

5th International LED professional Symposium +Expo
LpS 2015 | Sept 22-24, 2015 | Bregenz

Reliable and cost effective LED drivers

Eberhard Waffenschmidt

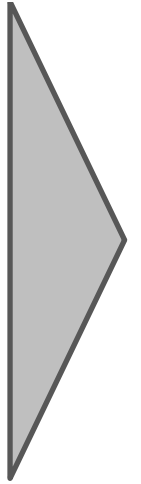
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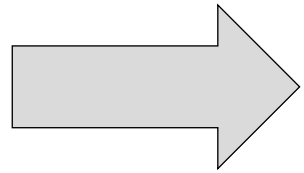
Theme-based Research Scheme (T22-715/12-N)
of the Research Grant Council of Hong Kong

- ❑ Survey of existing LED drivers
- ❑ Design challenge
- ❑ Reliable passive LED driver
- ❑ Active LED drivers: Low cap, low flicker

Survey of existing LED drivers

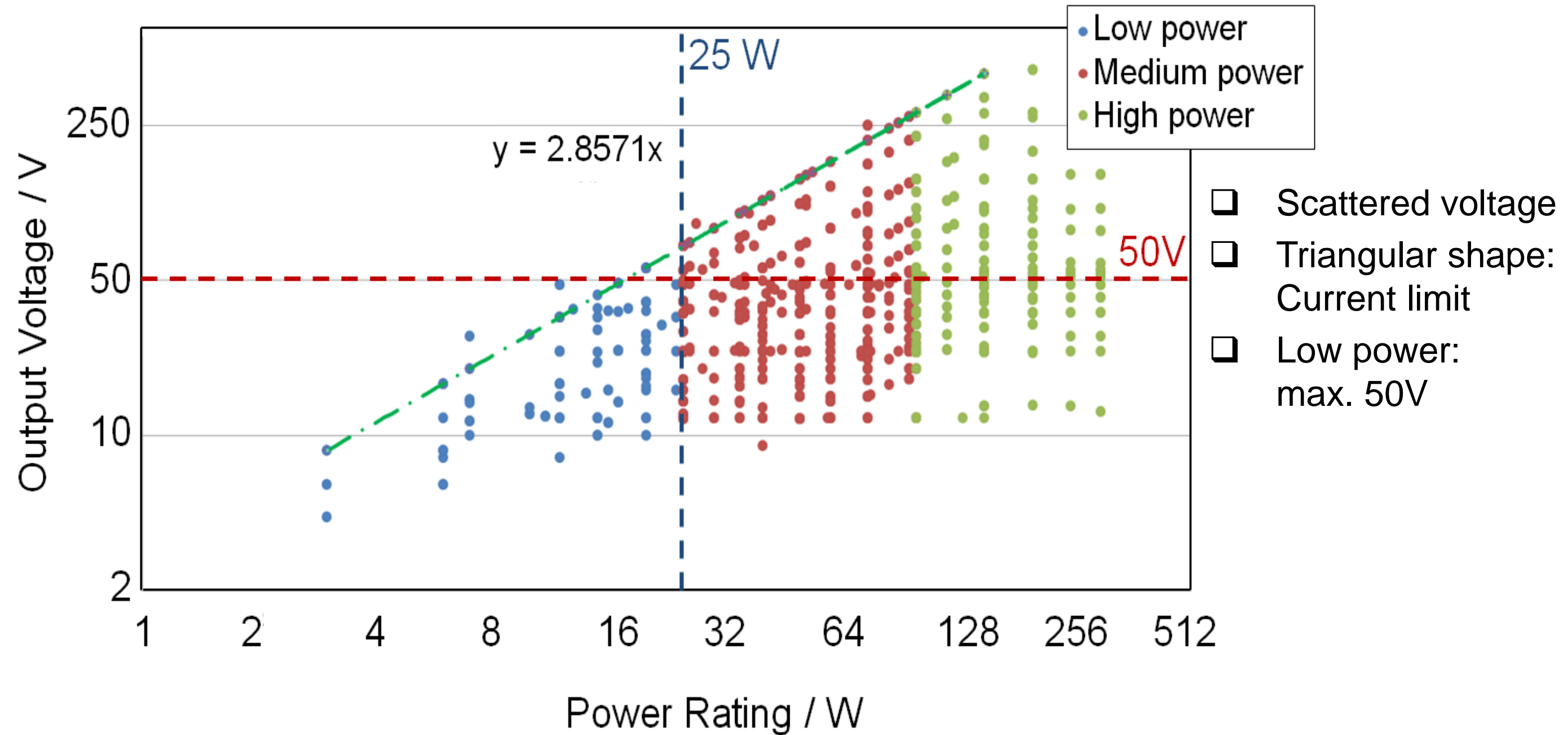


- ❑ >1400 commercial LED drivers
- ❑ Three groups:
 - ❑ low power <25W
 - ❑ medium power 25W-100W
 - ❑ high power >100W
- ❑ Sept. 2014

