Generator Lessons Learned from unexpected power outages Before, During and After

August 2, 20221

A huge thanks to all our Veterans!

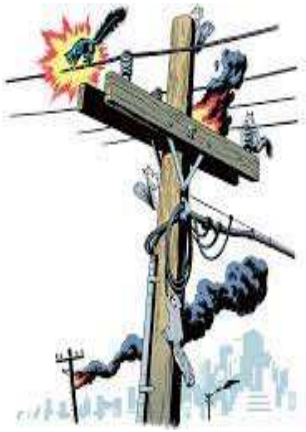
1/3 of WPP's Technicians Are Veterans

Company Profile

- Founded in 2008
- Houston owned and operated
- 50+ Employees; 23 technicians
- 4 Divisions: Sales, Rental, Service, Parts
- Seasoned/trained technicians
- Buy/sell generators, engines, parts worldwide
- Rental & Service - Greater Houston and Gulf Coast areas
  - 50+% of Service Contracts are with Municipalities
- Office/Shop/Yard in NW Houston at 5711 Brittmoore Rd.
- Authorized Dealers for HIPOWER, Isuzu Diesel, and Marelli
- Your one-stop shop for all your generator needs

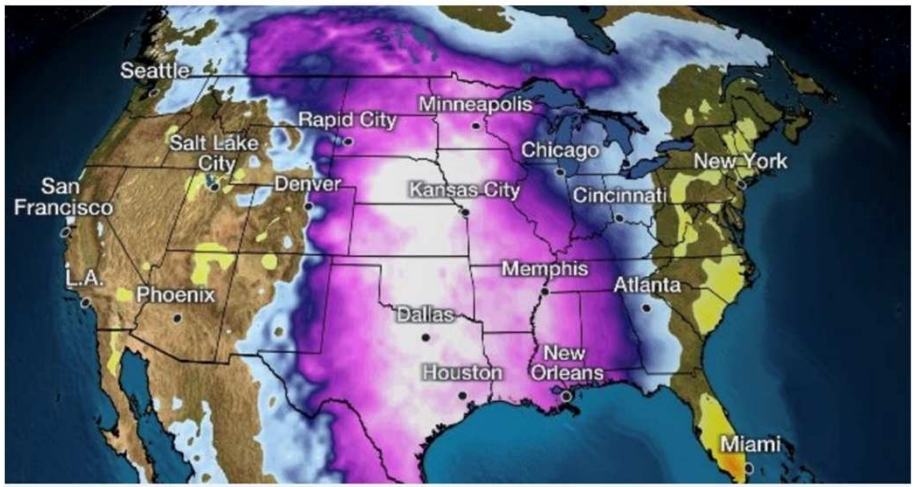
Causes of a power outage

- Floods
- Electrical storm
- High winds
- Winter storm
- Hurricane
- Vehicle accidents
- Aging infrastructure
- Wildlife



2021 Winter Storm Facts

- 3 Severe Winter Storms Swept Across US from Feb 10th - 20th
- 4 mins 37 seconds from complete grid failure
- 356 generators knocked offline. Double 2011 winter storm.
- 46,000 megawatts of power were taken off the grid due to power-generating failures (enough for 9 million homes)
- Prices jumped to $9,000 MWH. Avg. price = $35 MWH
- 9,924,000 Power Outages in US and Mexico
  - > 4.5 Million in Texas at peak on Feb. 16th
- Estimated $195 billion in property damages; exceeded damages from Harvey and Ike combined. Costliest natural disaster in US.



Coldest Outbreak in Over 30 Years Smashes Records in Southern Plains; Some Relief By...

