

### Typical power quality problems and available mitigation devices

Mitigation devices	Voltage sags	Voltage fluctuations	Over voltage	Under voltage	Inter-ruptions	Swells	Transients	Harmonics	Notches	Fault ride thru	Short circuit contribution
APF (TF)							x	x	x		
BESS	x	x	x	x	x	x	x				
DSTATCOM		x	x	x			x			(x)	
DSC		x		x							
DVR	x	x			x	x	x	x			
PFCC			x	x							
SA							x				
SC	x	x	x	x	x	x	x		(x)	x	x
SMES	x	x	x	x	x	x	x				
SETC	x		x	x		x					
SSTS	x				x	x					
SSCB					x						
SVC	x	x	x	x		x					
TCS				x			x				
UPS	x		x	x	x	x					

APF = Active power filter

BESS = Battery energy storage system

DSTATCOM = Distribution static synchronous compensator

DSC = Distribution series capacitor

DVR = Dynamic voltage restorer

PFCC = Power factor correction capacitor

SA = Surge arrester

SC = Synchronous condenser (rotating)

SMES = Superconducting magnetic energy storage system

SETC = Static electronic tap changer

SSTS = Solid-state transfer switch

SSCB = Solid-state circuit breaker

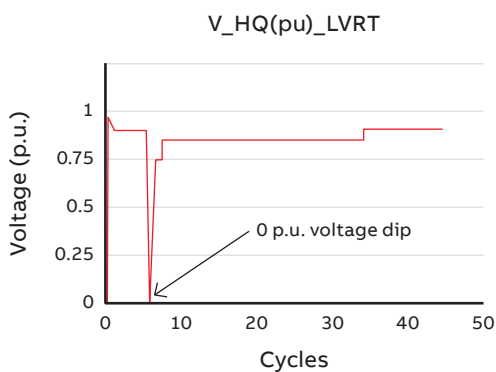
SVC = Static var compensator

TCS = Thyristor switched capacitor

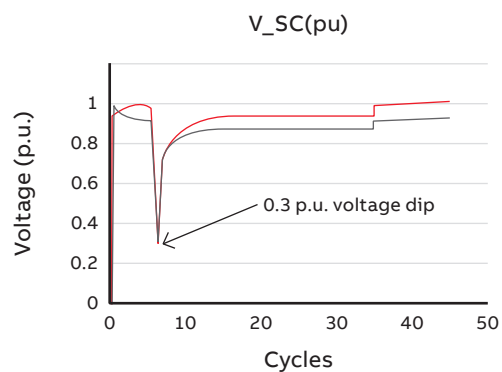
UPS = Uninterruptible power supply

Grid	Problems	Solution with ABB SC* at the connection point
Weak network (Ik)	Short circuit capacity is reduced due to reduced capacity / number of large fossil fuel power plants and increased number of new industries	The number of new SC's will improve the total Ik and provide redundancy for service shut downs
Unstable network (Hz)	Frequency fluctuating due to increased new load types and faults	With high inertia it can stabilise the frequency
Long distribution lines (V)	Voltage sags due to many consumers over long distances	Stabilise the voltage with boost output for several 100 ms
Temporary / periodically peak loads	Process industries can represent large uneven rapid changing loads	SC's have high* overload capability for 15-30 min
Temporary disturbances	Can be from e.g. lightning strokes or equipment failure	With high inertia it has good capability to ride through the faults

\* SC's will be optimised based on specific project requirements at each locations



Voltage profile on HV bus



Voltage profile on MV bus with SC is connected