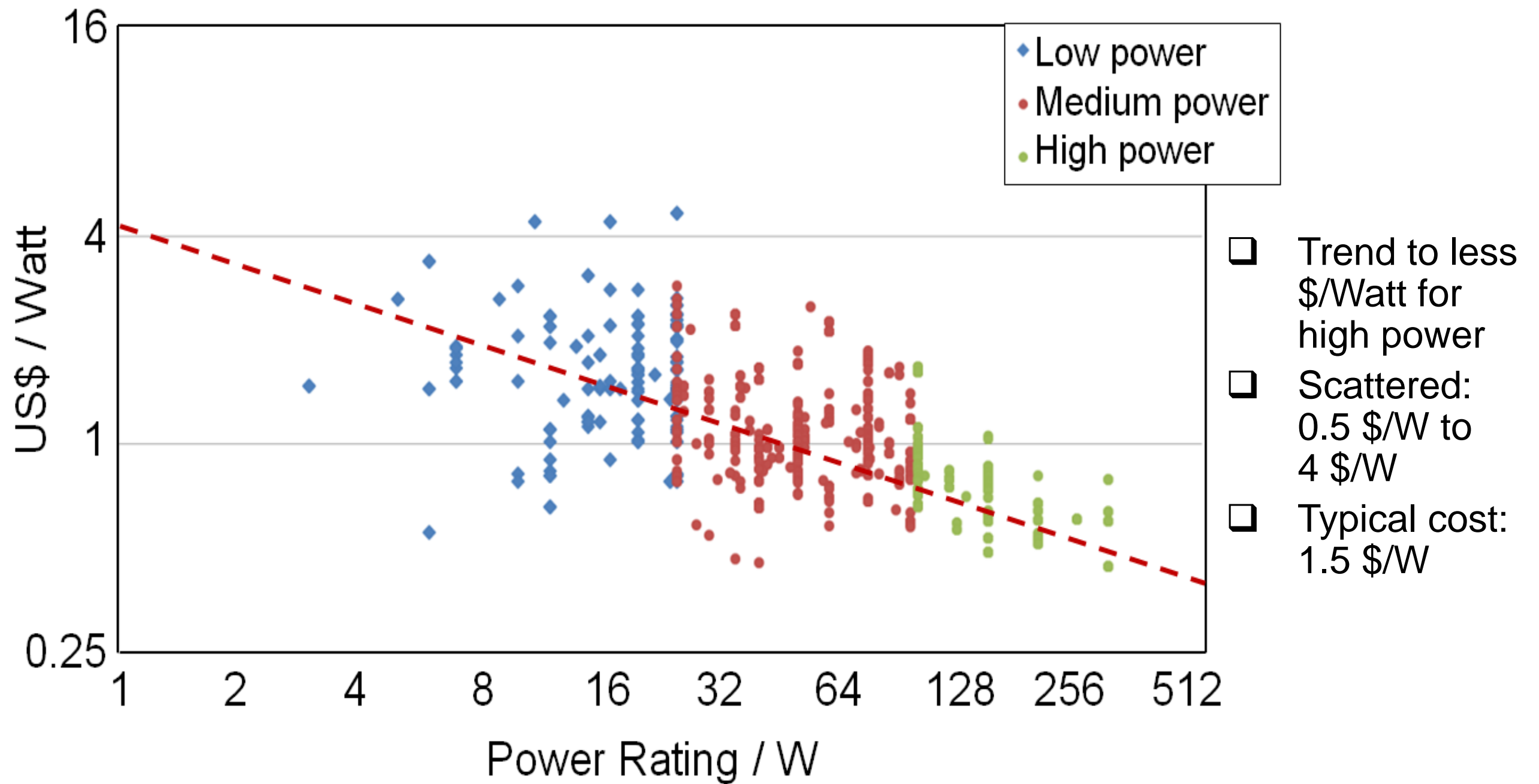


High diversity of LED-drivers:
Contrary to historical lighting solutions

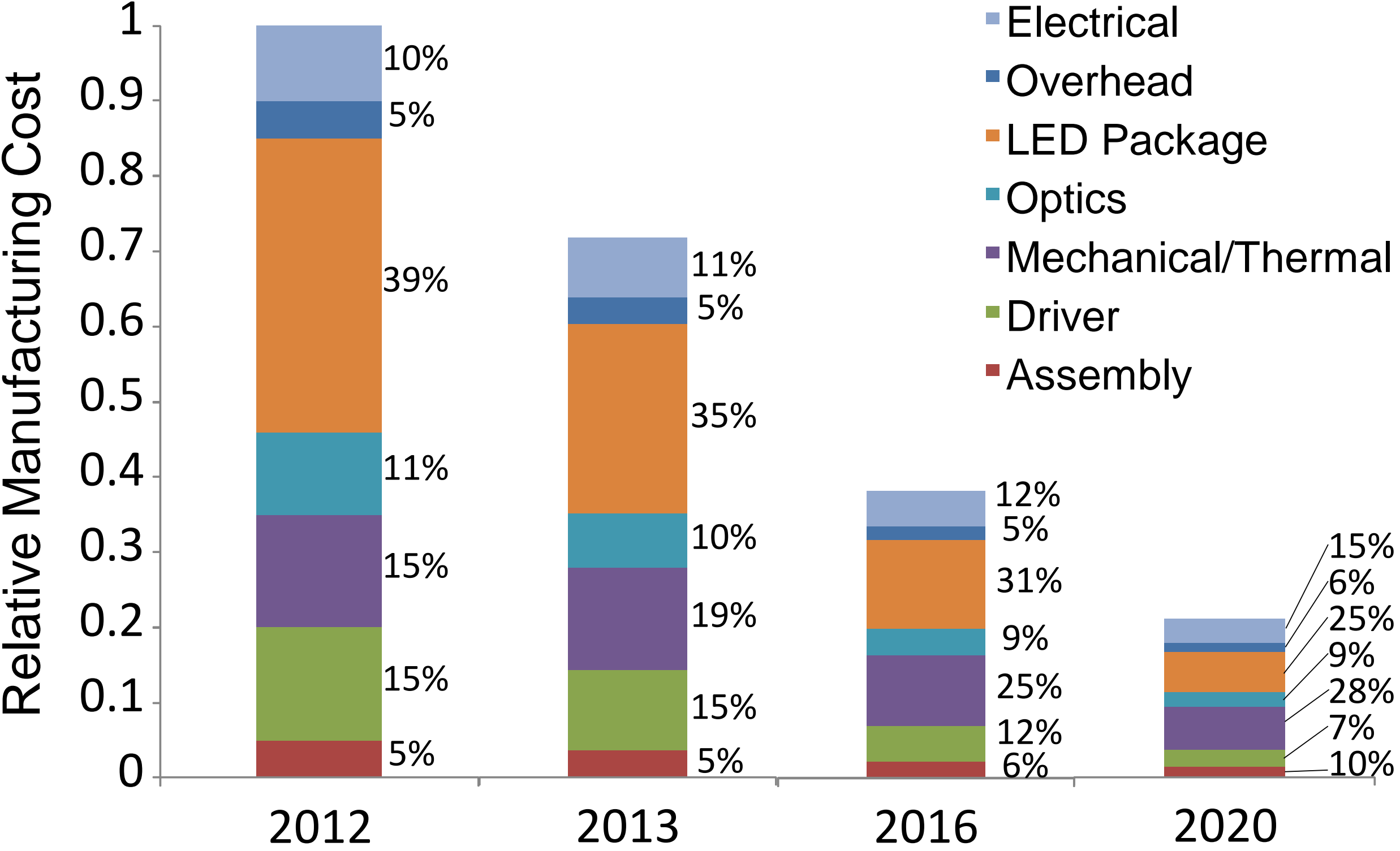
Typical output voltage range



Typical cost

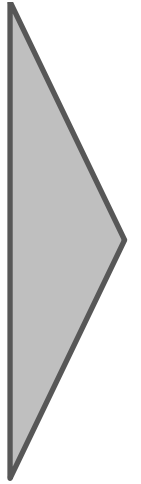


Cost distribution: Now and in future

