PILLER
Power Systems

THE FUTURE OF SUSTAINABLE & SCALABLE DATA CENTRE UPS POWER

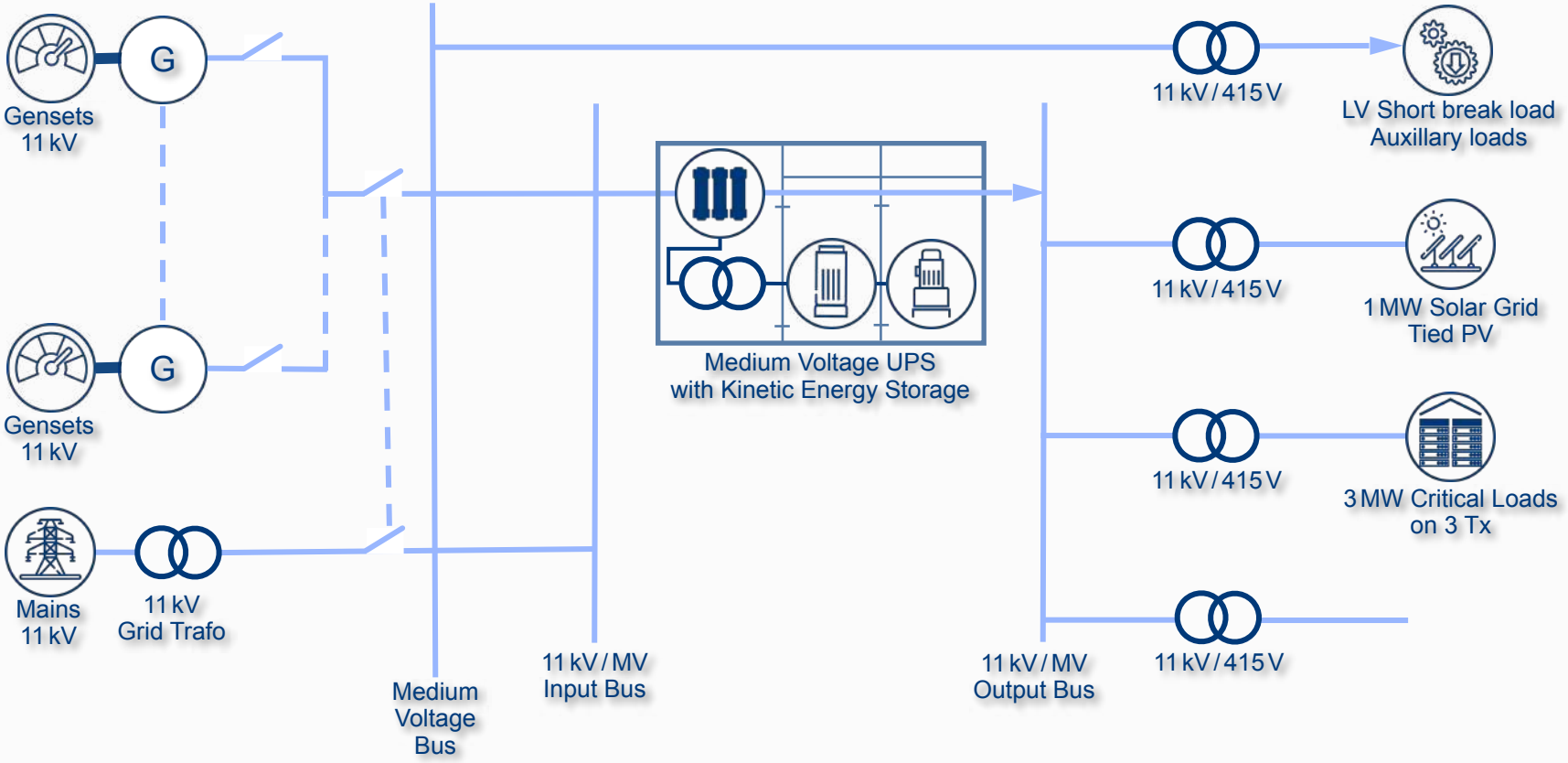
What is Sustainability?

