JULY 2024

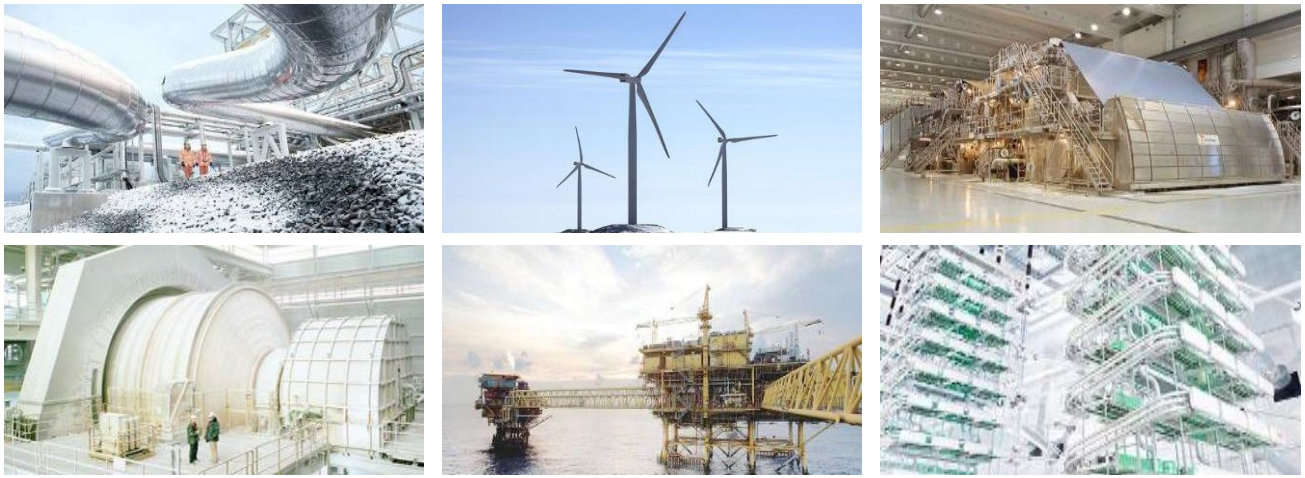
9th Nigeria Energy Forum Presentation

Maximizing Light Up Nigeria Project

Agbara Projects

NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

NDPHC's Strategy



As one of the nation's leading engineering companies, we help our customers to use electrical power efficiently, to increase industrial productivity and to lower environmental impact in a sustainable way.

NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

Overview of NDPHC accomplishments

- Construction of 10 power plants with total planned capacity of **Approx 5,000 MW**
  - **Approximately 4000MW** completed
  - **1,170 MW** Under construction – Alaoji Combined Cycle Stages, Omoku & Egbema
- Undertaken over 121 Transmission Line & Substation projects Expansion works carried out in 36 Nos TCN Substations
- Construction of about 374 Distribution projects

NDPHC NIGER DELTA POWER HOLDING COMPANY LIMITED NIPP

LIGHT UP NIGERIA PROJECT

- On 12th October 2023, H. E. Sen. Kashim Shettima launched the “Light up Nigeria” initiative at Agbara Industrial Area with the aim to increase power supply to all Nigerians, with focus on identified industrial clusters.
- This initiative will be launched in the six geopolitical regions. Southwest and Southeast have been covered.

STRATEGIES

Strategies to achieve this include:

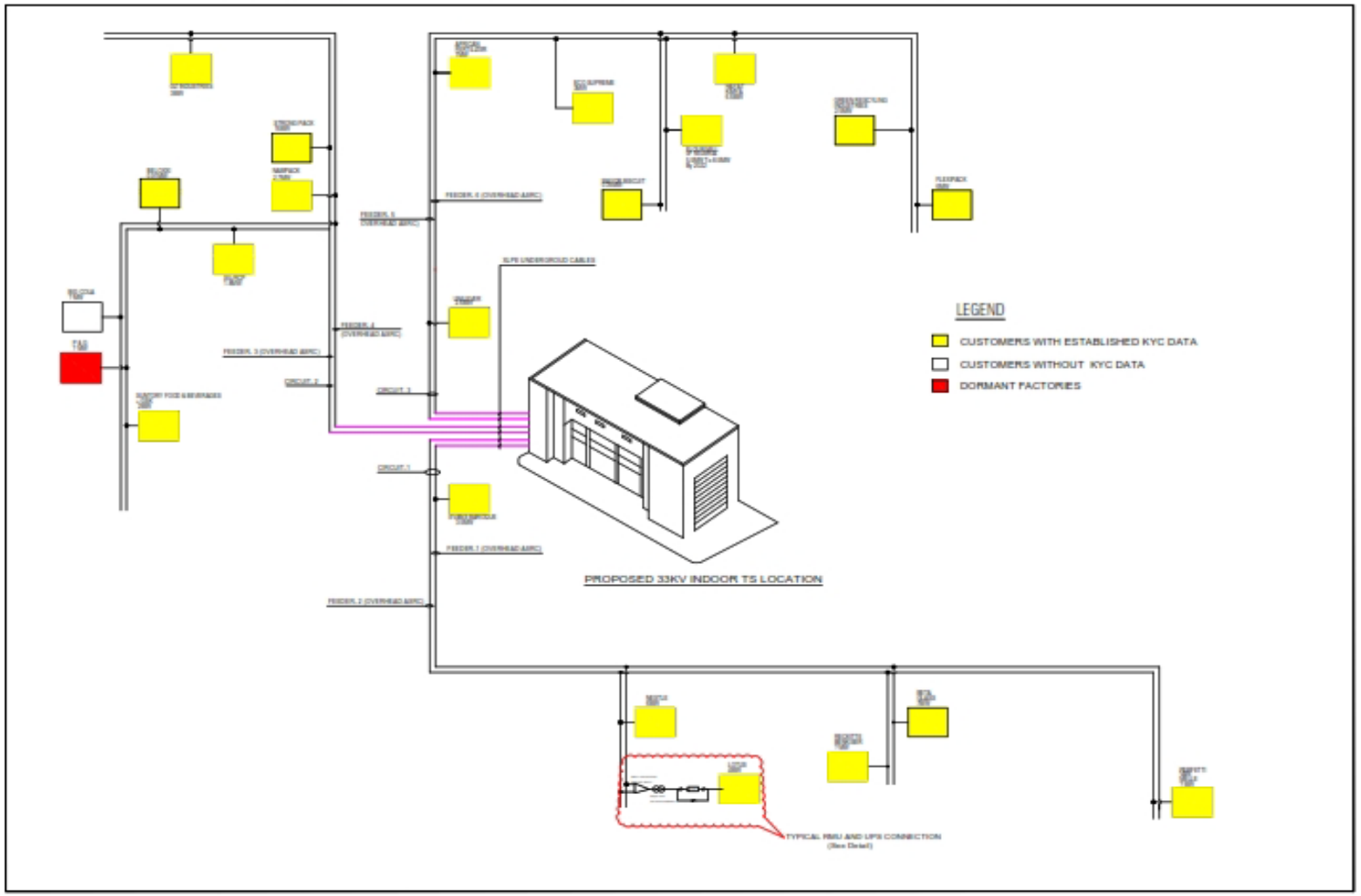
- Partnering with other Companies in the Sector
- Aggregation of customers and auxiliary services
- Infrastructure revamping
- Capacity Development
- Implementation of cross-supply programs

NDPHC envisions driving the growth of the Power Sector in Nigeria through this initiative, aiming to address the current power challenges and lay the foundation for a more electrified future.

