UPSL - Company Overview

- Uninterruptible Power Supplies Ltd (UPSL) Founded
- Partnership with Newave for UK&I
- UPSL Launches 1st 3-Phase Transformerless UPS into UK&I
- UPSL Launches 1st 3-Phase Transformerless Modular UPS into UK&I
- Kohler Power Group acquires UPSL
- UPSL opens Sales & Service Office in Singapore

Critical Power Protection Product & Service Solutions

- 1kVA to 5MVA
- Single Phase / Three Phase
- Transformerless UPS
- Modular & Standalone

Powerwave Generators
- 10kVA to 3.3MVA
- John Deere/Volvo/MTU Engines
- Leroy Somers Alternators

Service Excellence
- Nationwide Service Coverage
- 365/24/7 Service Contracts
- Battery Replacement
- Battery Monitoring
- UPS Remote Monitoring

Quality
- ISO9001, ISO14001, OHSAS18001 Approved
- Investor in People
- ROSPA Gold Award – 8 Consecutive Years
Digitisation

St Peter’s Basilica 2005
Digitisation

St Peter’s Basilica 2013
What does a UPS do?

Public Mains Voltage  UPS  Customers Load Voltage

Guarantees proper, green and continuous power to our customers equipments
# Power Disturbances

<table>
<thead>
<tr>
<th>Mains problem</th>
<th>Time</th>
<th>Example</th>
<th>UPS solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mains failure</td>
<td>&gt; 10 ms</td>
<td>![Waveform]</td>
<td>Off-Line</td>
</tr>
<tr>
<td>2. Power sag</td>
<td>&lt; 16 ms</td>
<td>![Waveform]</td>
<td>can handle 1,2,3</td>
</tr>
<tr>
<td>3. Power surge</td>
<td>&lt; 16 ms</td>
<td>![Waveform]</td>
<td>Line interactive Delta conversion</td>
</tr>
<tr>
<td>4. Undervoltage</td>
<td>continuous</td>
<td>![Waveform]</td>
<td>can handle 1,2,3,4,5</td>
</tr>
<tr>
<td>5. Overvoltage</td>
<td>continuous</td>
<td>![Waveform]</td>
<td>On-Line</td>
</tr>
<tr>
<td>6. Switching transient</td>
<td>intermittent</td>
<td>![Waveform]</td>
<td>Double conversion can handle 1,2,3,4,5,6,7,8,9,10</td>
</tr>
<tr>
<td>7. Power surge</td>
<td>&lt; 4 ms</td>
<td>![Waveform]</td>
<td></td>
</tr>
<tr>
<td>8. Frequency variation</td>
<td>intermittent</td>
<td>![Waveform]</td>
<td></td>
</tr>
<tr>
<td>9. Voltage burst</td>
<td>periodic</td>
<td>![Waveform]</td>
<td></td>
</tr>
<tr>
<td>10. Harmonic distortion</td>
<td>continuous</td>
<td>![Waveform]</td>
<td></td>
</tr>
</tbody>
</table>
Modern Loads

“back in the day”...

Load was very different!

And so were UPS!
Modern Loads

Modern load!

Modern UPS!

Source: datacenterknowledge.com
On-Line Double Conversion

- The majority of UPS are what we call “static double conversion UPS”
- A static UPS is one with few moving parts
- Double-conversion (or “online”) means there are two stages of energy conversion
Uninterruptible Power Supplies Ltd
UPS Internal Components

- Rectifier
- Inverter
- Battery
- Static Switch
UPS Evolution

**Standalone UPS**

*From In-efficient, Large-Footprint Transformer UPS…*


**Modular UPS**

1997 UPSL Launches 1st 3-Phase Transformerless UPS into UK&I

120kW Capacity (3 x 40kW Modules)

200kW Capacity (5 x 40kW Modules)

500kW Capacity (5 x 100kW Modules)

2002 UPSL Launches 1st 3-Phase Transformerless Modular UPS into UK&I

2007 2nd-Generation 3-Phase Transformerless Modular UPS

2013 3rd-Generation 3-Phase Transformerless Modular UPS

**Benefits of Transformerless UPS**

- **Higher Efficiency**
  - Reduced running cost
  - Reduced cooling requirements
  - Reduced CO\textsubscript{2} emissions
- **Space Saving**
  - Smaller Footprint
- **Less Weight**