"Making only such use of natural, renewable resources that people can continue to rely on their yields in the long term"

- As we demand more - more power, more natural resources, for more people, homes & cities, we must all strive to achieve this with less waste, fewer emissions, less energy consumption and wider sustainable thinking and action - in every aspect of our lives.
- In the data center ecosystem, this places greater emphasis on technology design and choice…..
  - Materials used – recyclable and reusable
  - Efficiencies and carbon footprint
  - Readiness for green fuels, co-operation with renewables
  - Complexity, components, (electrical) infrastructure
  - Economic sustainability – must be cost effective without compromising reliability of supply!

Source - Wikipedia

Existing installation:
UPS & Energy Storage – Integrating with Renewables

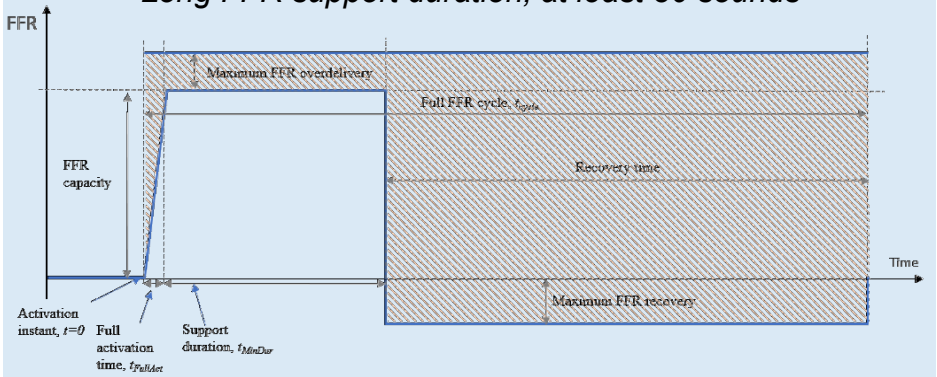


Grid Compatibility and Support

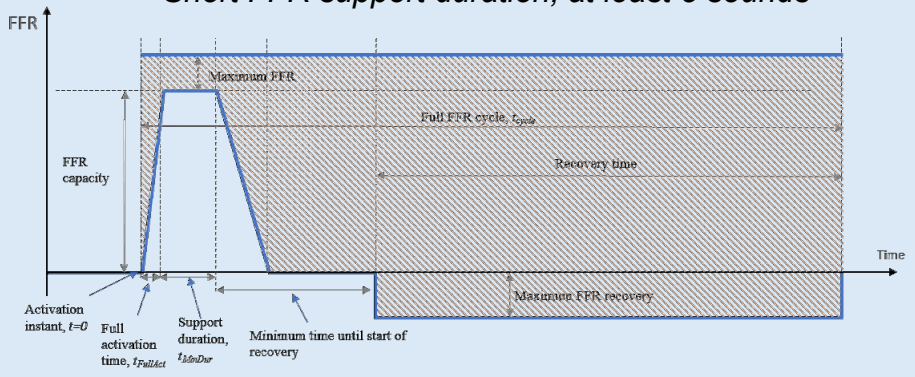
Specific description of the Fast Frequency Reserve (FFR) to provide, with respect to

- ❑ Expected FFR volume (in MV)
- ❑ Maximum activation time, and corresponding frequency activation level (free selection of one)
- ❑ FFR support duration (free selection of one)