NDPHC NIGER DELTA POWER HOLDING COMPANY LIMITED NIPP

AGBARA ELIGIBLE CUSTOMER CLUSTER OVERVIEW

33KV POWER DISTRIBUTION FROM EVANS TO ELIGIBLE FACTORIES AT AGBARA



NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

Power Availability & Power Quality

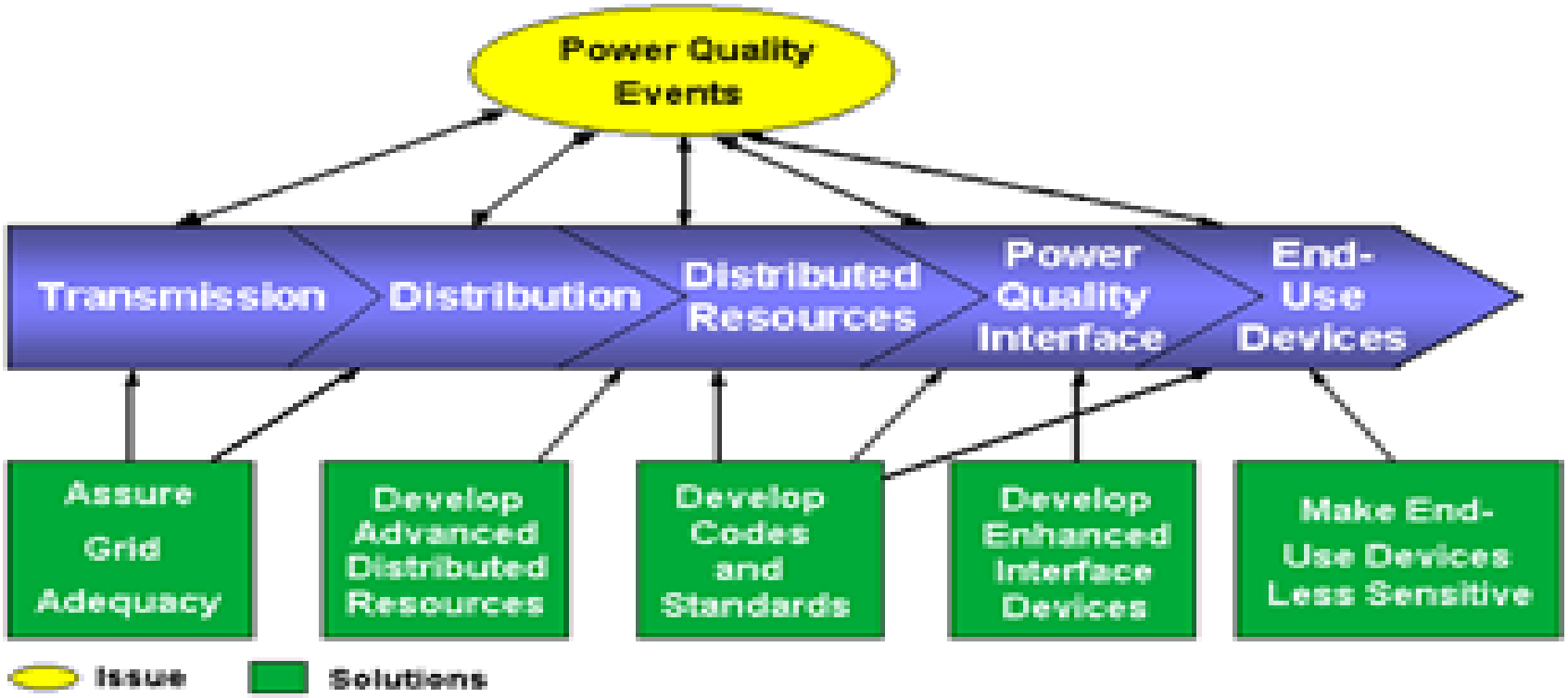
Power Availability	Power Quality (PQ)	Customer Satisfaction
▪ NDPHC is committed to provide stable & consistent power supply ▪ NDPHC strong collaboration with all Stakeholders will ensure and enhance the power availability ▪ NDPHC is committed to state-of-the-art equipment installation and ready to listen to Client concern whenever need arises	▪ Power Quality (PQ) related issues are of most concern nowadays. ▪ These loads are simultaneously the major causers and the major victims of power quality problems. Due to their non-linearity, all these loads cause disturbances in the voltage waveform.	▪ Client satisfaction is our breath ▪ PQ challenges are all considered and NDPHC with Stakeholders has proffer adequate solutions and willing to resolve and upcoming concern

NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

Most Common Power Quality Problems

1. Voltage sag (or dip)	**Description:** A decrease of the normal voltage level between 10 and 90% of the nominal rms voltage at the power frequency, for durations of 0,5 cycle to 1 minute. **Causes:** Faults on the transmission or distribution network (most of the times on parallel feeders). Faults in consumer's installation. Connection of heavy loads and start-up of large motors. **Consequences:** Malfunction of information technology equipment, namely microprocessor-based control systems (PCs, PLCs, ASDs, etc) that may lead to a process stoppage. Tripping of contactors and electromechanical relays. Disconnection and loss of efficiency in electric rotating machines.
2. Very short interruptions	**Description**: Total interruption of electrical supply for duration from few milliseconds to one or two seconds. **Causes**: Mainly due to the opening and automatic reclosure of protection devices to decommission a faulty section of the network. The main fault causes are insulation failure, lightning and insulator flashover. **Consequences**: Tripping of protection devices, loss of information and malfunction of data processing equipment. Stoppage of sensitive equipment, such as ASDs, PCs, PLCs, if they're not prepared to deal with this situation.
3. Long interruptions	**Description:** Total interruption of electrical supply for duration greater than 1 to 2 seconds **Causes:** Equipment failure in the power system network, storms and objects (trees, cars, etc) striking lines or poles, fire, human error, bad coordination or failure of protection devices. **Consequences:** Stoppage of all equipment.
4. Voltage spike	**Description:** Very fast variation of the voltage value for durations from a several microseconds to few milliseconds. These variations may reach thousands of volts, even in low voltage. **Causes:** Lightning, switching of lines or power factor correction capacitors, disconnection of heavy loads. **Consequences:** Destruction of components (particularly electronic components) and of insulation materials, data processing errors or data loss, electromagnetic interference.
5. Voltage swell	**Description:** Momentary increase of the voltage, at the power frequency, outside the normal tolerances, with duration of more than one cycle and typically less than a few seconds. **Causes:** Start/stop of heavy loads, badly dimensioned power sources, badly regulated transformers (mainly during off-peak hours). **Consequences:** Data loss, flickering of lighting and screens, stoppage or damage of sensitive equipment, if the voltage values are too high.
6. Harmonic distortion	**Description:** Voltage or current waveforms assume non-sinusoidal shape. The waveform corresponds to the sum of different sine-waves with different magnitude and phase, having frequencies that are multiples of power-system frequency. **Causes:** *Classic sources*: electric machines working above the knee of the magnetization curve (magnetic saturation), arc furnaces, welding machines, rectifiers, and DC brush motors. *Modern sources*: all non-linear loads, such as power electronics equipment including ASDs, switched mode power supplies, data processing equipment, high efficiency lighting. **Consequences:** Increased probability in occurrence of resonance, neutral overload in 3-phase systems, overheating of all cables and equipment, loss of efficiency in electric machines, electromagnetic interference with communication systems, errors in measures when using average reading meters, nuisance tripping of thermal protections.
7. Voltage fluctuation	**Description:** Oscillation of voltage value, amplitude modulated by a signal with frequency of 0 to 30 Hz. **Causes:** Arc furnaces, frequent start/stop of electric motors (for instance elevators), oscillating loads. **Consequences:** Most consequences are common to undervoltages. The most perceptible consequence is the flickering of lighting and screens, giving the impression of unsteadiness of visual perception.
8. Noise	**Description:** Superimposing of high frequency signals on the waveform of the power-system frequency. **Causes:** Electromagnetic interferences provoked by Hertzian waves such as microwaves, television diffusion, and radiation due to welding machines, arc furnaces, and electronic equipment. Improper grounding may also be a cause. **Consequences:** Disturbances on sensitive electronic equipment, usually not destructive. May cause data loss and data processing errors.
9. Voltage Unbalance	**Description:** A voltage variation in a three-phase system in which the three voltage magnitudes or the phase-angle differences between them are not equal. **Causes:** Large single-phase loads (induction furnaces, traction loads), incorrect distribution of all single-phase loads by the three phases of the system (this may be also due to a fault). **Consequences:** Unbalanced systems imply the existence of a negative sequence that is harmful to all three-phase loads. The most affected loads are three-phase induction machines.