**Technology Innovation**

**Benefits of Transformerless UPS**

- **Scalable** – Horizontally & Vertically
- **Easy to Replace ‘Hot-Swap’ Modules**
  - Reduced MTTR
  - Simple Power Upgrade
- **Maximum Availability**
  - Six Nines Availability (99.9999%)
Transformer v Transformerless Design

**Transformer**

1. **Mains supply**
2. Rectifier
3. Inverter
4. Output Tx
5. Output to Critical Load

- 240Vac → 340Vdc → 120Vac → 240Vac
- Battery
- Regulated dc busbar

**Transformerless**

1. **Mains supply**
2. Rectifier
3. DC Boost Converter
4. Inverter
5. Output to Critical Load

- 240Vac → 340Vdc → 700Vdc → 240Vac
- Battery
- Battery Charger
- Unregulated dc busbar
- Regulated dc busbar
UPS Evolution

Standalone UPS

From In-efficient, Large-Footprint Transformer UPS…

Technology Innovation

…To Efficient, Small-Footprint Transformerless UPS


Modular UPS

120kW Capacity (3 x 40kW Modules) 200kW Capacity (5 x 40kW Modules) 500kW Capacity (5 x 100kW Modules)

Benefits of Transformerless UPS

• Higher Efficiency
  – Reduced running cost
  – Reduced cooling requirements
  – Reduced CO₂ emissions

• Space Saving
  – Smaller Footprint

• Less Weight

Technology Innovation

Benefits of Transformerless UPS

• Scalable – Horizontally & Vertically

• Easy to Replace ‘Hot-Swap’ Modules
  – Reduced MTTR
  – Simple Power Upgrade

• Maximum Availability
  – Six Nines Availability (99.9999%)
Definition of modular:
Adjective

Employing or involving a module or modules as the basis of design or construction

Oxford English dictionary
Modular Interpretation of Definition of Modular?

**Manufactured in a Modular layout**

- Power Modules
- Static Switch
- Rectifier
Modular

Interpretation of Definition of Modular?

200kVA N + 1

2 x 200kVA

3 x 100kVA
Modular

Interpretation of Definition of Modular?

Diagram: Modular UPS Configuration
- Bypass Switch
- UPS 1
- UPS 2
- UPS 3
- UPS 4
Each module is a complete UPS:

- IGBT rectifier and inverter
- Control logic and display
- Battery converter
- Static bypass switch
UPS Evolution

UPSL Definition of Modular?
## UPS Systems

### Topologies

<table>
<thead>
<tr>
<th></th>
<th>Tier I</th>
<th>Tier II</th>
<th>Tier III</th>
<th>Tier IV</th>
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<tbody>
<tr>
<td><strong>Number of delivery paths</strong></td>
<td>Only 1</td>
<td>Only 1</td>
<td>1 Active</td>
<td>2 Active</td>
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<tr>
<td><strong>Redundancy</strong></td>
<td>N</td>
<td>N+1</td>
<td>N+1</td>
<td>S+S or</td>
</tr>
<tr>
<td><strong>Compartmentalisation</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Concurrently Maintainable</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Fault Tolerant to Worst Event</strong></td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Table 1: Tier requirements summary*
UPS Systems Topologies

“N” System

N = 200 kW

UPS Capacity = Load
UPS Systems Topologies

“N + 1” System

A + B = 200 kW

Load = 200kW

A = B = 200 kW

N+1 = 200kW + 200kW

N+1 = 200kW + 100kW
“N + N” or “2N” System

UPS Capacity = Load

\[ 2N = 2 \times 200kW \]

\[ A = B = 200 \text{ kW} \]

\[ 2N = 2 \times 200kW \]

\[ 2N = 2 \times 200kW \]
UPS Systems Topologies

“2(N+1)” System

A = B = 200 kW

Load = 200kW

2(N+1) = 2(200kW + 200kW)

Standalone

Modular

Load = 200kW

2(N+1) = 2(200kW + 100kW)
Configuring a UPS System:--

A Quick Guide

UPS System
Configuring a UPS System
UPS System

Resilience v Cost – A Balancing Act
UPS System
Design Criteria

Static UPS System:

200kVA
N+1

Battery Autonomy:

15 mins
UPS System

Battery range
Battery System

Tip!

