



# IEEE IAS Atlanta Chapter Meeting

10/17/22

# Agenda

- ▶ Members Open Forum
- ▶ Main Presentation
- ▶ Q&A
- ▶ Next Meeting Announcement

# Members Open Forum

*In an Orderly Fashion, Please Unmute Yourself or Request the Microphone*



# Dynamic UPS Systems

*Presenter: Ben Jones - General Manager Americas - HITEC Power Protection*

- ▶ Bachelor's in Building Service Engineering and Masters 's in Project Management from the University of Greenwich
- ▶ Based in Houston, TX
- ▶ Joined HITEC Power Protection in 2019
- ▶ Former CEO of Hitzinger USA, LLC
- ▶ Board Member for 7x24 Exchange – South Texas Chapter



[ben.jones@hitec-ups.com](mailto:ben.jones@hitec-ups.com)

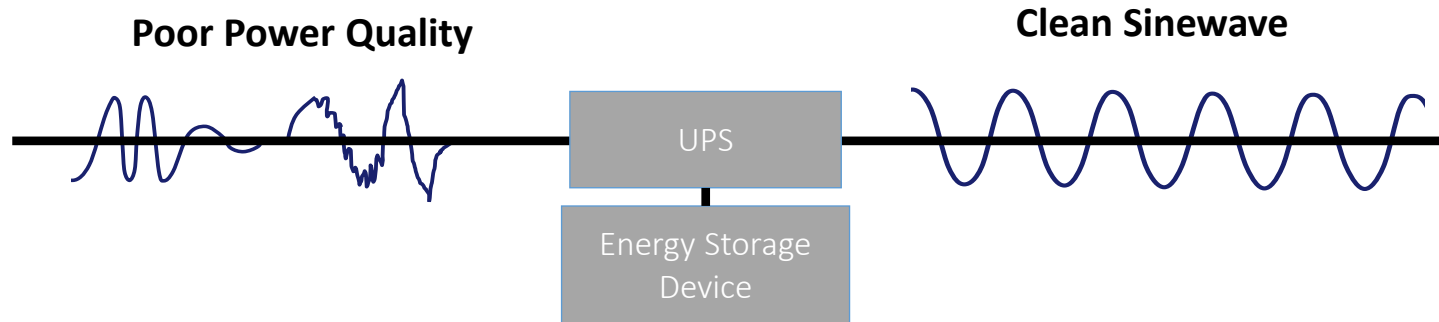
# Introduction

- Presentation will address the fundamentals of Dynamic UPS, including the various advantages/ disadvantages when comparing to Static UPS systems.
- Dynamic UPS first patented by HITEC Power Protection in 1956, with the basis on design a Rotary UPS with Battery.
- In 1991, the first Dynamic UPS with free rotating inner rotor was designed, mitigating the need for Battery Bank's in the system.
- With less than 5% Global Market Share, the Dynamic UPS tends to be isolated to large, multi-Megawatt applications and/ or non-IT related loads for the Semiconductor, Pharmaceutical and Critical Manufacturing industry.

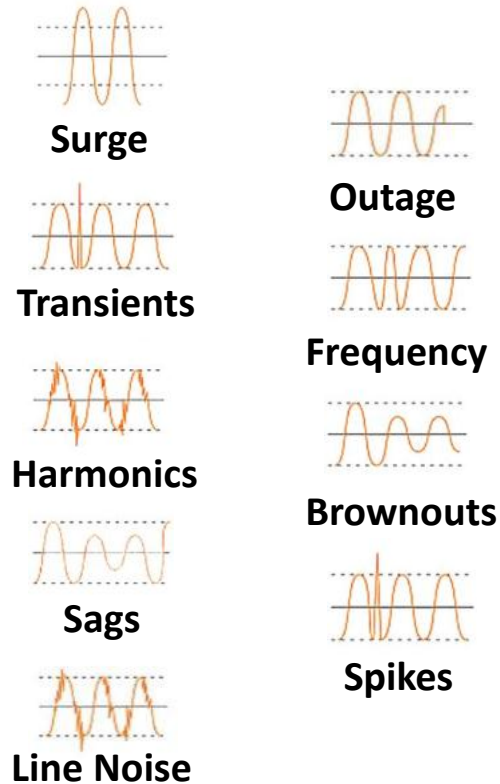
# UPS Basics

UPS Systems have two primary functions:

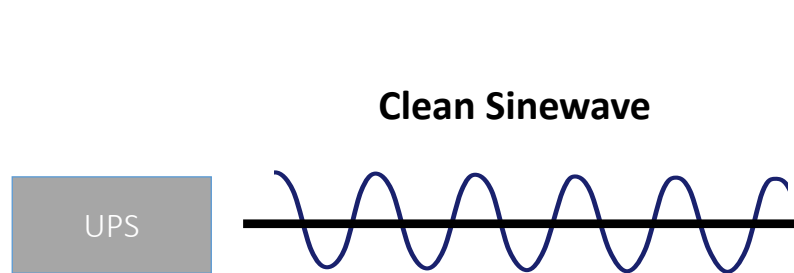
- (1) Provide clean conditioned power - irrespective of the poor mains quality
- (2) Protect against total utility failure - ensuring a clean transfer of energy over to the UPS source.



# (1) Provide Clean Conditioned Power - Irrespective of the Poor Mains Quality



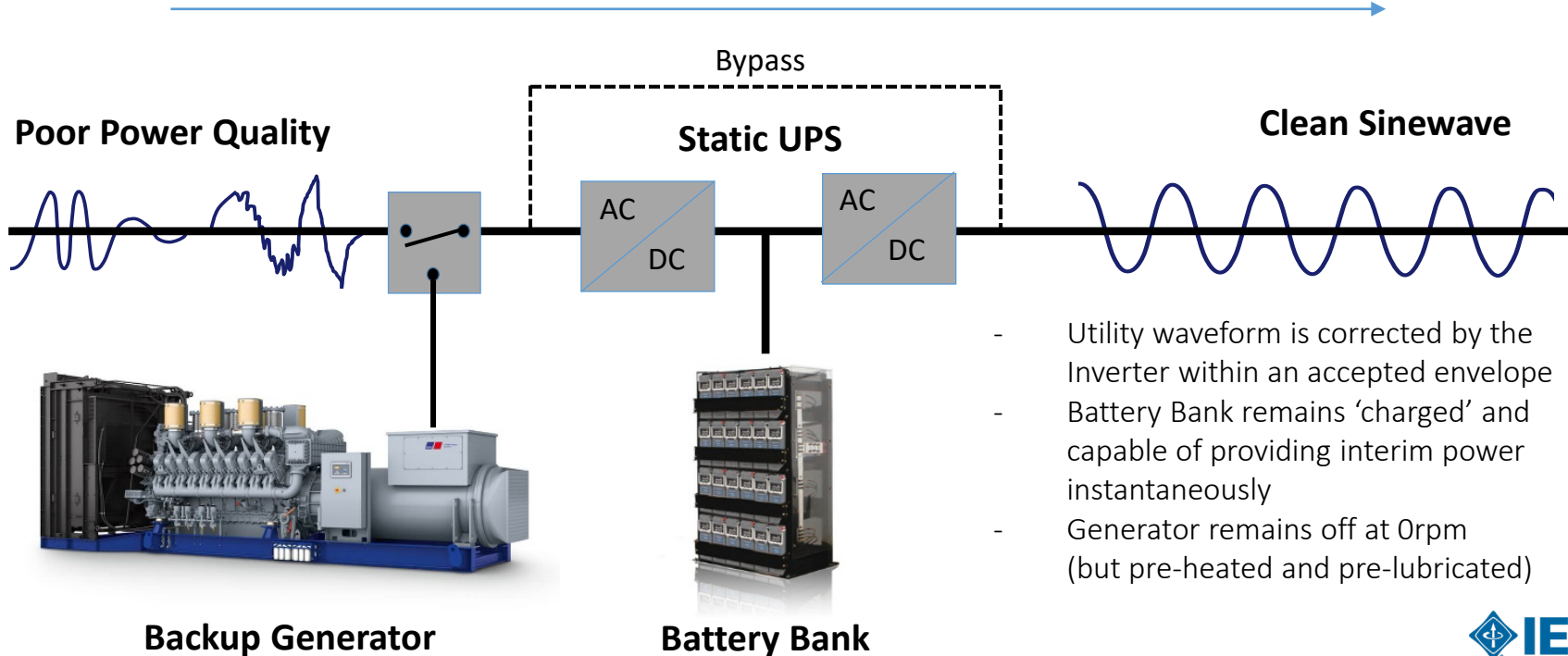
ALL UPS should protect against the 9 IEEE defined power problems, delivering a clean waveform within pre-agreed tolerances (ITIC/CEBMA)



The 'How' changes depending on the Technology (Static or Dynamic UPS), as does the topology. In this presentation we focus on Double Conversion Static UPS and Line Interactive Dynamic UPS.

