Power supply concepts DATA CENTER

- Reliable
- Sustainable
- Innovative
- Competitive

DC power demand

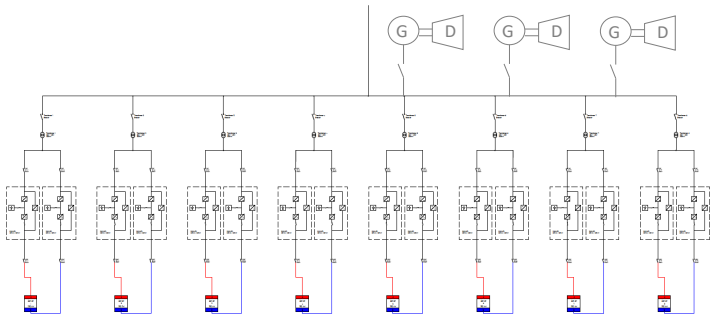
Rising Data Centre capacity requires an adaption of the power supply concept!

2 MW **5 MW** **10 MW** **20 MW**

Supply concept Low voltage

There is a power limit of > 3500 kVA beyond Low Voltage supplies cannot practically be used.

Solution: Multiple UPS sub-systems to supply load groups



Consequence: More systems means more infrastructure, more failures, more cost

For reliable and competitive high power supplies smarter concepts are required

Benefiting from Medium Voltage concepts

As data centres continue to get bigger, the future of Power at Scale is Medium Voltage. And this is how Piller does it….

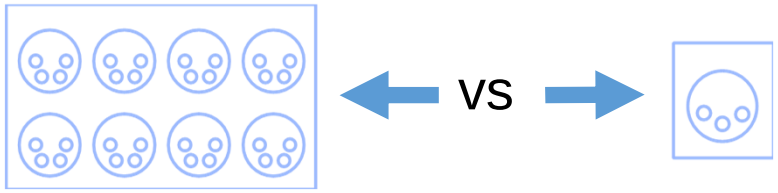
- Cut power losses – adds to green credentials
- Save infrastructure Capex
- MV achieves this without compromising reliability
- There is a limit beyond which Low Voltage cannot practically be used
- More systems means more infrastructure, more failures, more cost
- This limitation does not apply to Medium Voltage
- Renewables typically connected at MV thus a MV UPS & Energy Store fits naturally and optimises the entire system.

> **“We would suggest that the use of UPS at high voltage will become more and more prevalent in the coming years.”**