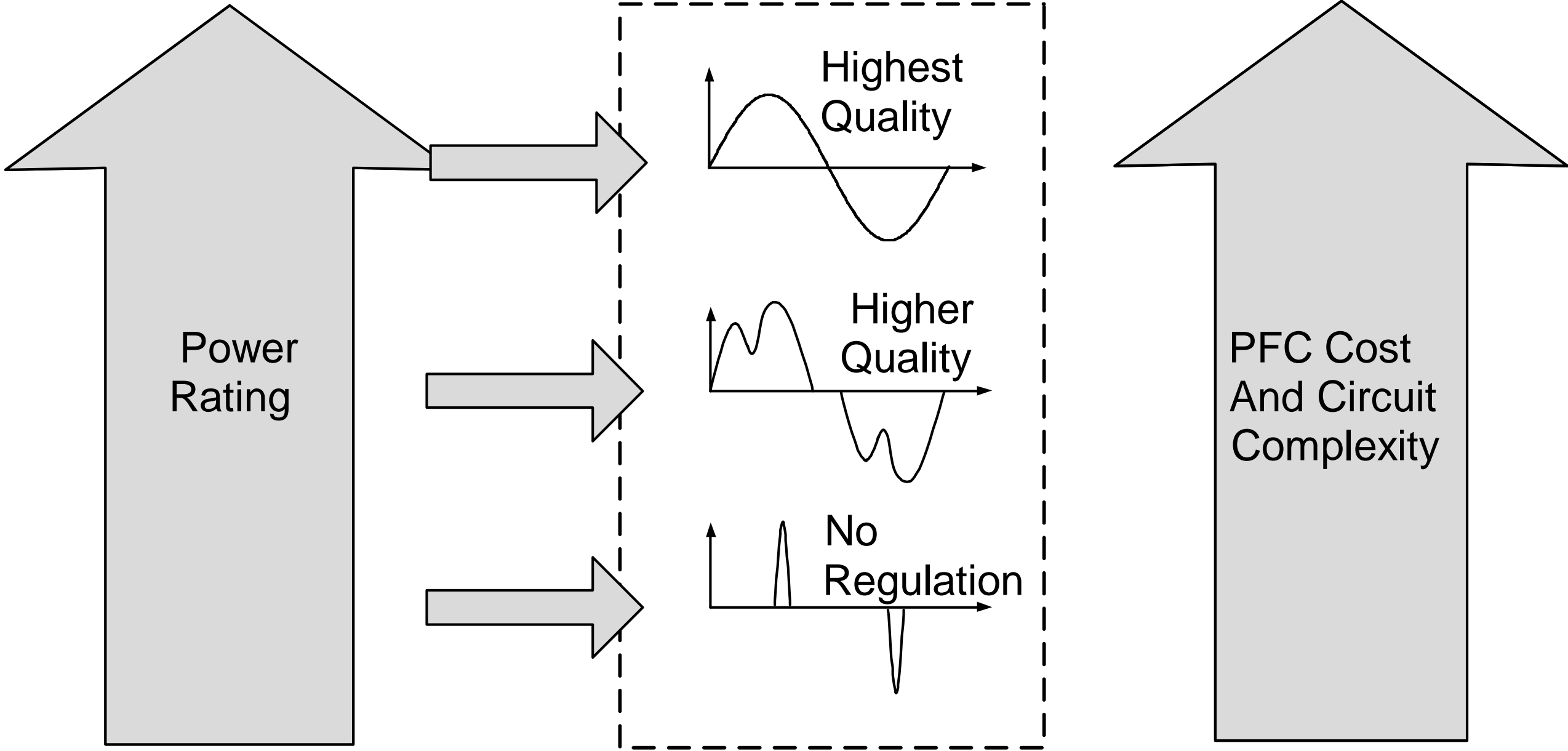


Source: DOE SSL Roundtable and Workshop attendees

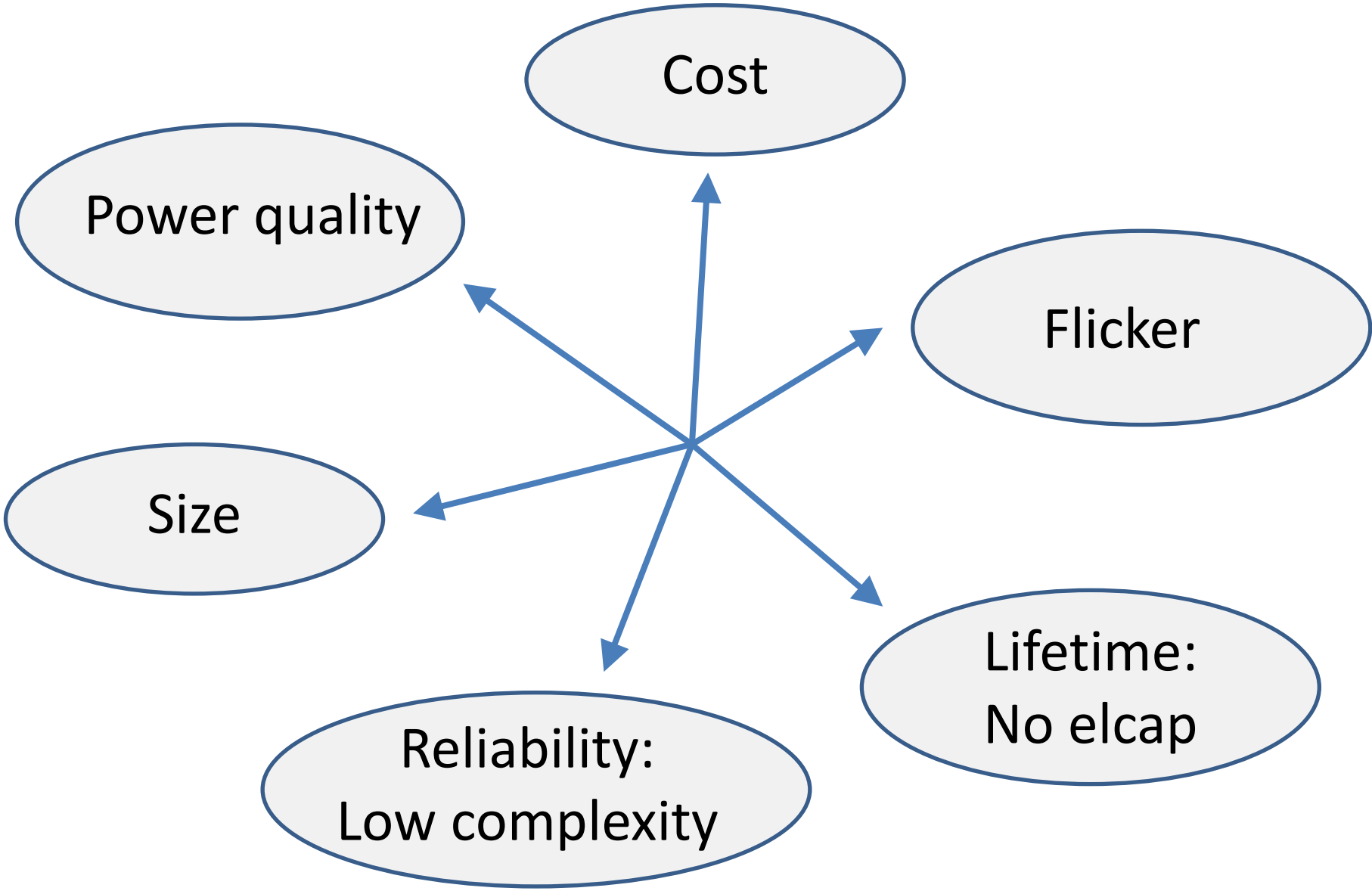
Design challenge



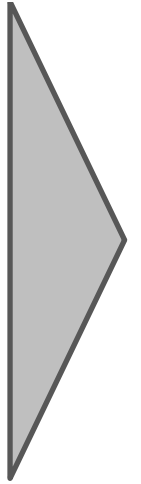
Design challenge



Design challenge



Reliable passive LED driver

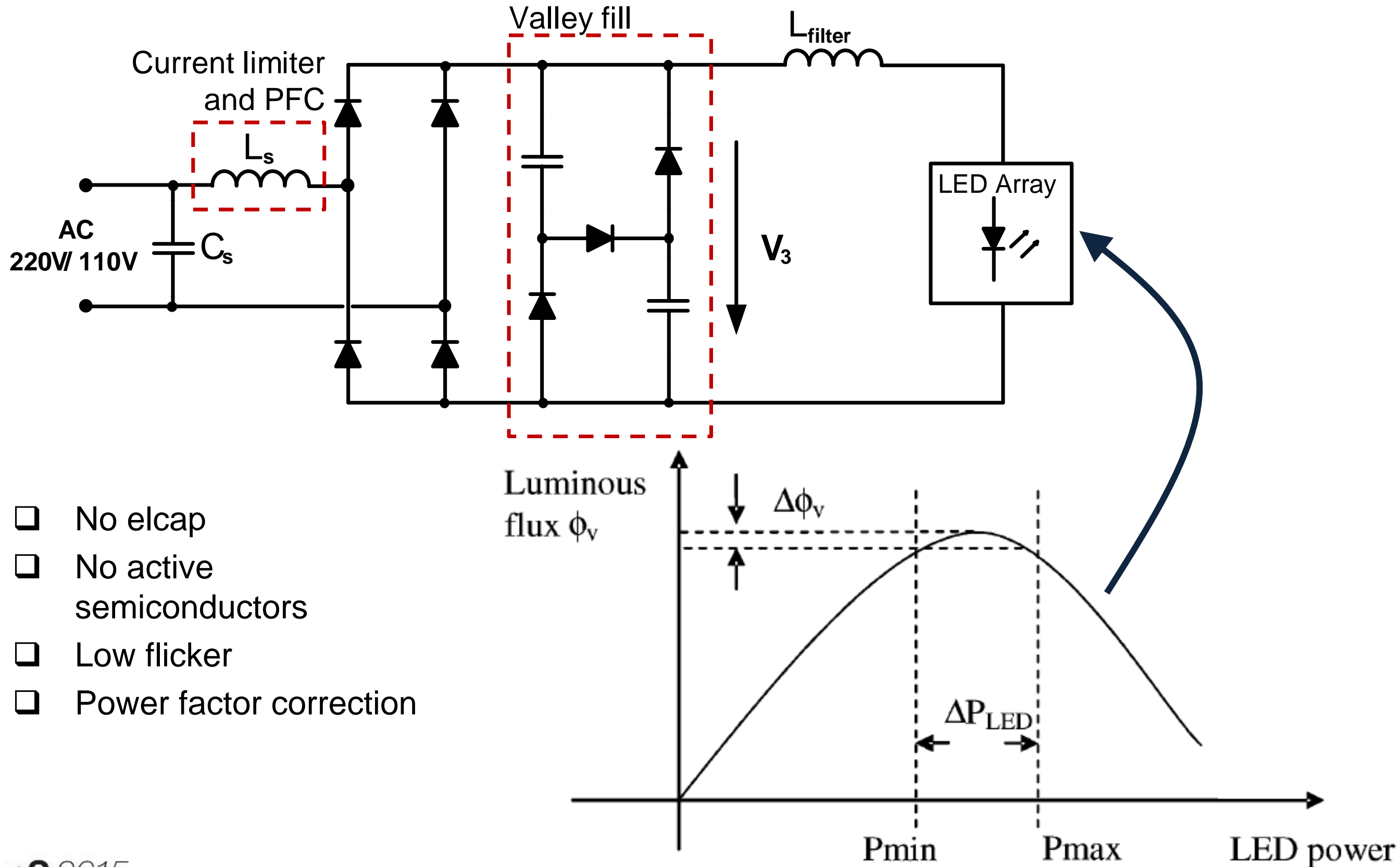


LED for street lighting



- ❑ Application:
Street lighting
- ❑ Risks:
 - ❑ Lightning stroke
 - ❑ Frozen electrolytic

Reliable passive LED driver



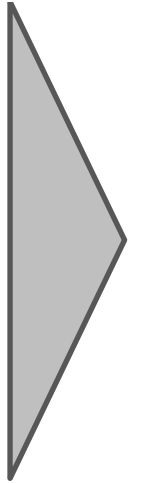
- No elcap
- No active semiconductors
- Low flicker
- Power factor correction

