

## UPS Trade-Off: G9000 vs. Econo-Mode

UPSs that operate in econo-mode (line-interactive topology) are touted as operating at higher efficiency with commensurate reduced operating costs compared to online (double conversion topology) UPSs.

The truth is that, as with all engineering solutions, there are trade-offs. The table below lists common adverse power events from power utilities, and compares the two topologies handling of these power events.

Power Event	Toshiba G9000 (Double Conversion)	Econo-Mode (Line-Interactive)
Power Failure	Backup load power immediately online.	Backup load must switch from static bypass to inverter.
Power Surge Sag Overvoltage Undervoltage	Load voltage regulated +/-1%.	Load experiences voltage surges, sags, overvoltages, and undervoltages until the power event exceeds preset UPS limit.  If using a constant voltage transformer, in industrial applications with varying loads, possibility of UPS going into current limit before the fault clears.
Switching Transients Line Noise	Load isolated from transients and line noise.	Load experiences voltage transients and line noise until preset limit is exceeded.
Frequency Variation Harmonic Distortion Voltage Unbalance	Load isolated from transients and line noise.	Line frequency variations, harmonic distortions, and voltage unbalance are passed on through the load.

UPS Parameter	Toshiba G9000 (Double Conversion)	Econo-Mode (Line-Interactive)
Efficiency	96.5%	95% to 99% (Claimed)
Voltage Regulation	+/- 0.5% to 1.0%.	Dependent on UPS parameter settings. Typically +/- 5%
THD	2% Linear load 5% Non-linear load	No limitation or power conditioning

The philosophical difference between these two topologies is simply that a line-interactive UPS is always in bypass mode and relies heavily on sensing and reacting to power events, whereas a double conversion UPS is always on line and keeps supplying conditioned power regardless of input power events.

Finally, from a failure mode perspective, there are more ways for things to fail with a line-interactive unit than with double conversion unit. More sensing means more potential for a sensor failure; more switching means an increased probability of dropping the load.

When selecting an Uninterruptable Power System, look beyond raw efficiency and balance your power quality requirements against the performance criteria of these two UPS topologies. Slightly lower operating costs may come at the expense of power quality and reliability.