# Power Quality to Achieve Energy Excellence -

## Reduce risks and improve profits for Sugar Industry

**Presented by | Manas Kundu**

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**6th August 2020**

**Green Sugar Summit - Virtual Conference**

**CII IGBC Hyderabad**

# Learning from APQI : A focus around 3 Missions

**A reference for all PQ matters in Asia**

- A network of European /Asian PQ experts
- Standard activity (standardization/certification body participation)
- Leads appropriate PQ study (PQ Survey, Application Note, Case study, PQ Regulation report)

**Education & training fine tuned for individuals**

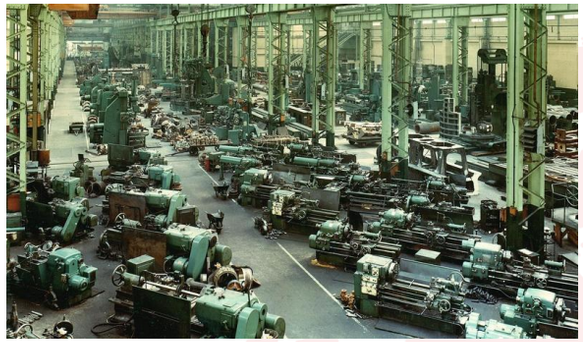
- Print publications
- Electronic library

**Lead the dynamic through adequate knowledge management & E-dissemination**

- Website
- Forums
- Seminars
- Webinars

**www.apqi.org**

# OLD AGE




# NEW AGE

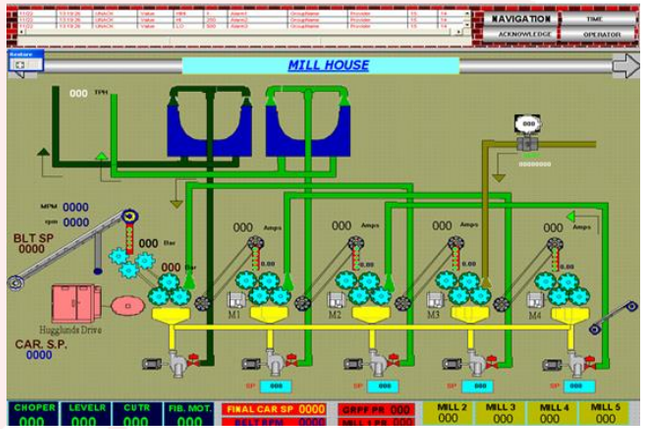



Acknowledgement: Mr. B M Jagtap - CTR

# No technology modernisation succeeds without convergence of supporting inputs

**Conventional**
Heavy mechanical equipment and machinery driving operations

**Co-generation**
Large scale Cogeneration plants turn sugar mills into Prosumers. Mechanical engineering is key to efficiency and sustainable functioning.