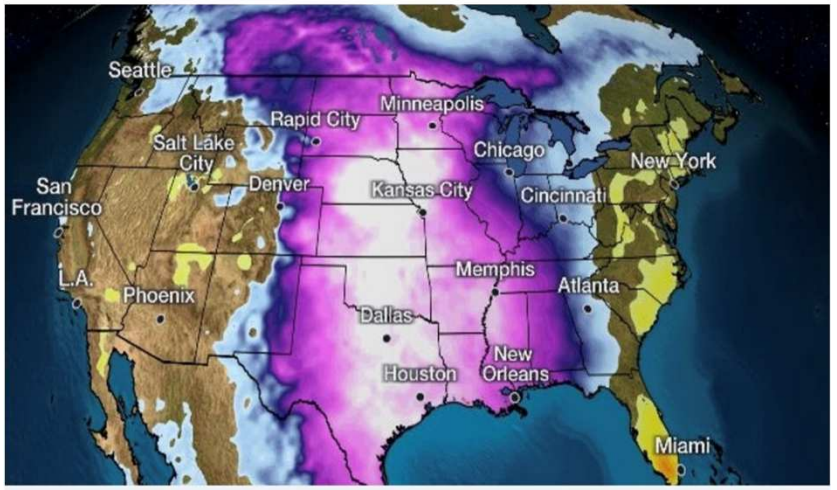
Louisiana Winter Storm Facts

Transmission system

- 14 lines
- 2 major structures
- 1 pole

Distribution system

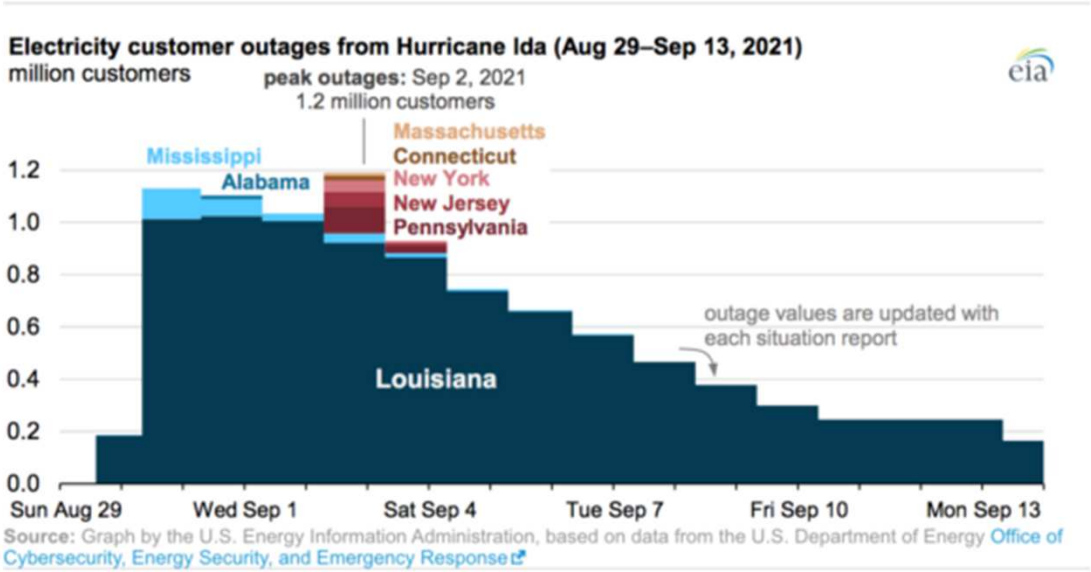
- 260 poles
- 158 damaged transformers
- 1,863 spans of wire



Coldest Outbreak in Over 30 Years Smashes Records in Southern Plains; Some Relief By...

Hurricane Ida

- Over 1.2 million customers lost power
- Some lost power for 14 days
- An estimated 30,000 power poles damaged
- Due to no power the heat was the hardest to cope with for some