Robert Thorogood – Hurley Palmer Flatt

Supply concept medium voltage – Less Material

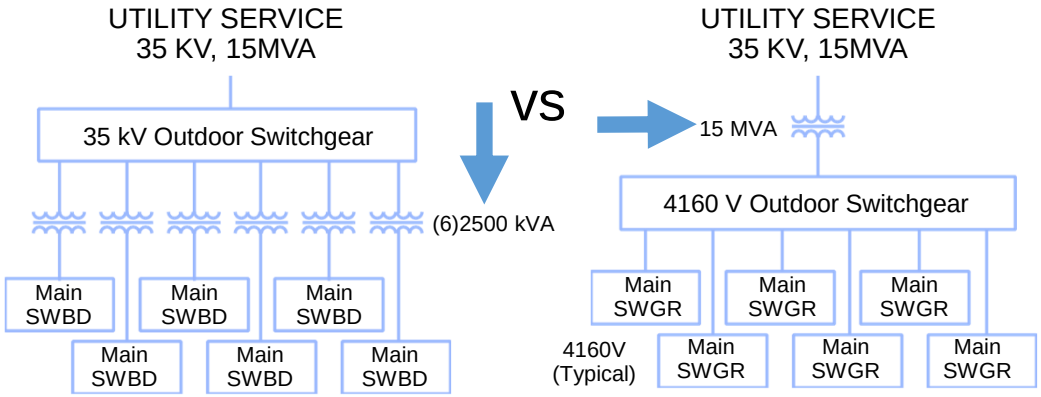
Feeder rationalisation



Up to 80% less Copper and PVC

Less Steel in armour and ladder rack

Large systems allow transformer consolidation

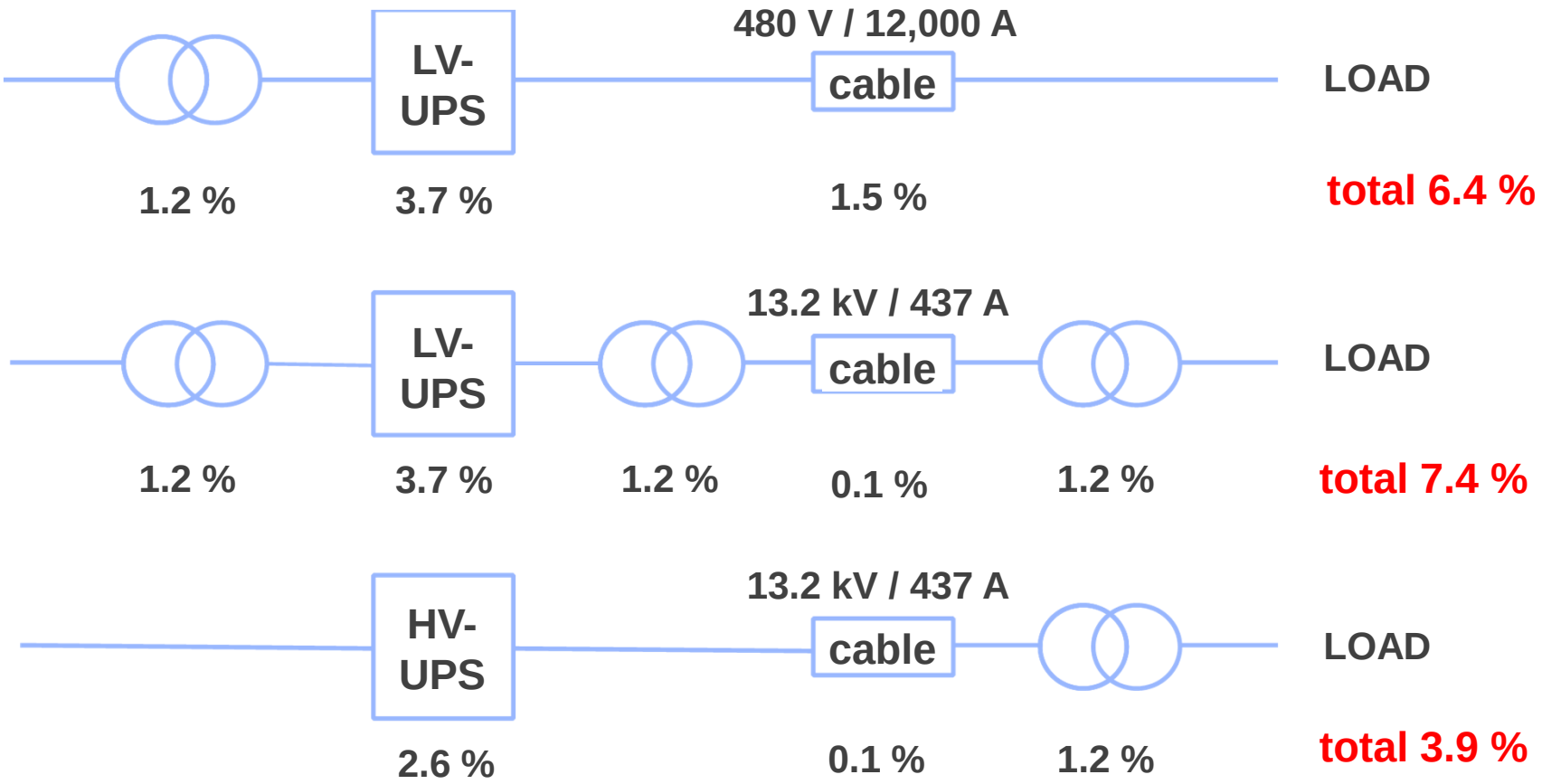


25% Reduction in plant room space

Less real estate building materials

Comparison of Losses - LV solution Vs HV solution

The schemes are showing the typical losses of 3 different configurations for a 10 MVA distribution.



Sustainable HV – Less Concerns Too

Breaker Reliability

600 Volt Insulated Case Breaker
Squared D Masterpact NW

vs

MV Mag-Actuated Vacuum
Breaker ABB VM-1

Endurance Test Results:

- The best 480 V breaker performed nearly 25,000 operations before failure
- The best 4160 V breaker went over 70,000 operations before testing was stopped

Reliability Increases with HV Breakers

Can have lower arc flash than equivalent LV system

Maintenance is less

Heat-related Switchboard issues are less

Terminations are fewer

Costs can be less

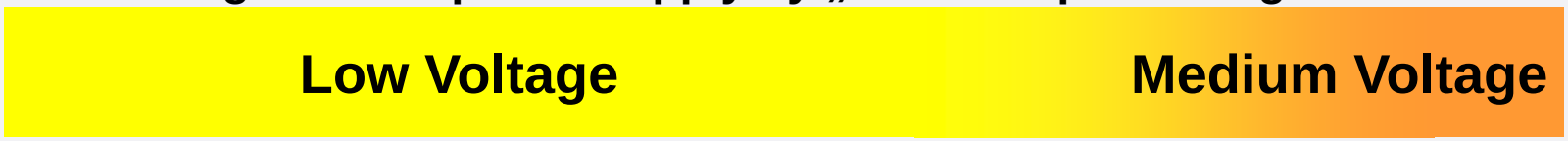
And HV has to be on the site of large scale facilities anyway – no issues with Approved Persons.

The challenge of increased power-demand

Increasing the UPS power supply can economically only be realized by paralleling.