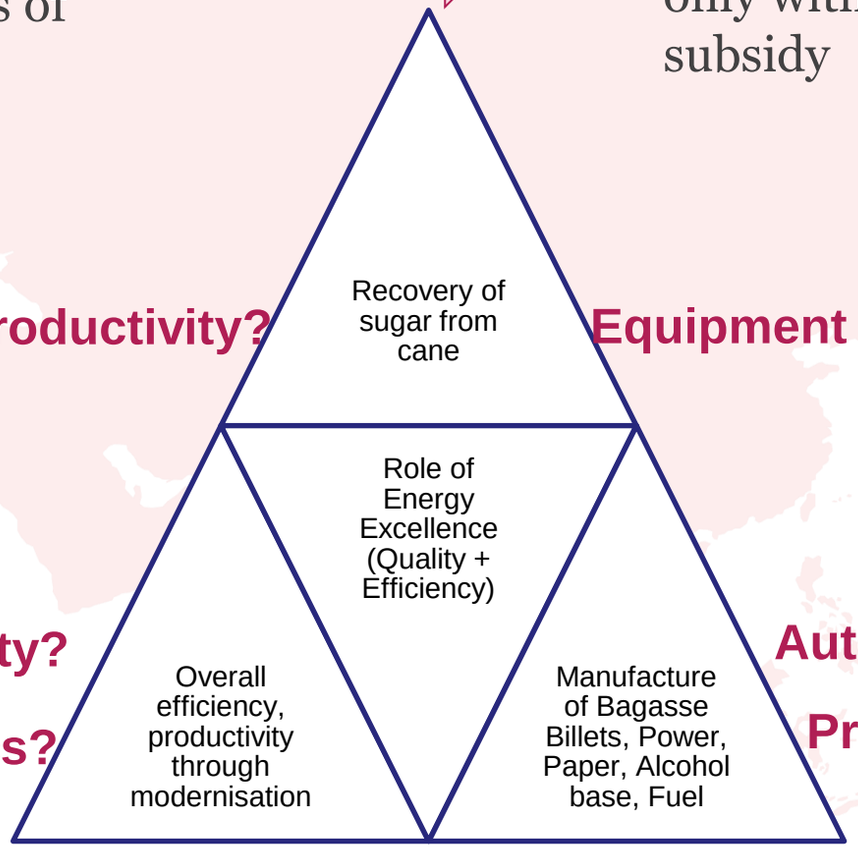



**Automation and IoT**
Good quality Electrical power that supports mill automation, Boiling and power house automation is key to efficient energy excellence and risk avoidance

# Excellence = Quality + Efficiency

**1840**'s India supplied 1/4 of the sugar needs of England.

**2020** Exporting sugar is feasible only with Govt. subsidy




**Productivity?**

**Equipment Life?**

**Reliability?**

**Volatile Economics?**

**Automation ready?**

**Prosumer economics?**


Power
Quality
Energy
Efficiency
….Key to achieve excellence

# Sugar – Energy Cost

| Process | Specific Electricity Consumption (kWh/MT *) |
|---|---|
| Milling tandem including cane handling | 10-12 |
| Clarification, Boiling, curing & sugar handling | 7-8 |
| Power plant including ESP | 7-8 |
| Utilities and lighting | 2 |
| Total | 26-32 |

**Source: TERI**
***Per MT of cane**

**Electricity cost would be around 4-7% of total operating cost**

# Broadened focus for good PQ is key to reducing costs and improving profits.

**Key PQ Parameters**

- Power Factor
- Harmonics
- Efficiency
- Transformer Losses
- EMFs
- Inrush Currents
- Voltage distortion
- Voltage Interruption
- Flicker
- Notch

Current Focus of Textile Paper Sugar Industries

The Required PQ Focus for sustainable and profitable operations

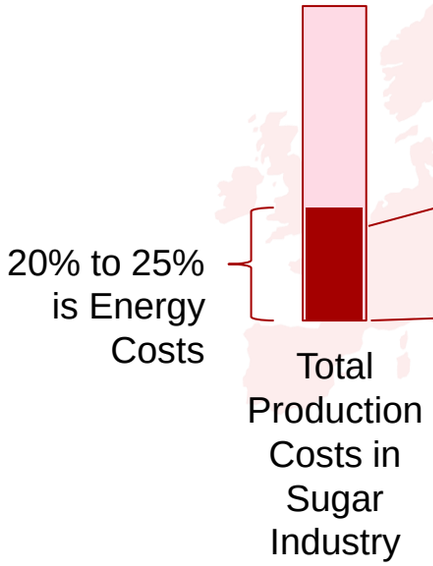
Quick Fix

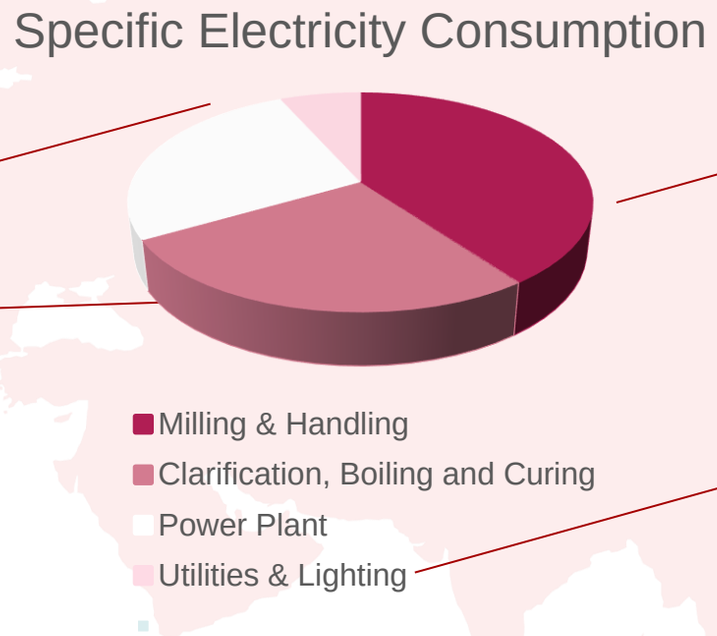
Long Term Strategic fix

| | Investments |
|---|---|
| Save on penalties charged for poor PQ (5% to 7% Energy Costs) | INR 5 L to 50 L |
| Improve Energy Efficiency through better design, infra update in PQ (5% to 25% Energy Savings) | INR 50 L to 200 L |
| Improved life-cycle with continuous and comprehensive PQ monitoring (5% to 50% savings in investments, faster RoI) | INR 50 L to 100 L |