Power Quality Resolution
NDPHC Approach/Strategy



- The mitigation of PQ problems may take place at different levels: transmission, distribution and the end- use equipment.

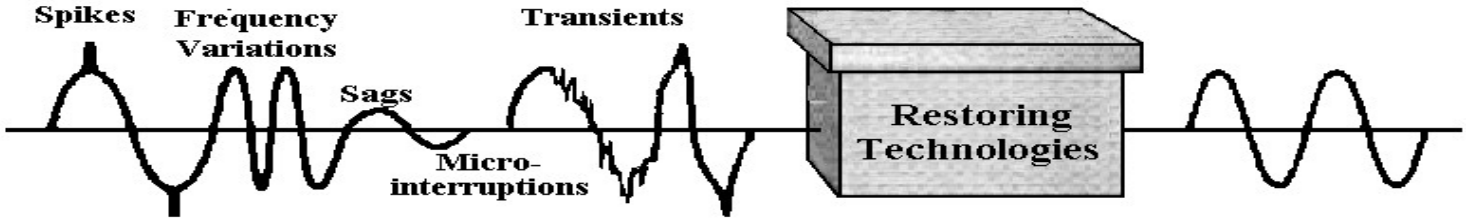
NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

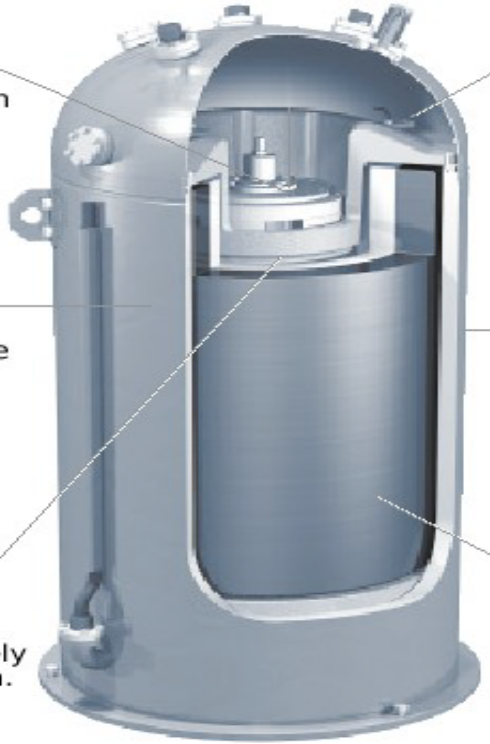
Power Quality Resolution
NDPHC Approach/Strategy

1. **Grid Adequacy**
2. **Distributed Resources – Energy Storage Systems (***Flywheels, Supercapacitors, SMES)*
3. **Distributed Resources – Distributed Generation**
4. **Enhanced Interface Devices (***Dynamic Voltage Restorer, Transient Voltage Surge suppressors (TVSS), Constant Voltage Transformers, Noise Filters, Isolation Transformers, Static VAR Compensators, Harmonic Filters)*
5. **Develop Codes and Standards**
6. **Make End-use Devices Less Sensitive*****

NDPHC NIGER DELTA POWER HOLDING COMPANY LIMITED NIPP

Power Quality Resolution
NDPHC Approach/Strategy





Motor/Generator

Instantaneous conversion of stored kinetic energy.
No data loss or voice interruption.

Vacuum Enclosure

Eliminates air drag on the flywheel and component corrosion issues.
20 year operating life.

Advanced Bearings

Magnetic bearing arrangement for extremely efficient flywheel rotation.
Longer system backup.