# Static UPS Basics (1/3)

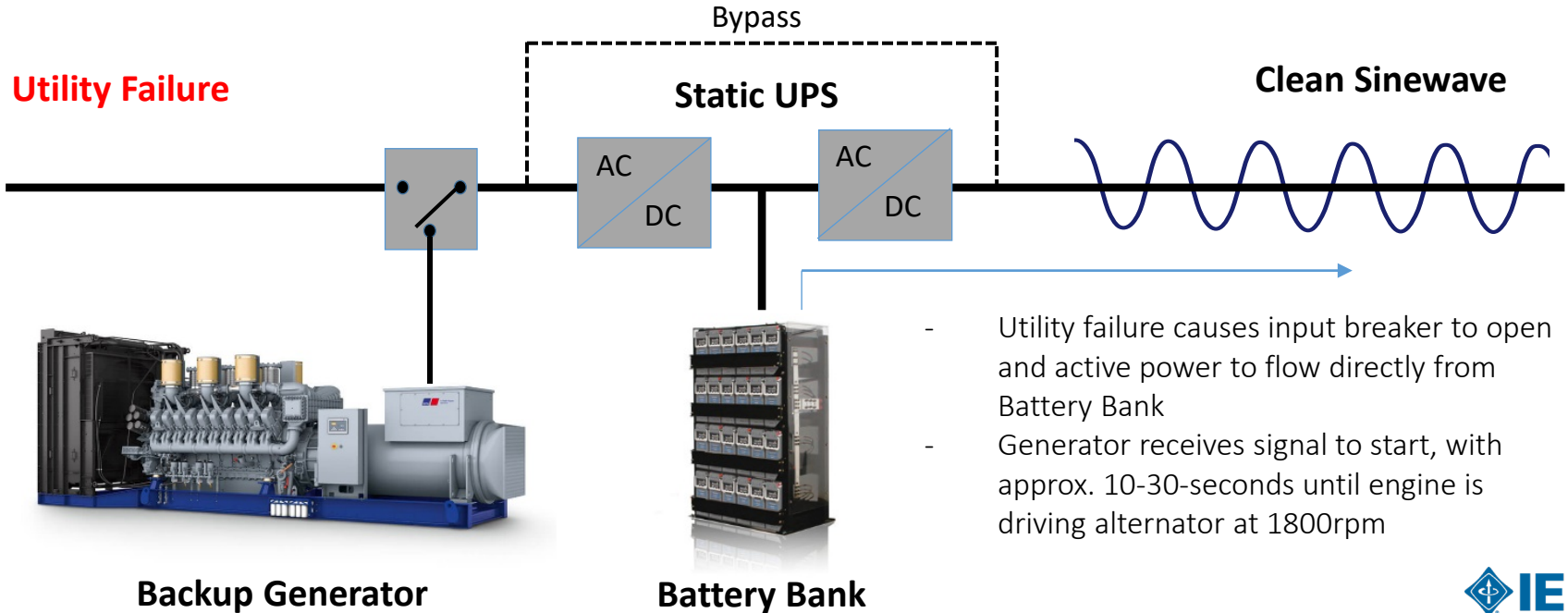
## Double Conversion Static UPS Normal Power Flow





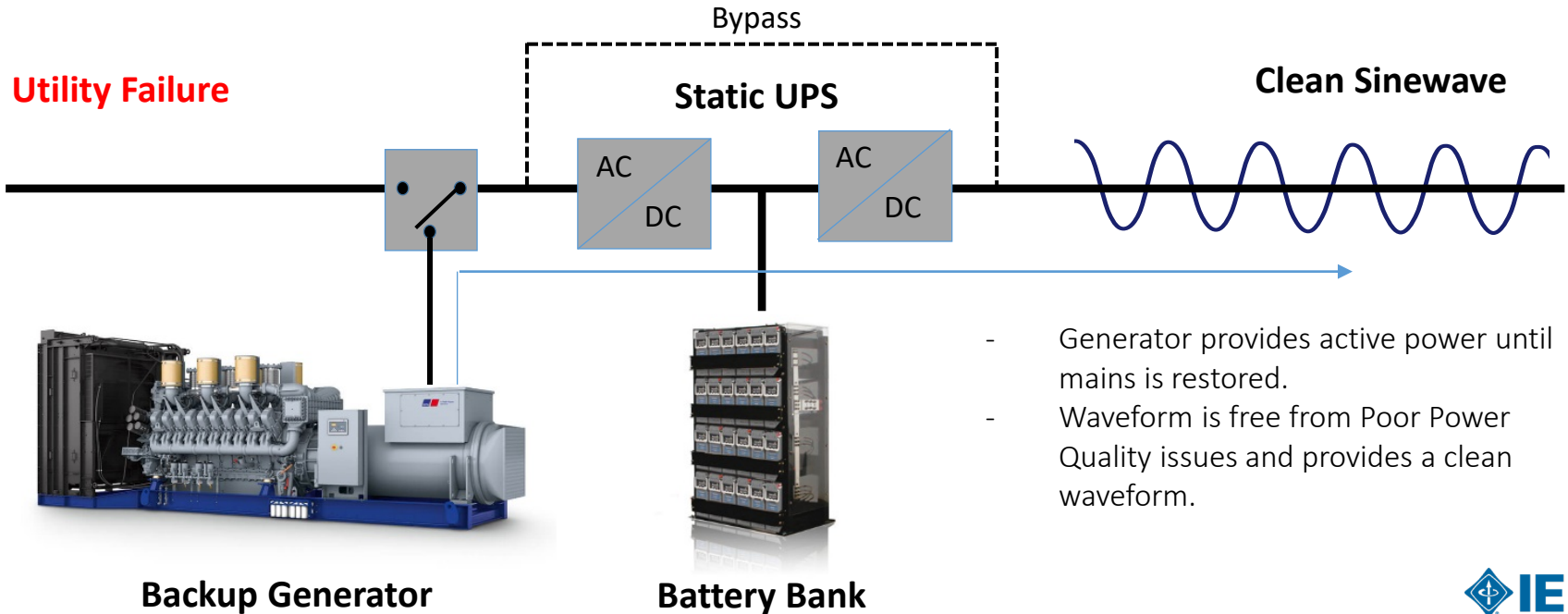
# Static UPS Basics (2/3)