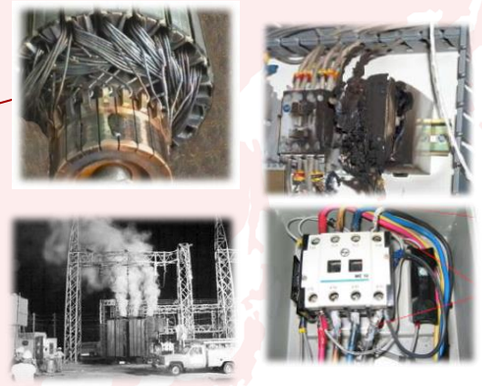
# Modernizing Sugar Production has its own costs…

Modernization is key to staying competitive




Modernisation adds non-linear loads such as VFDs, Power Electronics etc. accounting to about 50% of energy use

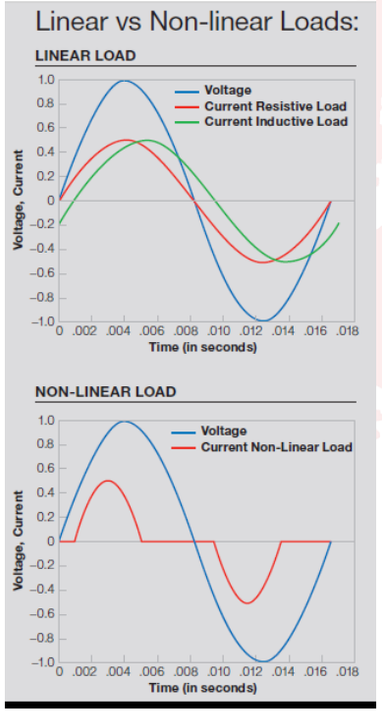


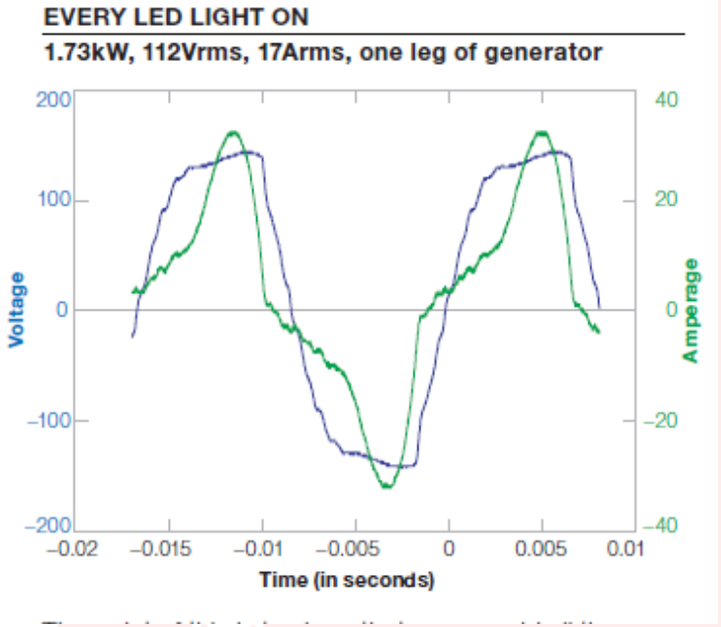
Unintended results of poor Power Quality environment and addition of non-linear loads