Remotely Monitored

Accurate, real-time information on key operating parameters via a computer screen.
Certainty of operation.

Totally Enclosed "Green" Technology

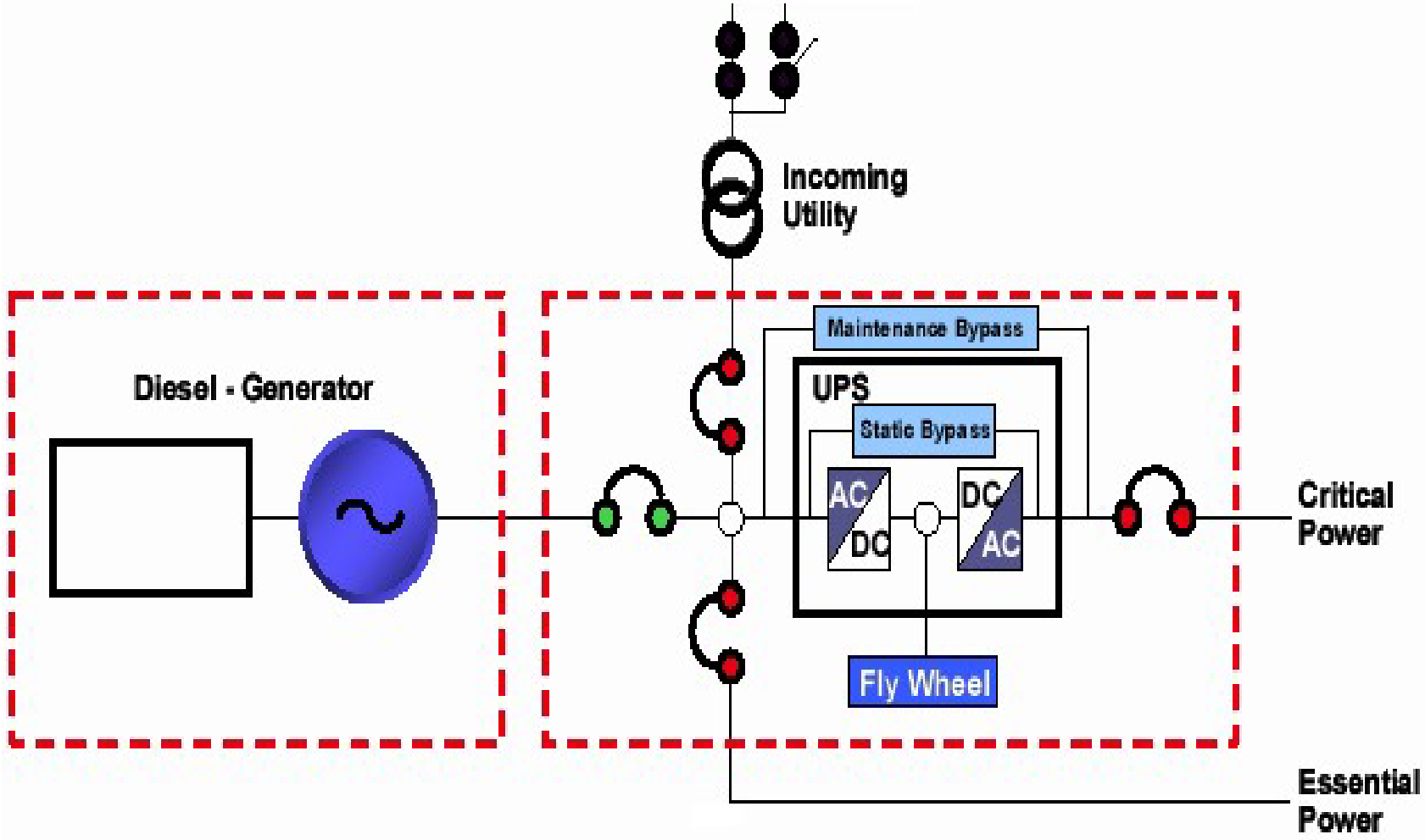
Contains no fuel or acid that could harm the environment.
A green power solution.