Long FFR support duration, at least 30 sounds



Short FFR support duration, at least 5 sounds



Source – entsoe.eu

Benefiting from High Voltage

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

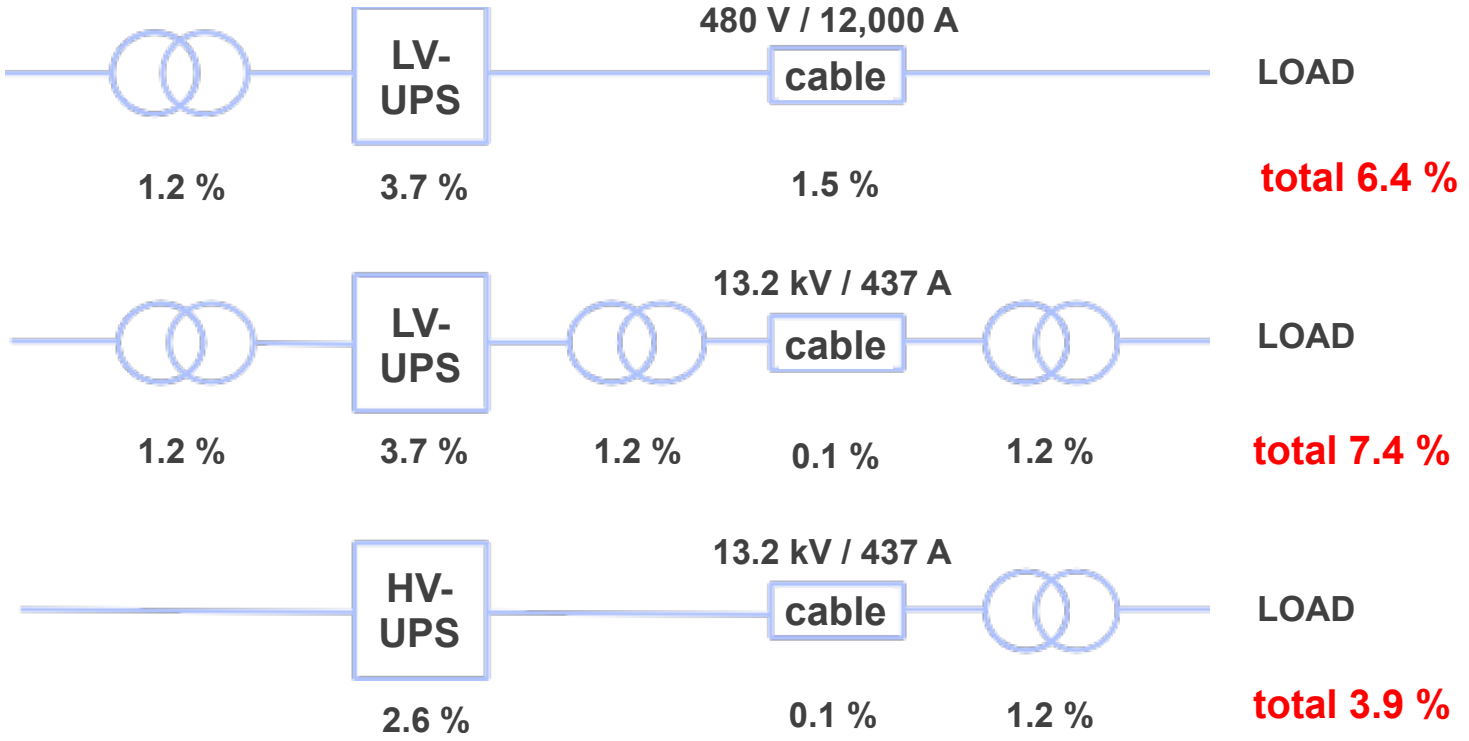
- Cut power losses – adds to green credentials
- Save infrastructure Capex
- HV achieves this without compromising reliability
- There is a limit beyond which Low Voltage cannot practically be used
- This limitation does not apply to High Voltage. More systems mean more infrastructure, more failures, more cost.
- Renewables typically connected at HV thus a HV 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

Comparison of Losses - LV solution Vs HV solution

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



Energy Storage Options

The power required by UPS systems for bridging mains failures can be provided in different ways:

- ☐ Battery
- ☐ Flywheel
- ☐ Capacitor
- ☐ Compressed air
- ☐ Superconducting coil (SMES)