## Double Conversion Static UPS Battery Operation



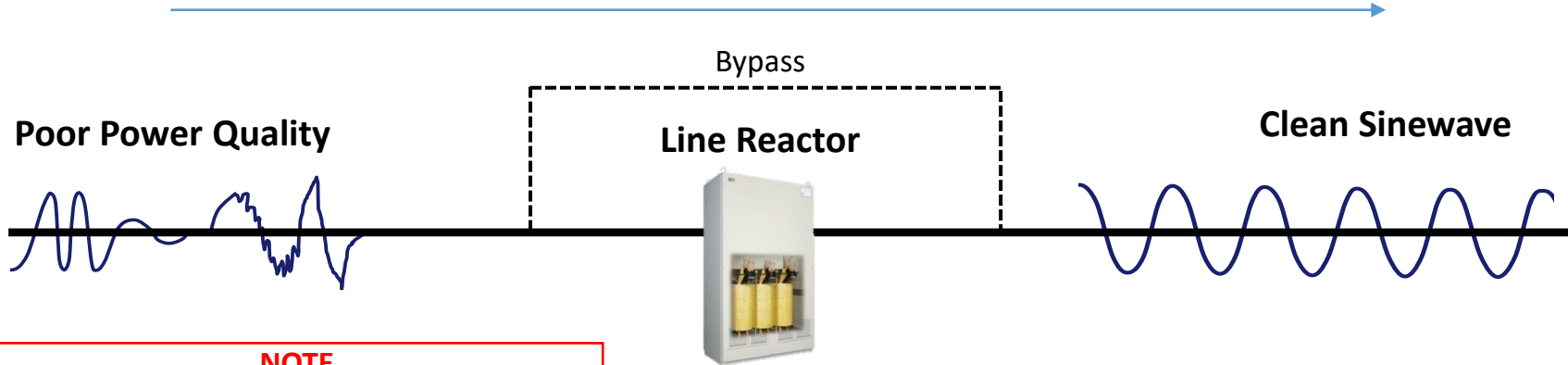
# Static UPS Basics (3/3)

## Double Conversion Static UPS Generator Operation



# Dynamic UPS Basics (1/5)

## Line Interactive UPS Normal Active Power Flow



### **NOTE**

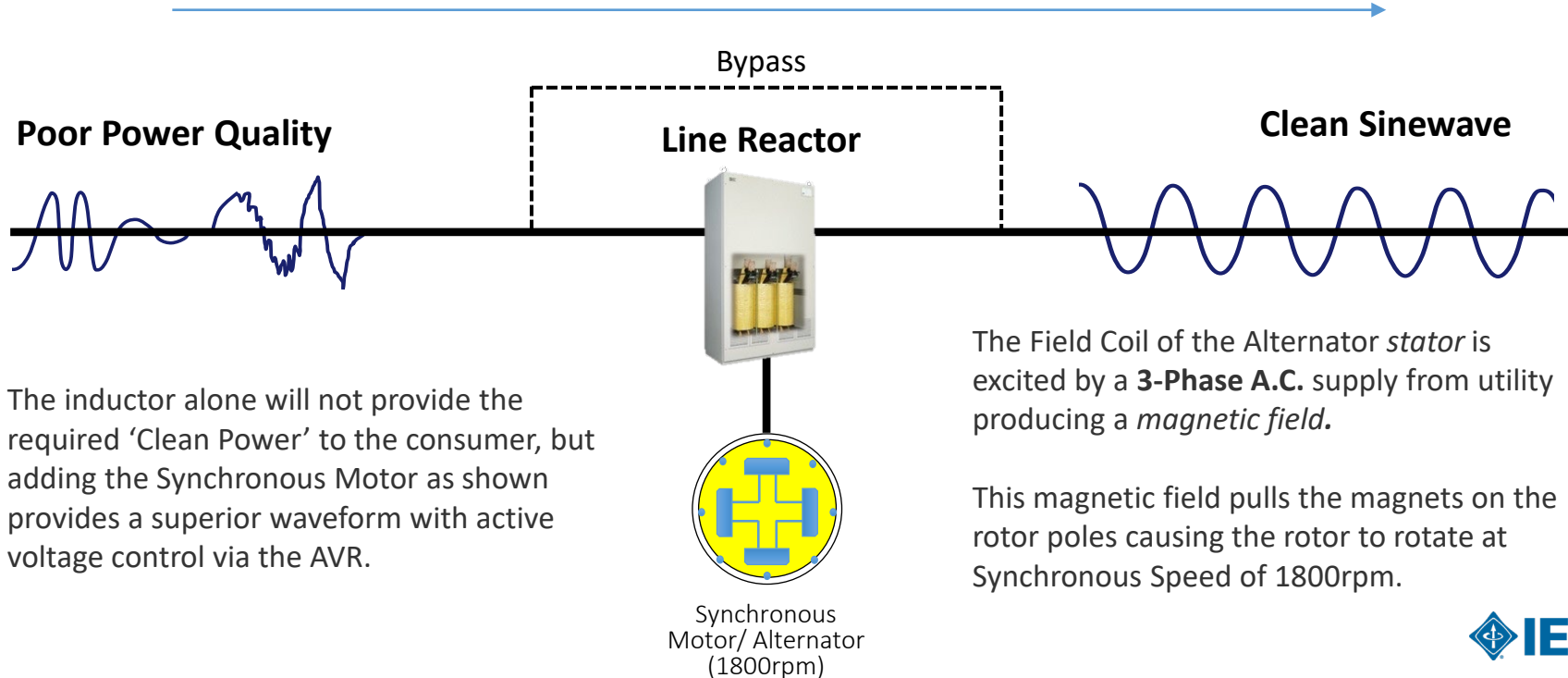
No need for AC/DC Conversion! Removes:

- Electronics Including Rectifier and Inverter
- DC Battery Bank
- Air Conditioning of Electronics

A Dynamic UPS is a line interactive type UPS! This requires an Inline Reactor (also called a coil, choke, or inductor) which stores energy in a magnetic field when electric current flows through it. The reactor consists of an insulated wire wound into a coil, which suppresses large fluctuations on the Input entering the Output.

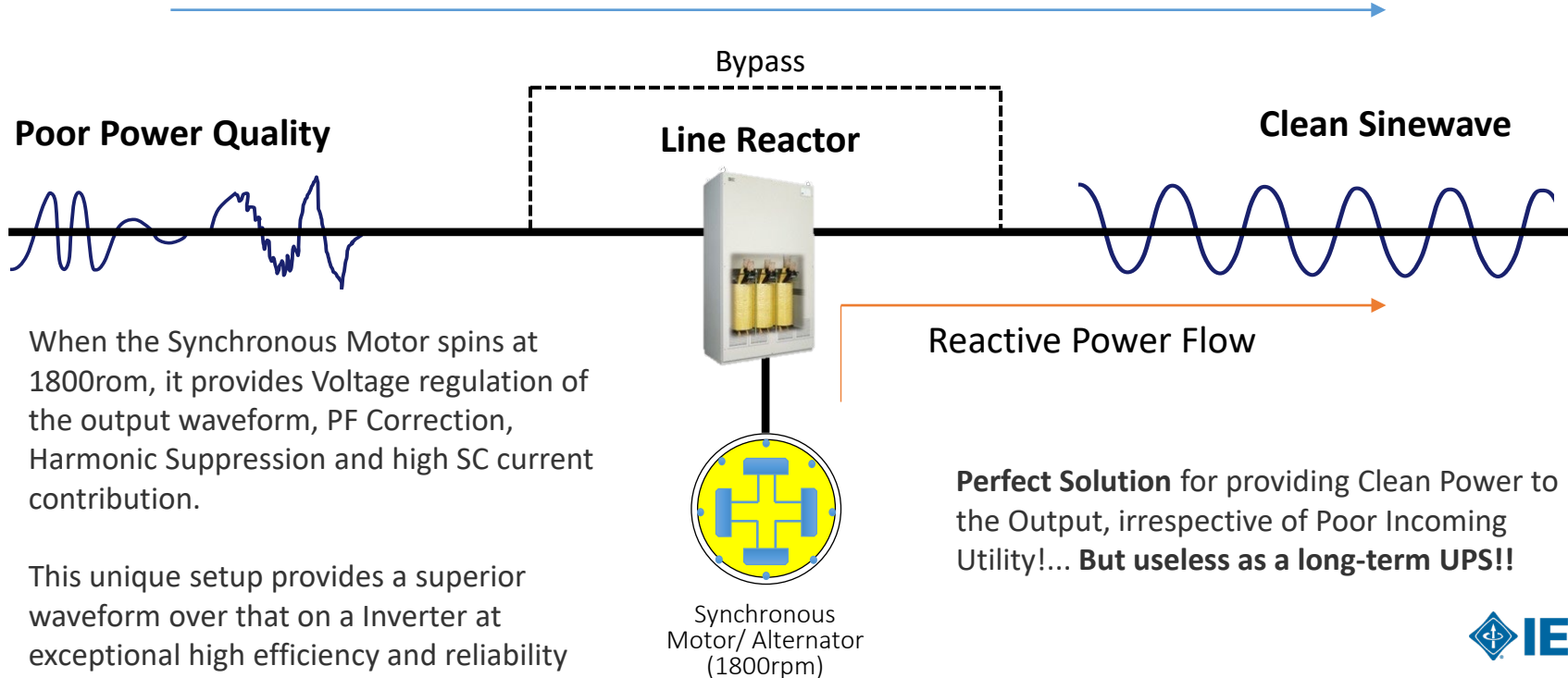
# Dynamic UPS Basics (2/5)