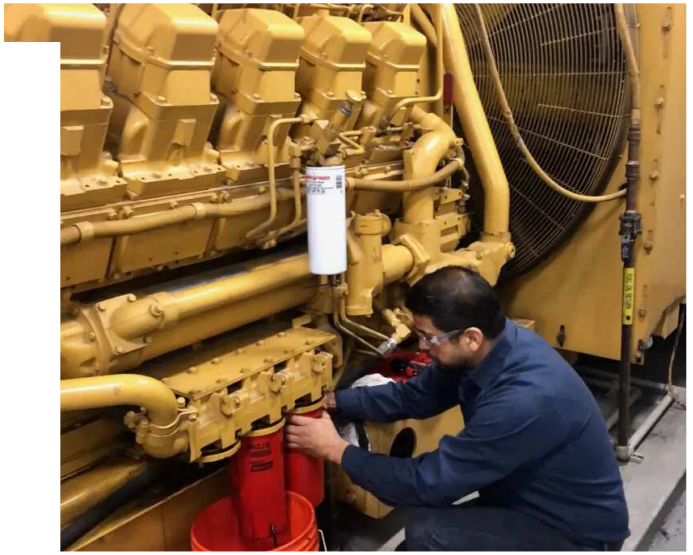


"REMEMBER: When disaster strikes, the time to prepare has passed!"

What equipment can run without power?

What to do Before a Power Outage Occurs

- Preventive maintenance & repairs
- Inspections by trained/qualified technicians
- Diesel fuel maintenance
- ATS preventive maintenance & repairs
- Spare parts (especially for older equipment)
- Weekly exercising (document)
- Monthly loaded exercising (document)
- Training and planning



Benefits of a Preventive Maintenance Program

- Reliability and peace of mind
- Compliance with LDEQ & NFPA 110 regulations
- Chances of equipment downtime and number of repairs drastically reduced
- Better conservation of assets and increased life expectancy & value
- Reduced overtime costs and more economical use of maintenance staff due to working on a scheduled basis instead of an emergency basis to repair breakdowns
- Timely, routine repairs prevent failures – small and large
- Improved safety and quality conditions for everyone

Preventive Maintenance (NFPA 110)

- National Fire Protection Association Standard 110 (NFPA 110), **the Standard for Emergency and Standby Power Systems**, contains requirements covering the installation and performance of backup power systems in critical applications where a power outage would create a life safety risk such as those in healthcare facilities …

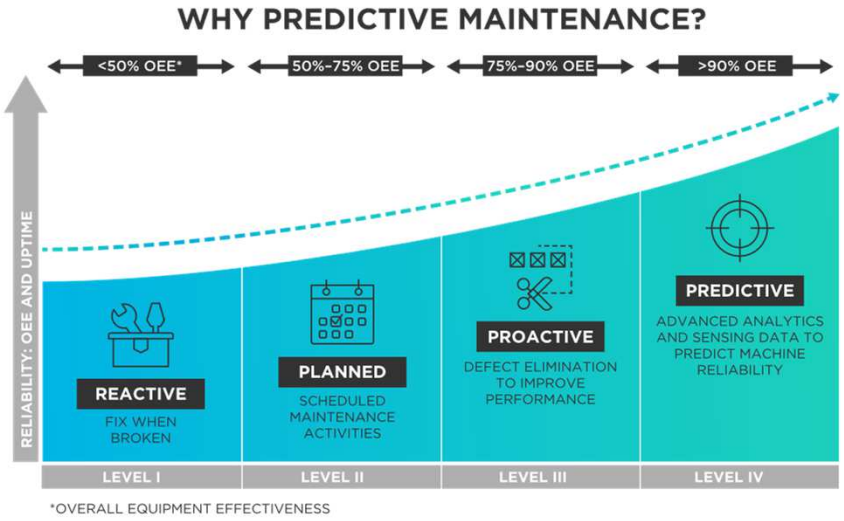
- Chapter 4 of NFPA 110 covers the Classification of Emergency Power Supply Systems (EPSSs). Many codes and standards refer to the class and type of EPSS as defined in NFPA 110. NFPA 110 does not determine which occupancies require a particular type, class, or level of EPSS. Rather, it recognizes two levels of classification:

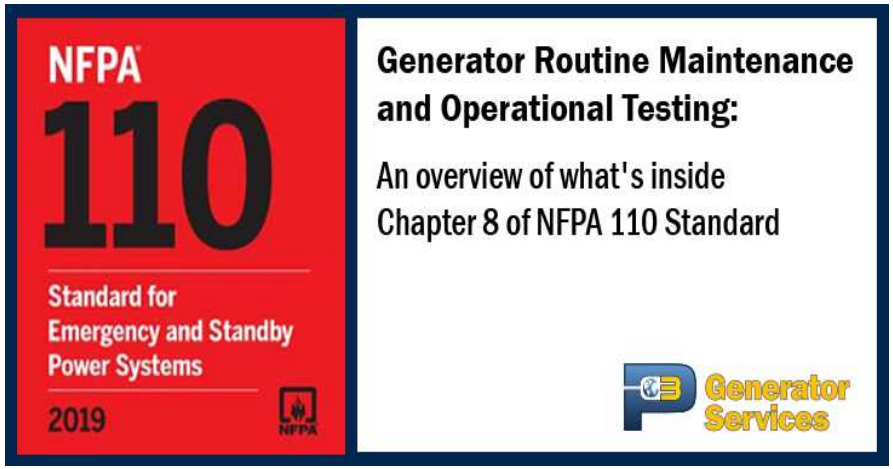
  - **Level 1** classifications are the most stringent and imposed where failure of the equipment to perform could result in loss of human life or serious injuries. (4.4.1)

  - **Level 2** classifications are used where failure of the EPSS to perform is less critical to human life and safety. (4.4.2)

Preventive maintenance levels

- Manufacture requirements
- Regulatory requirements
- Best practices (NFPA 110)
- Predictive maintenance