Amazon (Bezos) Flywheel

A flywheel… “Keep pushing and eventually it starts to help turn itself and generate its own momentum – and that's when a company goes from good to great”

Environmental Impact – Energy Storage

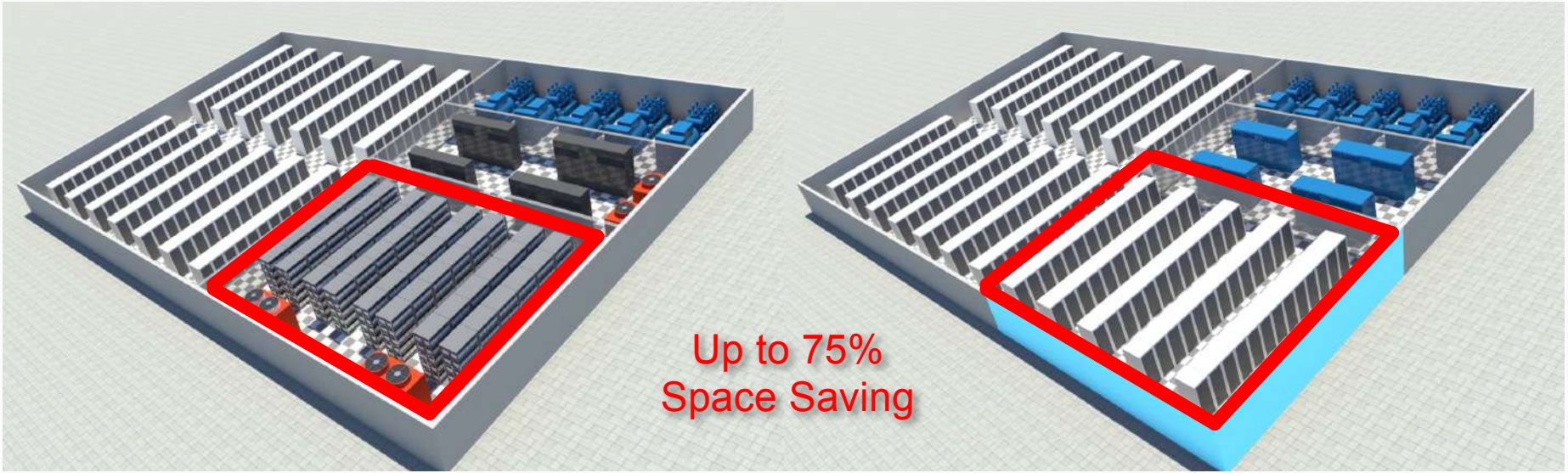
Lead Acid Battery	Li-Ion Battery	Flywheel
Material = plastic, acid, lead recyclable	Material must be recycled - unclear	Material=copper, steel 100% recyclable
Toxic components	Highly toxic components	Non toxic components
Limited transport – battery-dependent	Transport of dangerous goods	Standard transport without any restrictions
Air conditioning cooling	Thermo-management	No requirements
Hardly flammable	Flammable	Not flammable
5-8 years life time	up to15 years estimated life time	over 15 years life time

PLASTIC / LEAD / ACID

PLASTIC / ALUMINIUM /
COBALT + MANGAN / LITHIUM

STEEL / COPPER

MV IP + Kinetic Energy storage – Whitespace Savings Benefits



Consider a 30MW Data Centre with Static UPS and 10 min Lithium Ion LFP Battery backup …… adopting a battery-free UPS solution generates a significant space advantage up to 1000 Racks

30MW Colo, TCO Snapshot

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UPS Total Cost of Ownership (TCO) - Sustainability Savings