## Line Interactive UPS Normal Active Power Flow



# Dynamic UPS Basics (3/5)

## Line Interactive UPS Normal Active Power Flow



When the Synchronous Motor spins at 1800rpm, it provides Voltage regulation of the output waveform, PF Correction, Harmonic Suppression and high SC current contribution.

This unique setup provides a superior waveform over that on a Inverter at exceptional high efficiency and reliability

Reactive Power Flow

**Perfect Solution** for providing Clean Power to the Output, irrespective of Poor Incoming Utility!... **But useless as a long-term UPS!!**

# Energy Storage Difference

- Dynamic UPS stores energy in a rotating drum (flywheel) which provides the same interim gap of energy to allow a seamless transfer from Utility Operation to Generator Operation.
- The 'How' and 'Why' changes, but the fundamental goal is the same: **Provide Clean Uninterruptable Power to the Load!**
  
- In the case of a Flywheel, there is no need to convert the incoming AC waveform to DC (no battery bank). So, the 'How' is different which requires a change of philosophy when it comes to UPS.
- A Dynamic UPS is a Line Interactive Type configuration, but not to be confused, it still provides the same protection against the 9 IEEE identified quality issues AND provides a superior waveform on the output bus capable of dealing with High Inrush Currents, Overloads (Motors), Inherent Power Factor Correction and a high short-circuit contribution.



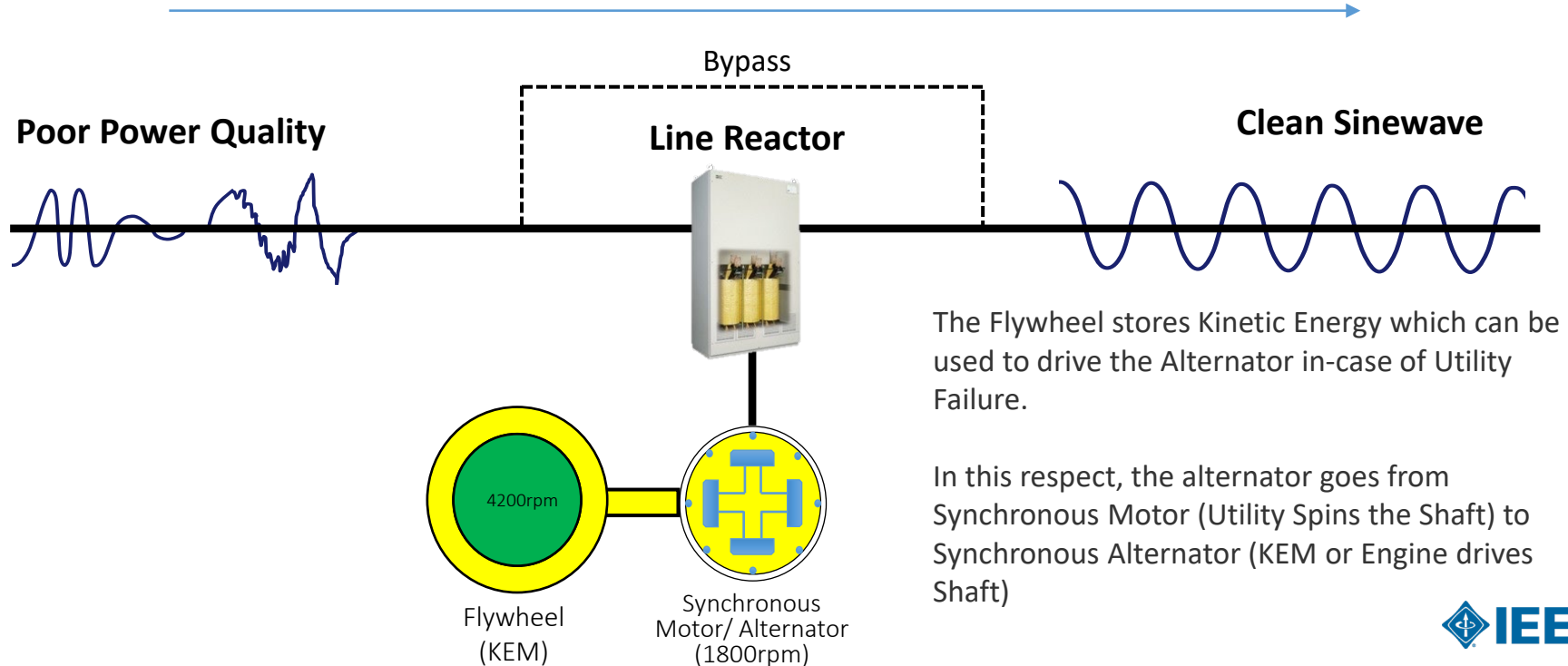
**Chemical Battery**



**Kinetic Energy**

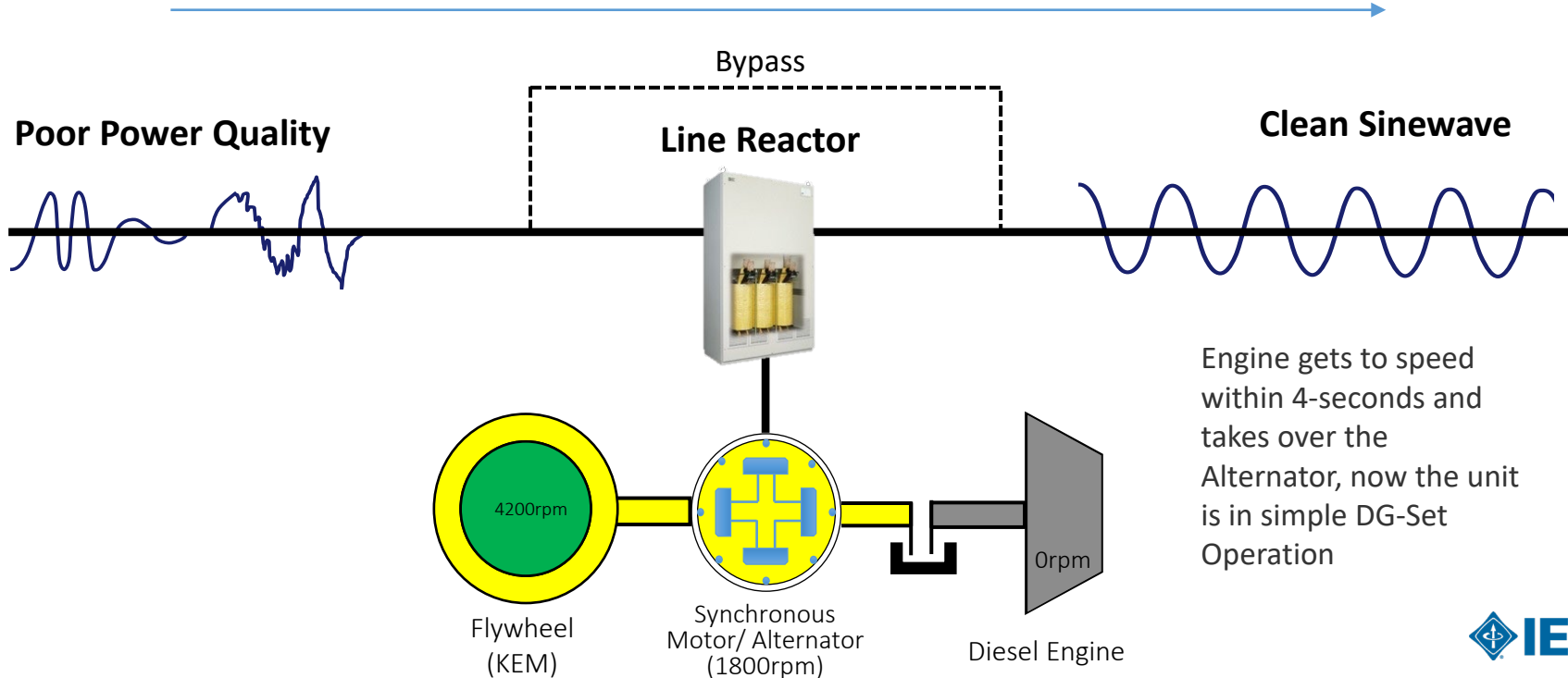
# Dynamic UPS Basics (4/5)