Increasing the UPS power supply by direct paralleling

Increasing the UPS power supply by „isolated“ paralleling



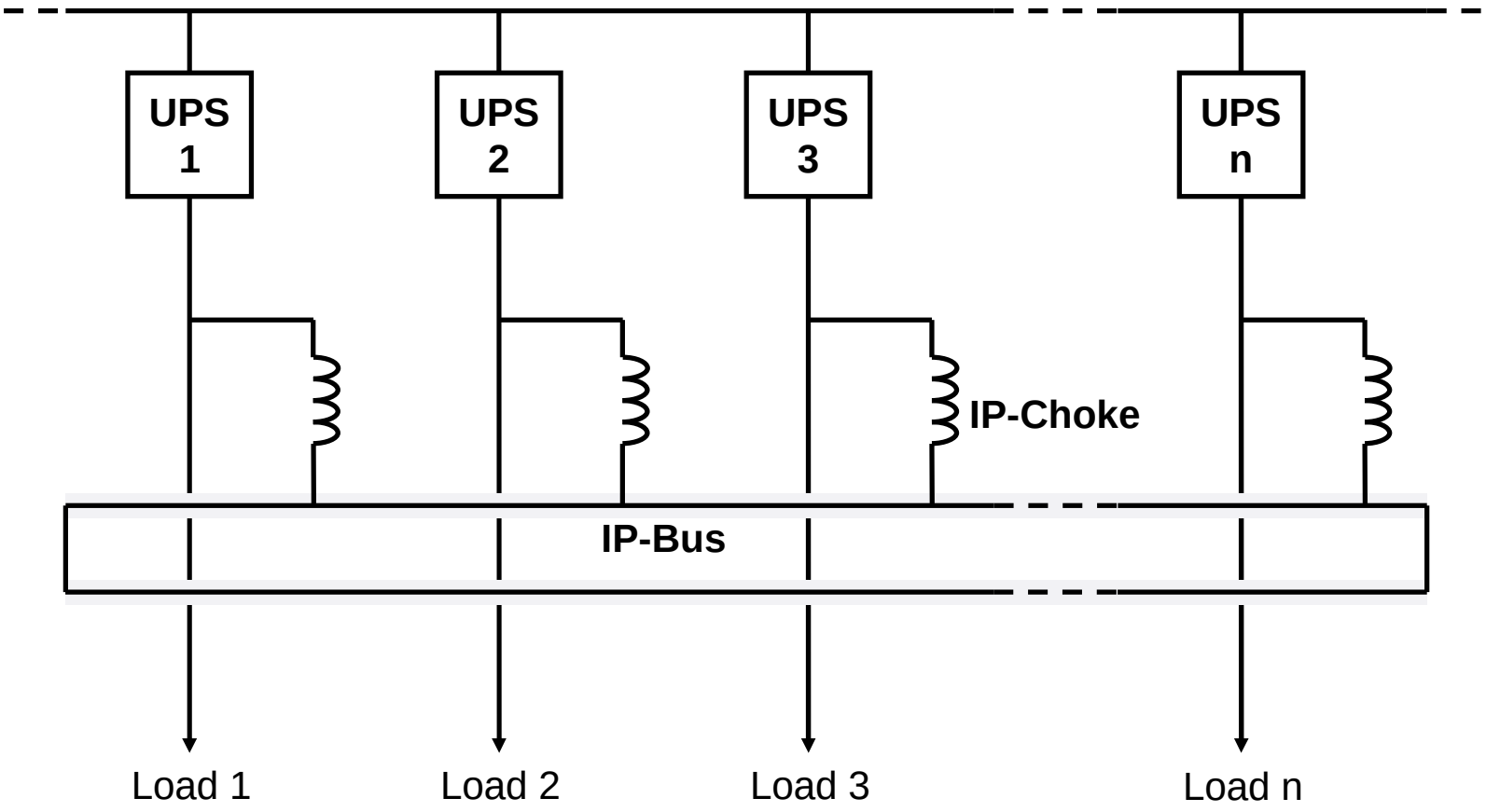
2 MW 5 MW 10 MW 20 MW

Supply concepts IP Bus

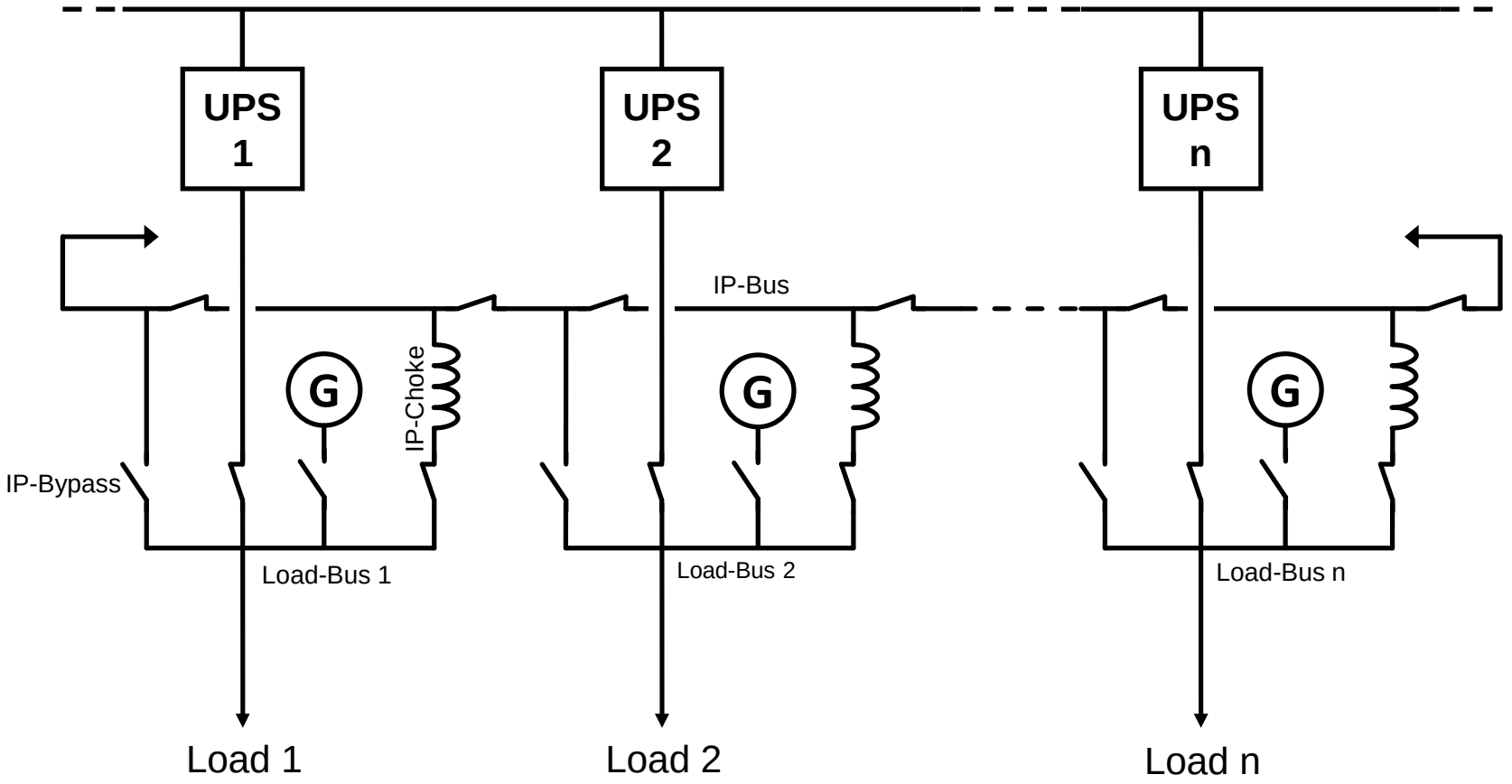
Ideal performance criteria of a reliable „high“ power supply system :

- ☑ **Possible short circuit currents shall be limited (isolated)**
- ☑ **A failure in a load distribution shall not have an influence on the non affected loads**
- ☑ **Each UPS shall run independently in single mode**
- ☑ **All units shall share the load, without “hard/direct” paralleling**
- ☑ **In case of a serious UPS failure the corresponding load shall automatically be supplied by the remaining UPS units without relying on any switching devices.**
- ☑ **The system shall be fault tolerant with redundancy**
- ☑ **Concurrently maintainable**

