Ensure your power quality

Power Consulting offers services to analyze and mitigate power quality challenges
The current challenges of power quality

The utility requirements for interconnections by industrial customers and power generation developers have standards that must be met. These often require the customer or developer to meet power factor, harmonic, voltage flicker or voltage fluctuation, and protective relaying requirements. Besides these interconnection requirements, the industrial customer or developer may also need to meet requirements for power ramp rates, motor starting, and voltage control. These are all power quality issues.

Often, power quality issues are mainly due to a weak grid, such as low fault level at the point of interconnection. The expansion of industrial system on the weak grid can increase the voltage flicker beyond the flicker limits where it can be seen by the utilities’ nearby customers.

Accelerating deployment of renewable generation is resulting in larger projects and harmonics and reactive power control become more important for these larger interconnections.

As system are changed, upgraded, and enhanced, various problems may arise such as high frequency resonance modes interfering with the motor drive controls and operation. Equipment failure as a result of voltage unbalance may also be a result of some power quality problem. ABB has experience in working with many types of power facilities and has experience in assisting our customers in addressing these problems.

Power quality is under pressure from...

**Changes in the generation mix**
- Increase level of renewables
  - Lower system stability/reliability/inertia
  - Increased harmonics
  - Voltage stability issues
- From centralized to distributed
  - More complex system controls
  - Microgrid deployments
  - Reverse flow issues
- Energy storage deployment
  - Increased level of harmonics
  - More complex system controls
  - Energy support duration uncertainty

**Traditional industries/demand**
- **Heavy industries**
  - Arc furnaces causing:
    - Large reactive power demand
    - Non compliance/penalties
    - Harmonic distortion
- **Other industries**
  - Mills, variable speed drives, heavy motors causing:
    - Poor power factor
    - Harmonics

**Railway systems**
- AC and DC railways causing:
  - Harmonics
  - Poor power factor
  - Poor load balance

**Digitalization and new load demands**
- **E-Mobility**
  - Spread location of chargers
  - Restrict feeder hosting capacity
  - 3-ph supply imbalance
  - Voltage sag during charging
- **Expansion of data centers**
  - Increased harmonics
  - Grid reinforcement required
  - High reliability & dependability need
- **Smart grids/cities**
  - Higher loads, harmonics and data flows from:
    - Internet of things/smart homes
    - Smart cities/highways

**Changes in the regulation**
- **New grid code requirements**
  - More stringent provisions for:
    - Dynamic voltage control
    - Harmonics
    - Reactive power support
- **TSO/DSO developments**
  - System operators develop new responsibilities/interfaces

**Share of market regulation costs**
- Energy trading
- Power factor correction
- Harmonics mitigation
"75% of the power quality related disturbances are caused due to voltage sags/swell, harmonics, and switching (capacitors, etc)."

Source: EPRI
Future drivers and challenges

ABB Power Consulting can also assist with power quality future drivers and challenges.

**Further renewable integration process**
- Larger Renewable integration
  - Technology cost reduction
  - Meet 2030 targets
  - Further increase of related current issues
- Substantial increase of DG and shut down of traditional plants
  - Further reductions in system inertia/stability

**Energy storage full deployment**
- Improve renewables dispatching
- Ancillary Services market
- Power systems control interactions

**Decarbonization process**
- Integration of RES at industrial
  - Reduce CO2 emissions
  - Impact on the industrial process – variability/power factor/harmonics
- E-mobility deployment
  - Mass transportation electrification (trucks)
  - Reverse flow issues with V2G

**Railway systems**
- SFC integration
- Energy storage deployment

**Digitalization and new load**
- Demand side management
  - Electrical equipment can be affected by power quality issues
- Further Expansion of data centers
  - Large power demand
  - Remote locations with lower
  - Green data centers

**Further development of Smart grids/cities**
- Demand increase
- Behind the meter generation

**New regulation and developments**
- New grid code requirements
  - More stringent provisions for:
    - New generation
    - New load type
    - Behind the meter regulation
- TSO/DSO developments
  - HV and MVDC grids
  - New interconnections
  - New principles for planning/operation
  - Further pressure to lower consumer prices
  - Use of system (UoS) charging mechanisms
Power Quality Solutions

Our solutions

Renewable generation
- Identify, clarify & investigate problems:
  - System studies
  - Other analysis
  - Expert advice on Grid Code and standards compliance
  - Optimized, technically compliant & economic solutions:
    - Equipment specifications
    - Test procedures
    - Site measurements
    - Failure modes & effects analysis (FMEA) or
    - Root cause failure analysis (RCFA)

Distribution systems
- Feeder hosting capacity studies
- Optimal capacitor placement studies
- Optimal breaker placement studies for loss reduction
- Volt-var compensation studies
- EV charging impact analysis
- Harmonic analysis
- Site Measurement and Observations
- Training

Industrial systems
- Site Measurements
- Power Quality Preliminary Audits
- Modelling and Analysis
- Condition Monitoring
- Feasibility Analysis
- Techno economical Recommendation
- Owner’s Consultant
- Compliance to Grid Regulations
- Root cause analysis
- Training the site team

Heavy industry
- Identify, clarify & investigate problems:
  - Site visit/measurements
  - System studies
  - Root cause fault analysis
  - Other analysis, as required
- Recommend targeted, compliant & optimized solutions to client problems:
  - Investment case for:
    - Reactive compensation
    - Active/passive filtering
    - Design, implementation, commissioning

Railways
- Identify, clarify & investigate problems:
  - Site visit/measurements
  - System studies, with harmonic & resonance evaluation
- Recommend targeted, compliant & optimised solutions to address:
  - Power system design strategy
  - Advanced compensation, load balancing, filtering
  - Proposals for energy savings, including through re-generative braking

Residential
For the distribution companies:
- Identify, clarify & investigate problems:
  - Site monitoring
  - System studies
  - Other analysis
- Strategies for:
  - Optimal capacitor placement
  - Optimal breaker placement
  - Volt-var compensation
  - EV charging
  - Demand-side management
  - System reconfiguration