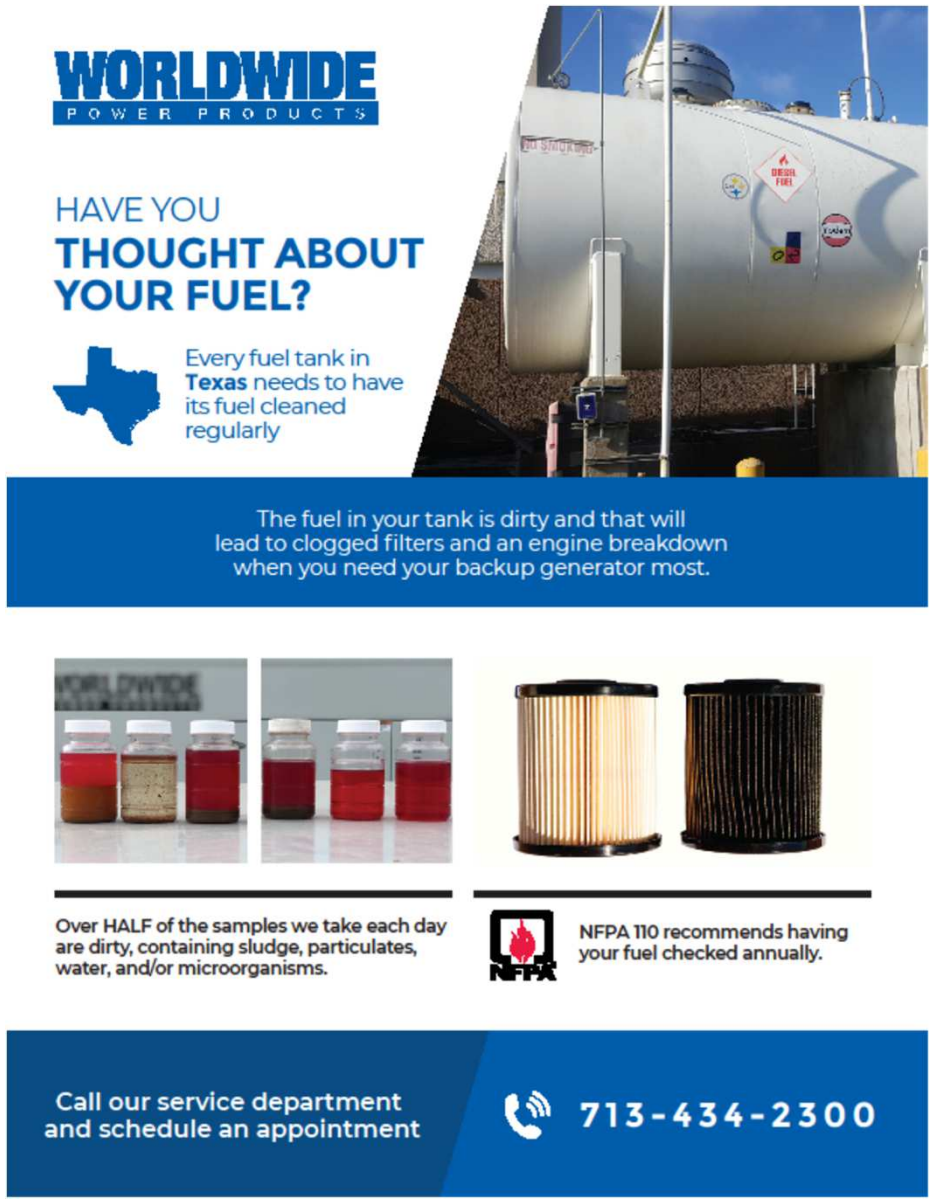




Load Bank Testing

- Required annually by local code or regulations (NFPA 110, 99, NEC,)
- Helps detect potential engine issues
- Insures full rated output capacity
- Removes potentially damaging deposits commonly referred to as “wet stacking” which occurs under light loads
- Load test reports should include:
  - Data results
  - Data graph
  - Compliance letter referencing NFPA and TCEQ

NFPA requires having your fuel analyzed each year



Diesel Fuel Maintenance

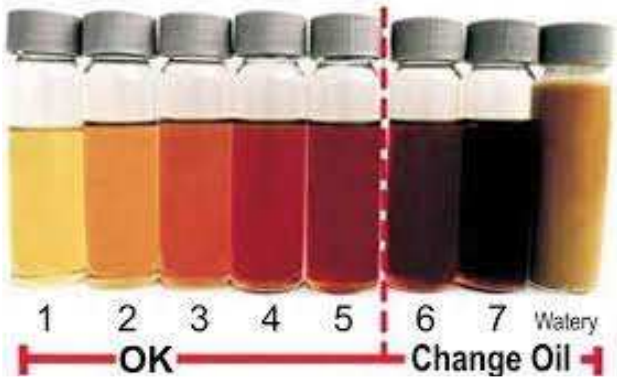
Factors that determine fuel quality…

- **Environment** — Hot humid conditions and direct sunlight make your tanks expand and contract, introducing more condensation
- **Amount of fuel in the tank** — A half-full tank has more air in it and leaves more room for condensation to form inside the tank. Recommend 90%+
- **Run time** — running a generator more frequently disturbs organism growth and adds heat from returned fuel
- **What's already in the tank?** Sediment and debris settle and build up over time creating sludge
- **How clean was the fuel tank prior to being filled?** Fuel grade and quality when delivered is vital.

Fluid analysis (fuel, oil & coolant)

There is no way to tell what the condition the inside an engine/fuel tank or engine cooling system is without completely disassembling them except for fluid analysis.

- Proper sample containers and equipment
- Proper sampling technique
- Independent lab that will not provide the results but recommended actions
- Recommended annually to create a baseline and start a trend of condition