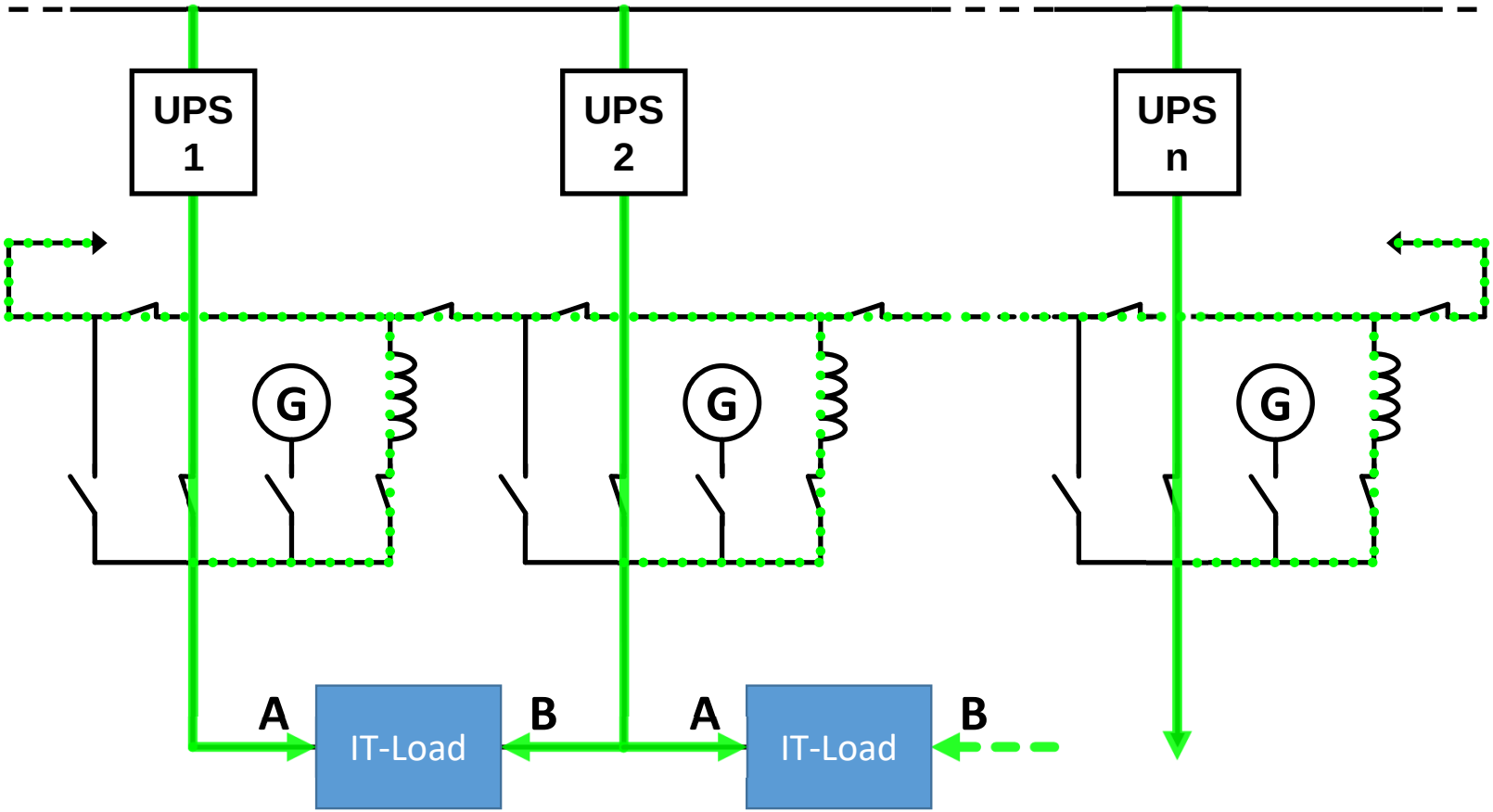
What is „Isolated Paralleling“ ?



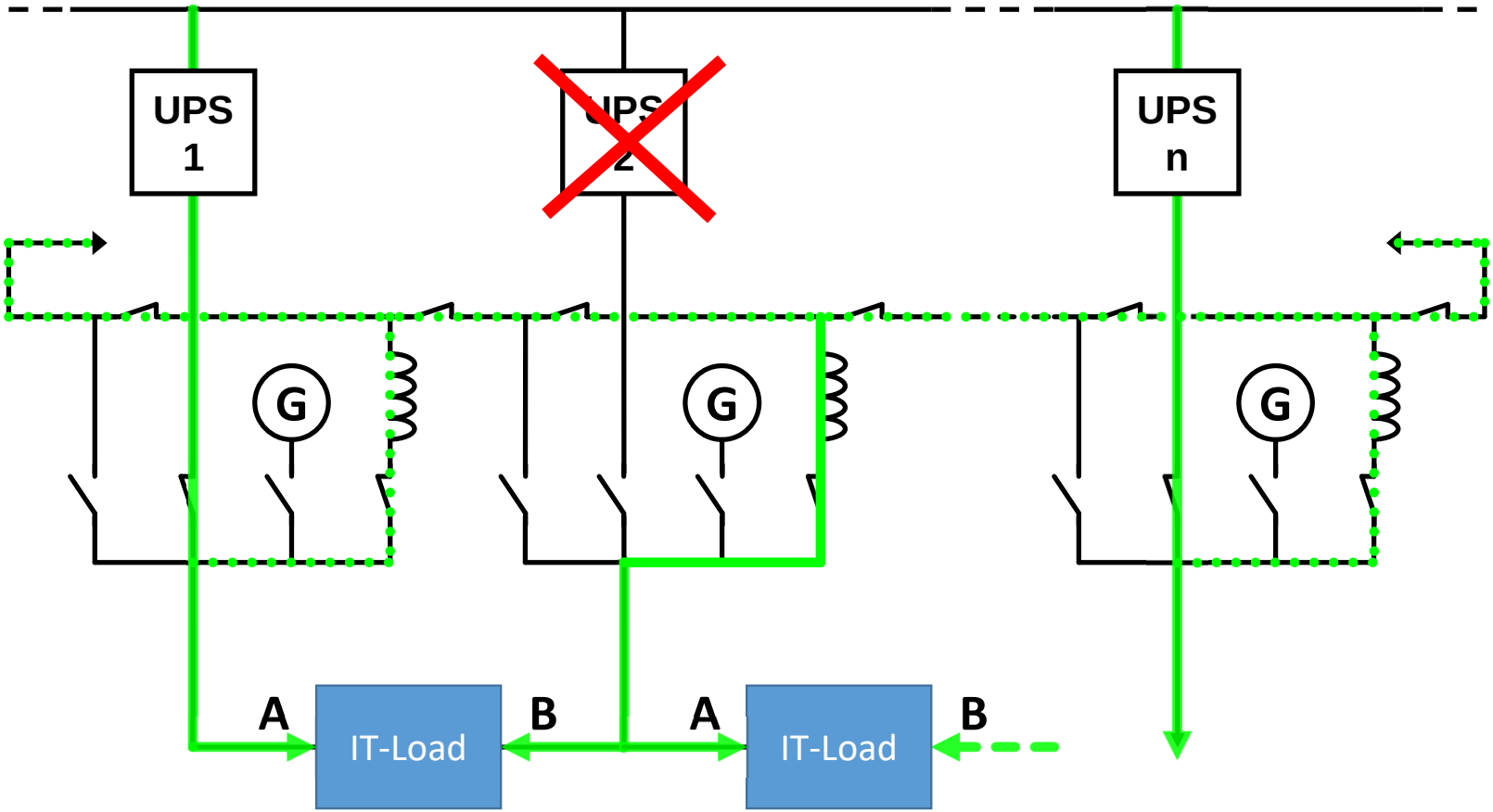
IP-System with downstream Diesel-Generators
Most versatile configuration



