Fast Load Shedding: Maintaining Operational Stability in Industrial Settings

In our Tech Talk, **Fast Load Shedding: Maintaining Operational Stability in Industrial Settings**, learn about the ideal architecture for an industrial fast load shedding scheme, including communications architectures and spinning reserve calculations.

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Question	Answer
What system does GE offer for fast load shedding (FLS)? How does it compare to legacy C90Plus FLS?	The GPG has the same fast load shed performance as the C90Plus and allows system expansions based on the use of aggregators. It can accept up to 128 data units with 32 infeeds and 128 load groups. The C90Plus can accept 64 data units with 32 infeeds and 32 load groups. GE offers the GE Power Gateway (GPG) as a fast load shed solution and not a product as it was with the C90Plus. It is engineered and configured to customer requirements.
Are scheme configurations performed by GE or can they be done through my current channel partner?	Channel partners can configure the GPG for fast load shed solutions if they are trained and certified. This service can also be provided by GE's consulting teams in Bilbao and Markham, with other teams scheduled to be added in the months ahead.
Is there a preference to use load shedding as opposed to fast bus or in-phase transfer to preserve power balance in heavy industry settings? Are these schemes being used mutually exclusively or in combination with the "transfer" variable in load shed schemes?	Fast load shedding is used to re-establish power balance once an infeed or incoming power source (such as a generator or utility transformer) is lost, whereas fast bus transfer is used to re-energize a critical load or motor/motor bus. These tools are used mutually exclusively depending on the application (infeed loss vs load loss). It should be noted that the IEEE PSRC is in the process of updating its fast bus transfer requirements.
How fast should the load shedding algorithm shed load? What´s the minimum controller scan cycle?	The fast load shed controller should shed load as fast as possible to ensure the system can recover from the loss of power. If not, the frequency will deteriorate fast and cause a local system blackout. That is why frequency protection is generally too slow. The GPG scan-time is 1 or 2 milliseconds, allowing the total shedding to occur within 15ms.
Are there any techniques to dynamically decide the time delay to shed load depending on the severity of the disturbance (large power or frequency oscillation)?	There is no time delay introduced in the fast load shed algorithm; shedding is purely done based on power (infeed) lost minus remaining reserve. The goal is to shed load as quickly as possible in order to prevent a system-wide outage. Additional frequency-based time delayed shedding is sometimes used as a backup to fast load shedding.

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Is GE's FLS still be able to perform if one or more communications relays fail?	Yes, the FLS will still perform and re-calculate power balance if relay communications are lost, even if multiple relays are affected. The FLS will take the loss of infeed power out of the total incoming power calculation (however can't initiate to shed for the one or more infeeds where comms is lost, and it is getting tripped) and take loss of load relays out of the sheddable load calculation. Custom logic must be created if the scheme is to be blocked in the event that specific critical infeeds or load relays communications are lost.
What are the communications requirements for next generation protection and control equipment used in an FLS scheme?	Generally, for newer protection and control systems, including fast load shed, Ethernet communications is recommended. Fiber Ethernet is preferred. These systems can be redundant, depending on criticality of the system. If fast load shed is deployed and deemed critical, then redundant communications using parallel redundancy protocol (PRP) is recommended.
How does one determine the best load shedding scheme to use in a facility?	This depends on the largest infeed (generator or utility transformer) and number of infeeds. If the system can tolerate the loss of the largest infeed, then fast load shed might not be needed, and frequency protection can be used instead for this function. However, if the remaining system can't compensate for the loss of the largest infeed, then fast load shedding is recommended.
Can the FLS controller be designed to have a phased load restoration system when operating a plant on gas engine-based generators?	Absolutely, however, this will require dedicated logic that is unique to each power plant. Restoration can be implemented as a phased or other approach and can be dynamic based on system/plant configuration.
How do you solve latency communication between relays and FLS controllers?	IEC 61850 using an Ethernet network is recommended to reduce latency which is more apparent when using other communications protocols. The 15ms shedding time includes the latency that can be expected from Ethernet switches and IED processing time. Using IEC 61850 is not critical for power metering since analogs need to be communicated to the fast load shed controller once per second; however, the offline status of all infeeds and the shed command is recommended to be IEC 61850 GOOSE so as not to impact system performance.