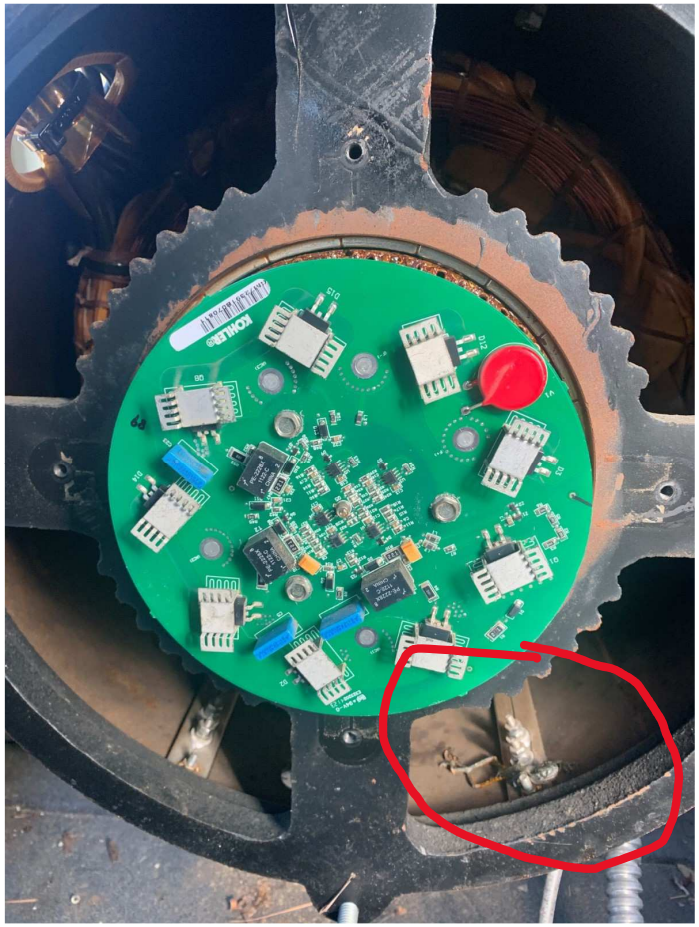
Monthly Emergency and Standby Power System Log

Facility **Date**

Component (as applicable)	Procedure NR - Needs Repair OK - It is in good condition Visual Inspection	Check	Clean	Test	Level	Comments
1. Fuel						
(a) Main supply tank level						
(b) Day tank level						
(g) Water in system						
(h) Flexible hose and connectors						
(i) Tank vents and overflowing piping unobstructed						
(j) Piping						
2. Lubrication System						
(a) Oil level						
3. Cooling System						
(a) Level						
(f) Adequate fresh air through radiator						
(h) Fan and alternator belt						
(i) Condition of flexible hoses and connection						
(k) Jacket water heater						
4. Exhaust System						
(a) Leakage						
(b) Drain condensate trap						
(c) Insulation and fire hazards						
5. Battery System						
(a) Electrolyte level						
(b) Terminals clean and tight						
(c) Remove corrosion, case exterior clean and dry						
(d) Specific gravity or state of charge						
(e) Charger and charge rate						
6. Electrical System						
(a) General inspection						
7. Prime Mover						
(a) General inspection						
(c) Governor oil level and linkage						
8. Generator Housing						
(a) General condition of EPSS, any unusual condition of vibration, leakage, noise, temperature or deterioration						
9. Weather protection structure						
(a) Service room or housing housekeeping						
10. Normal Power Restoration System						
(a) System to automatic operation condition						
11. Elapsed Time Meter						
(a) Reading at login						

Overall Comments:

The Wildlife factor



Wildlife

- Warm place to call home
- Secluded
- Protected from the elements

Contingency Planning

Many organizations work hard to create an emergency power contingency plan, but often fail to test it. When their power fails, it is as if they never planned at all.

Contingency Planning - Steps

1. **Plan Prior to the Outage**

   - *Licensed electrician needed* –

   a. Determine appropriate generator size (whole facility or only critical areas?)

   b. Supply voltage - 240V, 208V, 480V (1PH or 3PH)

   c. Connection Plan - existing electrical panel or quick connect panel

   d. Determine a location from generator to electrical connection (50' cable sections)

   e. Safe and level area needed for portable generator (easily accessible for fuel drops)

   f. Know the timing for delivery of the rental generator from generator vendor to site

2. **Fuel Vendor/Supplier**

   a. Determine fuel drop schedule based on the generator run-time capacity

   b. Have at least 1 backup fuel vendor

3. **Document necessary information and steps**

   a. Practice/test your contingency plan with all key contacts

   b. Make sure all points of contacts are included in the contingency plan documents (cell #, email)

      Contacts: Key company personnel, Electrician, Generator rep, Fuel vendor, Technical support