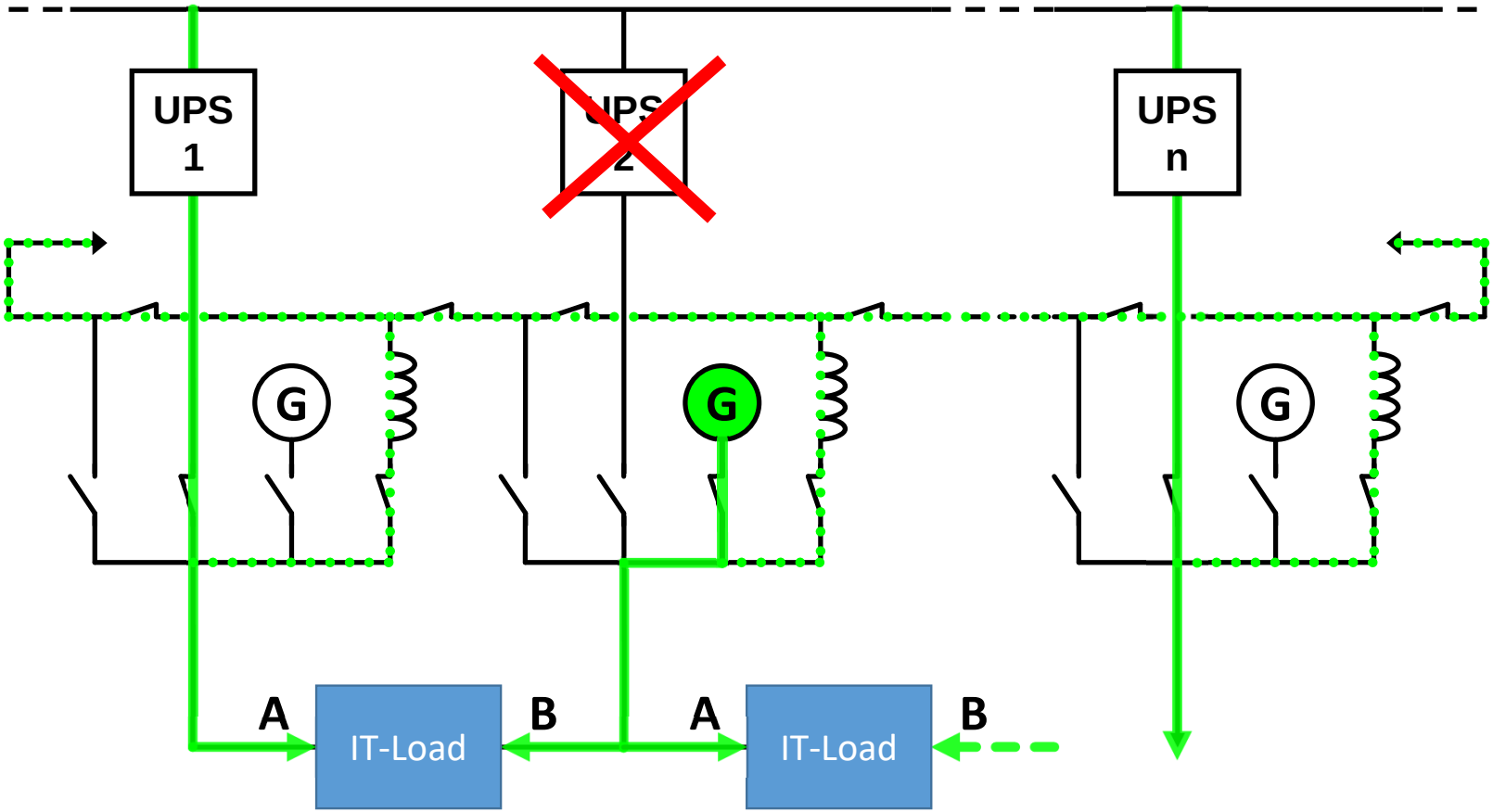
IP-System – Load Flow in Standard Operation