Reliable passive LED driver

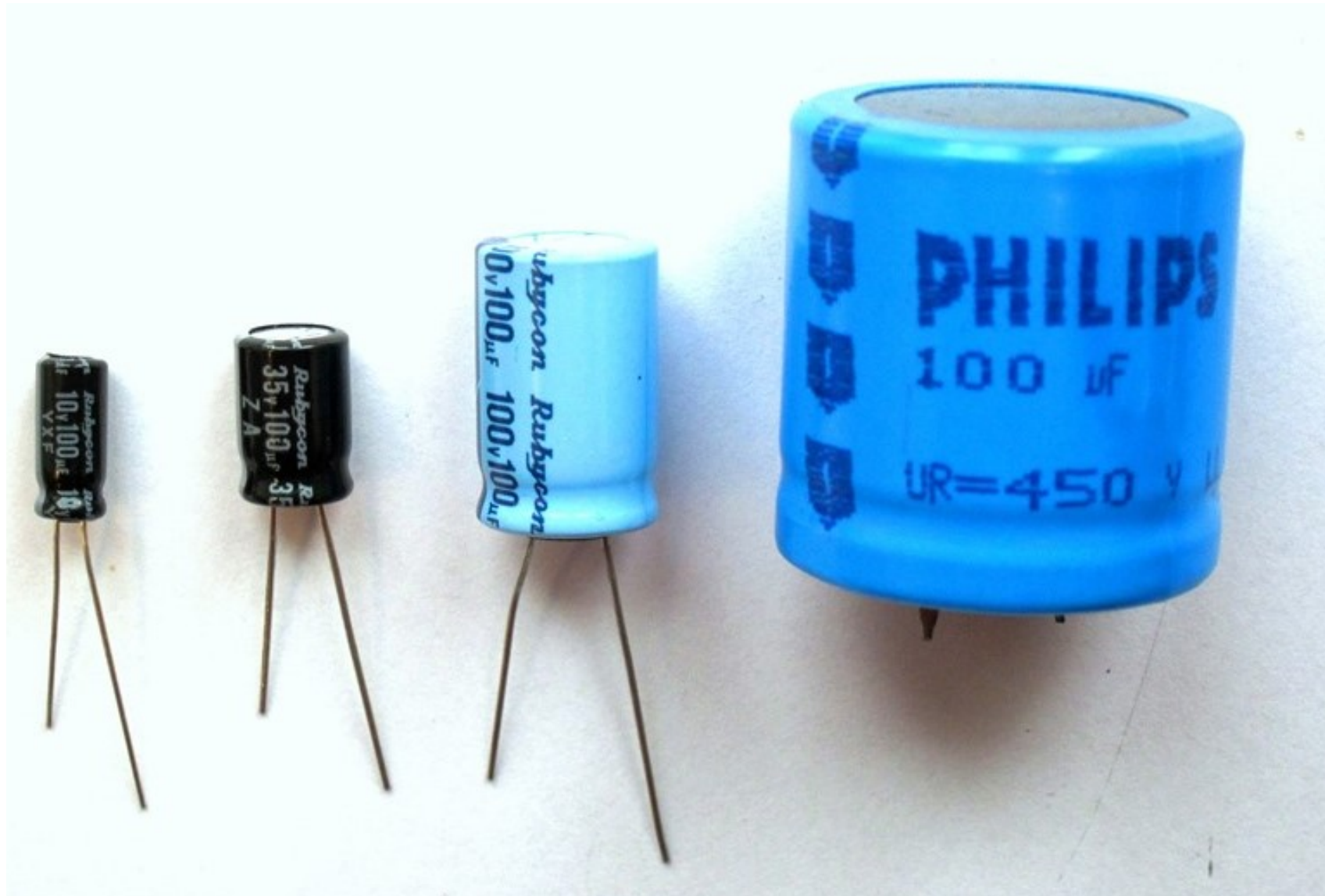


- ❑ Test results: No failures
- ❑ Disadvantage: Size

Active LED drivers



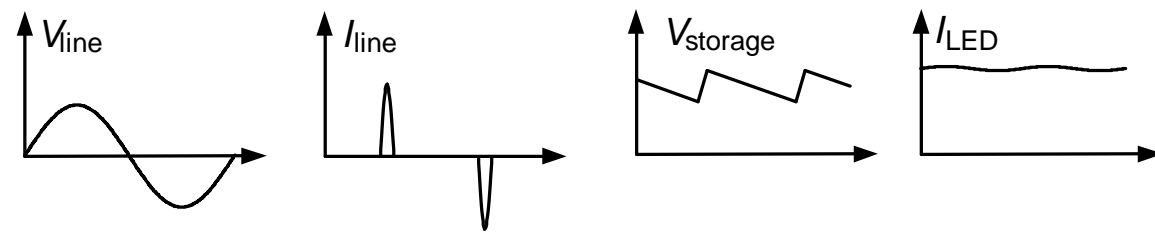
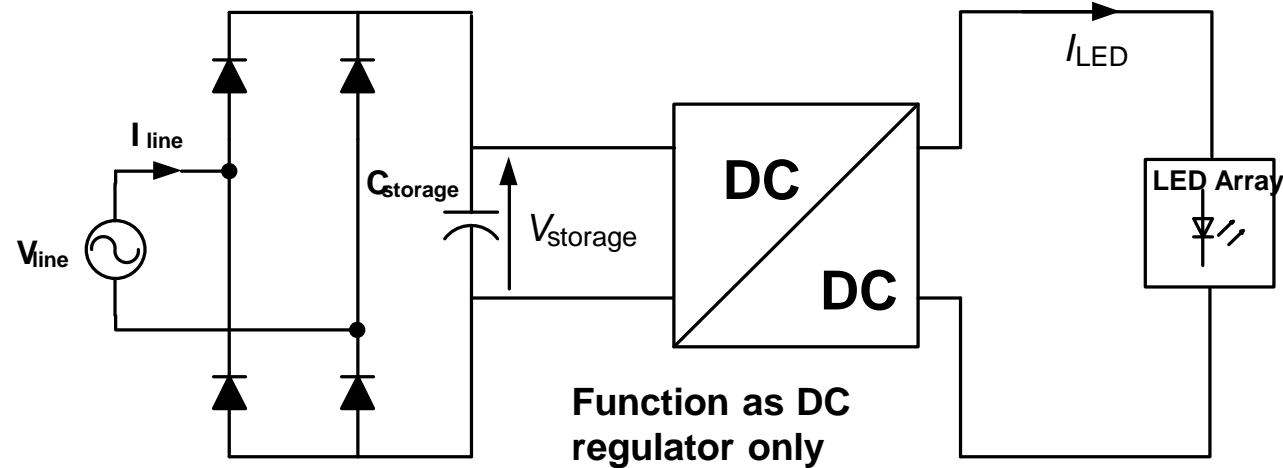
Electrolytic capacitors



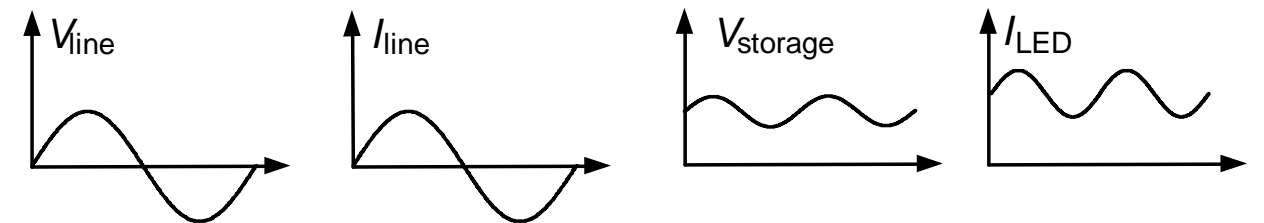
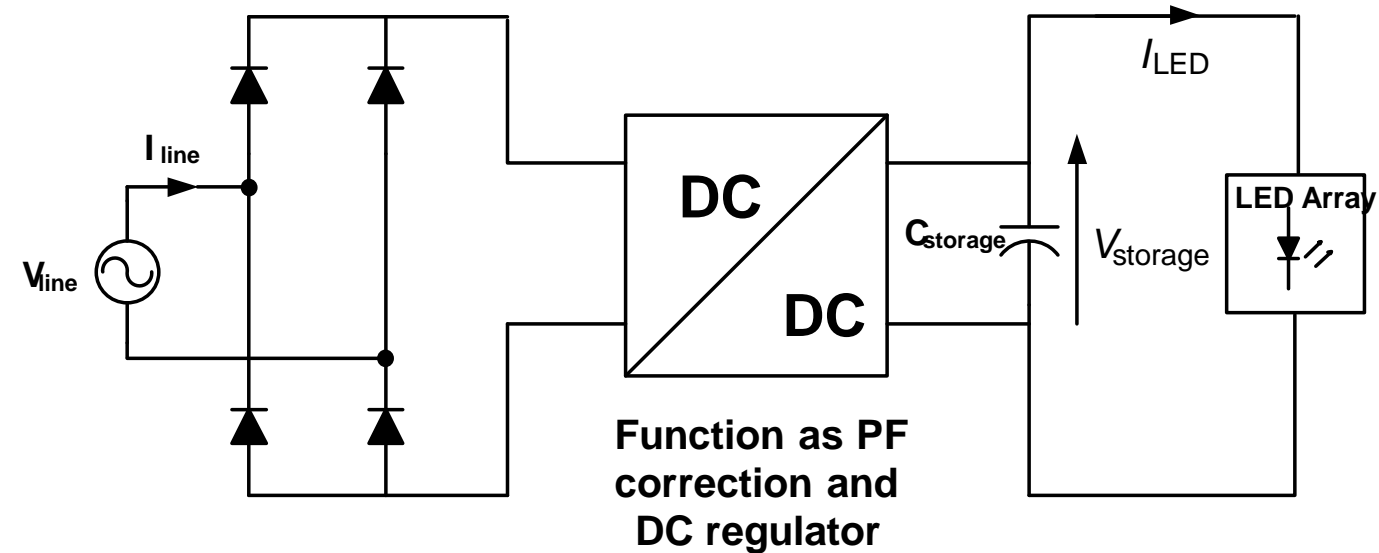
- Bulky
- Expensive
- Unreliable

➔ Reduce them!

Single stage drivers

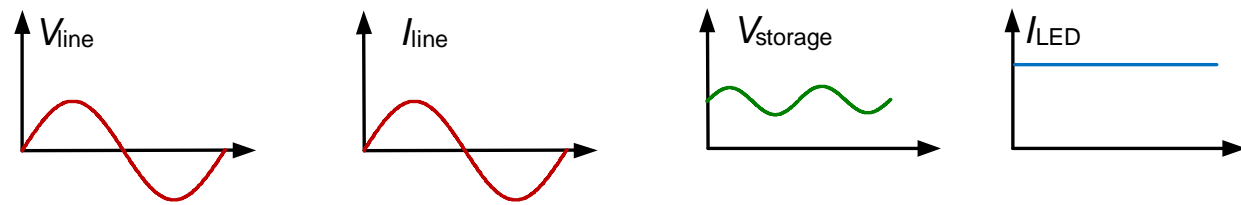
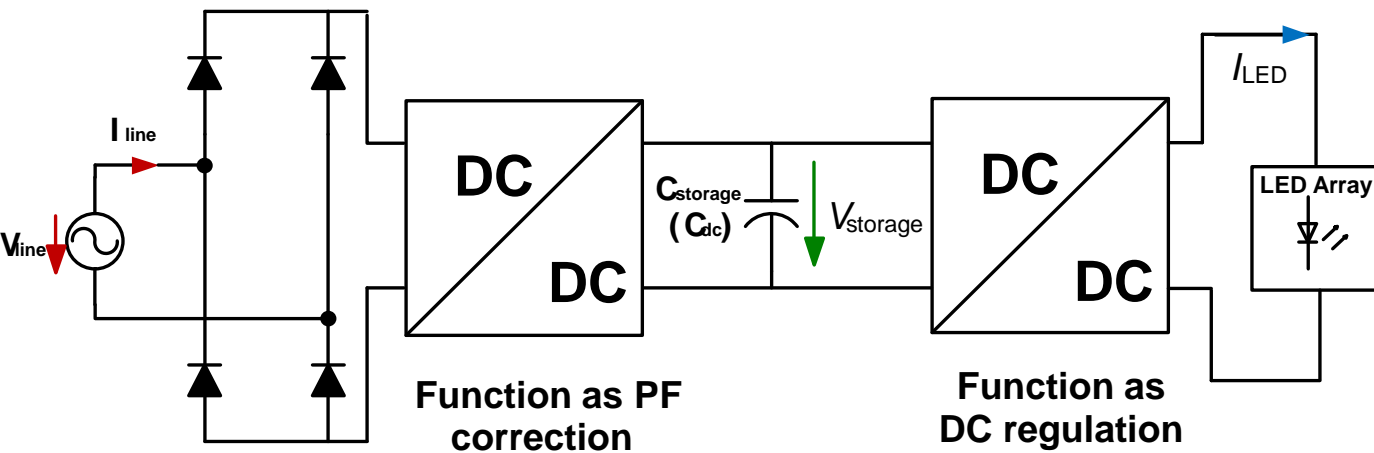


- Simple topology
- Low ripple -> no flicker
- Bad power quality

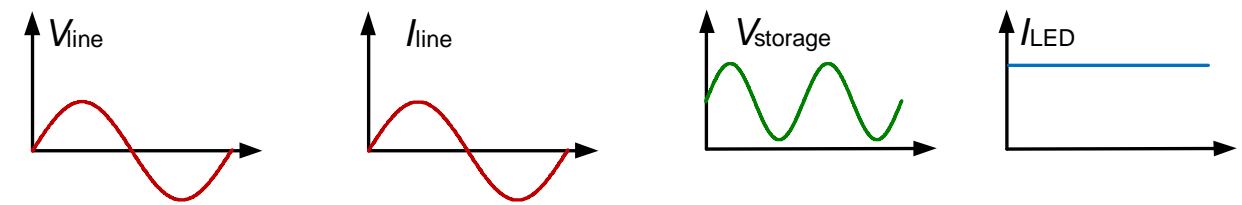
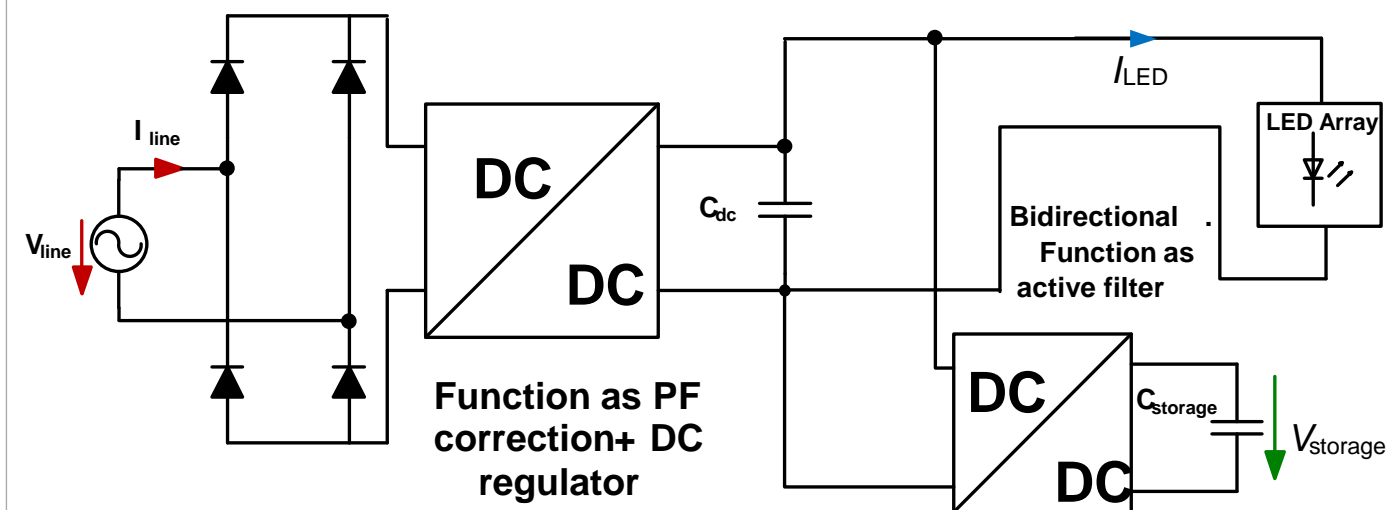


- Simple topology
- High ripple -> flicker
- Good power quality

Dual stage drivers

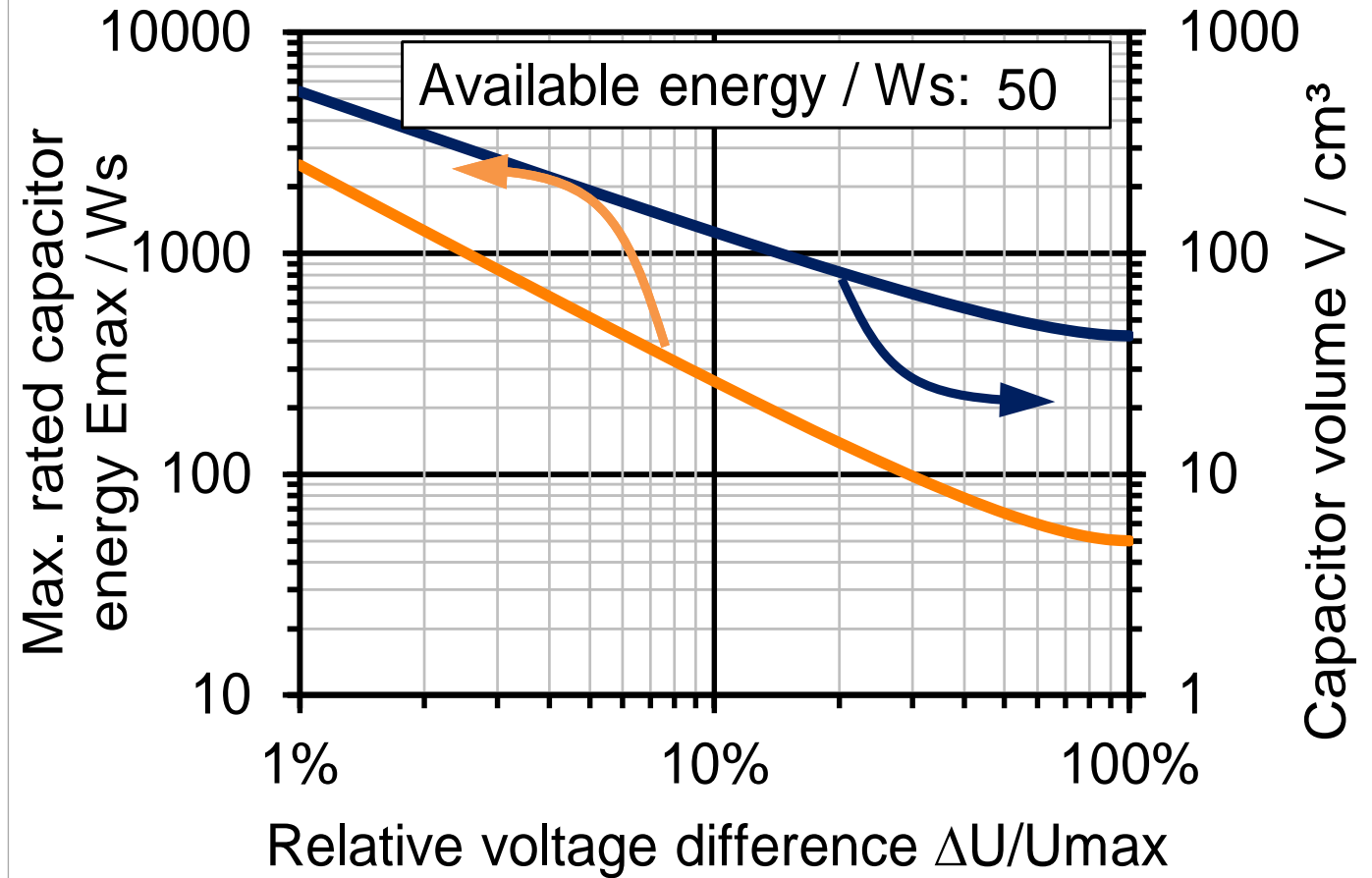
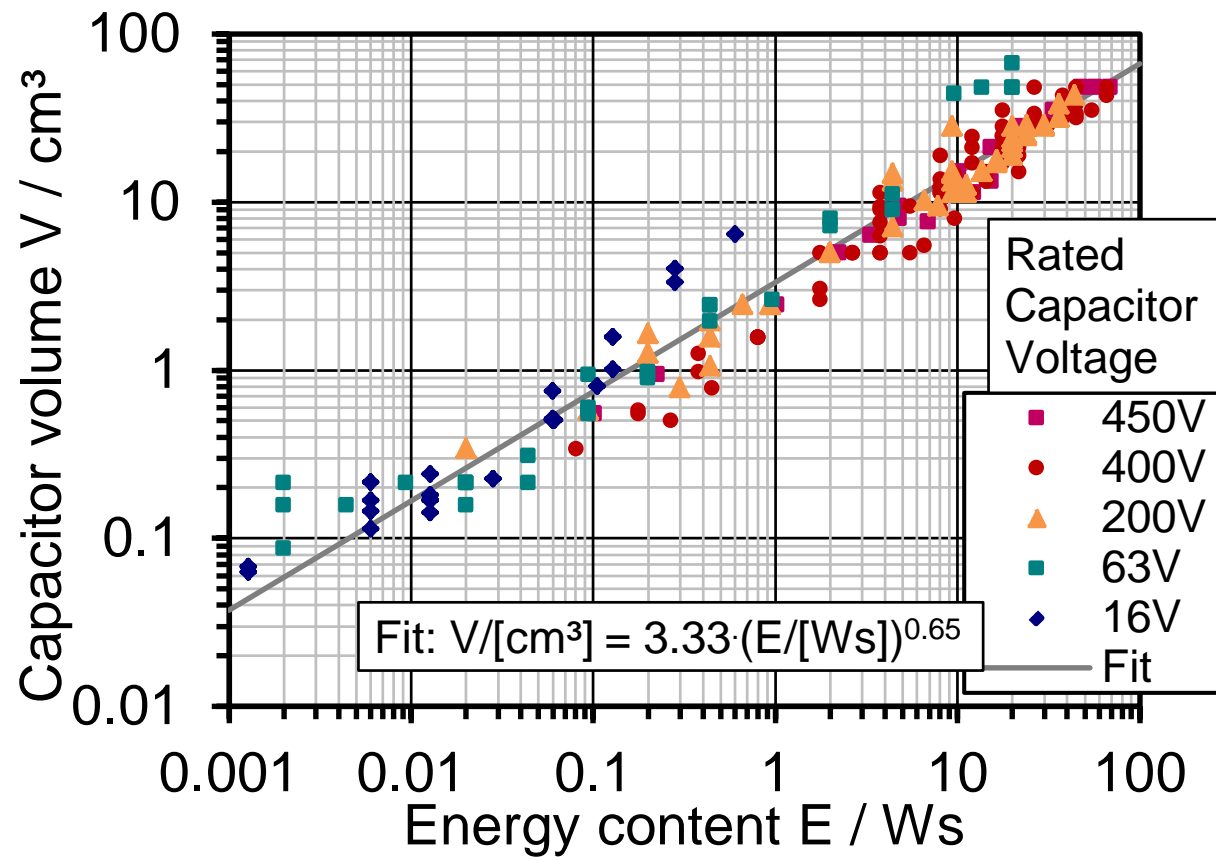


- Standard topologies
- Low ripple -> no flicker
- Good power quality



- Reduced size of second stage
- Low ripple -> no flicker
- Good power quality

Required electrolytic capacitor

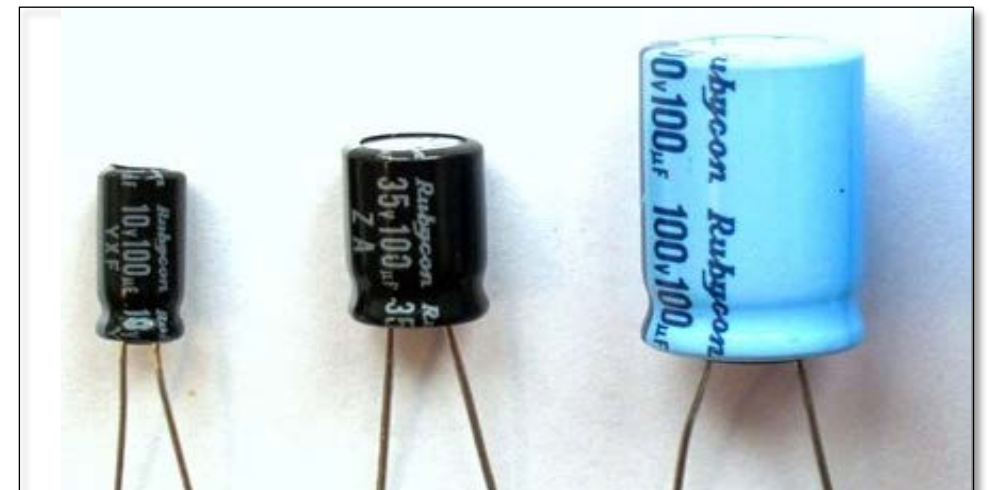
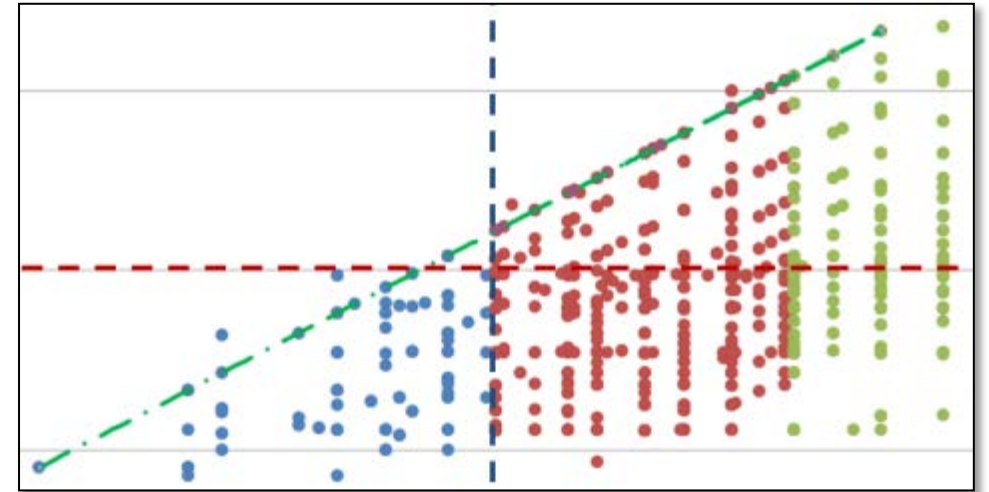


- Elcap size:
- Scales with energy content:
 $E = \frac{1}{2} C \cdot U^2$
- Nearly same size for same energy

- Low voltage ripple:
Energy can be used only partially
- Higher ripple -> Smaller capacitor

Summary

- ❑ High diversity of LED-drivers:
Contrary to historical lighting
solutions
- ❑ Reliable passive LED driver
for street lighting shown
- ❑ Reduction of elcap size
by smart design possible



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