Mark Vermeulen
Director strategic alliances and partnerships

Why do we power smart connected buildings as we did in 1900?

DC versus AC

Why is our grid AC and not DC

in 1880

- AC was easier converted to different voltages than DC
- Losses in the distribution grid were therefore lower
- Edison (DC) lost to Tesla/Westinghouse (AC)

+100 years

In 1980

- AC was still easier to convert to different voltages
- Switched-mode technology was in its infancy
- Lighting (fluorescent, HID) was still running on AC (Ballasts)

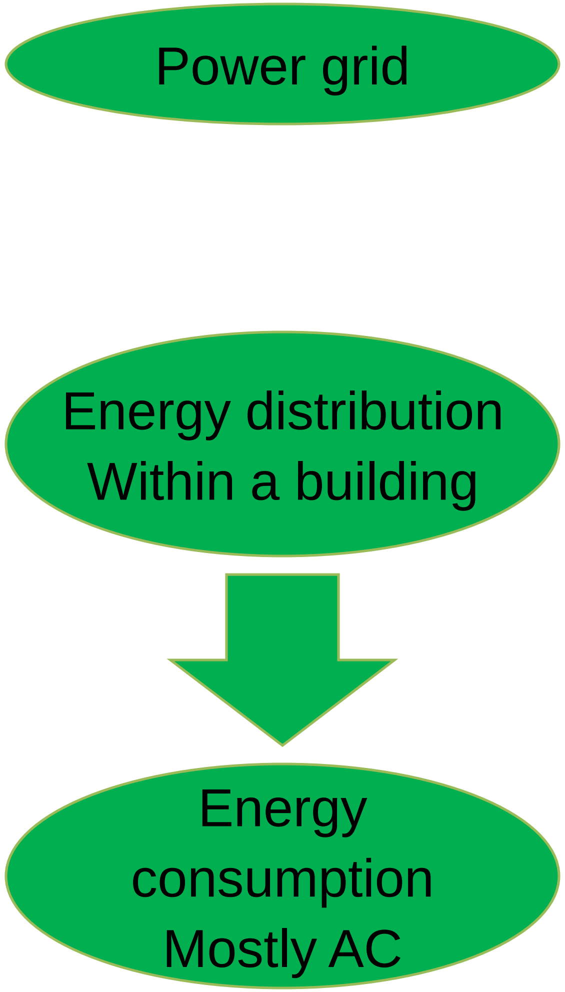
+30 years

In 2020

- AC conversion is achieved via an intermediate DC step
- Losses of DC conversion are lower than of AC conversion
- LED lighting is DC based (but running on AC)

Yesterday’s infrastructure

AC was the norm and logical



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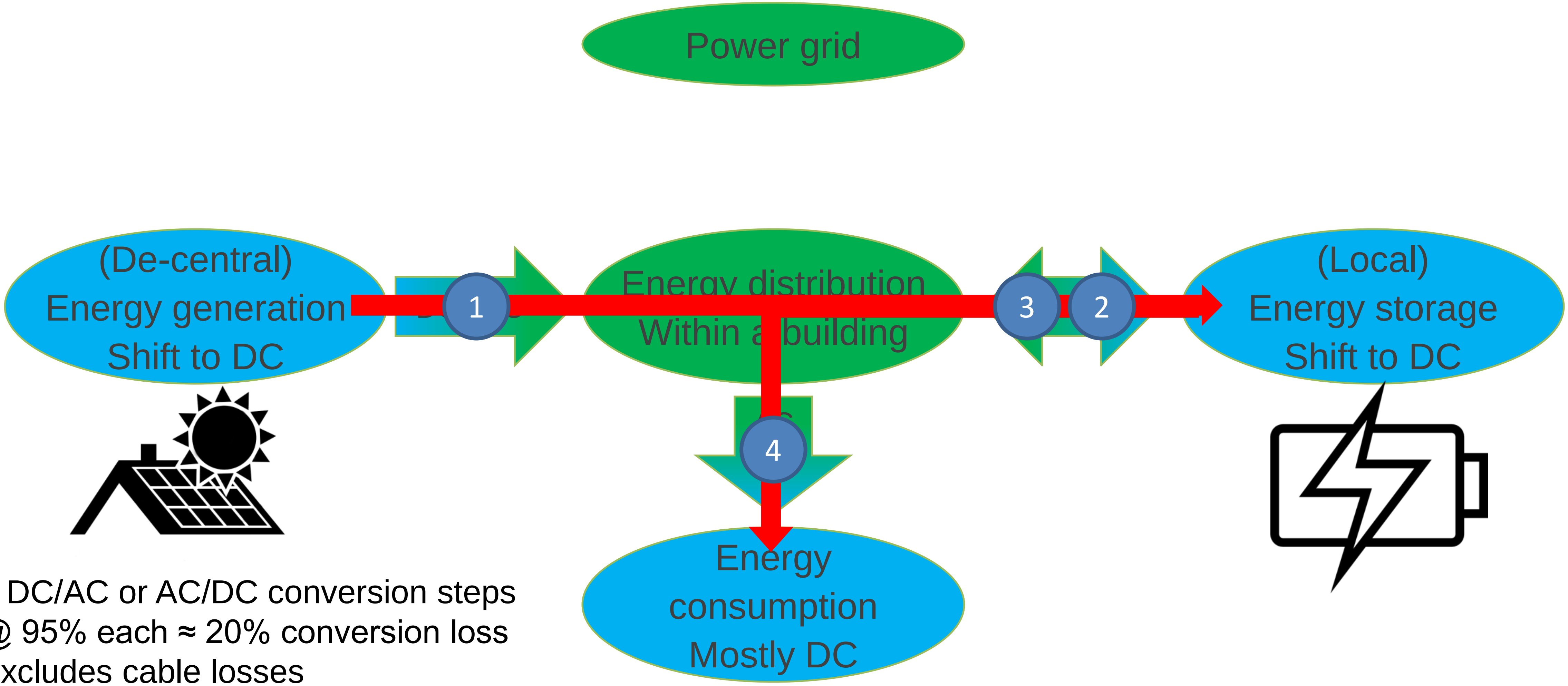
Today’s infrastructure

Inefficient links via the AC grid voltage



4 DC/AC or AC/DC conversion steps
@ 95% each ≈ 20% conversion loss
Excludes cable losses

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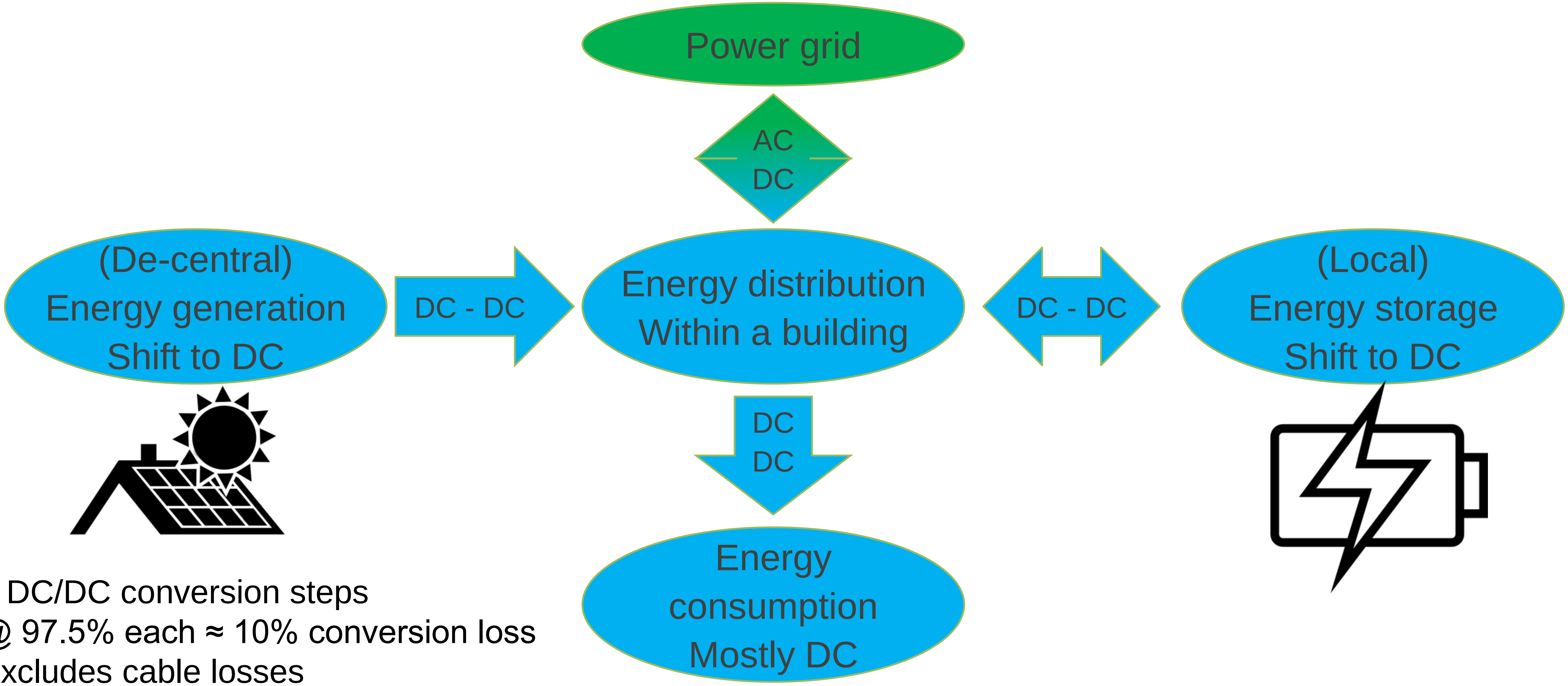
Tomorrow's infrastructure?

A single link to the AC grid voltage is more efficient



4 DC/DC conversion steps
@ 97.5% each ≈ 10% conversion loss
Excludes cable losses

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DC and the Sustainable Development Goals of Europe

https://ec.europa.eu/europeaid/policies/sustainable-development-goals_en

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The Evolution of Digital Lighting Systems

The 3rd phase is starting: Lighting becomes digital

Phase 1
Early LED adopters

Phase 2
Affordable for all

Phase 3
New value creation

Rise of the LED
SSL as new technology lighting entering first foothold markets (high-use applications)

Broad LEDification
SSL as established lighting technology starting to compete with traditional lamps

Beyond illumination
SSL light as integral part of the IoT, with functionalities beyond illumination (e.g. sensing)

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The topic of DC is not really new : Lux review article

10 reasons the future of lighting is DC grids

- Lighting has effectively gone DC thanks to LEDs. Why have the expense of local drivers for each luminaire when they can all be run off the same local DC network?
- The power industry is moving to distributed power generation, thanks to a switch to renewables such as solar panels and the advent of energy storage.
- It's much easier to integrate battery packs such as those produced by Siemens and Tesla into DC systems and grids. DC to DC converters are up to 20 times smaller that AC/DC equivalents.
- There's a significant energy loss every time power is converted from AC to DC at each device. Removing a stage can improve system efficiency by 5 to 10 per cent.
- System reliability will be improved. By removing AC/DC converters, especially those with electrolytic capacitors, we can dramatically improve the mean time between failures.
- By using a relatively higher voltage such 380V DC rather than 48V DC, we can solve the challenges of direct current such as voltage drop and increased cabling sizes, while maintaining safety.
- There's less local heat at the luminaires when there is no power conversion electronics built into the housing, leading to cooler-running, more efficient and longer life LEDs and cooler ceiling voids and interiors.
- A local DC grid opens up opportunities to connect other DC devices, such as sensors and cameras, to the lighting to create an network which can use data to deliver new services.
- The technology is field proven and is used by blue-chip clients such as Carrefour and MaxMara. Louis Vuitton, for instance, is using DC microgids for its lighting at 40 of its newer stores in both Europe and China.

Louis Vuitton is using 48V DC microgrids for its lighting at 40 of its newer stores in both Europe and China.

http://luxreview.com/article/2018/06/10-reasons-the-future-of-lighting-is-dc-grids

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Standards have converged on ‘safe’ DC voltages

- Since July 2015, all regions of the world consider up to 60Vdc as ‘safe’ (incl Canada)
- Key difference between SELV and UL Class 2 is power restriction (at 48Vdc)
- Based on power constraints of UL Class 2, a star topology is required, but not for SELV

	Europe	**USA**	**Canada**
Standard	SELV	UL Class 2	CSA class 2
Techical specs Vmax Imax Pmax	 60Vdc N/A N/A	 60Vdc 7A 100W	 42,4Vdc (60Vdc) 7A 100W
Insulation	Double reinforced	Double reinforced	Double reinforced

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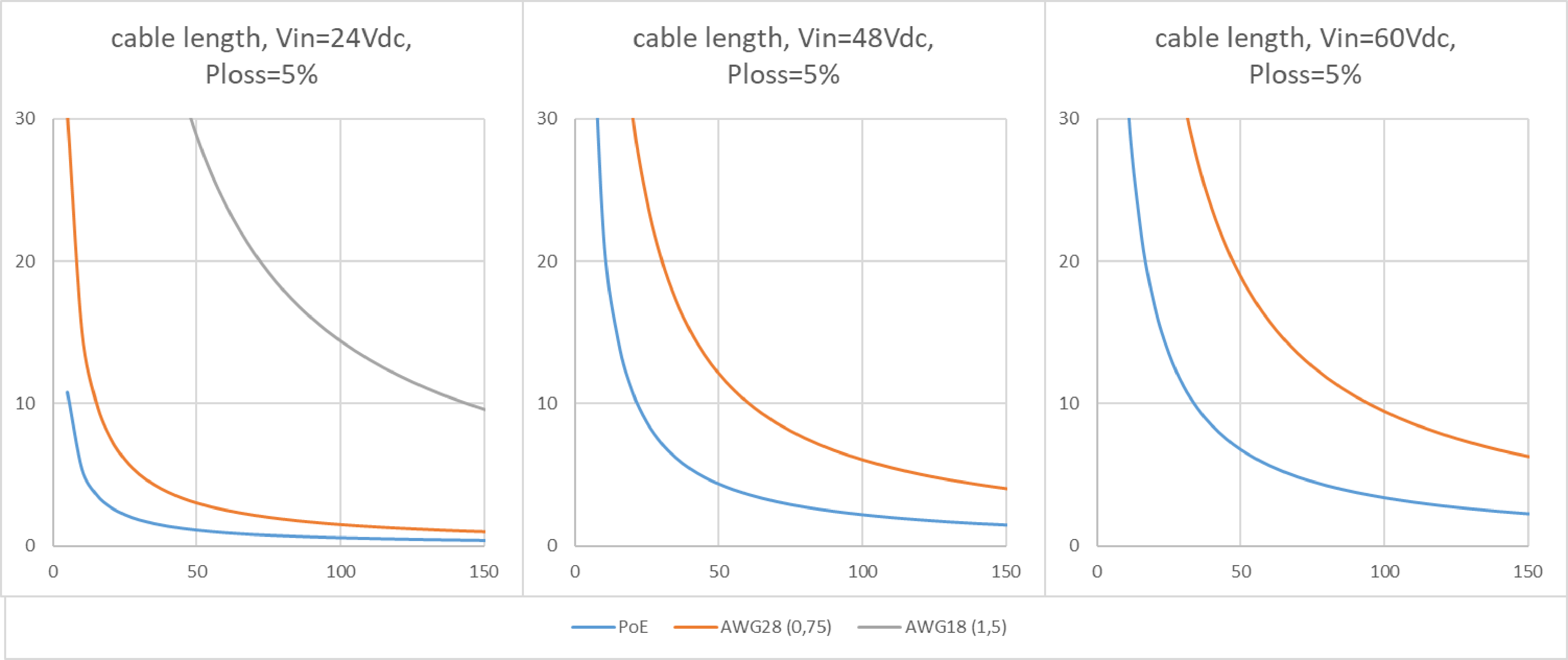
Automotive industry is moving towards 48VDC as well

- Audi SQ7, Bentley Bentayga are first to adopt 48VDC in parallel to legacy 12VDC
- Fuels availability of <60VDC components incl LED driver IC’s

Efficient 'last mile' power distribution requires 48VDC



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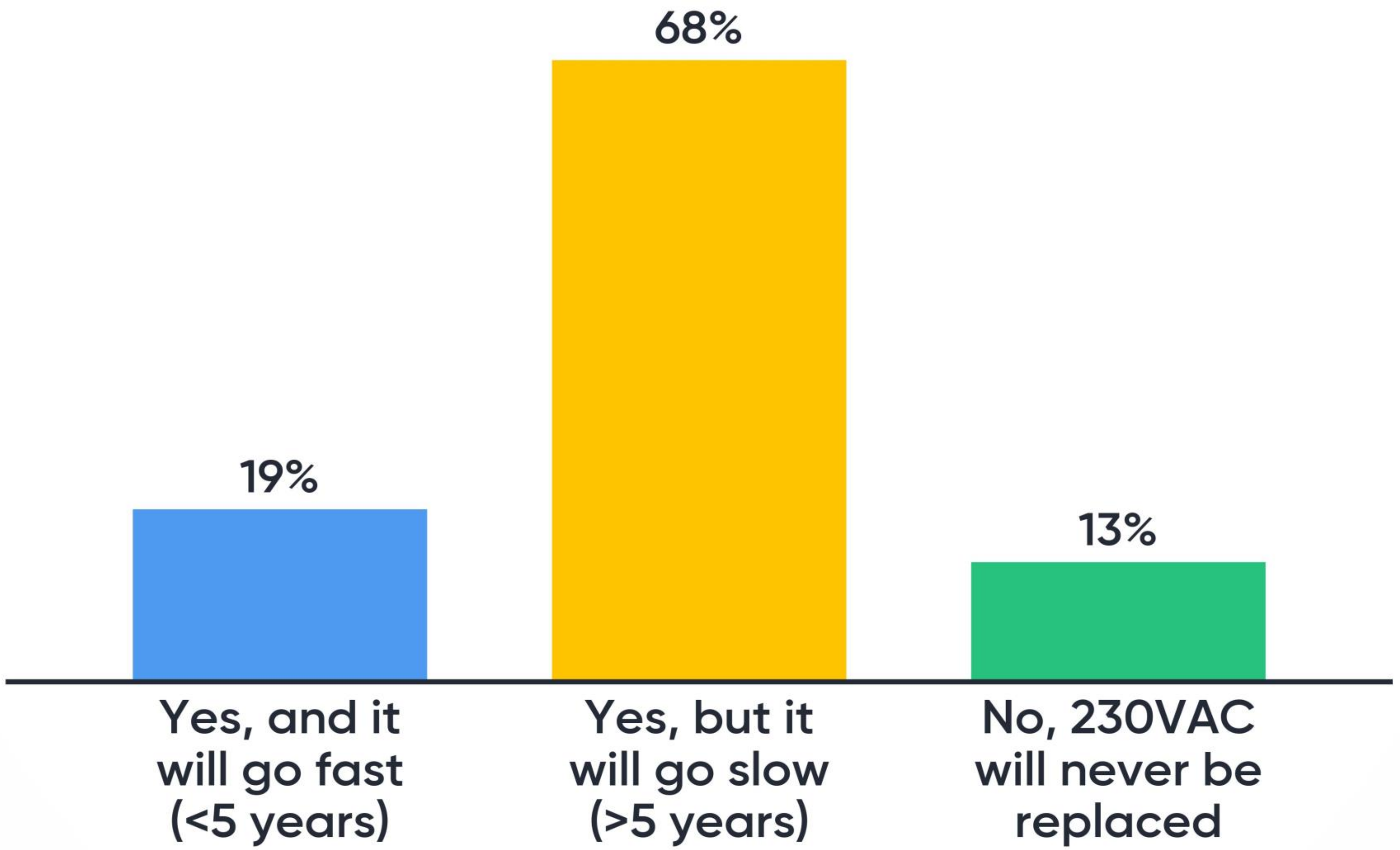
Do DC grids seem the future?



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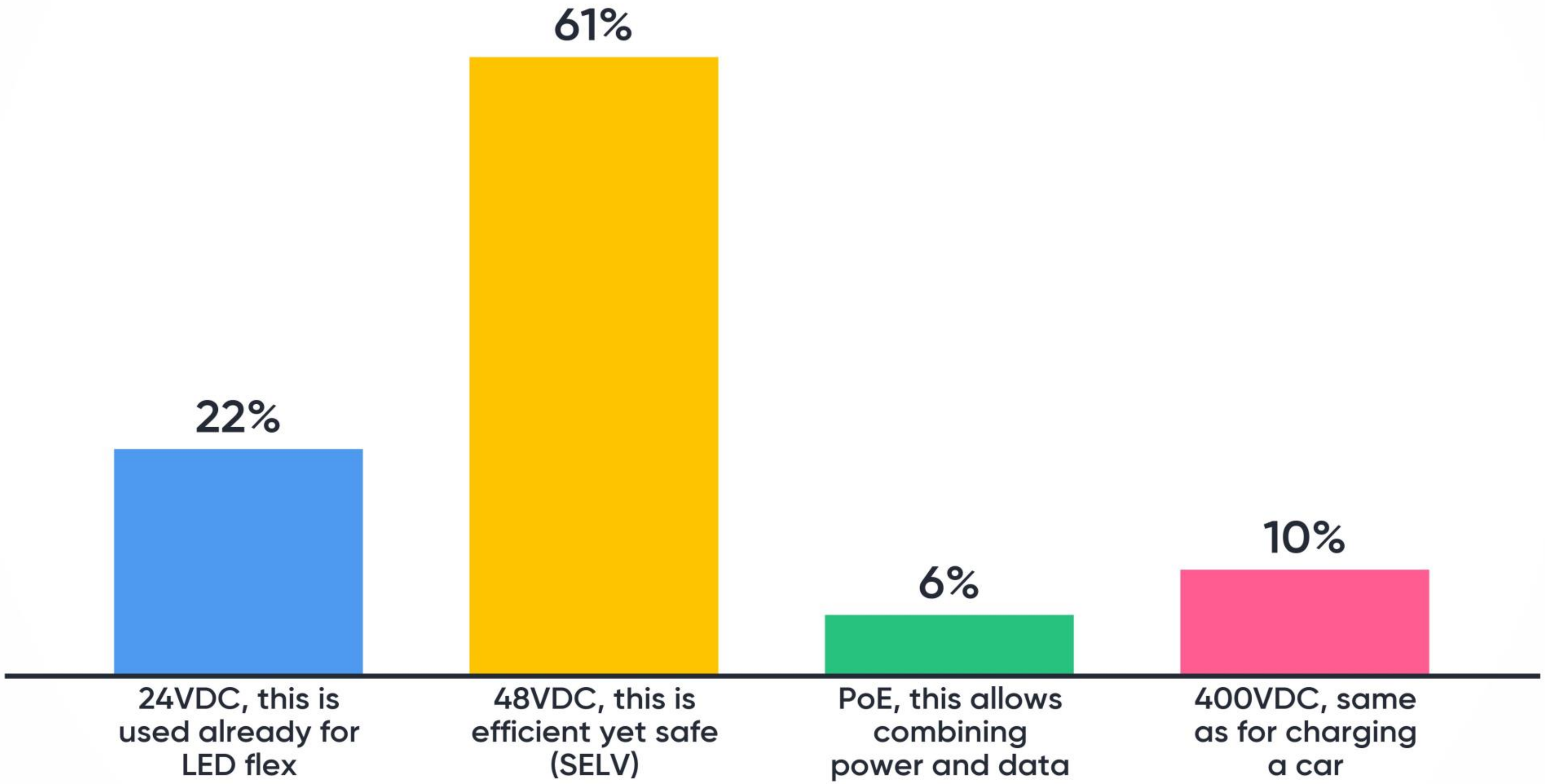
What will a DC grid look like in a building?



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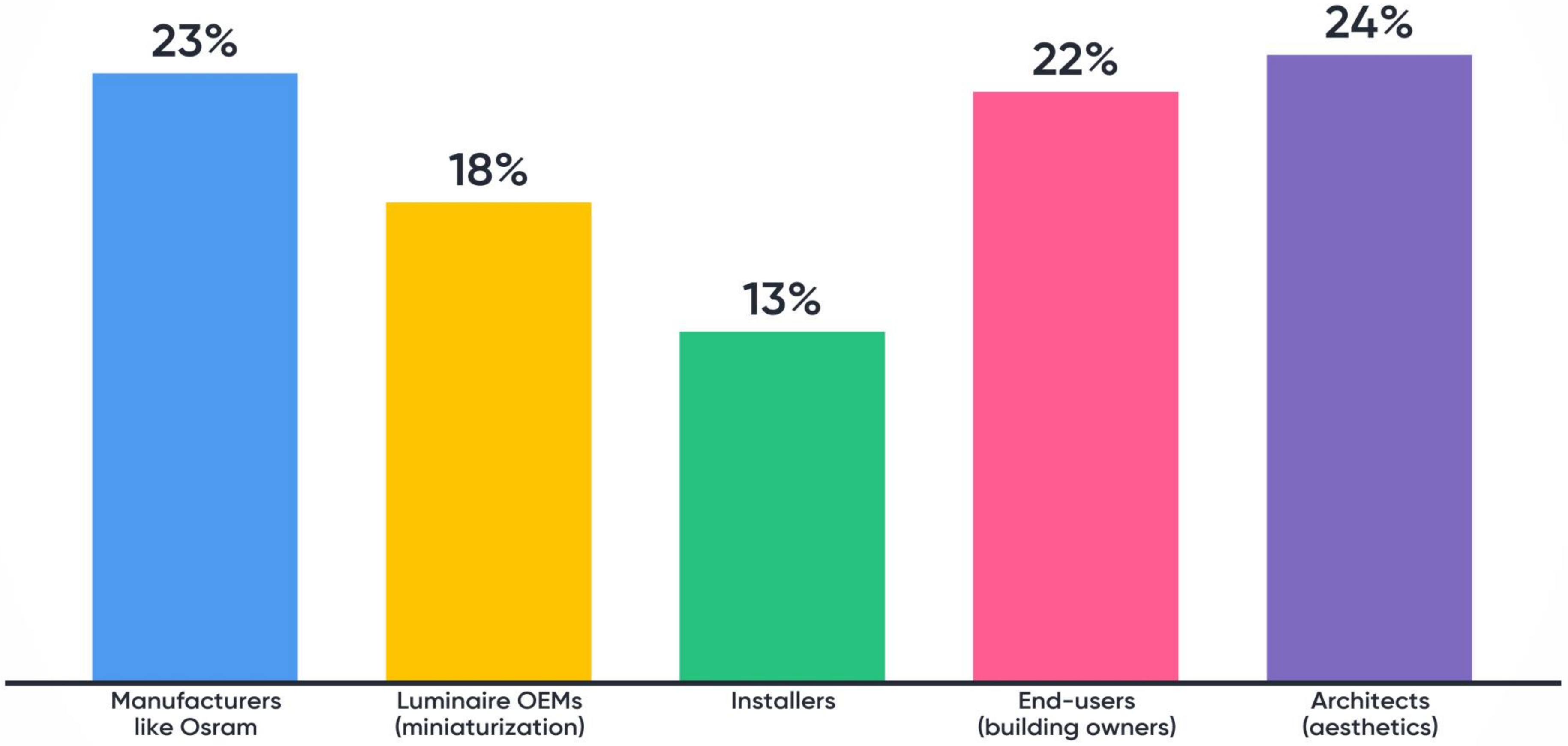
Who will drive adoption of LVDC for Lighting?

Mentimeter



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