Composite Flywheel

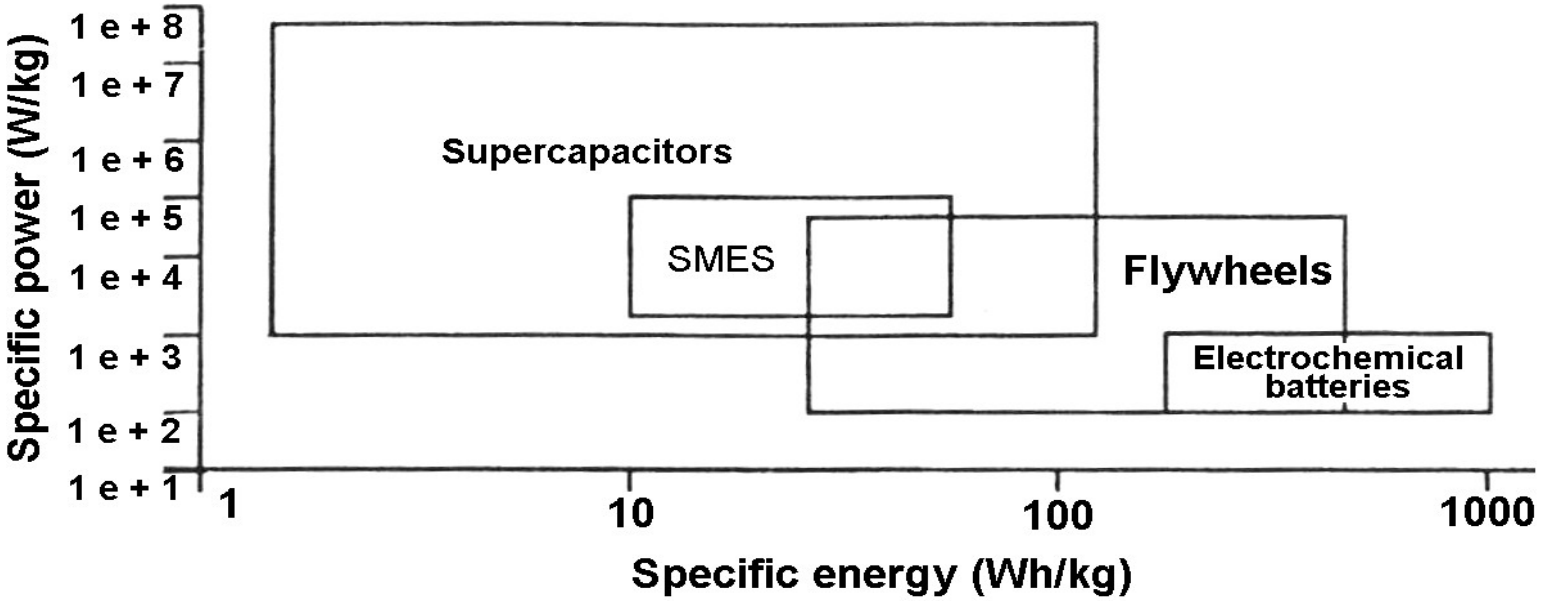
Stores energy more cost effectively than metal flywheels.
Cost effective packaging for competitive pricing.

NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

Power Quality Resolution
NDPHC Approach/Strategy



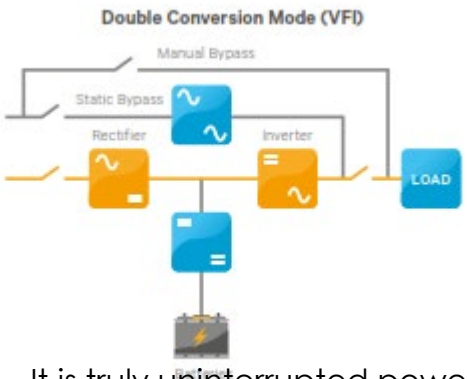
Power Quality Resolution
Comparative Analysis