## Line Interactive UPS Normal Active Power Flow



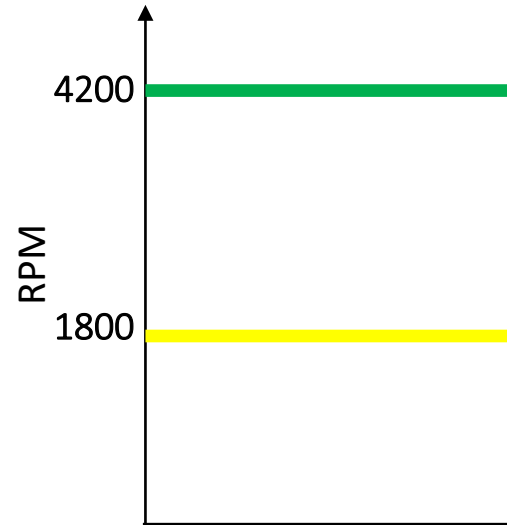
# Dynamic UPS Basics (5/5)

## Line Interactive UPS Normal Active Power Flow

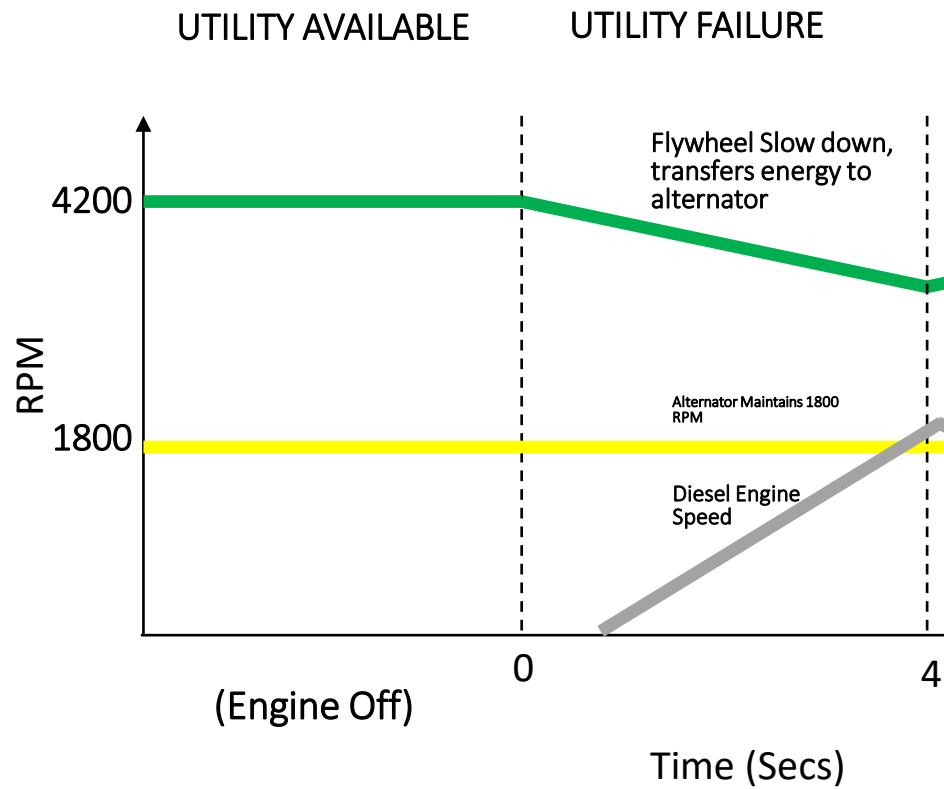


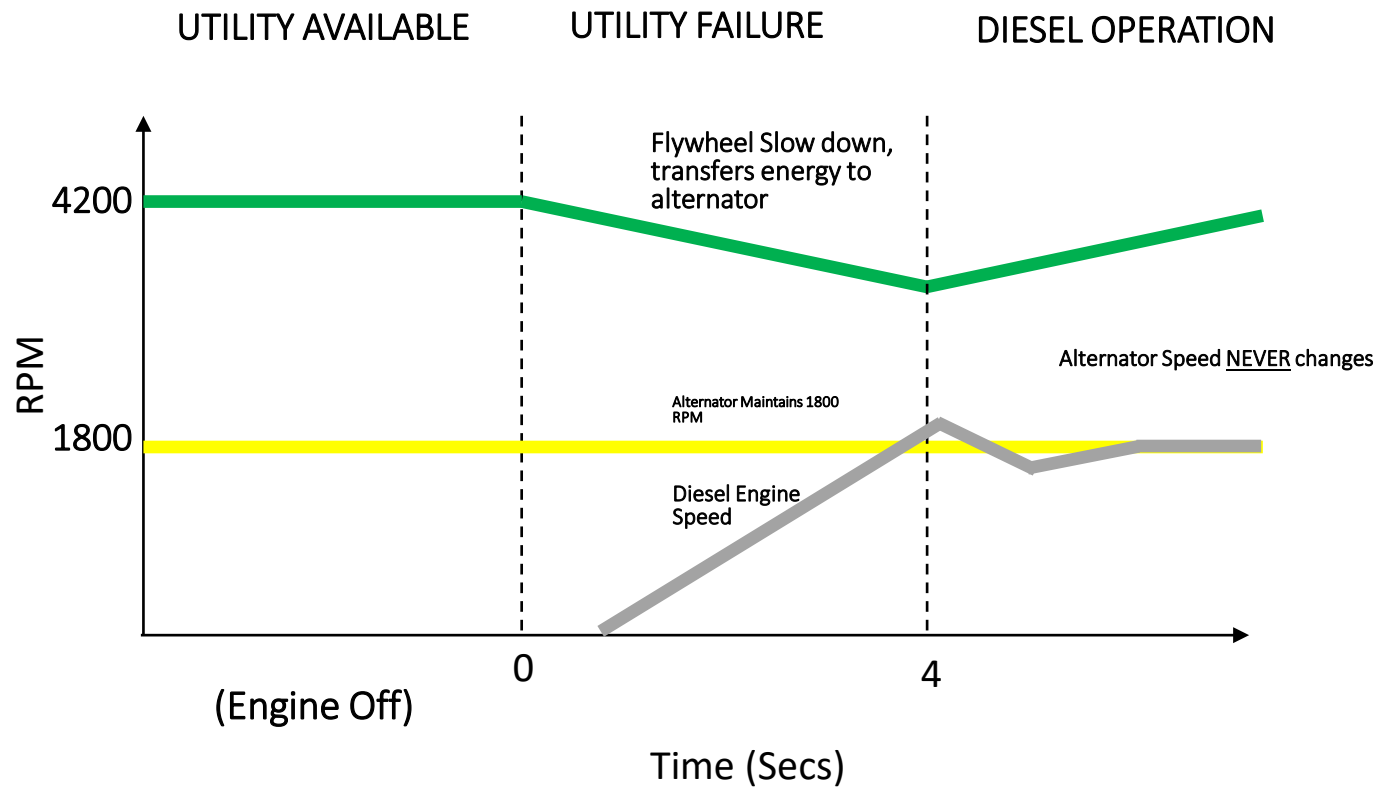


## UTILITY AVAILABLE



(Engine Off)