Fewer number of Battery Strings of larger blocks

= Commercially advantageous

≠ Resilience
Selecting a UPS

“N + 1” System

- Redundant Capacity 200kW
- Redundant Capacity 100 kW
- Redundant Capacity 100 kW
- Redundant Capacity 33 kW
- Redundant Capacity 33 kW
- Redundant Capacity 33 kW
200KVA N+1 Standalone Topology (2 x 200kVA)

Load = 200kVA

A = B = 200 kVA
200KVA N+1 Standalone
Switchgear (2 x 200kVA)
200KVA N+1 Standalone

Separate Battery Options

15 minute Battery System per 200kVA UPS frame, Single string

1 x 50 x SWL4250

Note:- 400kVA of Batteries
200KVA N+1 Standalone
Separate Battery Options

15 minute Battery System per 200kVA UPS frame, Multiple strings, Limited redundancy

2 x (2 x 50) x SWL2300

Note: 400kVA of Batteries One string = 3.5 minutes
200KVA N+1 Standalone

Separate Battery Options

15 minute Battery System per 200kVA UPS frame, Multiple strings, With redundancy

2 x (2 x 50) x SWL4250

Note:– 800kVA of Batteries
200KVA N+1 Standalone
Separate Battery Options

15 minute Battery System per 200kVA UPS frame, Multiple strings, With redundancy

2 x (3 x 50) x SWL2300

Note:- 600kVA of Batteries, Two strings = 15 mins
200KVA N+1 Standalone

Common Battery Options

15 minute Common Battery System between Each 200kVA UPS frame

1 x 50 x SWL4250

Note:- 200kVA of Batteries
200KVA N+1 Standalone

Common Battery Options

15 minute Common Battery System between Each 200kVA UPS frame, Multiple strings, Limited redundancy

2 x 50 x SWL2300

Note:- 200kVA of Batteries One string = 3.5 minutes
15 minute Common Battery System between Each 200kVA UPS frame, Multiple strings, With redundancy

2 x 50 x SWL4250

Note:- 400kVA of Batteries One string = 15 minutes
200KVA N+1 Standalone

Common Battery Options

15 minute Common Battery System between Each 200kVA UPS frame, Multiple strings, with One string redundancy

3 x 50 x SWL2300

Note:- 300kVA of Batteries Two strings = 15 minutes
Selecting a UPS

“N + 1” System

<table>
<thead>
<tr>
<th>Redundant Capacity</th>
<th>100 kW Redundant Capacity</th>
<th>100 kW Redundant Capacity</th>
<th>33 kW Redundant Capacity</th>
<th>33 kW Redundant Capacity</th>
<th>33 kW Redundant Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
200KVA N+1 Standalone

Topology (3 x 100kVA)

Load = 200kVA

A = B = C = 100 kVA
200KVA N+1 Standalone
Switchgear (3 x 200kVA)
200KVA N+1 Standalone

Separate Battery Options

15 minute Battery System per 100kVA UPS frame, Single string

1 x 50 x SWL2250

Note:- 300kVA of Batteries
200KVA N+1 Standalone
Separate Battery Options

15 minute Battery System per 100kVA UPS frame, Multiple strings, Limited redundancy

2 x (2 x 50) x SWL1100

Note:- 300kVA of Batteries One string = 3.5 minutes
200KVA N+1 Standalone

Separate Battery Options

15 minute Battery System per 100kVA UPS frame, Multiple strings, With redundancy

3 x (2 x 50) x SWL2250

Note:- 600kVA of Batteries
200KVA N+1 Standalone

Separate Battery Options

15 minute Battery System per 100kVA UPS frame, Multiple strings, With redundancy

3 x (3 x 50) x SWL1100

Note:- 450kVA of Batteries, Two strings = 15 mins
200KVA N+1 Standalone

Common Battery Options

15 minute Common Battery System between Each 100kVA UPS frame

1 x 50 x SWL4250

Note:- 200kVA of Batteries
200KVA N+1 Standalone

Common Battery Options

15 minute Common Battery System between Each 100kVA UPS frame, Multiple strings, Limited redundancy

2 x 50 x SWL2300

Note: 200kVA of Batteries One string = 3.5 minutes
200KVA N+1 Standalone
Common Battery Options

15 minute Common Battery System between Each 100kVA UPS frame, Multiple strings, With redundancy

Note:
- 400kVA of Batteries
- One string = 15 minutes

2 x 50 x SWL4250
15 minute Common Battery System between Each 100kVA UPS frame, Multiple strings, with One string redundancy

3 x 50 x SWL2300

Note: 300kVA of Batteries Two strings = 15 minutes
Selecting a UPS

“N + 1” System
200KVA N+1 Modular Topology (5 x 50kVA)

Load = 200kVA

5 X 50kVA = 200 kVA N+1
200KVA N+1 Standalone Topology (5 x 50kVA)
200KVA N+1 Standalone

Separate Battery Options

1 x 50 x SWL1100

Note:- 250kVA of Batteries
200KVA N+1 Standalone

Common Battery Options

1 x 50 x SWL4250

15 minute Battery System per UPS frame, Single string

Note:- 200kVA of Batteries
200KVA N+1 Standalone

Common Battery Options

15 minute Battery System per UPS frame, Multiple strings, Limited redundancy

Note: - 200kVA of Batteries
One string = 3.5 minutes

2 x (2 x 50) x SWL2300
200KVA N+1 Standalone

Common Battery Options

15 minute Battery System per UPS frame, Multiple strings, With redundancy

2 x (2 x 50) x SWL4250

Note:- 400kVA of Batteries
One string = 15 minutes
Selecting a UPS

“N + 1” System

A

B

Redundant Capacity

100 kW Redundant Capacity

100 kW Redundant Capacity

33 kW Redundant Capacity

33 kW Redundant Capacity

33 kW Redundant Capacity
200KVA N+1 Modular Topology (5 x 50kVA)

Load = 200kVA

3 X 100kVA = 200 kVA N+1
200KVA N+1 Standalone

Topology (5 x 50kVA)
200KVA N+1 Standalone
Separate Battery Options

1 x 50 x SWL1100

Note:- 250kVA of Batteries
200KVA N+1 Standalone

Common Battery Options

1 x 50 x SWL4250

15 minute Battery System Per UPS frame, Single string

Note:- 200kVA of Batteries
200KVA N+1 Standalone

Common Battery Options

2 x (2 x 50) x SWL2300

15 minute Battery System per UPS frame, Multiple strings, Limited redundancy

Note:- 200kVA of Batteries
One string = 3.5 minutes
200KVA N+1 Standalone

Common Battery Options

15 minute Battery System
Per UPS frame, Multiple strings, With redundancy

Note: 400kVA of Batteries
One string = 15 minutes

2 x (2 x 50) x SWL4250
Battery Systems

Calculating a Battery System - Variables

Calculating battery systems is a process of iteration…

<table>
<thead>
<tr>
<th>Pre-requisite</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load kVA + p.f</td>
<td>End of discharge voltage</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Temperature</td>
</tr>
<tr>
<td></td>
<td>UPS efficiency</td>
</tr>
<tr>
<td></td>
<td>Manufacturing tolerance</td>
</tr>
</tbody>
</table>
## Battery Systems

### Calculating a Battery System

#### Watts per Cell Chart @ 20Deg C

<table>
<thead>
<tr>
<th>EODV (W/Cell)</th>
<th>Discharge Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VPC</td>
<td>2</td>
</tr>
<tr>
<td>1.5</td>
<td>768</td>
</tr>
<tr>
<td>1.6</td>
<td>763</td>
</tr>
<tr>
<td>1.65</td>
<td>757</td>
</tr>
<tr>
<td>1.7</td>
<td>737</td>
</tr>
<tr>
<td>1.75</td>
<td>673</td>
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<tr>
<td>1.8</td>
<td>547</td>
</tr>
<tr>
<td>1.85</td>
<td>515</td>
</tr>
<tr>
<td>1.9</td>
<td>390</td>
</tr>
</tbody>
</table>
Battery Systems
Calculating a Battery System