Disaster Response & Contingency Planning

Power disruption/outages can result from:

- Natural causes – weather related (hurricane, flooding, wind, ice storms, blown transformer, etc.)
- Technological Failures
- Wiring Malfunctions
- Human Error

Generator Issues During the Winter Storm

- Shut down due to “low oil” (Natural gas engines burn more oil vs diesel engines)
- Shut down due to “low coolant” or low fuel
- "My unit won’t start!"
  - No Fuel or
  - Fuel is below the fuel sensor line (if below 25%, unit will shut down example)
  - Chewed wires by varmints
  - Clogged fuel filters or running rough - What causes this to happen?
  - Dead batteries
- Fuel transfer pump stuck in the on position
- Weak batteries will affect the ECM operation
- Natural gas regulators (moisture inside/old/installed upside down)
- Coolant hose leaks (metal shrinks with cold and expands with heat)
- Rodents build nest(s) on top of exhaust and unit caught on fire

The Most Common Generator Failures

- Batteries
- Shut down alarm (oil or coolant)
- Poor Fuel Quality
- Fuel Supply
- Operator Error (e-stop)
- Automatic Transfer Switch

What can I do during a power outage?

- Have oil on hand (diesel & nat. gas)
- Daily check for oil leaks
- Daily check oil level & top off if needed
- Listen for abnormal noises
- Know your diesel burn rate (Fuel consumption chart)
- Have your diesel supplier on a scheduled route

What to do after a power outage event?

- Most manufactures recommend an oil and filter change every 250 hours of runtime
- Post event inspection
- Sample fuel tanks and act from findings
- Top off clean fuel tanks
- Replenish oil and coolant stock
- Replenish any spare parts that were used
- Revise contingency plan as needed
- Trian your team on the revisions

Diesel vs Natural Gas

Diesel generators - pros

- Sturdy, reliable and have a long lifespan
- Typically, smaller in size when comparing similar capabilities of gas generators
- Ideal for portable or rental applications in addition to stand-by power sources
- More fuel efficient
- The fuel is less flammable and less explosive
- Typically, less in upfront capital costs

Diesel generators - cons

- Fluctuations in diesel fuel pricing
- Diesel Fuel Storage
- Fuel filtering required
- EPA is more heavily focused on diesel engines with the new regulations
- New Installations require Tier 4F compliant Engines for Peak Shaving/Load Management

Diesel vs Natural Gas

Natural gas generators - pros

- On hand readily-available consistent fuel source... "unlimited fuel supply"
- Lower Fuel costs
- Natural gas is cleaner with less emissions than most other fossil fuels
- The generators do not have the pungent odor associated with the burning of diese
- Less focus from the EPA on Natural Gas Engines
- You can use Natural Gas for peak shaving, load management programs
- If running prime power – they have much lower operating costs

Natural gas generators - cons

- The generators have a shorter lifespan (less than 150kW)
- They are larger and take up more space compared to the diesel counterparts
- Natural disasters can disrupt natural gas flow
- Natural gas is explosive; fire hazards can occur should a pipeline burst
- Natural gas, while cleaner overall, emits more carbon dioxide than diesel
- Greater than 500kW – Natural Gas engines cannot typically block load (ISO 8528)
- Uses more oil while running under a load

Methods to acquire generators

Purchase through co-ops

- TIPS-USA (The Interlocal Purchasing Service)
- GSA (General Services Administration)
- Buy Board

Purchase direct

- Direct purchase with vendors
- Direct purchase with financing

RPO (Rent Purchase Option)

- Rental Purchase Options (RPOs) are rental agreements that apply a percentage of the rental payment toward the purchase price of the equipment. At the end of the established rental term, you have the option to purchase the equipment, but not obligated to do so.

Rental

- Hurricane rental program (6 months June – November) locks a unit in for you
- "When needed rental" (can't wait until you need it, they will be gone)

THE WPP TEAM IS HERE TO SUPPORT YOU!
THANK YOU FOR YOUR TIME!

ANY QUESTIONS ?

DEQ
LOUISIANA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY