HITEC
Power Protection

CONTINUOUS POWER IN YOUR CONTROL
DRUPS - WHAT IS IT?
The complete and seamless mechanical integration of a UPS with a stand-by diesel generator set…
…but it’s not static – it’s dynamic!

battery (chemical) based energy storage

flywheel (mechanical) based energy storage
HOW DOES IT WORK?
AS A POWER CONDITIONER
Power Factor Correction

Input > 0.98 pf

Supply

Load

Utility

Reactive power
Sag/Surge Mitigation

±10% Utility Voltage

100% ±1 Nominal Voltage

Supply

Isolation Impedance

Load

Automatic Voltage Regulation
Harmonic Filtering

Supply/UPS Input

Harmonic voltages

Xa.n

Xb.n

Xc.n (= - Xg.n)

Xg.n

UPS Output/Load

Harmonic currents
AS AN OUTAGE ELIMINATOR
Power Module Components

Flywheel

Energy Transfer Module (ETM)

Alternator

Low Emission Engine

Freewheel Clutch
The UPS “Prime Mover”

- DC Windings
- Alternator & Diesel Generator
- Laminated Core
- Flywheel
- Inner Rotor
- Outer Rotor
- Housing
Conditioning Mode

Q1

Q2

Q3

f1 / f2

1500 RPM

3000 RPM

M
UPS Mode

Q1

Q2

Q3

1500 RPM

Regulating
Diesel (Genset) Mode

Q1

Q2

Q3

1500 RPM

1500 RPM

3000 RPM

f1

f2

M

1500 RPM

1500 RPM
In 2.5 Seconds From 0 to 1500 RPM
How is that possible?

- 1 Utility mode
- 2 KEM flywheel mode + engine start
- 3 Engine / KEM flywheel mode
- 4 Cool down/shut  mode
- 1 Utility Mode

Utility failure:
- Take energy from inner rotor
- Q1 open
- Start engine
About the Diesel engine

- Continuously lubricated
- Pre-heated
- No load at start up
- Up to speed in 2.5 to 3 seconds
- N+1 starter motors with rectified starter panels
- Gravity-fed day tanks
- Sized to load
About the Freewheel clutch

- Fully automatic, single direction
- The relative rotational speed of the driving and driven parts determine engagement
- Integrated lubrication system
- Mechanical connection with engine
- No electrical controls
- Robust & Reliable
About the alternator

- Generates AC power
- Acts as a synchronous condenser that improves power factor
- Up to 50% oversized to system
- Up to 14 X Full Load Current
- Rotary can generate enough current to clear faults without going to bypass unlike Static UPS
- Very stiff source
30+ Year Life
Single-line diagram – Typical installation – Static UPS

Utility

Standby Diesel Generators

Paralleling Switchgear

Automatic Transfer Switches

PF Correction

Essential loads

Critical Loads

Paralleling Switchgear

UPS + Batteries

Cooling + Thermal Storage
Single-line diagram - Typical installation – DRUPS

Utility

Critical Loads (incl. cooling)

Essential loads

Simplification = Reliability
Space-Saving

- Battery
- Low voltage switchgear
- Standby generators
- UPS
- Battery
- Xfmr
- UPS
- Xfmr
Space-Saving

Switchgear  DRUPS, Distribution, Controls  Switchgear
Space-Saving

40%

60%
Highly Efficient

![Graph showing efficiency (%)](image)

- **Efficiency (%)** vs **Load (%)**
- **25% Load** to **100% Load**
- 0.9 cap.
- 1.0 (unity)
- 0.9 ind.
Highly Efficient

- 100% PFC
- 97% UPS
- 100% Battery
- 92% Air Conditioning
- 92% PFC

Diagram showing efficient components and their respective efficiencies.
Game Changing