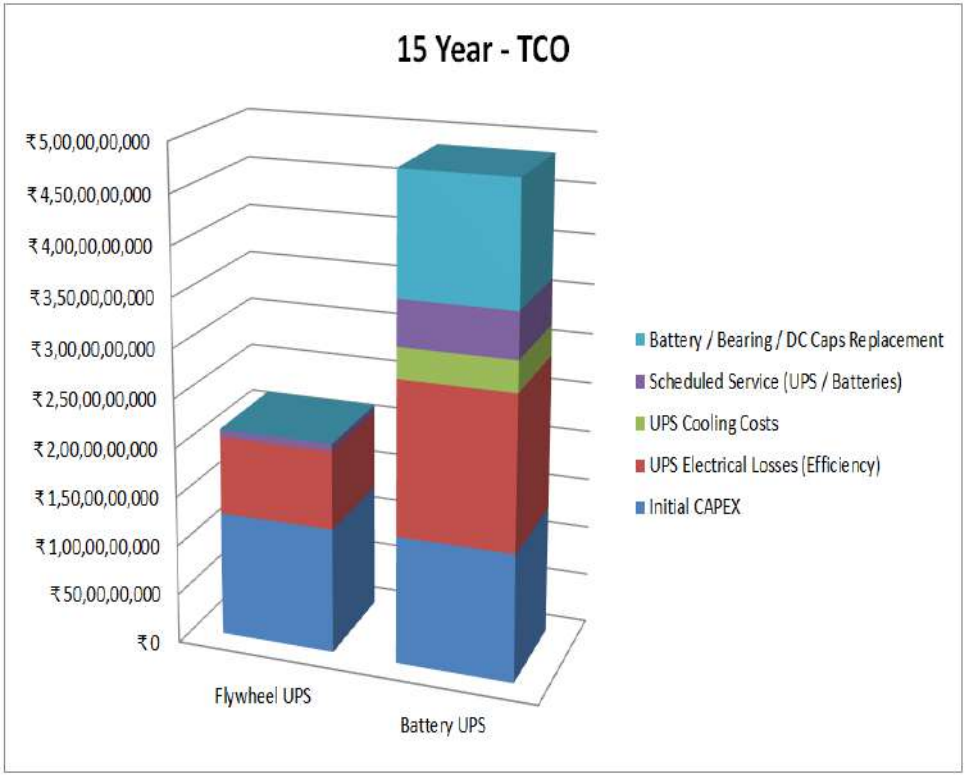
Flywheel UPS Solution Savings	
15 year TCO Savings ($)	**₹ 2,69,24,53,712**
15 year TCO Savings (%)	**56%**

Carbon Emission Savings	Flywheel	Battery
15 year Carbon Emission (metric tons)	**72,502**	**1,71,539**
Flywheel 15 year Carbon Emission Savings (metric tons)	99,037	
Flywheel 15 year Carbon Emission Savings (%)	**58%**	

Sustainability Savings Comparisons (15 years)	
Coal (metric tons)	75,494
Natural Gas (Mcf or 1,000 cubic ft)	14,51,924
Oil (barrels)	2,52,176
Oil (gallons)	1,05,91,405
Gasoline/Diesel (gallons)	78,17,466
Train cars of 100 tons of coal (units)	755
Homes powered per year (units)	11,910
Cars off the road per year (units)	21,361
Roundtrip flights New York to Los Angeles (units)	219
Roundtrip flights Dallas to Sydney (units)	63

Sources:

https://www.eia.gov/tools/faqs/faq.cfm?id=667&t=2
http://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references
http://www.carbonbalanced.org/calculator/flights.asp?deleteid=48866



4x 1800KW MV UPS on Hybrid IP bus,

NetApp Bangalore Campus view 6-hectare campus, 100k m² built-up space, LEED

Conclusion

- Sustainability is key for the future!
- Electrical networks require client & UPS operators participation in demand response.
- Classifying UPS is not as simple as it once used to be - it needs to do more!
- HV UPS and distribution network within the DC works well with renewables upstream.
- Historic labels are insufficient in indicating the differences surrounding
  - performance,
  - maintenance,
  - reliability and flexibility, especially in the context of the modern Data Centre.


Q&A