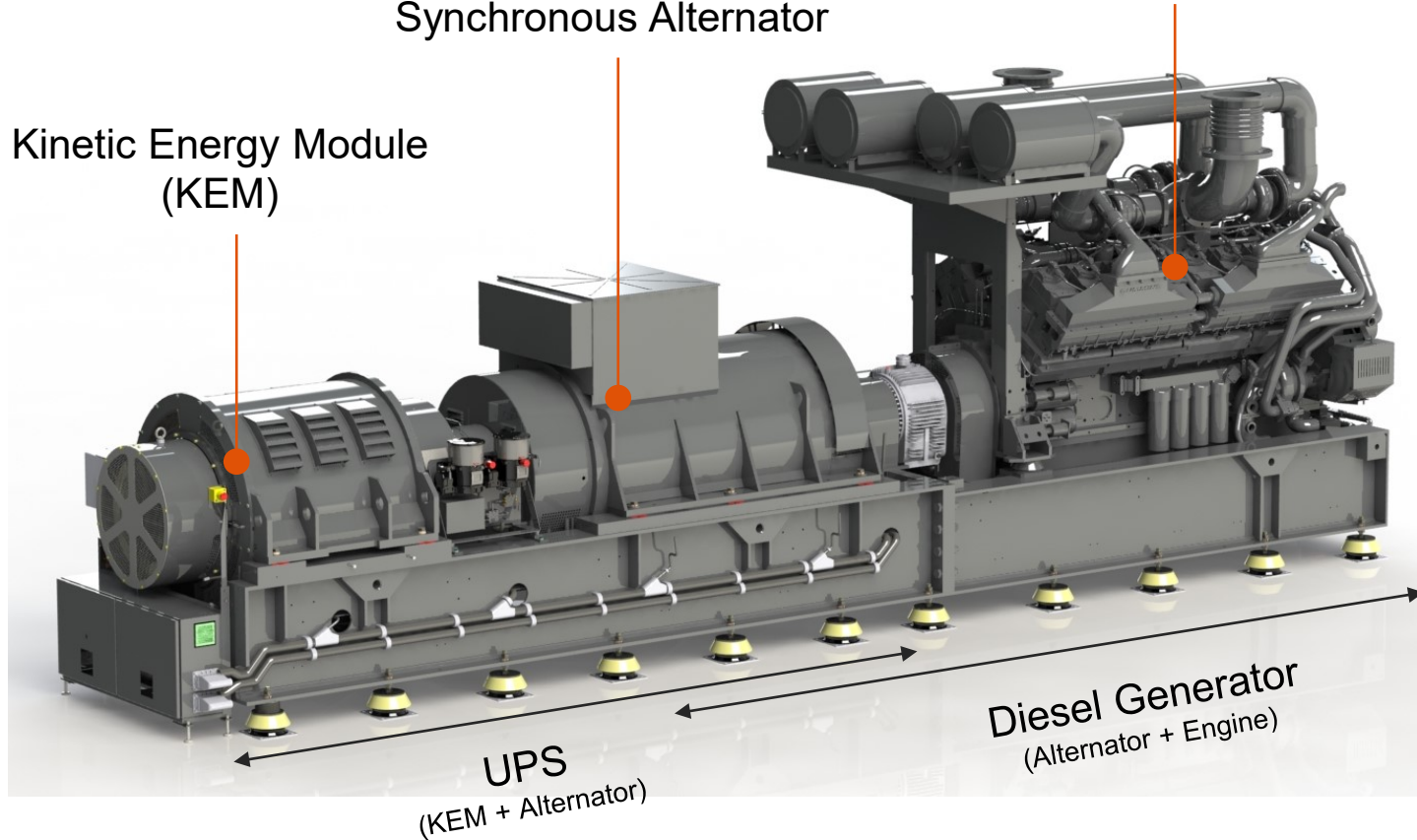


# Dynamic UPS

Low Emission Diesel Engine

Synchronous Alternator

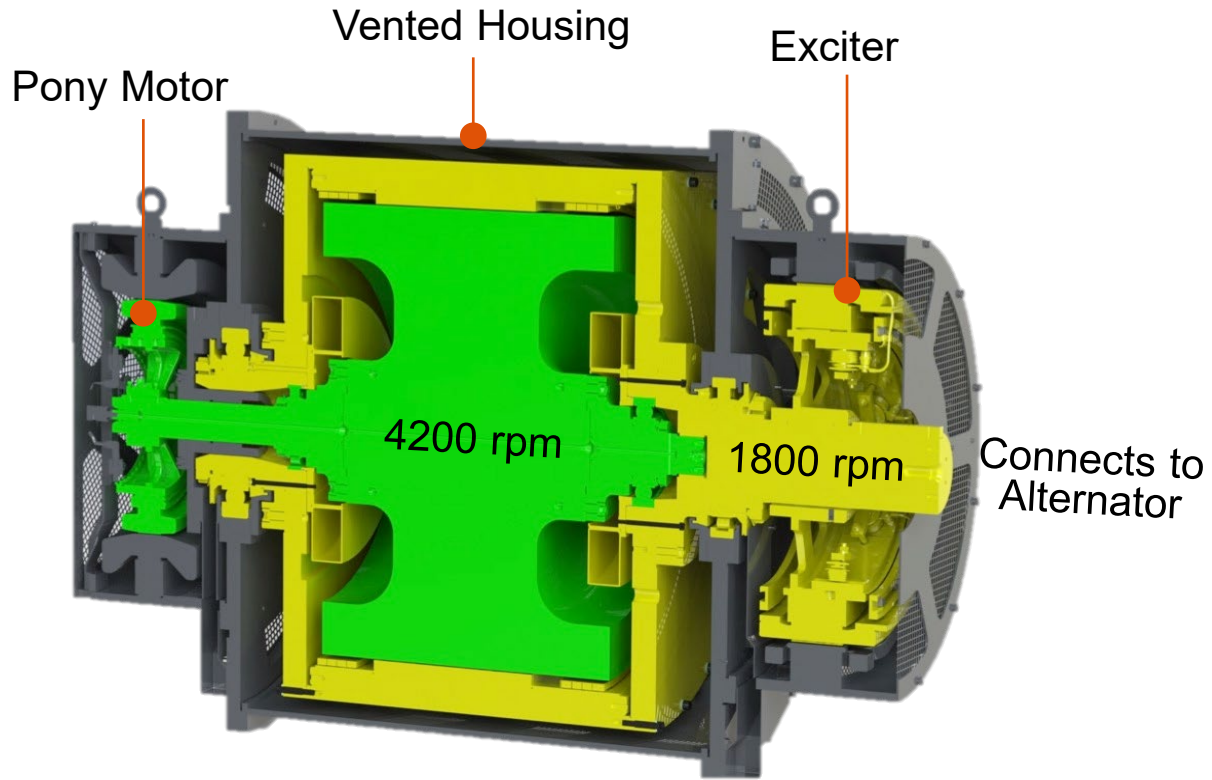
Kinetic Energy Module  
(KEM)