Generator

UPS

Thermal Storage

IT Load

Mechanical Load

DRUPS

IT Load

Mechanical Load
Fault Clearing Capability

Upstream Short Circuit

2 X Inom

Downstream Short Circuit

14 X Inom
### Benefits Dynamic UPS

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Footprint</strong></td>
<td>• Saves 40% in foot print</td>
</tr>
<tr>
<td><strong>No batteries</strong></td>
<td>• Unlimited number of cycles, fast recharge, no fire hazard, no toxic metals, no hydrogen</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>• No cooling for UPS or batteries required</td>
</tr>
<tr>
<td><strong>Simplicity</strong></td>
<td>• Less equipment, less distribution, less cables, easier to install, easier to manage</td>
</tr>
<tr>
<td><strong>Lifetime</strong></td>
<td>• Lasting 25-30 years with only 2 overhauls. Static UPS lasts 10-12 years, batteries even less.</td>
</tr>
<tr>
<td><strong>Suitable for any load, LV or MV</strong></td>
<td>• Allows also for mechanical (cooling) loads. Maximum flexibility.</td>
</tr>
<tr>
<td><strong>High fault clearing capability</strong></td>
<td>• Fast clearing: Minimizes the impact to other loads as a result of faults in the distribution</td>
</tr>
</tbody>
</table>
Benefits Summarized

Clean
Efficient
Long lasting
Robust
Simple
TOTAL COST OF OWNERSHIP
## CAPEX – initial investment

<table>
<thead>
<tr>
<th>A</th>
<th>Initial Asset Cost (one time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Planning and programming</td>
</tr>
<tr>
<td>A.2</td>
<td>Acquisition</td>
</tr>
<tr>
<td>A.3</td>
<td>Design</td>
</tr>
<tr>
<td>A.4</td>
<td>Constructive / Site Development</td>
</tr>
<tr>
<td>A.5</td>
<td>Commissioning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Operations and Maintenance (recurring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>Lease or Rental</td>
</tr>
<tr>
<td>B.2</td>
<td>Maintenance</td>
</tr>
<tr>
<td>B.3</td>
<td>Operations</td>
</tr>
<tr>
<td>B.4</td>
<td>Overhead and Administration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Utilities (recurring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1</td>
<td>Heat dissipation</td>
</tr>
<tr>
<td>C.2</td>
<td>Cooling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Renewal</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.1</td>
<td>Replacement</td>
</tr>
<tr>
<td>D.2</td>
<td>Overhauls</td>
</tr>
<tr>
<td>D.3</td>
<td>Upgrades</td>
</tr>
<tr>
<td>D.4</td>
<td>Improvements/Enhancements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>End of Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.1</td>
<td>Sales / Adaptive Re-Use</td>
</tr>
<tr>
<td>E.2</td>
<td>Re-sale Value / Salvage Value</td>
</tr>
<tr>
<td>E.3</td>
<td>Removal</td>
</tr>
<tr>
<td>E.4</td>
<td>Site Restoration/Remediation</td>
</tr>
<tr>
<td>E.5</td>
<td>Deconstruction/Recycling</td>
</tr>
</tbody>
</table>

### A.2 Acquisition

- A.2.1 Static UPS systems
- A.2.2 Switchgear (input/output)
- A.2.3 Batteries / racks / cabinets
- A.2.4 Battery monitoring
- A.2.5 Hydrogen detection
- A.2.6 Battery cabling and installation
- A.2.7 Floor space
- A.2.8 Fire suppression
- A.2.9 HVAC system (UPS and battery room)
- A.2.10 Thermal storage
- A.2.11 Diesel Generator
- A.2.12 Automatic Transfer Switch
- A.2.13 Ventilation
CAPEX

- Fire protection
- Air conditioning
- Building shell
- Distribution and transformers
- Monitoring systems
- Batteries
- Hydrogen detection
- Racks/containment
# OPEX – running expenses (recurring)