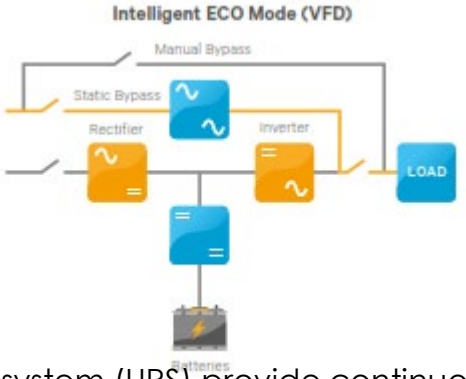


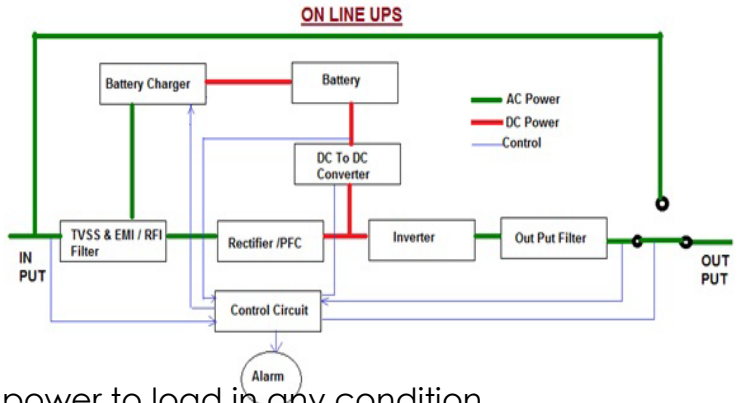
- The high-speed flywheel is in about the same cost range as the SMES and supercapacitors and about 5 times more expensive than a low-speed flywheel due to its more complicated design and limited power rating. Electrochemical battery has a high degree of mature and a simple design. Below a storage time of 25 seconds the low-speed flywheel can be more cost effective than the battery.

NDPHC NIGER DELTA POWER HOLDING COMPANY LIMITED NIPP

Power Quality Resolution
ON Line UPS/ Double Conversion UPS







- It is truly uninterrupted power system (UPS) provide continuous power to load in any condition.
- Online UPS sometimes called "double conversion" UPS.
- Today most users with highly-critical loads are choose online UPS. It is used to protect sensitive equipment and data from mains problems at all times with any extra cost.
- This UPS have no power transfer switches and therefore no transfer time is existed under the mains power failure. Thus this is truly an uninterrupted system.
- In Online UPS to maintain the charge of the battery, a battery charging unit is continuously powered from the AC mains.
- Online UPSs are often called 'double conversion' types because incoming power is Firstly converted once AC to DC for the battery and then back Secondly Converter DC to AC before reaching the load which is therefore well-insulated from the mains like an electrical firewall between the incoming power and sensitive electronic equipments. It also control of the output voltage and frequency regardless of the input voltage and frequency.
- The online UPS continuously filters power through the battery before sending it to your computer.
- By contrast, online UPS systems draw power through the power conditioning and charging components during normal operation, so the load always receives conditioned power rather than raw mains.

BENEFITS OF LIGHT UP NIGERIA PROJECT

- Economic Growth
- Increased Access to Electricity
- Reduced Energy Shortages
- Attraction of Investment Opportunities
- Revenue Generation
- Energy Security
- Regulatory Oversight
- Reduction in Budget Deficit and Opportunity Costs

NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

Committed to the highest standards of business ethics
Integrity as bedrock of NDPHC's global culture

"Whatever change may be going on in the world around us, one thing remains unchanged: NDPHC's commitment to maintain the highest standards of business ethics and integrity."

NDPHC
NIGER DELTA POWER HOLDING COMPANY LIMITED
NIPP

NIGER DELTA POWER HOLDING CO LTD

THANK YOU!

NIGER DELTA POWER HOLDING COMPANY LIMITED