power to the primary power panel which, in turn, feeds the BDFB (battery distribution fuse bay). Rectifiers also keep the battery banks charged in case of an AC power failure backing up the feed to the power panel. If external power fails, the batteries continue to power the equipment with no "switchover," like that of an AC uninterruptible power supply (UPS).

Combined, these DC sources make up redundancy for feeding the BDFB.

Sizing the battery plant depends on:

- the amount of equipment supported
- the amount of unpowered "float" time required
- anticipated rate of growth.

The BDFB is typically equipped with circuit breakers or fuses and serves DC power to multiple racks of equipment. This secondary power distribution is to a dedicated fuse panel or equipment located in equipment relay racks. In addition to providing more protection than AC – a single blown fuse affects far less equipment – the fuse panels allow A-B redundancy.

This provides two parallel power paths from the fuse panel to each individual piece of equipment, reducing the chance of power interruption. If one path fails, the other continues to supply power, allowing the device to continue to operate.

DC IN ACTION

There are operators already using DC to power virtually everything they use. The impact is apparent almost immediately.

- DC power is conditioned power, so equipment tends to run more reliably and efficiently.
- Systems can be configured for longer standby at the hubs – up to eight hours.
- Since equipment is direct-wired rather than plugged in, connections are unlikely to be inadvertently disconnected.
- Each piece of equipment is now individually fused. AC typically provides only two breakers for a 10-plug strip, so one tripped breaker takes down a lot of equipment.
- There is A-B power redundancy to each individual piece of equipment.
- It is easier to monitor the DC power plant.
- Cable management is cleaner.

RIDING THE LEARNING CURVE

There's no denying that DC installation is a learning process, and initially more expensive than AC. The real payoff comes from ongoing operations – increased reliability and reduction of lost revenue. Initial installation should probably be left to a qualified DC vendor, and

operators should plan to thoroughly train technical personnel.

Because the DC plant is negative 48 VDC and has different grounding requirements than AC, DC circuits appear "backwards" to AC-trained technicians. Retraining often involves some initial confusion and some blown fuses, but that's what training is for.

It's also an opportunity for technicians to learn, preferably from outside experts, how DC circuits are run and tied down.

Site designers should also plan for completely separate overhead runs for DC, fiber, audio/video, and RF cabling. This can simplify management, speed repair, eliminate problems caused by unnecessary handling and maintain codes and standards.

TAKING THE PLUNGE

Having established that conversion to DC will not be easy, the question becomes how to make it easier. Here are some simple steps.

• Pay close attention to standards. Power systems for communications are some of the most rigorously tested and standardized of all products. By demanding the highest levels of standards-compliance in products used, unnecessary problems can be avoided. Approvals should include: Underwriter's Laboratories; Network Equipment Building Standards (NEBS), a standard set by Telcordia (formerly Bellcore); National Electrical Code, written by the National Fire Protection Agency; Conformité Européenne is required of telecommunications equipment sold into the European Union and global markets.

• If you are a dominant carrier, you may be able to generate additional revenue by sharing facilities with other providers.

These providers will be co-locating and connecting to your network. The standards you set will carry over to those you interface with, and will enable you to protect your network.

• Look for modularity in power components. The ability to mix and match interfaces and fuse types will help control "sprawl" in your equipment bays.

• Demand the highest level of physical protection for equipment and cables. At the same time, look for ease of access for maintenance and repair.

• Make a commitment to thorough training. People are the most valuable asset, especially in today's labor market. Anything you can do to keep them safe and make them efficient will pay big dividends.

• Don't be afraid to hire or retain experts to help with the conversion. When entering unknown territory, it pays to bring an experienced guide.

The Bottom Line

There's no need to be afraid of DC powering. It has been around in the telephony world for most of a century. It works and has shown itself to be reliable and safe. It is supported by a growing number of equipment vendors and has already been adopted by some very demanding operators. Like any investment, it will cost you money, but the risks are controllable and the payback is clear. You don't necessarily have to be the next to go DC, but when the time comes, it will pay to be ready.