<table>
<thead>
<tr>
<th>A</th>
<th>Initial Asset Cost (one time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Planning and programming</td>
</tr>
<tr>
<td>A.2</td>
<td>Acquisition</td>
</tr>
<tr>
<td>A.3</td>
<td>Design</td>
</tr>
<tr>
<td>A.4</td>
<td>Constructive / Site Development</td>
</tr>
<tr>
<td>A.5</td>
<td>Commissioning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Operations and Maintenance (recurring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>Lease or Rental</td>
</tr>
<tr>
<td>B.2</td>
<td>Maintenance</td>
</tr>
<tr>
<td>B.3</td>
<td>Operations</td>
</tr>
<tr>
<td>B.4</td>
<td>Overhead and Administration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Utilities (recurring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1</td>
<td>UPS heat dissipation</td>
</tr>
<tr>
<td>C.2</td>
<td>Cooling capacity UPS room</td>
</tr>
<tr>
<td>C.3</td>
<td>Cooling capacity Battery room</td>
</tr>
<tr>
<td>C.4</td>
<td>Ventilation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Renewal</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.1.1</td>
<td>Replacement of Capacitor</td>
</tr>
<tr>
<td>D.1.2</td>
<td>Replacement of Cooling Fans</td>
</tr>
<tr>
<td>D.1.3</td>
<td>Replacement of Batteries</td>
</tr>
<tr>
<td>D.1.4</td>
<td>Replacement of UPS</td>
</tr>
<tr>
<td>D.1.5</td>
<td>Overhaul Induction coupling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>End of Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.1</td>
<td>Sales / Adaptive Re-Use</td>
</tr>
<tr>
<td>E.2</td>
<td>Re-sale Value / Salvage Value</td>
</tr>
<tr>
<td>E.3</td>
<td>Removal</td>
</tr>
<tr>
<td>E.4</td>
<td>Site Restoration/Remediation</td>
</tr>
<tr>
<td>E.5</td>
<td>Deconstruction/Recycling</td>
</tr>
</tbody>
</table>
MODELS AND SIZES
Product Range

**PowerPRO series**

**Power range 470 – 3600 kVA**

**DYNAMIC UPS SYSTEMS**

The HITEC Power PRO series has the greatest reliability and uptime and the reduced energy consumption makes it the most efficient Dynamic UPS solution available in today’s market. PowerPRO’s innovative battery-free design increases reliability, saves space and minimizes environmental impact.

**PowerKEM series**

**Power range 400 – 1000 kVA**

**DYNAMIC KEM SYSTEMS**

The PowerKEM has been designed to be the central component of the power system of any facility that requires power protection and improved power quality. The PowerKEM series reinforces HITEC’s range to provide a simple UPS system that can be configured to provide the desired level of redundancy and resiliency for your facility.
**PowerPRO**

**DRUPS**

1500 RPM

**PowerKEM**

**RUPS**

1500 RPM
## Product Range

<table>
<thead>
<tr>
<th>Model</th>
<th>Range 50Hz</th>
<th>Product</th>
<th>Length</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PowerPRO 1000</strong></td>
<td>470-1000 kVA</td>
<td>![Image]</td>
<td>6.4 m</td>
<td>7.7 t</td>
</tr>
<tr>
<td><strong>PowerPRO 1800</strong></td>
<td>1250-1700 kVA</td>
<td>![Image]</td>
<td>7.8 m</td>
<td>14.7 t</td>
</tr>
<tr>
<td><strong>PowerPRO 2700</strong></td>
<td>1600-2230 kVA</td>
<td>![Image]</td>
<td>8.7 m</td>
<td>26.5 t</td>
</tr>
<tr>
<td><strong>PowerPRO 3600</strong></td>
<td>2500-3000 kVA</td>
<td>![Image]</td>
<td>11.8 m</td>
<td>41.5 t</td>
</tr>
<tr>
<td><strong>PowerKEM</strong></td>
<td>400-2000 kVA</td>
<td>![Image]</td>
<td>2.9 m</td>
<td>8.0 t</td>
</tr>
</tbody>
</table>
PowerPro 2700: state of the art
Power Module Components

- Kinetic Energy Module
- Alternator
- Clutch
- Low Emission Engine
Integrated air filtration & ducted cooling