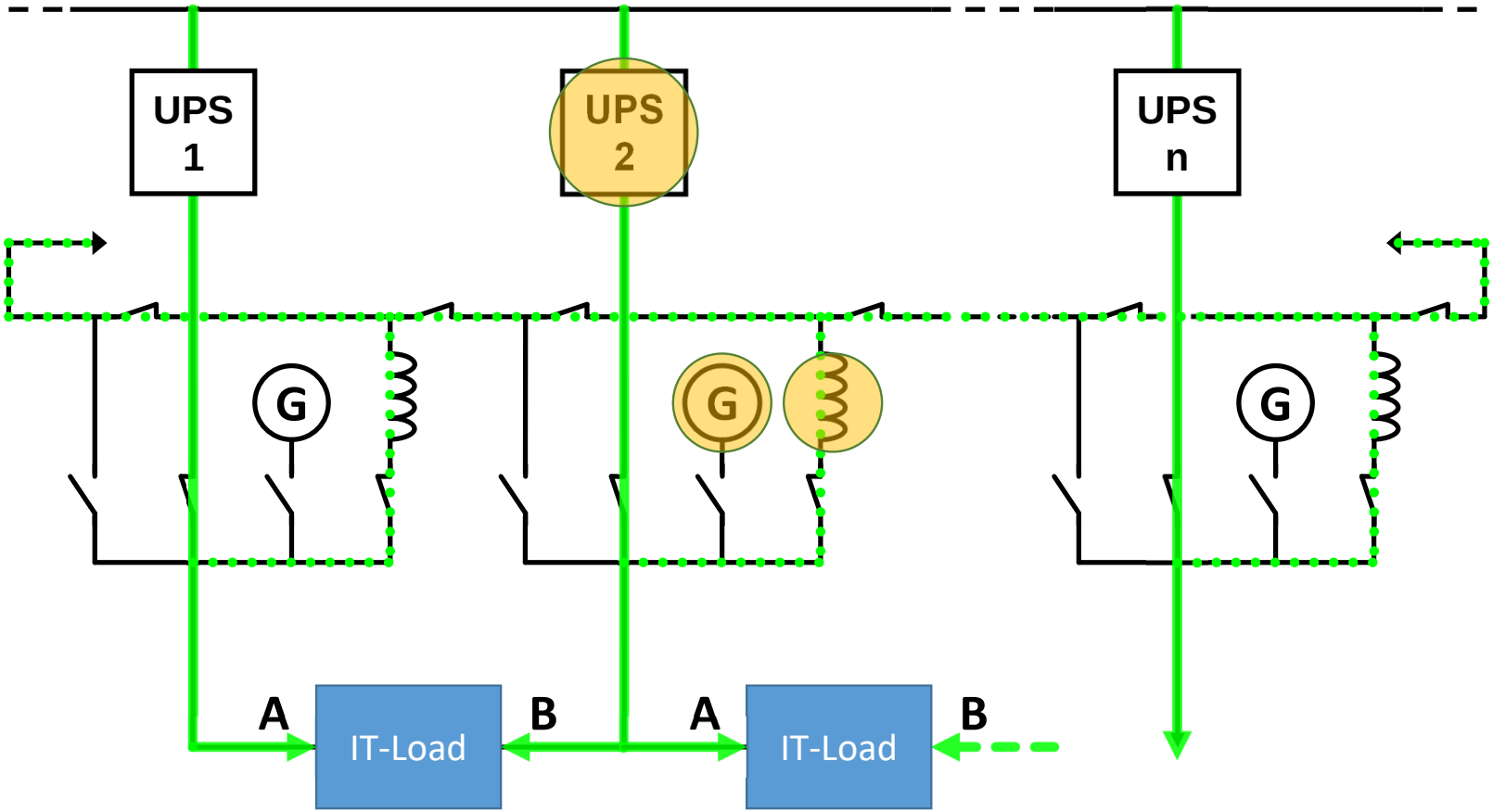
IP-System – UPS Failure
Step 1 – All supply path remain functional