## Poor PQ leads to…

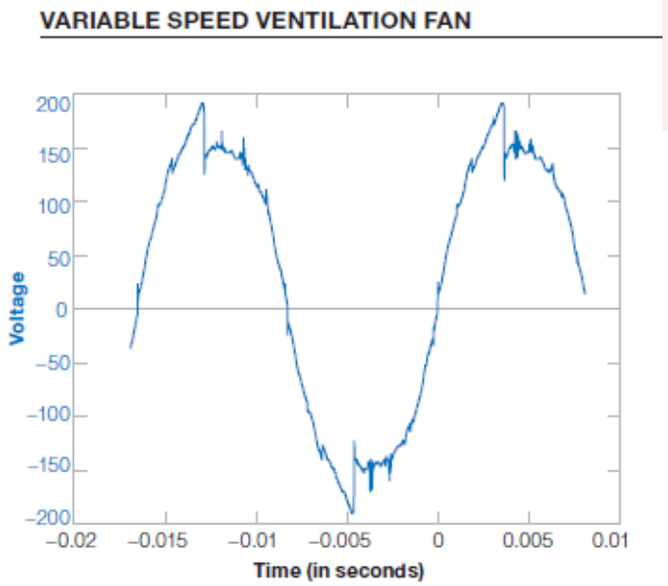
- Transformer heating
- Circuit Breaker Tripping
- Capacitor Bank Failures
- Electric Motor Heat-up
- Motor insulation failure
- Switchgear heating
- Thermal overload relay tripping
- Electronic Card Failure
- PLC/HMI Failure
- Servo Motor and Drive Failure
- UPS Malfunctioning Failure
- Compressor Problems
- VFD Failure

# The role of good PQ in energy excellence is beyond doubt.




Sudden change in voltage profile after load of LED lights.




Sudden dip in voltage in a VSD ventilation Fan due to the non-linear current draw, in addition to the high frequency non-idealities.

## Effects of Non-Linear Loads on Generator Electrical Systems

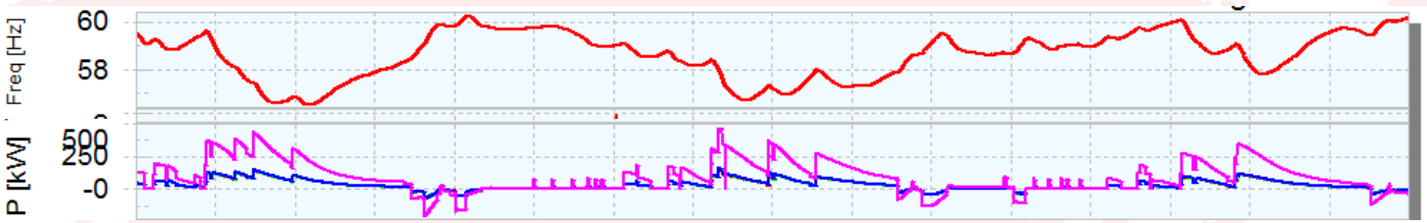
**Source: Whitepaper by Cummins USA**

# Typical PQ Issues in Sugar

## Frequency Deviations:

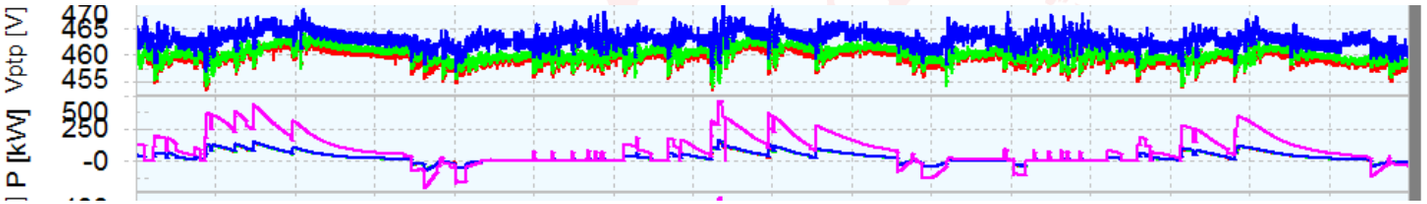
Starting/stopping of mill large loads can cause frequency variation

Increase in frequency will cause fluctuating torque




## Voltage Dips:

Starting mill large loads can cause voltage dips – May cause tripping of drives



# Typical PQ Issues in Sugar

**Constant and desirable torque is key to maximum recovery in sugar industry**

**Harmonics:**

- Drives (DC or AC) will generate current harmonics
- High impedance of captive power plant – high voltage harmonics
- Over heating of motors
- Variable torque in rotating machines
- Can cause reduction in sugar recovery percentage