Effect of Temperature
Watts per Cell Chart @ 25Deg C

<table>
<thead>
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<th>EODV</th>
<th>Discharge Time (min)</th>
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<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>VPC</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>738</td>
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<tr>
<td>1.6</td>
<td>753</td>
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<tr>
<td>1.65</td>
<td>769</td>
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<td>1.67</td>
<td>747</td>
</tr>
<tr>
<td>1.7</td>
<td>714</td>
</tr>
<tr>
<td>1.75</td>
<td>707</td>
</tr>
<tr>
<td>1.8</td>
<td>574</td>
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<tr>
<td>1.85</td>
<td>541</td>
</tr>
<tr>
<td>1.9</td>
<td>410</td>
</tr>
</tbody>
</table>
Battery Systems

UPS Efficiency

Overall UPS Efficiency 96.1%

Inverter Efficiency 1%
Battery Systems

Calculating a Battery System

200kVA @ 0.8 p.f. @ 97.1% UPS efficiency = 164,778W

164,778W /50 Battery Blocks/6 Cells per Block = 549 WPC

Watts per cell table @ 25Deg C  EODV @ 1.67

<table>
<thead>
<tr>
<th>EODV</th>
<th>(W/Cell)</th>
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</table>

<table>
<thead>
<tr>
<th>Discharge Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
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<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
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<tr>
<td>15</td>
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</tbody>
</table>
Battery Systems

Calculating a Battery System

200kVA @ 0.8 p.f. @ 92.5% UPS efficiency = 172,973

172,973W /50 Battery Blocks/6 Cells per Block = **577 WPC**

Watts per cell table @ 20Deg C    EODV @ 1.75

<table>
<thead>
<tr>
<th>EODV</th>
<th>(W/Cell)</th>
<th>Discharge Time (min)</th>
</tr>
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<tbody>
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<td>401</td>
</tr>
</tbody>
</table>

EODV: End of Discharge Voltage
VPC: Voltage per Cell

Constant Power Discharge Table For The SWL2500

Watts per cell table @ 20Deg C

EODV: End of Discharge Voltage
VPC: Voltage per Cell

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<td>1.9</td>
<td>410</td>
<td>401</td>
</tr>
</tbody>
</table>

EODV: End of Discharge Voltage
VPC: Voltage per Cell

Watts per cell table @ 20Deg C

EODV: End of Discharge Voltage
VPC: Voltage per Cell

<table>
<thead>
<tr>
<th>EODV</th>
<th>(W/Cell)</th>
<th>Discharge Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td>VPC</td>
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<td>5</td>
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<td>8</td>
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<td>9</td>
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<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>1.5</td>
<td>738</td>
<td>656</td>
</tr>
<tr>
<td>1.6</td>
<td>753</td>
<td>682</td>
</tr>
<tr>
<td>1.65</td>
<td>769</td>
<td>702</td>
</tr>
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EODV: End of Discharge Voltage
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Watts per cell table @ 20Deg C

EODV: End of Discharge Voltage
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Battery Systems

Calculating a Battery System

Battery System One = 1 String of 50 x SWL4250

= 2 Strings of 50 x SWL2300

Battery System Two = 1 String No Configuration

= 2 Strings of 40 x SWL2500

Note:- Excludes additional costs for DC Isolation, Battery Assembly, Larger Rack, Transport
Transformerless Design UPS = flexible battery arrangements

Configure for autonomy

Configure for cost-effectiveness

30 – 50 Blocks!
Battery Systems

End of Life?