High efficiency cooling

Sound attenuated covers

Low emission engine

Health indicator

Accessible measuring points

Sliding covers

Automatic bearing lubrication

Service access
The ETM/KEM

Exciter

Vented Housing

Pony Motor

Outer Rotor
1500 / 1800 rpm

Inner Rotor
1500/1800 - 3000 rpm
# PowerPro 2700: state of the art

<table>
<thead>
<tr>
<th>PowerPro 2700</th>
<th>Air inlet</th>
<th>Kinetic energy module</th>
<th>Generator</th>
<th>Freewheel clutch</th>
<th>Diesel engine</th>
<th>Base frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration monitoring</td>
<td>NA</td>
<td>Standard</td>
<td>Standard</td>
<td>NA</td>
<td>NA</td>
<td>Standard</td>
</tr>
<tr>
<td>Condition monitoring</td>
<td>NA</td>
<td>Standard</td>
<td>Standard</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Oil suppletion facility</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Optional</td>
</tr>
</tbody>
</table>

- Air inlet
- Kinetic energy module
- Generator
- Freewheel clutch
- Diesel engine
- Base frame

- Standard
- Optional
- NA

HITEC Power Protection
Kinetic Energy Module

“Automatic bearing lubrication”

- Lubrication of KEM and generator bearings
- Daily lubrication of all 6 bearings
- 2 grease reservoirs of each 2 Liters
- Refill grease reservoir 1x per year
- Grease level and flow detection
- Control & feedback to monitoring system

“Standard on PowerPRO2700 range”
Kinetic Energy Module

“Automatic bearing lubrication”

- Continuous and controlled lubrication while running (No STOP)
- Refill of grease reservoirs 1x per year while running (No STOP)
- Recommended overhaul time once every 10 years
- Calculated bearing lifetime of 10 years

“Low service requirements = Low TCO”
CONFIGURATIONS
Single Systems

Isolated Redundant

Distributed Redundant
Parallel Systems

Master Slave

Cross-Link

Parallel
Everything In Between

Isolated Parallel
Turnkey Solutions
Containerized Solutions for any environment

Ambient: 50 °C

Air inlet

Air outlet

Switchgear and control panels

Transformers (MV/LV)
INSTALLED BASE EXAMPLES
IBM Cogeco

First 3600kVA site in North America

4160V alternators

Distributed redundancy

Up to 5,760kW of N+1 power

490 ft² footprint
Intel

Wafer fabrication

Medium voltage

Temp, pressure, humidity, filtration

Micro treatment plant

8 x 1600 kVA
DuPont Fabros

- Turnkey & in-building options
- Isolated/distributed redundant hybrid
- 22 x 2000kW units
- 6000 gallon base tanks
- 480 Volts
Morgan Stanley

Retrofit units, 3 x 2250 kW

Distributed redundant

Integrated with Siemens gear

Ni-Cad diesel starting

480 Volts
Nampak South Africa

Glass Manufacturing

10 x 2000 kVA

Parallel Configuration

Ni-Cad diesel starting

11kV / 50Hz
Data Center in Singapore

- Colocation facility
- 5 x 2000kVA
- Parallel Configuration
- PowerPRO 2700
Hitec, the Company
The company begins life as HEEMAF, a Dutch electrical appliance manufacturer.

HEEMAF becomes Holec Holdings.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec changes its name to: HITEC Power Protection.

A flywheel is added and the ETM reengineered for the 60Hz US market.

HITEC breaks the 3,000 kVA capacity mark with its VQZ.

Capacity for the flagship QPS unit now sits at a record 3,600 kVA.

HITEC rebrands and launches the first cladded DRUPS unit in production.

HITEC celebrates the 40th anniversary of the creation of the DRUPS unit.

The company begins life as HEEMAF, a Dutch electrical appliance manufacturer.

HEEMAF creates the first rotary uninterruptible power supply.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

HEEMAF becomes Holec Holdings.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.

Holec develops the first independently rotating inner and outer bearing, the principal design for the next generation of equipment.

Holec introduces the largest diesel rotary unit seen in the market to date: a 500 kVA DRUPS.

Holec unites a diesel generator with a rotary UPS, creating the first DRUPS unit in the world.
Test facility at Almelo, The Netherlands
Thank you for your time.