**De-rating of alternators and generators is one of major harmonic related issue in sugar industry**

# Investments to improve PQ are key to staying competitive.

**Good PQ = Good Economics**

| Key Equipment | Long-term impact of good PQ |
|---|---|
| **Steam/Boiler and Cogen Plants** (use Transformers and Breakers, Protection equipment) | Effective use of CAPEX, Reduced losses, extended life, No nuisance tripping, extended life |
| **Crushers** (Uses Motors, VFDs) | 5% to 10% longer life for seals, windings etc., significantly lower breakdowns, lesser maintenance costs |
| **Automation** (use VFDs) | Avoidance of nuisance tripping, Extended life, lesser breakdowns |
| **Modern Machines, SCADA Power Electronics** (PLC, HMI) | Seamless functioning without interruption/breakdowns, Significantly reduced risk of failure throughout life-cycle |
| **Cables** | Longer life, reduced risk of short circuit, sparking etc. due to insulation damage |

# Changing Standards & Regulations

Doc No.: ETD 01 (12059)
IS 17036 : 2018

भारतीय मानक
वितरण प्रणाली हेतु आपूर्ति वोल्टता की गुणवत्ता

*Indian Standard*
**Distribution System Supply Voltage Quality**

ICS 29.240.01

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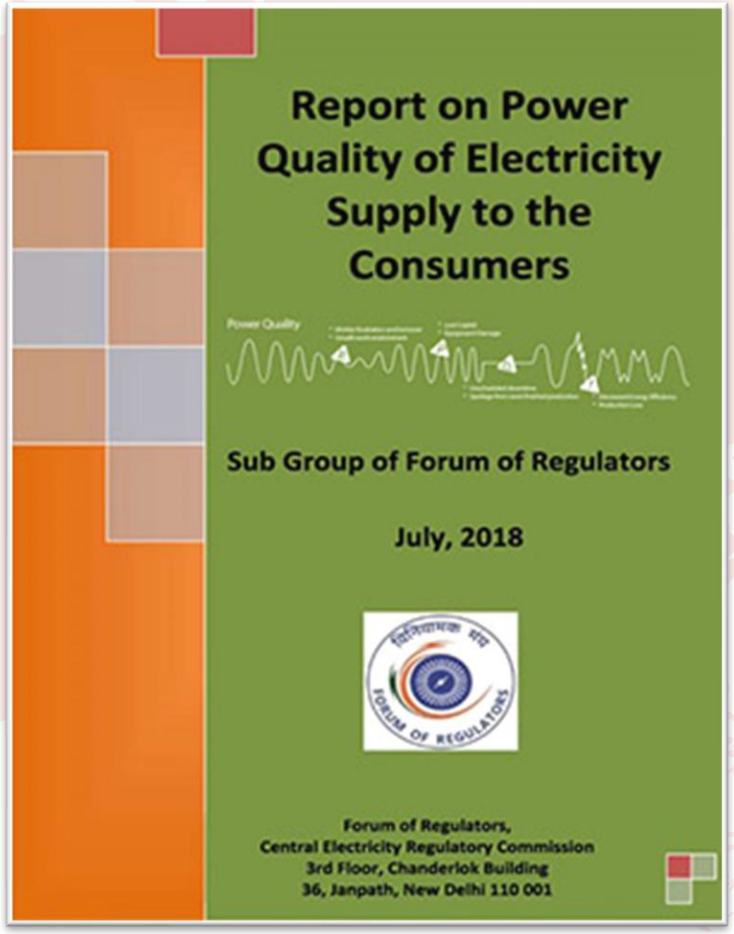
July 2018 Price Group




1. CEA(**Grid Standards**) Regulations 2010
2. CEA(Technical Standard for **Grid Connectivity**) Regulations, 2007, amended in 2013 and 2019
3. CEA( Technical Standards Connectivity of the Distributed Generation Resources) Regulation 2013 renamed as CEA(**Technical Standard for Grid Connectivity below 33 kilovolts)** Regulations, 2019

# PQ Mindsets

**The Reactive**
It's an emergency!

**The Risk taker**
We will see when we have problems

**The Calculated Risk Taker**
We have a budget for problems

**The Confident**
Problems? With all these investments?

**The Innocent**
We have done everything right

**The Proactive**
We invest in keeping network healthy

**The Futuristic**
Here are our PQ goals!

**We cannot progress without 'excellence' mindset.**

# 6 things you should consider taking up. Sustain the success by being regulatory compliant.

**1**
**Monitor** extended range of PQ parameters, continuously

**2**
**Measure** saving opportunities beyond PF and Harmonics

**3**
**Add to** energy efficiency with PQ improvement initiatives

**4**
**Comply** to the present and upcoming PQ regulations

**5**
**Avoid** investing in pseudo solutions to solve PQ issues

**6**
**Adopt** System Solution rather than product solution

# Thank You.
# Appreciate your patience and attention.
# Learn more @
# www.apqi.org