• Standards define EOL for a battery as 80% capacity
  • Eg: Start at 100AH, after 10 years 80AH

• For 100AH at 10 years oversize by 25%

• Drop off in capacity is towards end of life
Battery Systems

Battery Containment
Battery Systems

Battery Containment
## Configuring a UPS System

### Checklist - UPS

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What model of UPS system is proposed?</td>
</tr>
<tr>
<td>2</td>
<td>Standalone system - which UPS frame is proposed?</td>
</tr>
<tr>
<td>3</td>
<td>Standalone system - what configuration of frames?</td>
</tr>
<tr>
<td>4</td>
<td>Modular system - which UPS frame is proposed?</td>
</tr>
<tr>
<td>5</td>
<td>Modular System - How many UPS modules, of what rating?</td>
</tr>
</tbody>
</table>
### Configuring a UPS System

**Checklist – Battery System**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery autonomy @ what load?</td>
</tr>
<tr>
<td>2</td>
<td>Separate or Common battery system</td>
</tr>
<tr>
<td>3</td>
<td>Number of battery strings</td>
</tr>
<tr>
<td>4</td>
<td>Number of battery blocks per string</td>
</tr>
<tr>
<td>5</td>
<td>Manufacturer and model number of battery block</td>
</tr>
<tr>
<td>6</td>
<td>5 or 10 year batteries</td>
</tr>
<tr>
<td>7</td>
<td>Battery containment system</td>
</tr>
<tr>
<td>8</td>
<td>Method of battery string dc isolation- per string and UPS</td>
</tr>
<tr>
<td>9</td>
<td>Dimensions of battery containment system and weight</td>
</tr>
<tr>
<td>10</td>
<td>Battery autonomy calculations: -</td>
</tr>
<tr>
<td></td>
<td>• what efficiency has been used for the UPS unit</td>
</tr>
<tr>
<td></td>
<td>• final end of discharge voltage (EODV) value per battery cell</td>
</tr>
<tr>
<td></td>
<td>• temperature at which autonomy has been calculated</td>
</tr>
</tbody>
</table>
## Configuring a UPS System

### Checklist – Supplier Contracts & After-Sales Service

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How many projects in the UK has the supplier installed?</td>
</tr>
<tr>
<td>2</td>
<td>Who will commission, maintain, repair, and support the UPS system?</td>
</tr>
<tr>
<td>3</td>
<td><strong>SLA’s?</strong></td>
</tr>
<tr>
<td></td>
<td>• Guaranteed Response Time</td>
</tr>
<tr>
<td></td>
<td>• Preventive Maintenance Visits</td>
</tr>
<tr>
<td></td>
<td>• 24 Hour Telephone support</td>
</tr>
<tr>
<td></td>
<td>• Free Labour, travelling and expenses</td>
</tr>
<tr>
<td></td>
<td>• Replacement Parts included</td>
</tr>
<tr>
<td>4</td>
<td>Is a full range of Spare Parts stored in the UK to support a Service Contract and response times?</td>
</tr>
<tr>
<td>5</td>
<td>Who is the Warranty held by?</td>
</tr>
</tbody>
</table>
UPSL

Product Range

**Standalone**
- **powerWay E 3000T**
  - Single-Phase UPS for 7.5 to 20kVA power output

**Modular**
- **powerWay E 5000**
  - Three-Phase UPS for 7.5 to 40kVA power output
- **powerWay E 6000**
  - Modular, scalable three-phase UPS for 60 to 500kVA power output or parallel multiple units to 5MVA
- **powerWay E 8000 DPA**
  - Modular, scalable three-phase UPS up to 200kVA (100kVA N+1) or parallel redundancy up to 1.5MVA N+1
- **powerWay E 9000 DPA**
  - Modular, scalable three-phase UPS for up to 250kVA (200kVA N+1) or parallel redundancy up to 1.5MVA N+1
- **powerWay E 9500 DPA**
  - Modular, scalable three-phase UPS for up to 500kVA (400kVA N+1) or parallel redundancy up to 3MVA N+1
1. UPS Technology has improved over the years

2. Transformerless UPS technology has matured and overtaken transformer UPS

3. Modular UPS is the newest technology in the UPS evolution offering real CAPEX and OPEX savings

4. Modular technology is available for large data centres now, with 100KVA modules and 500KVA building blocks

5. UPS system design – a balance of cost v resilience

6. UPS system design – technical submittals evaluation
Thank you for your time.

Any questions?