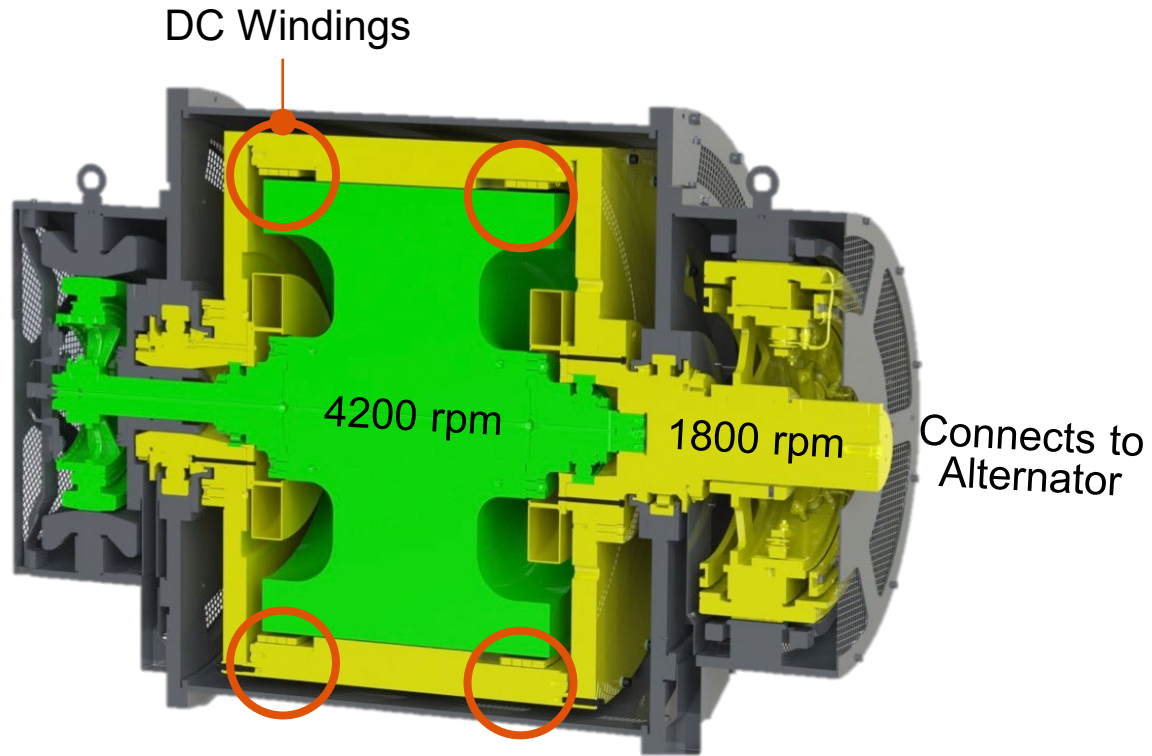
UPS  
(KEM + Alternator)

Diesel Generator  
(Alternator + Engine)