IP-System – UPS Failure
Step 3 – Restoring Redundancy



IP-System –Maintainability Concurrently and Individuably



NEXTDC Data Centres in Australia first with Uptime Inst. (UTI) Tier certificates

PILLER Power Systems

BRISBANE

B1 BRISBANE

Piller RUPS Units
UBT+ 1500
Qty :8
Tier IV certified

B2 BRISBANE
Tier IV certified

CANBERRA

C1 CANBERRA

Piller RUPS Units
UBT+ 1500
Qty :3
N+1
Tier III certified

SYDNEY

S1 SYDNEY

Piller DRUPS

14+1, UBTD 1670
DRUPS
Isolated Parallel Bus
for IT and
mechanical power

S2 SYDNEY

S3 SYDNEY

MELBOURNE

M1 MELBOURNE

Piller DRUPS

12+1, UBTD 1670
DRUPS
Isolated Parallel Bus
for IT and
mechanical power
Tier III certified

M2 MELBOURNE
Tier IV certified

PERTH

P1 PERTH

Piller DRUPS

6+1, UBTD 1670
DRUPS
Containerised
Isolated Parallel Bus
for IT and
mechanical power
Tier III certified

P2 PERTH
Tier IV certified

Also RAD Bynat / Jerusalem received the Tier III certificate for their 10 MVA IP-bus DRUPS installation !

https://www.nextdc.com/data-centres

Resumee IP bus

- **All UPS modules are running with almost full load and therefore with their maximum efficiency**
- **There are no additional standby units with no load**
- **A UPS shutdown can be handled without relying on switching devices**
- **High serviceability**
- **IP-Return-Bus can be used as Bypass, available also during a mains outage**
- **High short circuit capacity**
- **Active damping by the regulation of the UNIBLOCK UPS avoids any oscillation in the system in any mode of operation.**

References IP bus

- **IP Bus technology is successfully installed since 2006, with 16 years of experience meanwhile**
- **More than 80 projects are executed in 11 different countries**
- **Wide mix of RUPS with external Gensets and Diesel UPS (DRUPS) in LV and MV**
- **455 units running on IP bus installation**
- **Installed UPS power > 850 MW.**

Diesel UPS Systems DRUPS

UNIBLOCK™ UBTD+ features

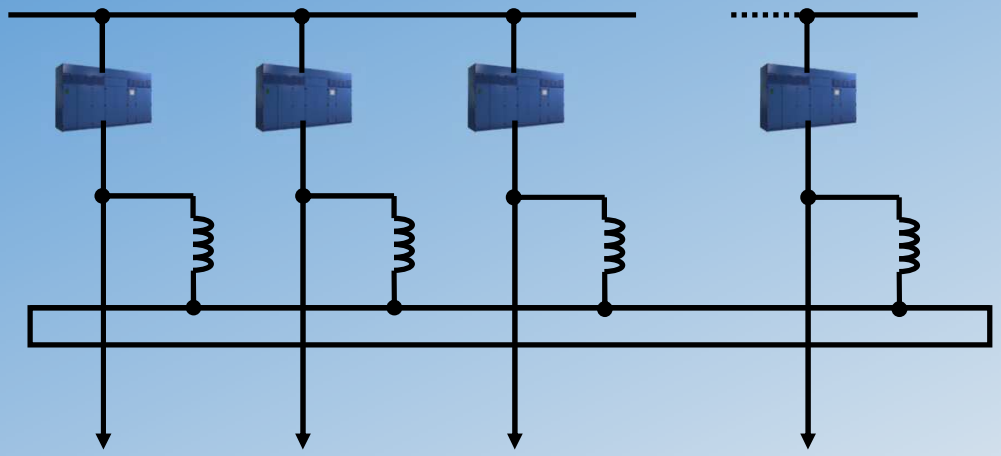
- Rotary UPS from 500kW up to 2700kW
- Paralleling up to 40MW
- Higher reliability than other technologies
- Highest partial and full load efficiencies with energy store connected
- Total design flexibility
- Medium and low voltage options
- Battery or flywheel-backed versions
- Small footprint and high power density

High performance Non Diesel UPS Systems, RUPS

UNIBLOCK™ UB-V features

- High reliability / MTBF – units up to 3600kVA
- Low operation cost
- Design flexibility and space saving
- Leading and lagging load power factor range
- Handling of 100% load changes
- Lithium ion, VRLA or flywheel ride-through time
- Medium and low voltage options
- Stabilisation of power supply in co-operation with gas Gensetor gas turbines even in island operation

Supply concept IP Bus



IB-Bus features

- Highest level of resiliance
- Significantly reduces capital costs
- All units are operating in optimised load range
- System naturally balanced
- No unnecessary switching operations
- Suited for battery-/flywheel and Diesel back-up
- Medium and low voltage options
- System capable of modular expansion to meet growth needs

Summary and Conclusion

"Making Sense"

- Larger single module design – less infrastructure
- Less complexity – far higher reliability
- Much lower downtime for maintenance
- Far wider flexibility for DC design

"Making money"

- Saving on energy consumption
- Lower capex - less infrastructure
- Choice of system voltage and architecture for better economies of scale
- Smaller foot print for higher power density and/or increased white space
- Low maintenance / operational cost
- Better TCO