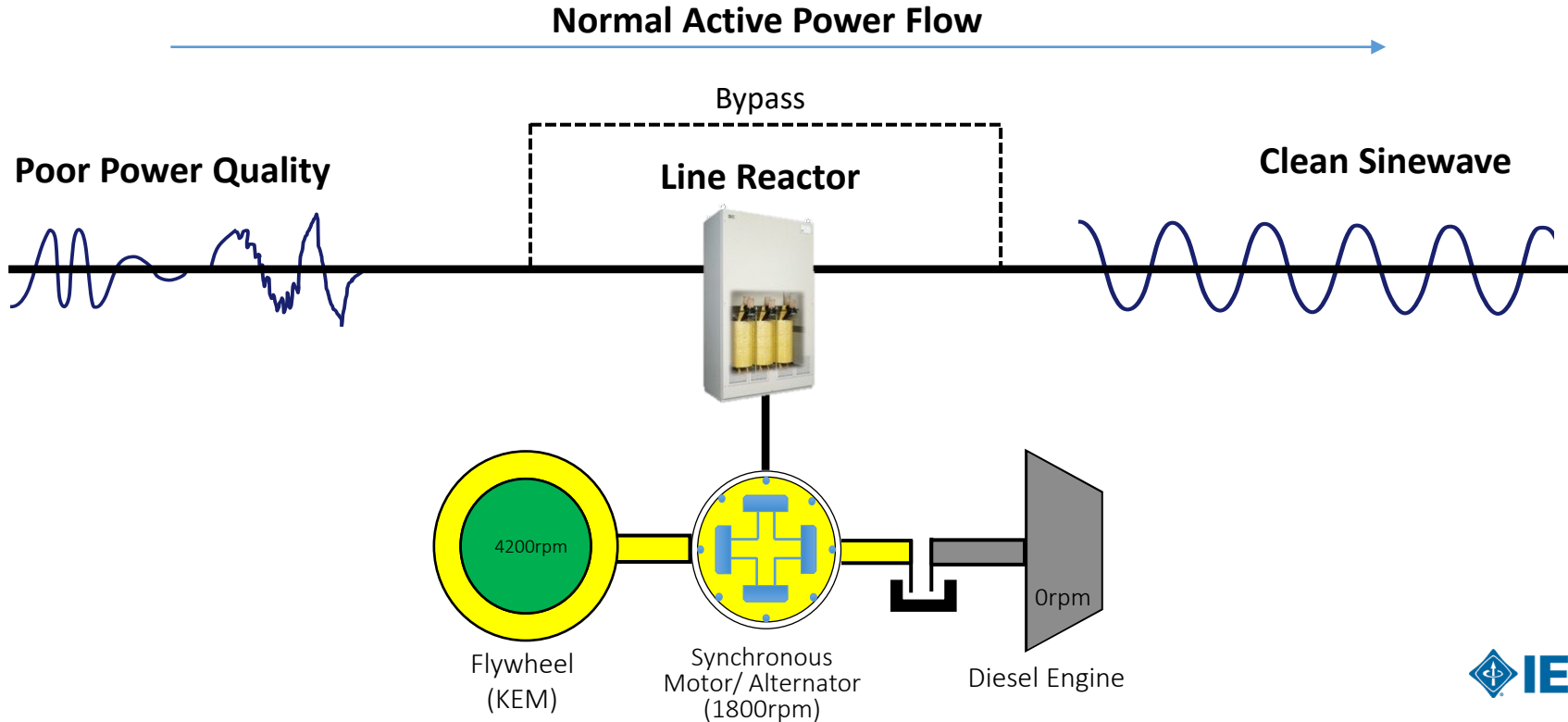
# Flywheel

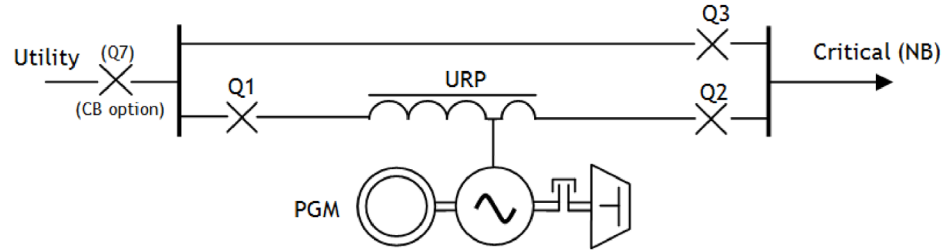


# Flywheel

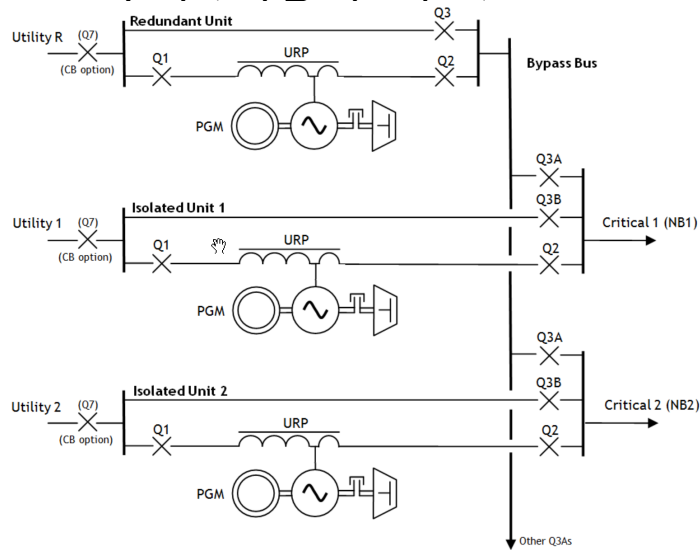


# Summary of Energy Flow

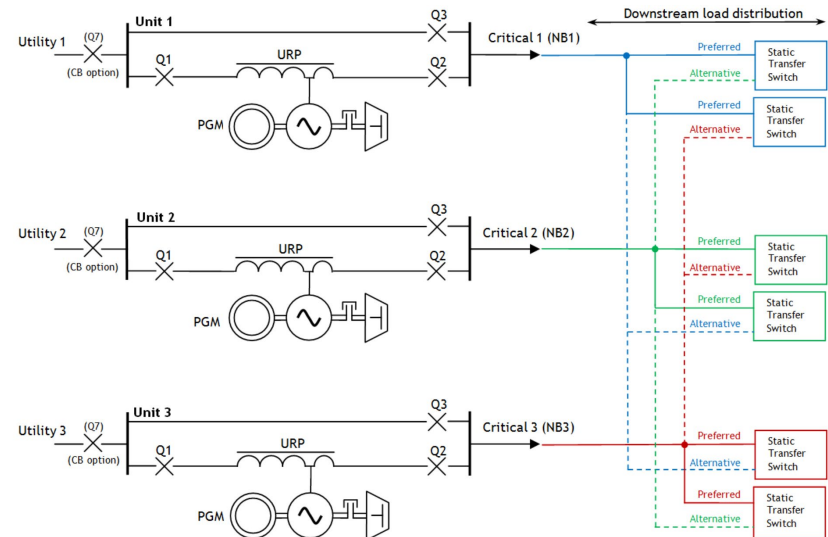




## Single System



## Distributed Redundant



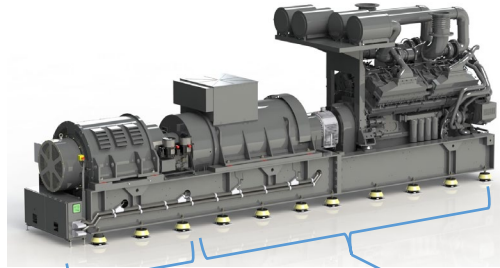


## Advantages - Long Lifetime and Reliability



# Advantages - Footprint

High Power Density  
UPS  
2.17MW within 27ft<sup>2</sup>



**Footprint Savings  
40%-60% Average**



Battery



UPS



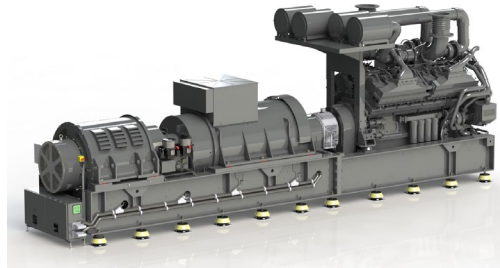
Air Conditioning



Diesel Genset

# Advantages – System Efficiency

100%



96.4%



100%



**Battery**  
Inc. in UPS Losses



**UPS**  
60kW (97%)



**Air Conditioning**  
239000BTU/hr = 69.7kW

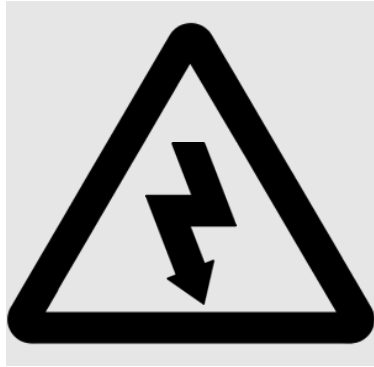


**Diesel Genset**  
~5kW

93.2%



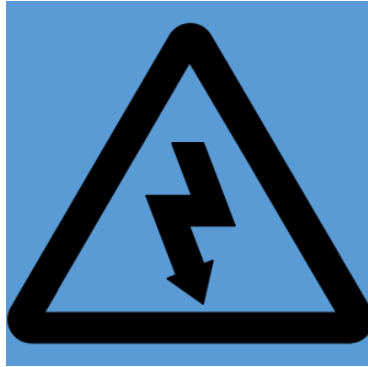
## Advantages – Medium Voltage



**Low Voltage**

**400 – 600V**

**3 ph. 3 wire  
3 ph. 4 wire**



**Medium Voltage**

**5 – 15kV  
Direct Generation**

**3 ph. 3 wire  
3 ph. 4 wire**



**High Voltage**

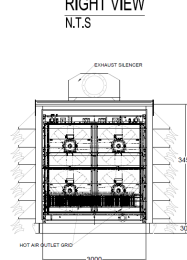
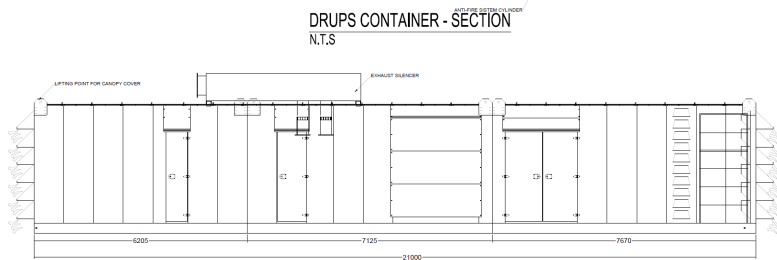
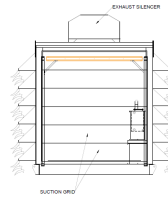
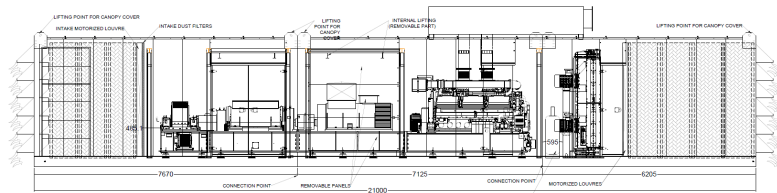
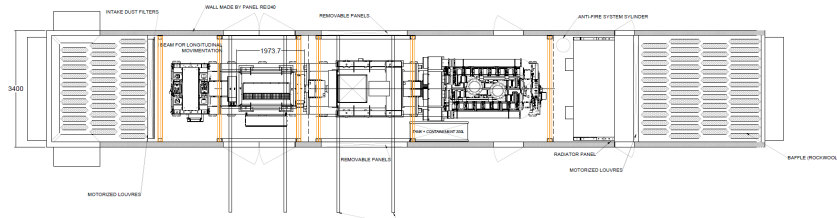
**15kV+  
Via Step-up Tx**

**3 ph. 3 wire  
3 ph. 4 wire**

# Advantages – LOW Maintenance



# Advantages – Outdoor Solutions



Redmond, WA



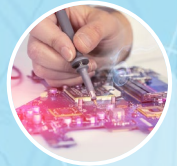
Puerto Rico

# Questions?

**Contact:**

**Yves Bouhadana**  
**East Coast Sales Manager**  
**[yves.bouhadana@hitec-ups.com](mailto:yves.bouhadana@hitec-ups.com)**  
**614-633-9365**





# Next Meeting: Monday 11/21/22

*Topic: Industrial Automation Trends & Emerging Technologies*

*Presenter: Mike Crevar - Automation Sales Executive*

*Schneider Electric*