

ENERGY STORAGE Inspection 2026



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by the German Bundestag

Test report
Energy Storage Inspection 2026

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Version

Version 1.0 (March 2026)

Web

www.energy-storage-inspection.com

PARTICIPANTS OF THE ENERGY STORAGE INSPECTION 2026

5 KILOWATT CLASS

10 KILOWATT CLASS

KOSTAL + BYD



KOSTAL + BYD



ENERGY STORAGE
Inspection
2026

as well as two companies that participated passively, whose independently purchased devices achieved energy efficiency classes D and G.



All actively participating energy storage manufacturers achieved **EFFICIENCY CLASS A**

AWARD WINNERS OF THE ENERGY STORAGE INSPECTION 2026

5 KILOWATT CLASS



10 KILOWATT CLASS



SMA

DC-coupled



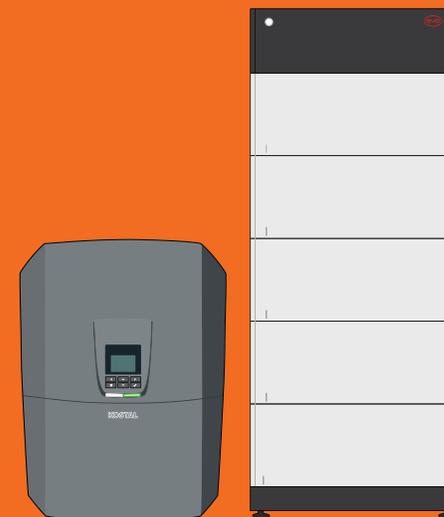
SAX POWER

AC-coupled



FOX ESS

DC-coupled



KOSTAL AND BYD

AC-coupled



TOP PERFORMING BATTERY SYSTEMS IN THE 10 KW CLASS

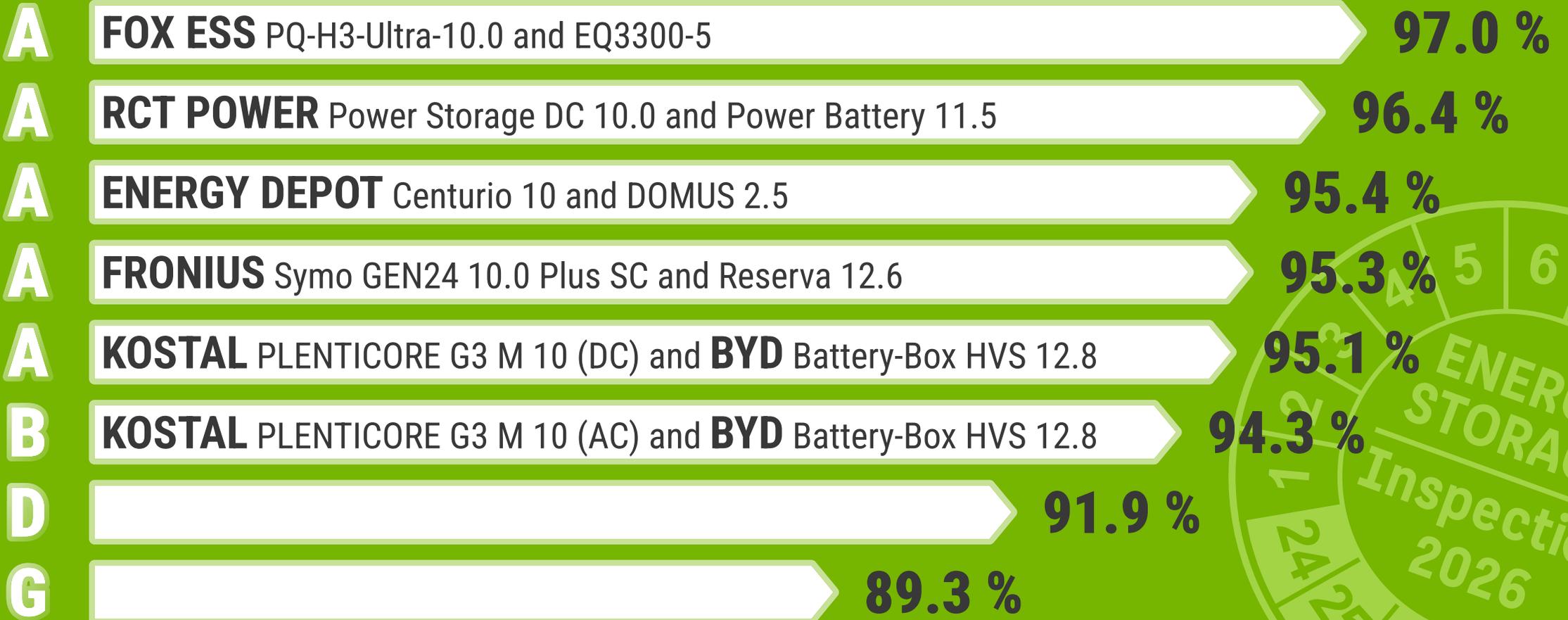
EFFICIENCY
CLASS



Energy Storage Inspection 2026



SPI



Rated "Very Good" in the 10 kW class: System Performance Index (SPI) (10 kW) over 93.5 % (efficiency classes A and B)
All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

MOST EFFICIENT STORAGE SYSTEMS IN THE 5 KW CLASS IN 2026

SPI



SAX POWER

Home Plus

93.2 %



SMA Sunny Boy Smart Energy 5.0
and Home Storage 6.5

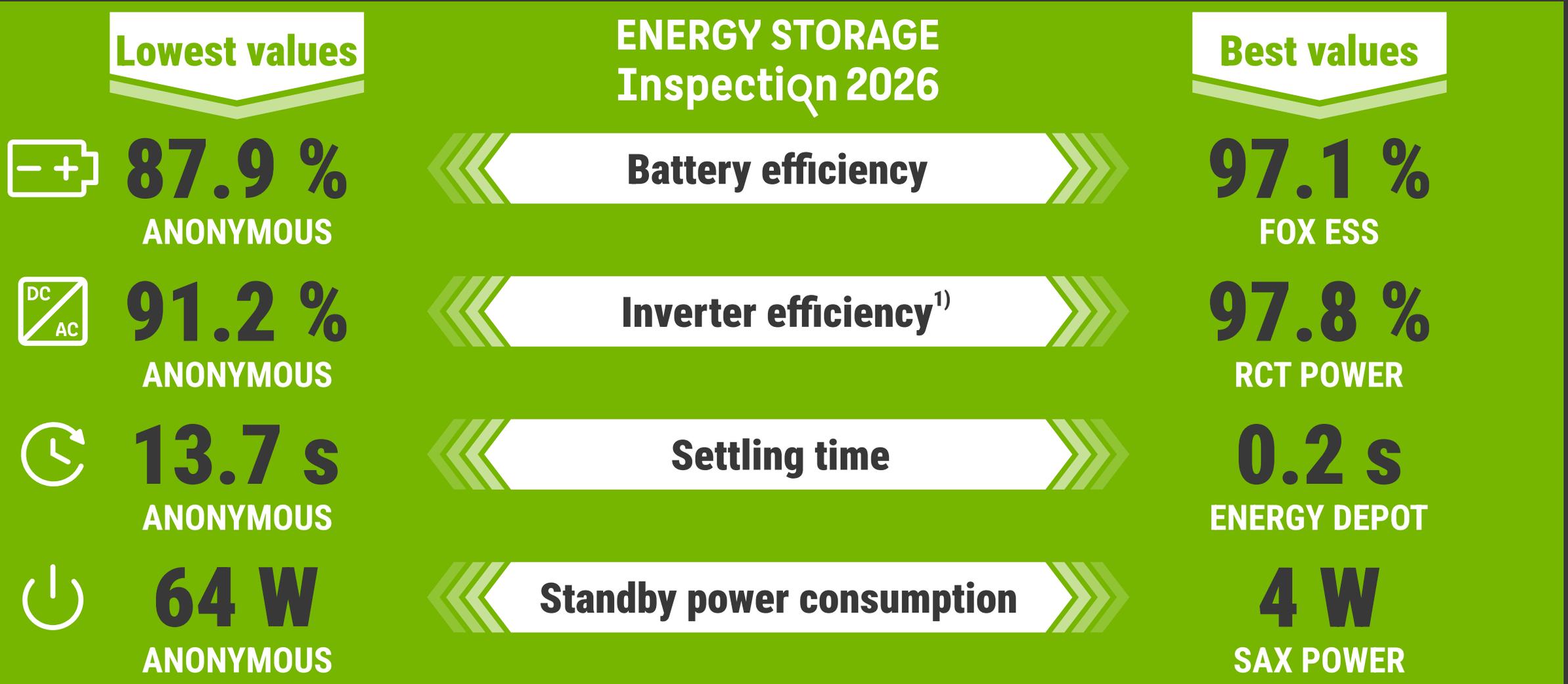
92.8 %



KOSTAL PLENTICORE MP G3 M 4.6
and **BYD** Battery-Box HVS+ 7.7

92.7 %

SOLAR ENERGY STORAGE SYSTEMS VARY WIDELY IN EFFICIENCY



1) Average inverter efficiency during discharging (BAT2AC) in accordance with the DIN VDE V 0510-200 standard
All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

FEATURES OF THE TESTED SOLAR BATTERY SYSTEMS

ENERGY STORAGE Inspection 2026



	SMA	KOSTAL+ BYD	SMA	Fronius	FOX ESS	RCT power	energy depot	
Battery connection	AC	AC/DC	AC/DC	DC	DC	DC	DC	
Nominal AC power in kW	4.6	4.6	10.0	4.6	10.0	10.0	9.9	9.9
Number of MPP trackers		2	2	3	2	3	2	2
Usable energy in kWh	7.6	7.3	12.2	6.6	12.6	14.4	10.4	15.0
Backup power capability	✓	✓	✓	✓	✓	✓	✓	✓
Dynamic electricity tariffs and time-of-use grid fees: charging with grid power ¹⁾		✓ ²⁾	✓ ²⁾			✓ ²⁾	✓	✓

Compared features of actively participating manufacturers, 1) as of February 2026, 2) using the EMS of an external provider
All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

WARRANTY FOR STORAGE SYSTEMS: 6 IMPORTANT QUESTIONS



How many years does the warranty valid for the inverter and battery system?



Is registration required for a free warranty extension?



What percentage of the initial capacity is guaranteed until the end of the warranty period?



Are requirements for providing evidence listed in the warranty terms and conditions?

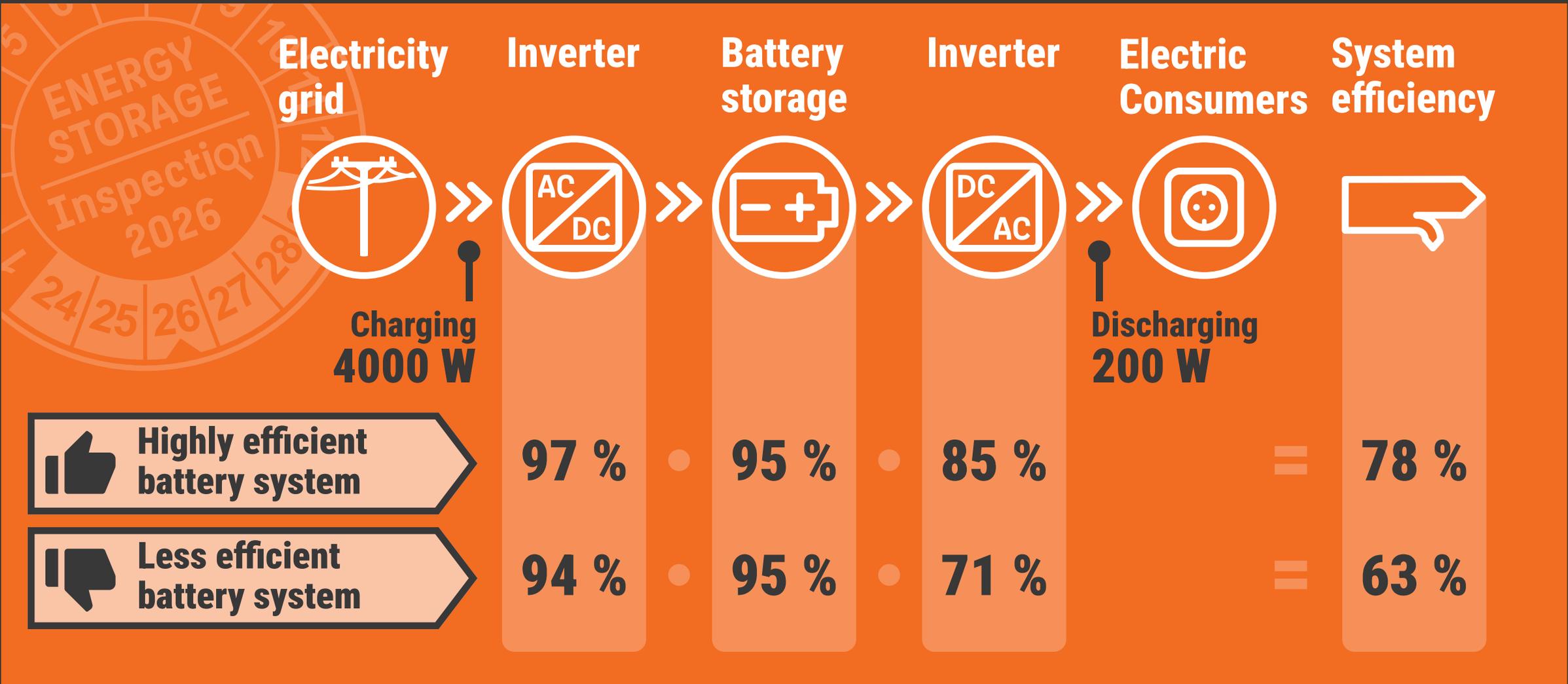


How many days after the damage occurs must the guarantor be informed?



Does the manufacturer also cover the cost of replacement under warranty?

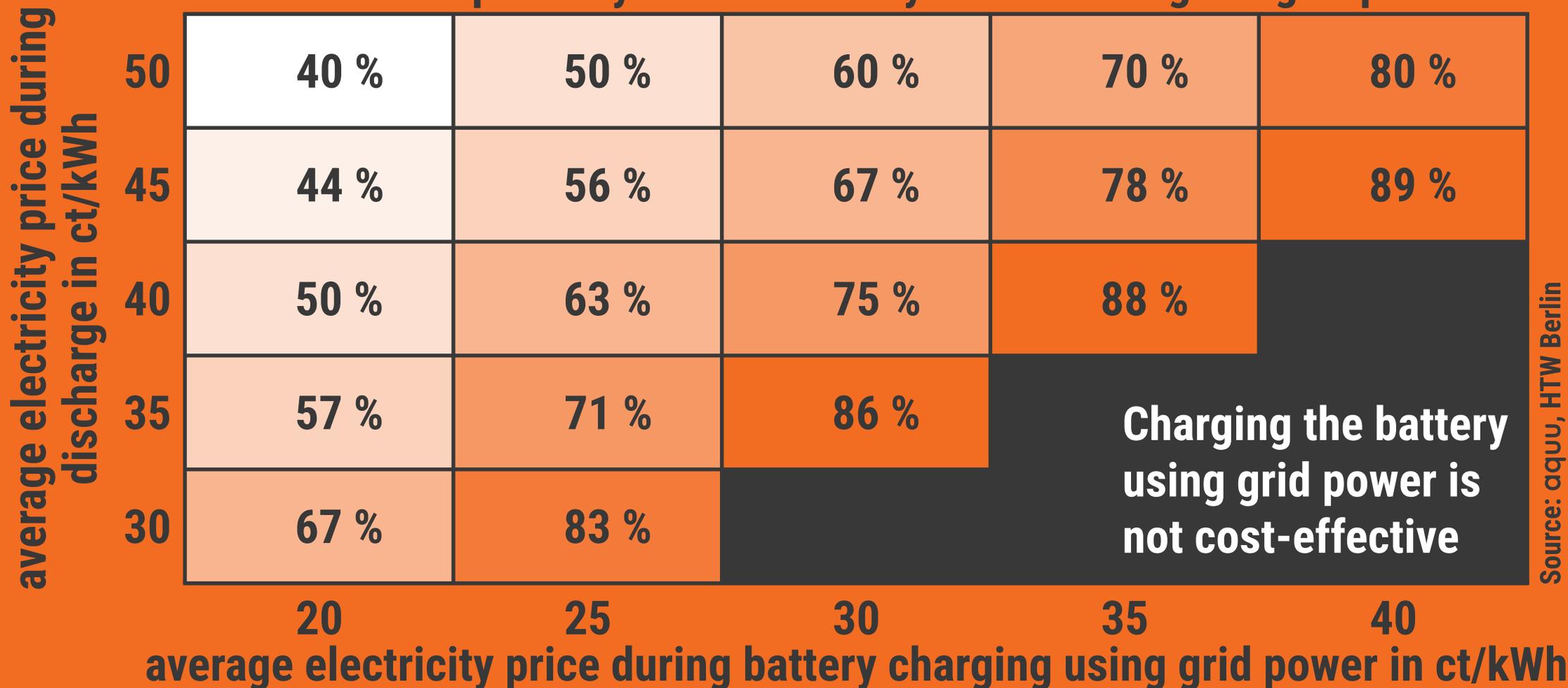
EFFICIENCY LOSSES WHEN STORING GRID POWER



Conversion efficiencies for the highly efficient battery system: FRONIUS Symo GEN24 10.0 Plus SC and Reserva 12.6
 All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

THIS IS HOW EFFICIENT GRID POWER STORAGE NEEDS TO BE

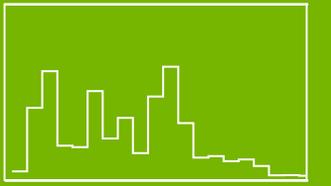
minimum required system efficiency for the storage of grid power



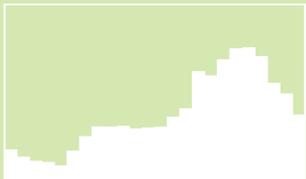
Source: aquu, HTW Berlin

System efficiency depends on the inverter efficiency during charging and discharging and on battery efficiency
 All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

Main topics of the Energy Storage Inspection 2026

1	Comparison of laboratory test results and characteristics of 12 PV-battery systems	
2	Efficiency evaluation of PV-battery systems using the System Performance Index (SPI)	
3	Cost-optimized battery charging using grid power with dynamic electricity pricing	
4	Analysis of the warranty terms and conditions of 20 battery and inverter manufacturers	
5	Analysis of the German market for residential PV-battery systems	

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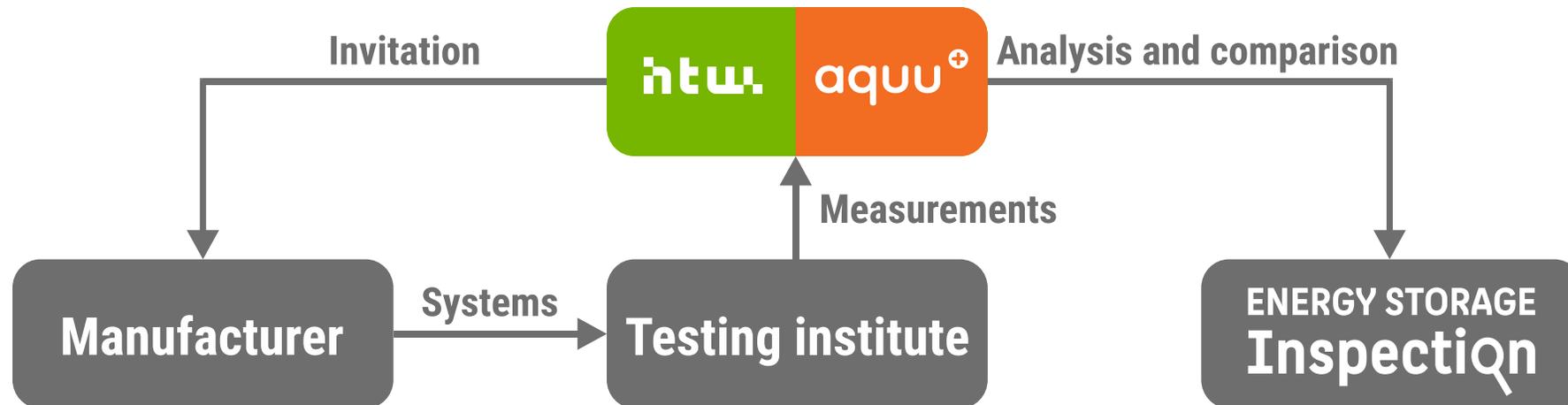
Participants of the Energy Storage Inspection 2026

- For the ninth consecutive year, all manufacturers of systems or components for solar electricity storage in residential buildings have been invited to participate in the **Energy Storage Inspection 2026**.
- The Energy Storage Inspection 2026 compared **12 energy storage systems** from 10 manufacturers.
- Two of those systems were purchased **independently**.
- The following 8 manufacturers are contributing to greater transparency in the home storage market by **participating by name**.



Analysis of system properties according to the Efficiency Guideline

- Laboratory tests were conducted by **independent testing institutes** following the **“Efficiency Guideline for PV Storage Systems”**.
- To each analyzed system, a **system abbreviation** (e.g. A1) was assigned.
- The battery storage systems of the **AC-coupled systems** A1 to B2 are equipped with battery inverters. The **DC-coupled systems** B3 to I1 have so-called hybrid inverters. Details on the methodology are provided in the **Energy Storage Inspections 2018 and 2023**.



Analyzed systems in the Energy Storage Inspection 2026

A1 ENERGY STORAGE Inspection 2026



SAX Power Home Plus

Battery connection	AC
Battery capacity	7.6 kWh
Discharge power	4.5 kW
PV output power	-
Efficiency class	A

B1 ENERGY STORAGE Inspection 2026



KOSTAL PLENTICORE MP G3 M 4.6 (AC) and BYD Battery-Box HVS+ 7.7

Battery connection	AC
Battery capacity	7.4 kWh
Discharge power	4.6 kW
PV output power	-
Efficiency class	B

B2 ENERGY STORAGE Inspection 2026



KOSTAL PLENTICORE G3 M 10 (AC) and BYD Battery-Box Premium HVS 12.8

Battery connection	AC
Battery capacity	11.9 kWh
Discharge power	10.1 kW
PV output power	-
Efficiency class	B

Analyzed systems in the Energy Storage Inspection 2026

B3 ENERGY STORAGE Inspection 2026



**KOSTAL PLENTICORE MP G3 M 4.6 (DC) and
BYD Battery-Box HVS+ 7.7**

Battery connection	DC
Battery capacity	7.4 kWh
Discharge power	4.6 kW
PV output power	4.6 kW
Efficiency class	A

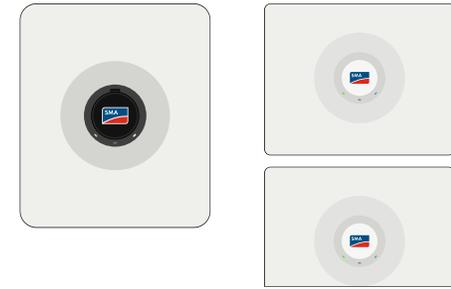
B4 ENERGY STORAGE Inspection 2026



**KOSTAL PLENTICORE G3 M 10 (DC) and
BYD Battery-Box Premium HVS 12.8**

Battery connection	DC
Battery capacity	11.9 kWh
Discharge power	10.1 kW
PV output power	10.0 kW
Efficiency class	A

C1 ENERGY STORAGE Inspection 2026



**SMA Sunny Boy Smart Energy 5.0 and
Home Storage 6.5**

Battery connection	DC
Battery capacity	6.4 kWh
Discharge power	4.6 kW
PV output power	4.6 kW
Efficiency class	A

Analyzed systems in the Energy Storage Inspection 2026

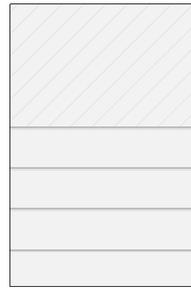
D1 ENERGY STORAGE Inspection 2026



FRONIUS Symo GEN24 10.0 Plus SC and Reserva 12.6

Battery connection	DC
Battery capacity	13.2 kWh
Discharge power	8.8 kW
PV output power	10.2 kW
Efficiency class	A

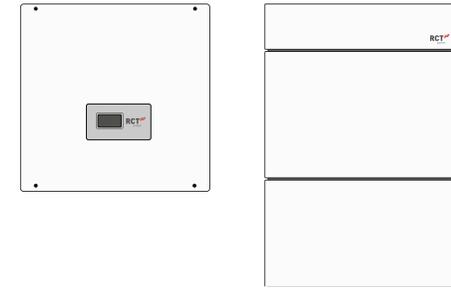
E1 ENERGY STORAGE Inspection 2026



FOX ESS PQ-H3-Ultra-10.0 and EQ3300-5

Battery connection	DC
Battery capacity	14.7 kWh
Discharge power	10.3 kW
PV output power	10.5 kW
Efficiency class	A

F1 ENERGY STORAGE Inspection 2026



RCT POWER Power Storage DC 10.0 and Power Battery 11.5

Battery connection	DC
Battery capacity	10.6 kWh
Discharge power	9.9 kW
PV output power	10.0 kW
Efficiency class	A

Analyzed systems in the Energy Storage Inspection 2026

G1 ENERGY STORAGE Inspection 2026



ENERGY DEPOT Centurio 10 and
DOMUS 2.5

Battery connection	DC
Battery capacity	15.1 kWh
Discharge power	7.5 kW
PV output power	10.3 kW
Efficiency class	A

H1 ENERGY STORAGE Inspection 2026



DC-coupled system, purchased
independently

Battery connection	DC
Battery capacity	8.9 kWh
Discharge power	4.3 kW
PV output power	9.8 kW
Efficiency class	D

I1 ENERGY STORAGE Inspection 2026



DC-coupled system, purchased
independently

Battery connection	DC
Battery capacity	9.8 kWh
Discharge power	4.8 kW
PV output power	10.0 kW
Efficiency class	G

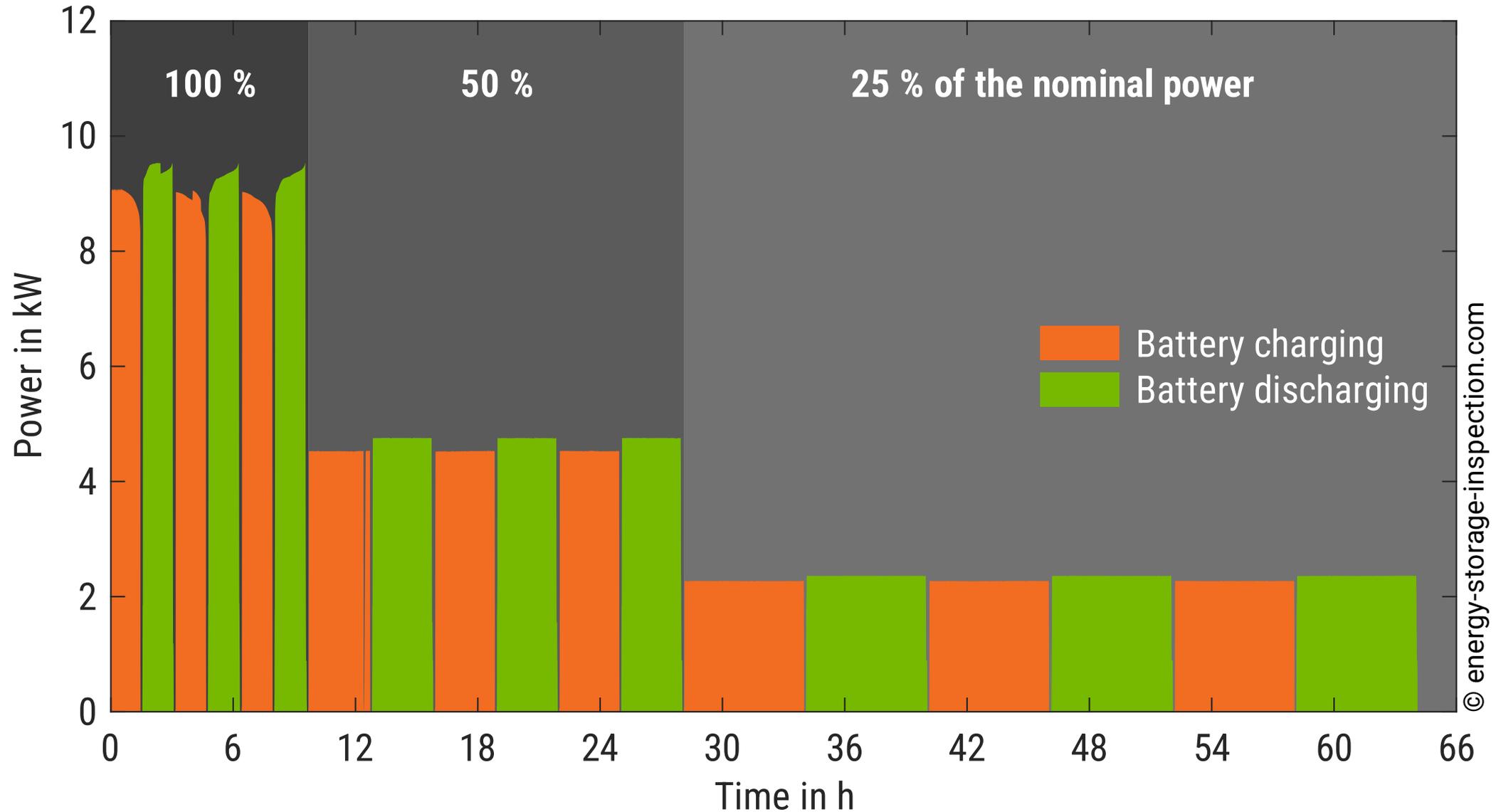
System abbreviations

System	Product name
A1	SAX Power Home Plus
B1	KOSTAL PLENTICORE MP G3 M 4.6 (AC) and BYD Battery-Box HVS+ 7.7
B2	KOSTAL PLENTICORE G3 M 10 (AC) and BYD Battery-Box Premium HVS 12.8
B3	KOSTAL PLENTICORE MP G3 M 4.6 (DC) and BYD Battery-Box HVS+ 7.7
B4	KOSTAL PLENTICORE G3 M 10 (DC) and BYD Battery-Box Premium HVS 12.8
C1	SMA Sunny Boy Smart Energy 5.0 and Home Storage 6.5

System abbreviations

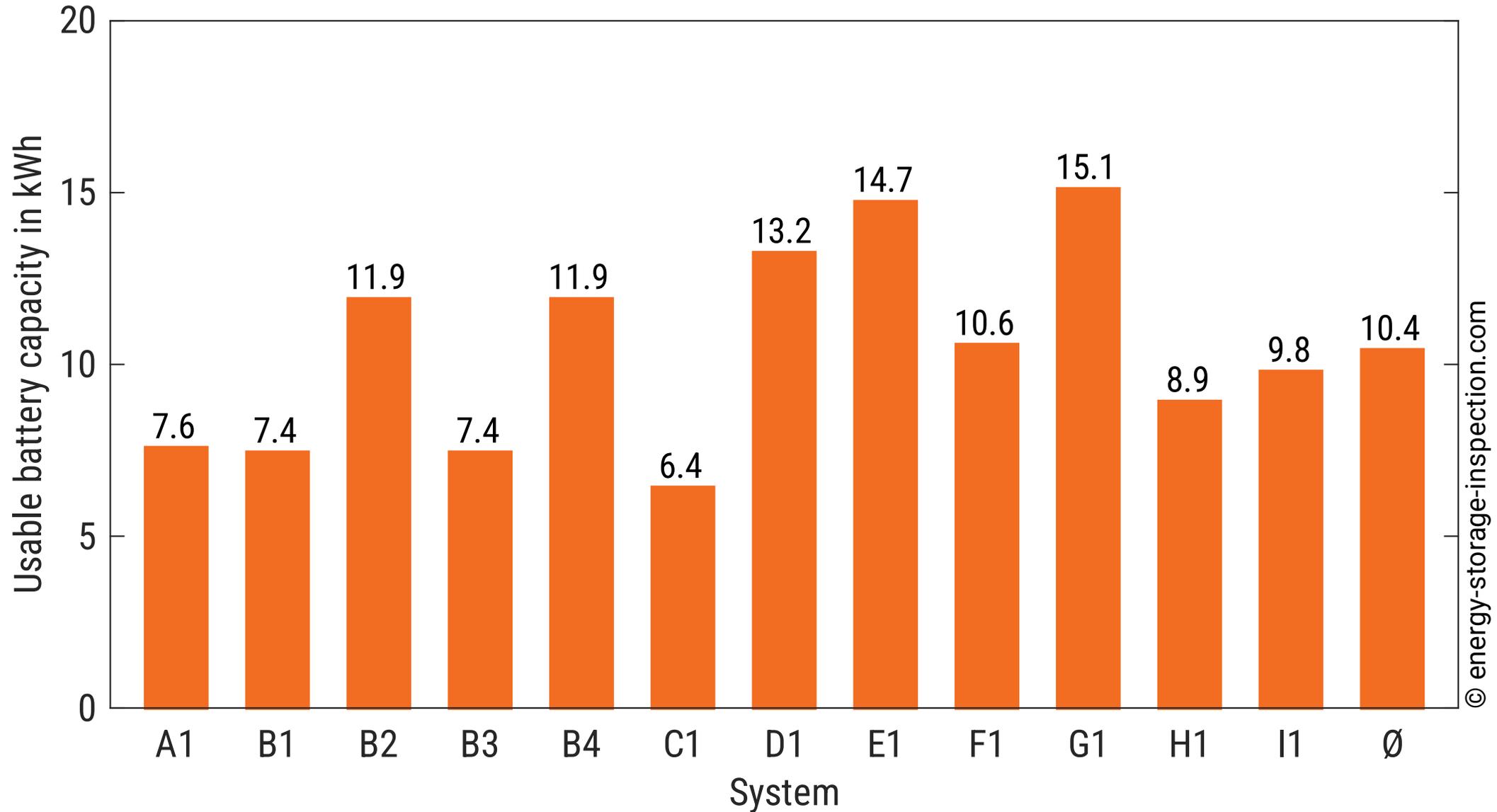
System	Product name
D1	FRONIUS Symo GEN24 10.0 Plus SC and Reserva 12.6
E1	FOX ESS PQ-H3-Ultra-10.0 and EQ3300-5
F1	RCT POWER Power Storage DC 10.0 and Power Battery 11.5
G1	ENERGY DEPOT Centurio 10 and DOMUS 2.5
H1	DC-coupled system purchased independently
I1	DC-coupled system purchased independently

Determination of the usable battery capacity of the systems



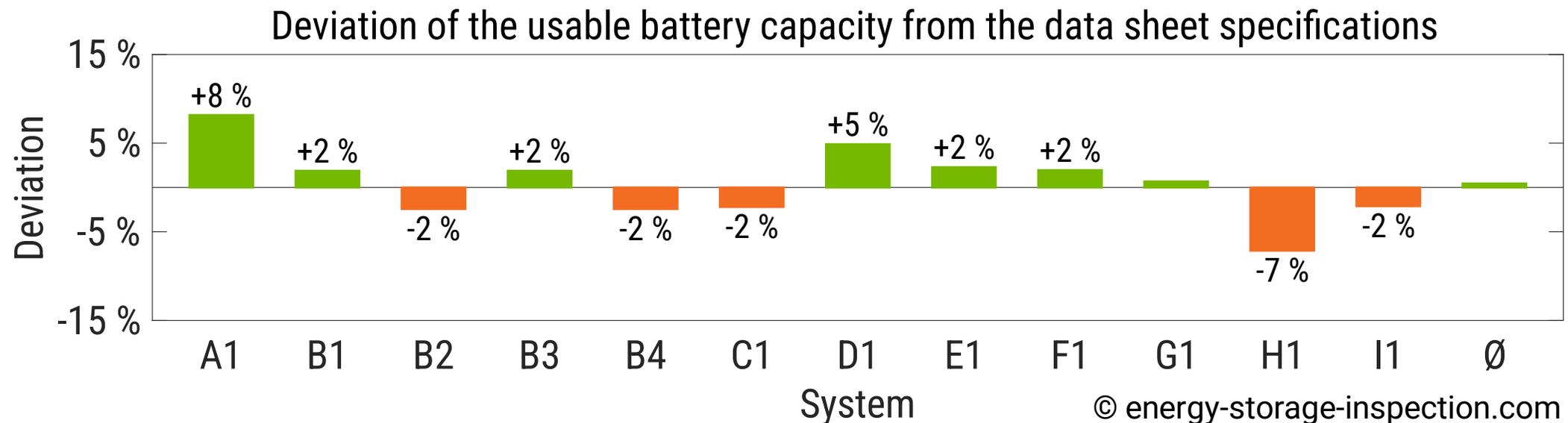
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Usable battery capacity of the analyzed systems

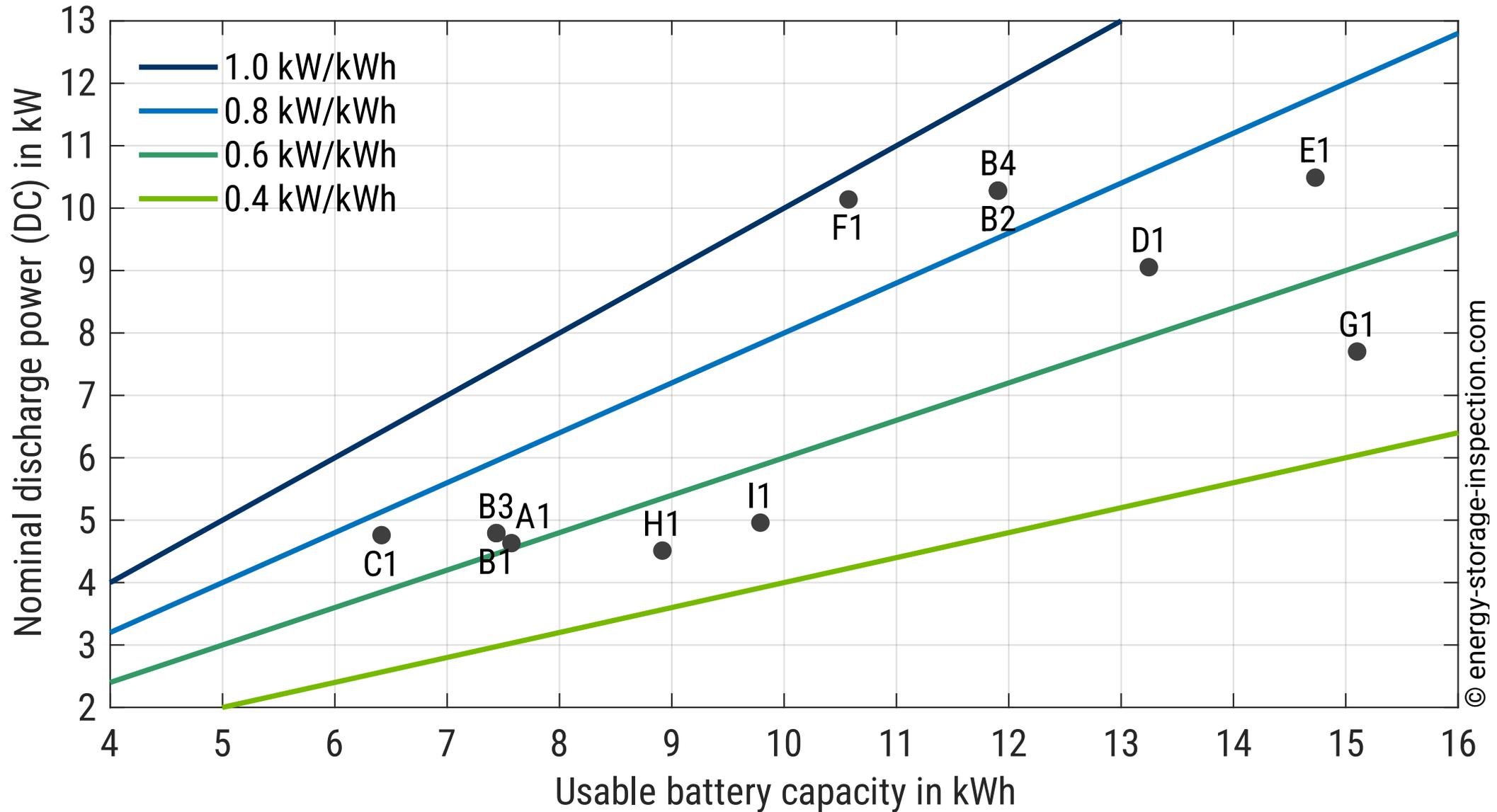


Comparison of data sheet specifications and measurements

- For 7 of the 12 systems tested, **higher usable storage capacities** were determined in the laboratory test than those declared on the data sheets.
- The specified depth of discharge, which is intended to **prevent deep discharge**, is often the reason for the measured values being lower.
- The usable battery capacity of systems A1 and D1 is 0.6 kWh (8 % and 5 %) higher than the value specified in the data sheet.

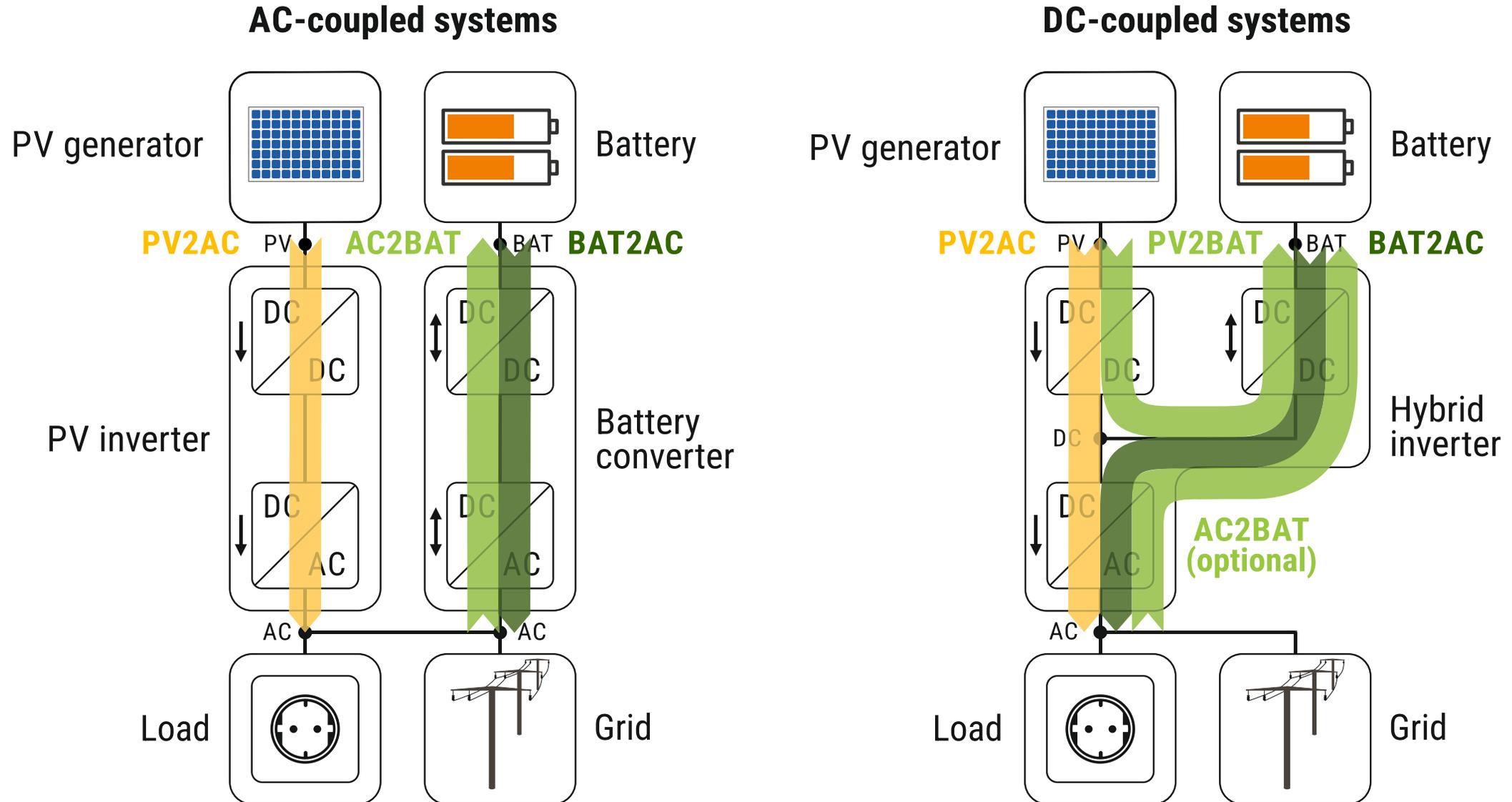


Nominal discharge power of the analyzed systems

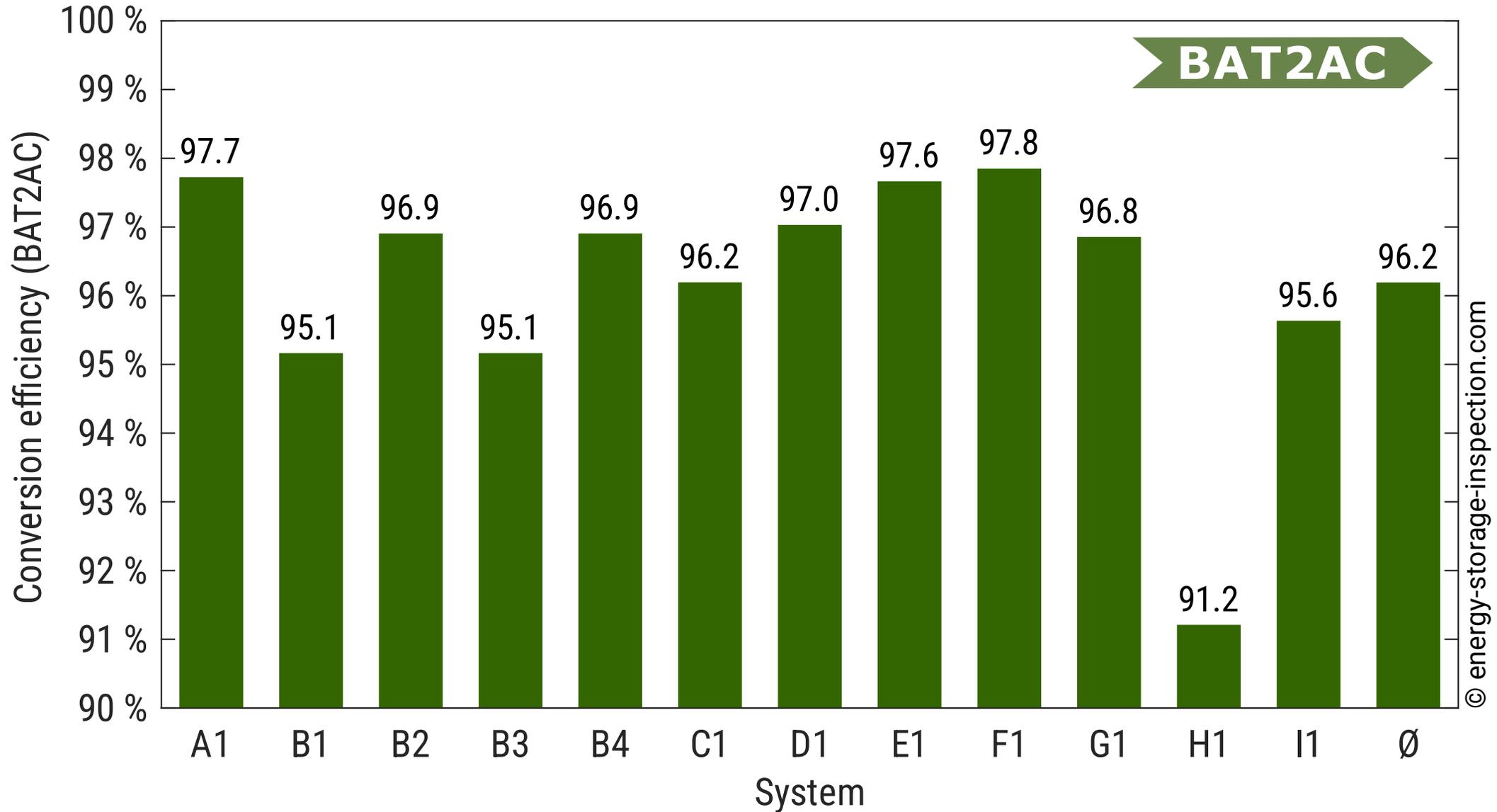


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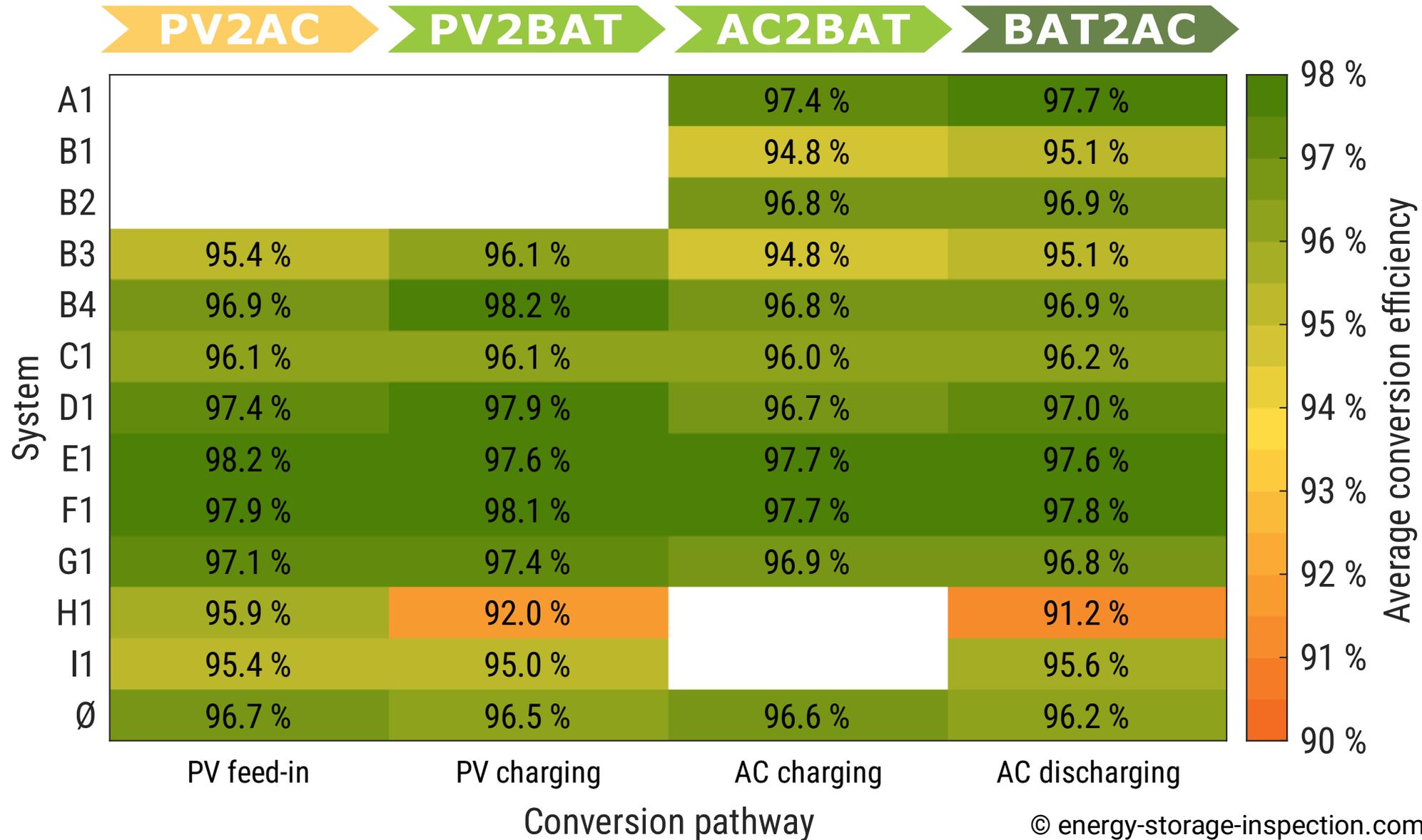
Energy conversion pathways of the different system topologies



Average conversion efficiency of AC battery discharging



Average efficiency of the energy conversion pathways



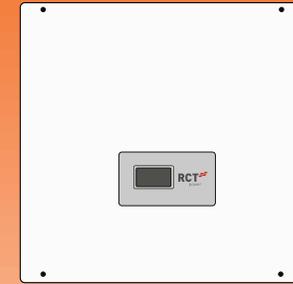
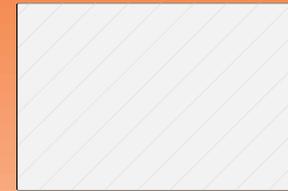
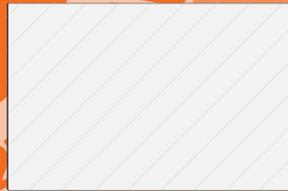
Hybrid inverters with the highest efficiencies in 2026

PV2AC

PV2BAT

AC2BAT

BAT2AC



98.2 %

98.2 %

97.7 %

97.8 %

FOX
ESS

KOSTAL

FOX
ESS

RCT
power

PQ-H3-Ultra-10.0

PLENTICORE G3 M 10

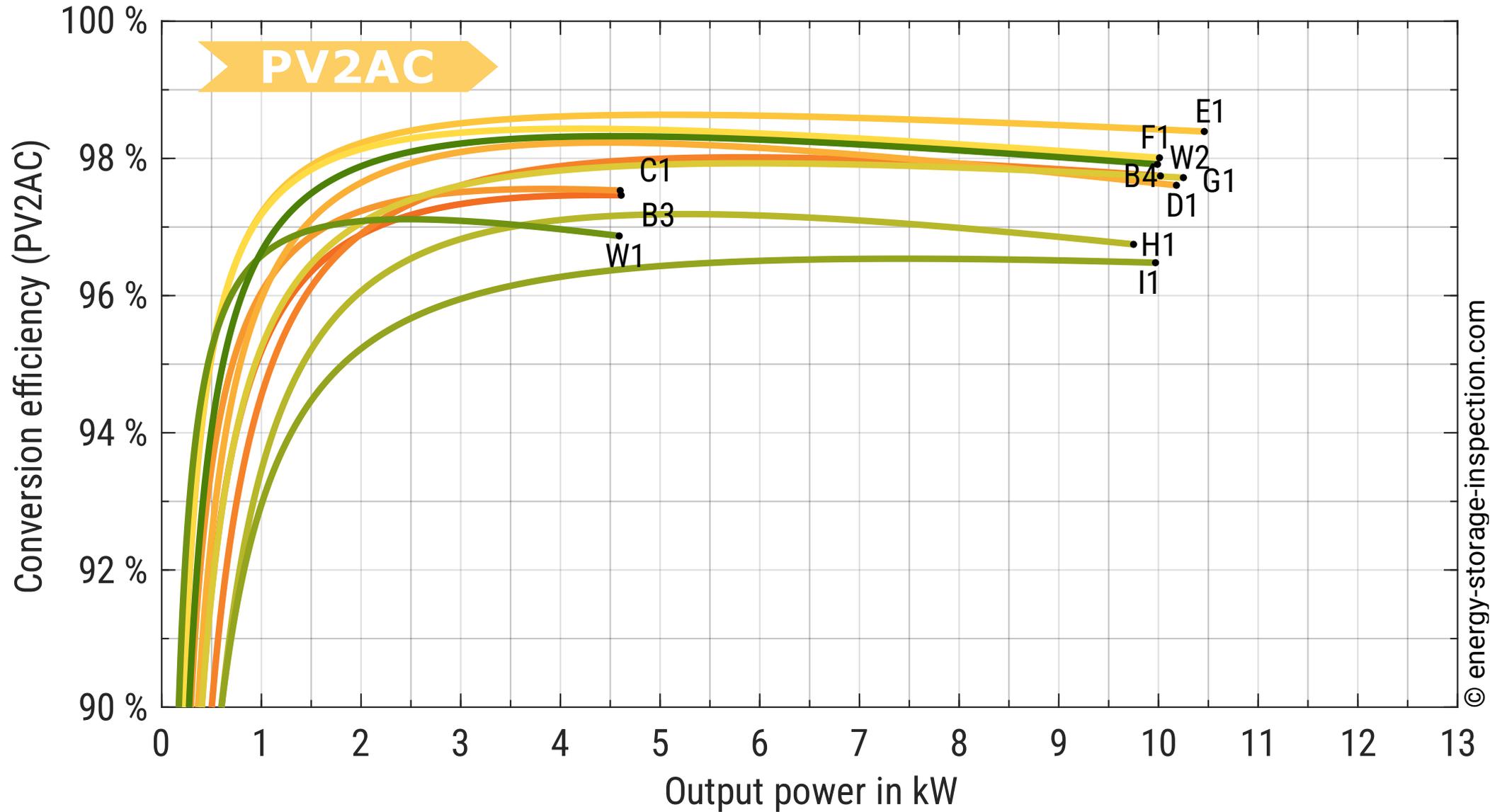
PQ-H3-Ultra-10.0

Power Storage DC 10.0

Average efficiency at 10 test points in accordance with the DIN VDE V 0510-200 standard
All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

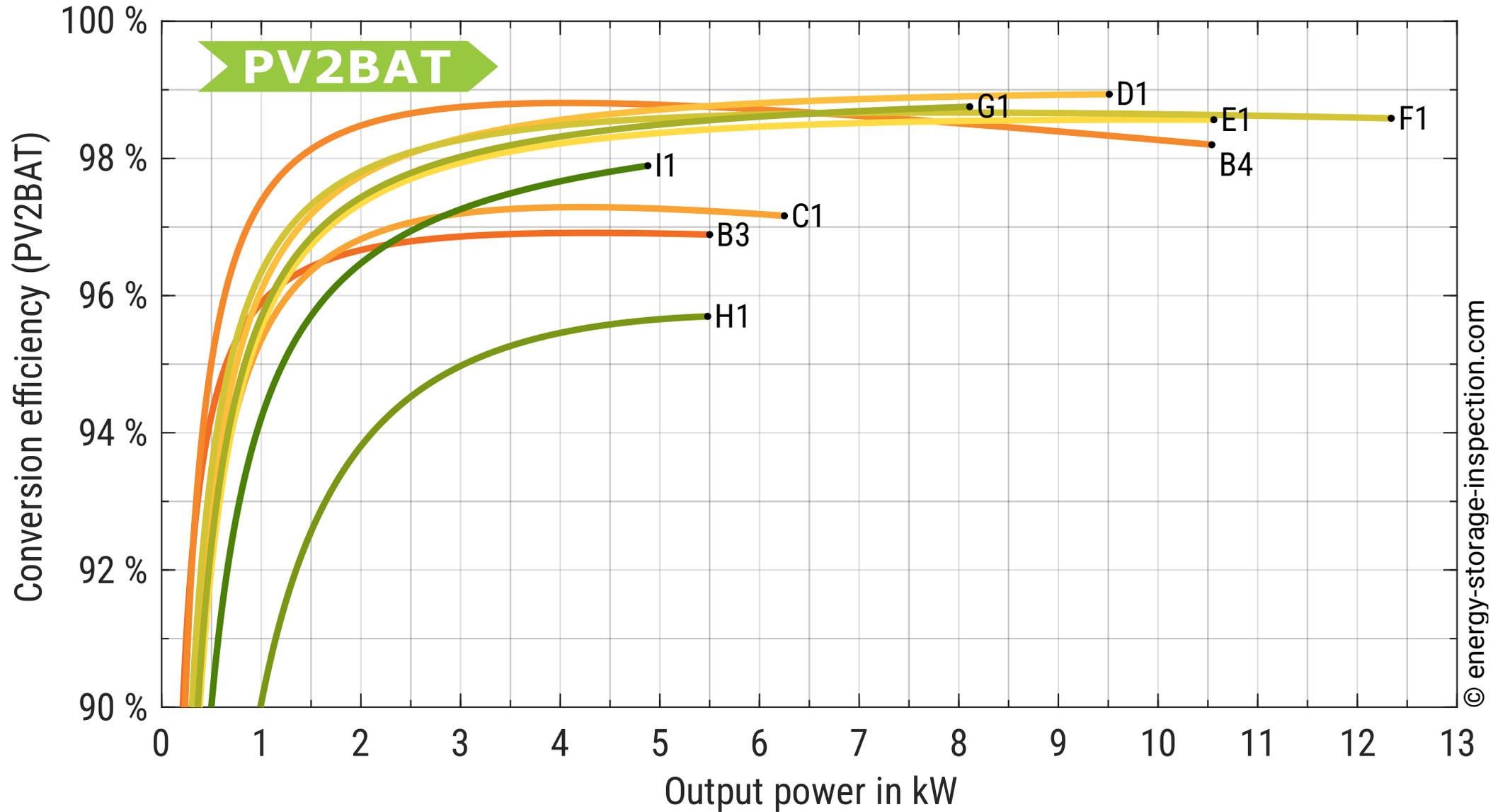
htw aquu⁺

PV feed-in pathway efficiency



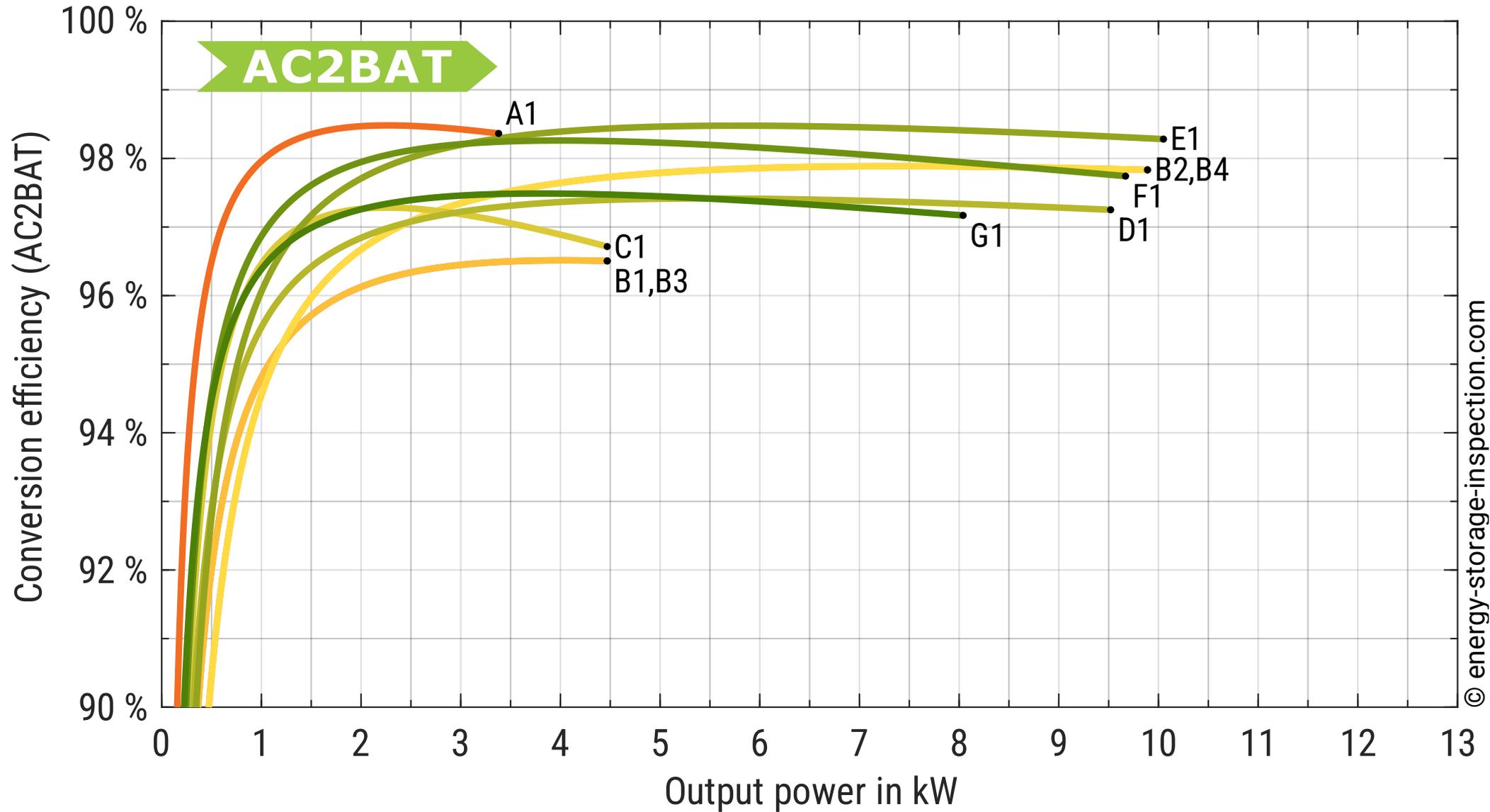
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PV battery charging pathway efficiency



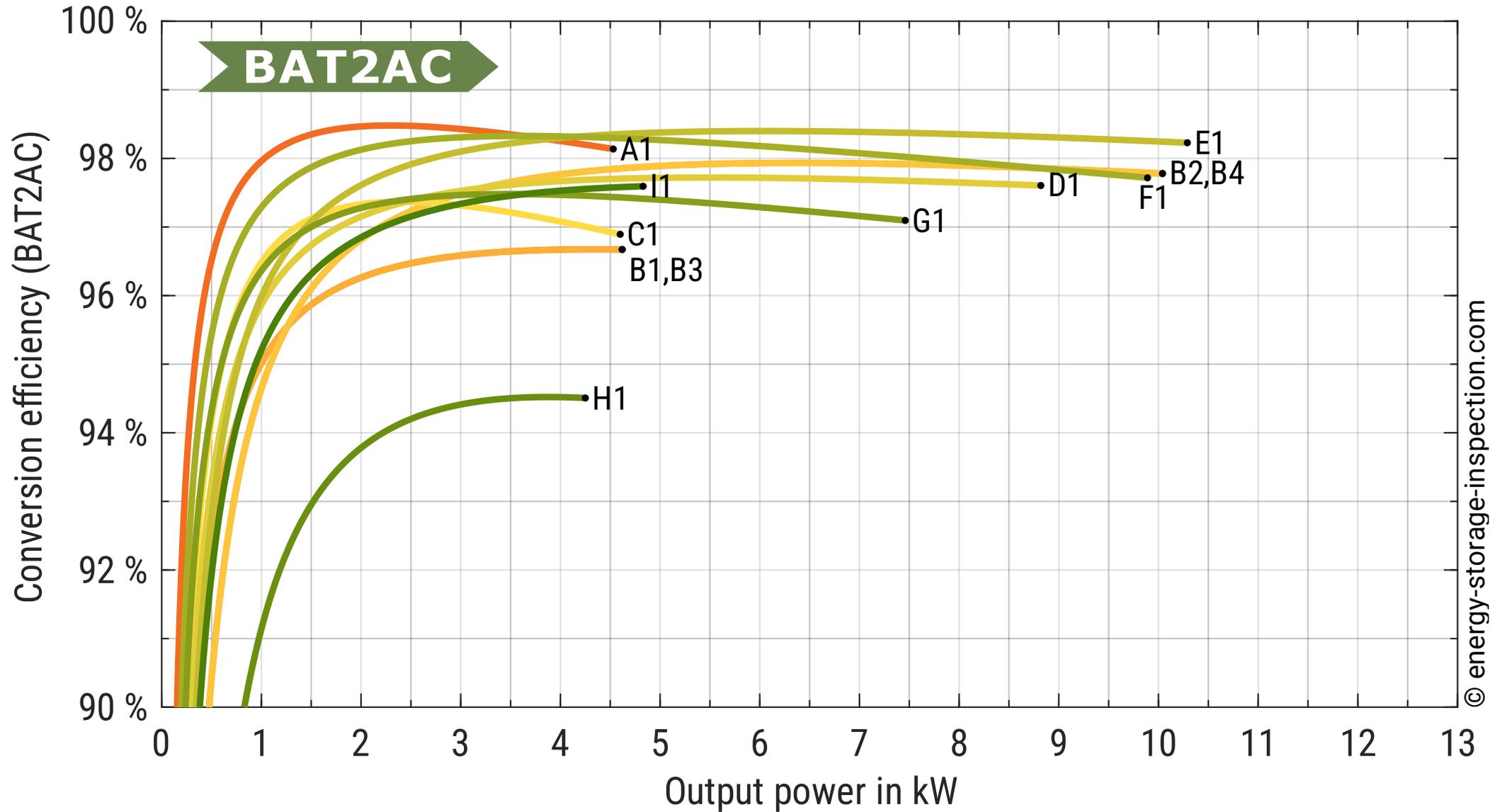
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AC battery charging pathway efficiency



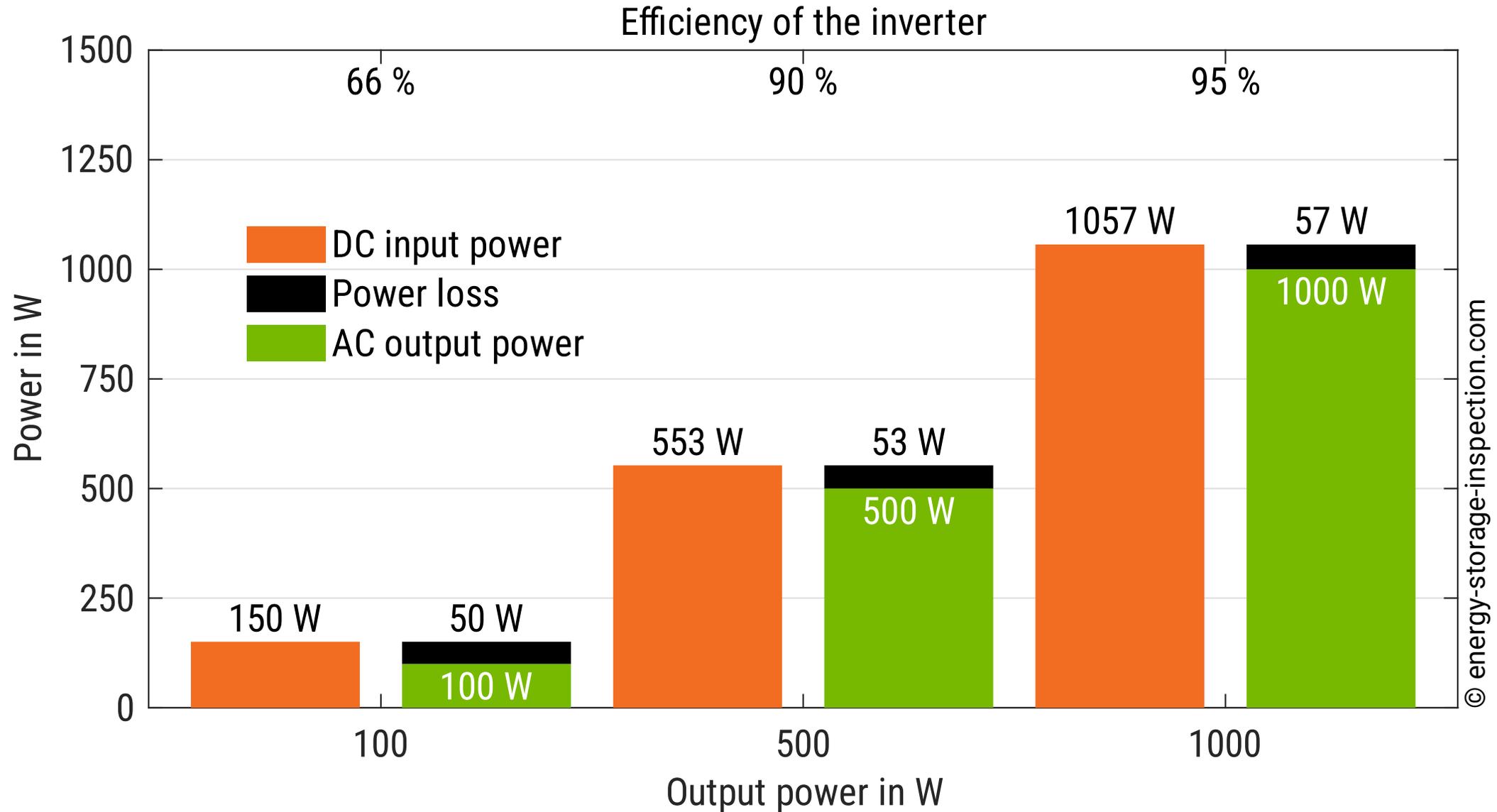
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AC battery discharging pathway efficiency

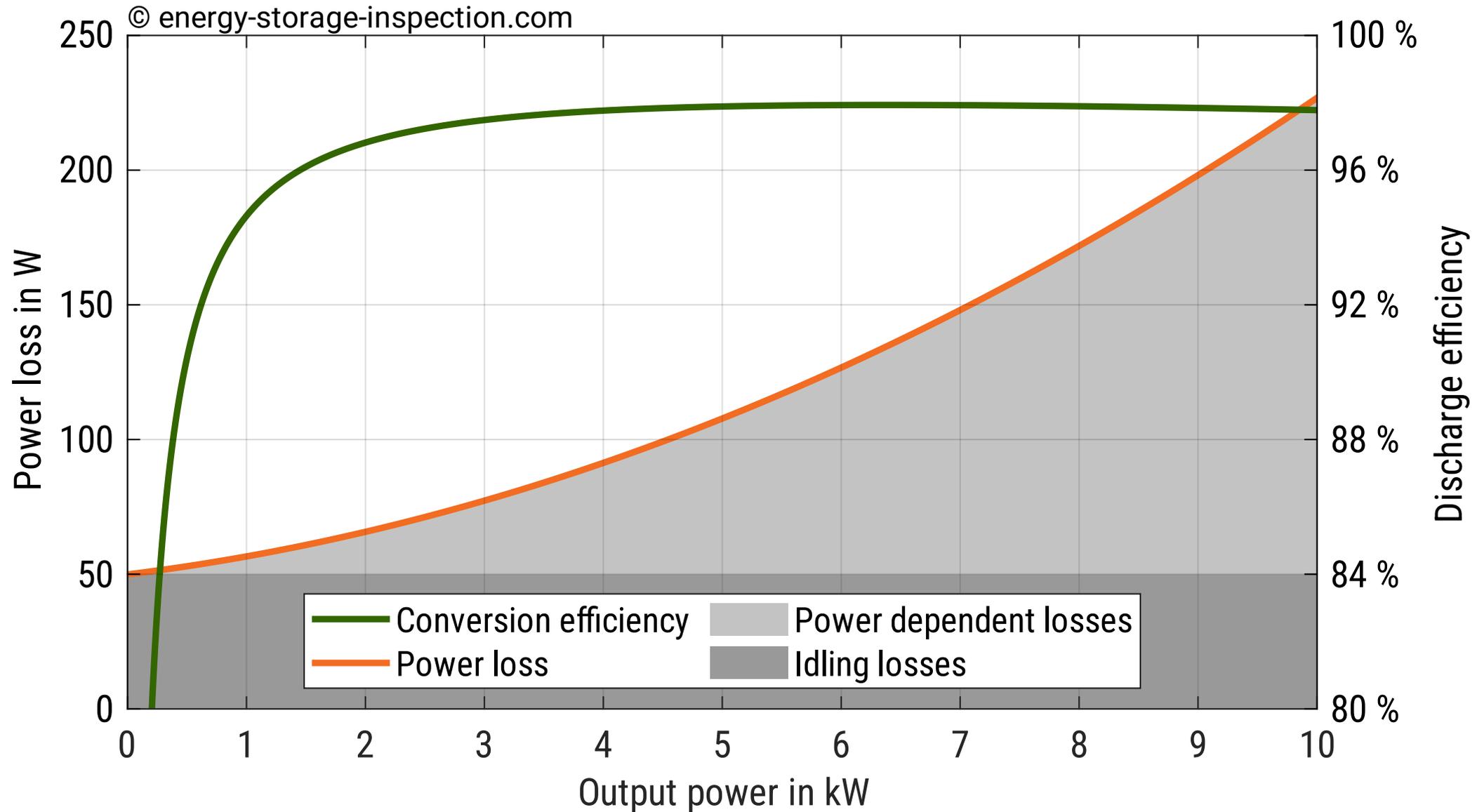


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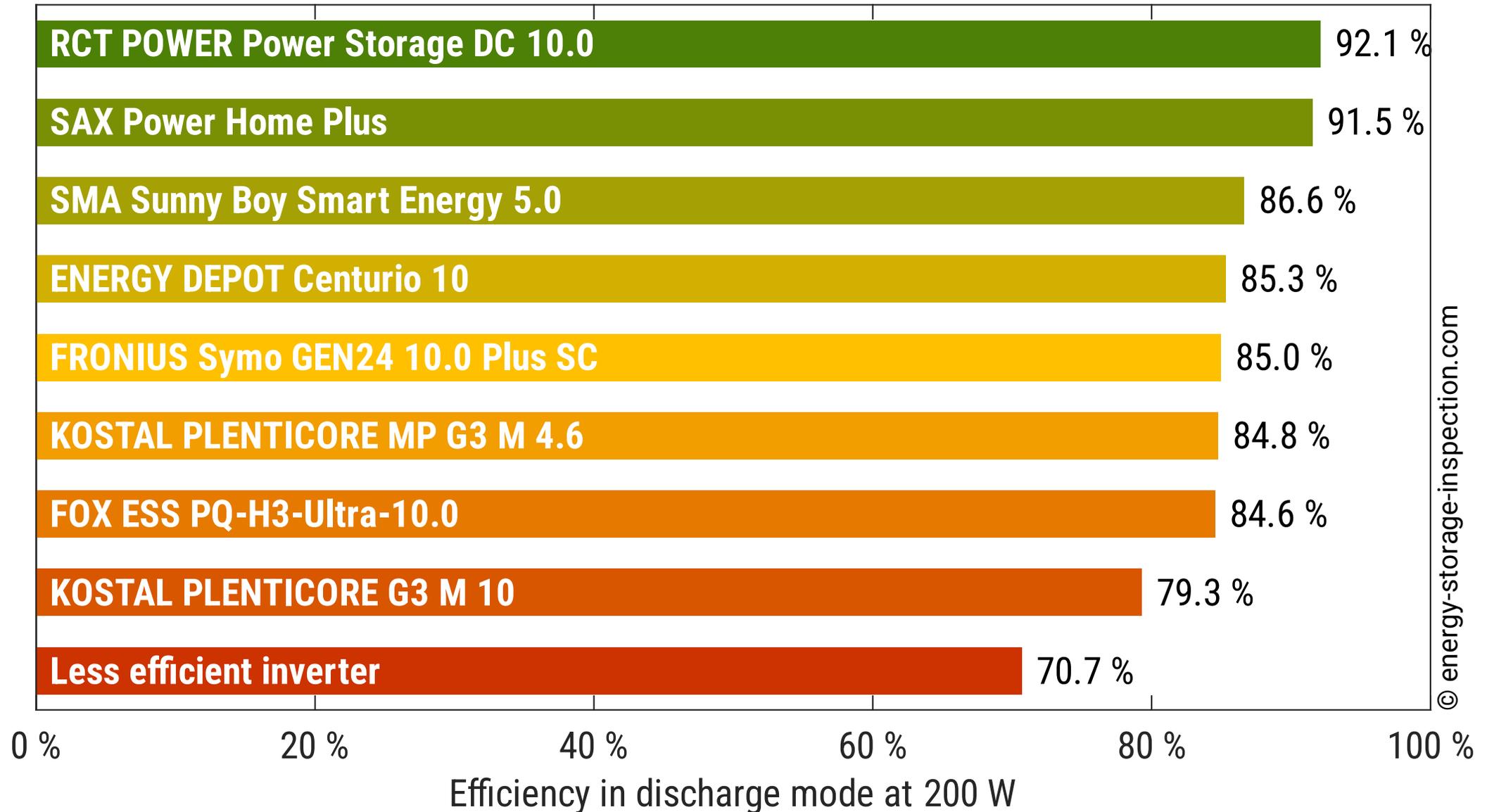
Why does inverter efficiency decrease at lower power levels?



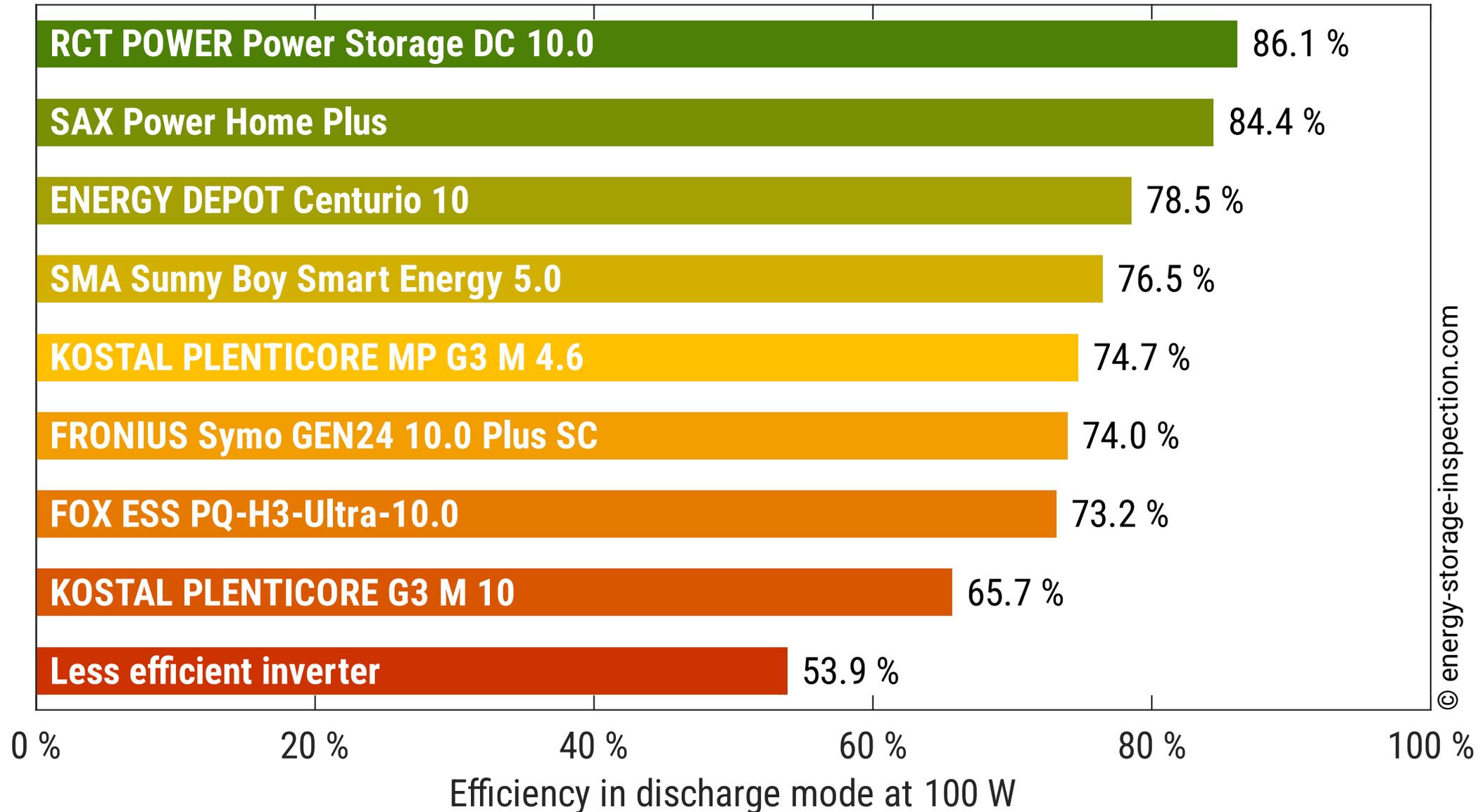
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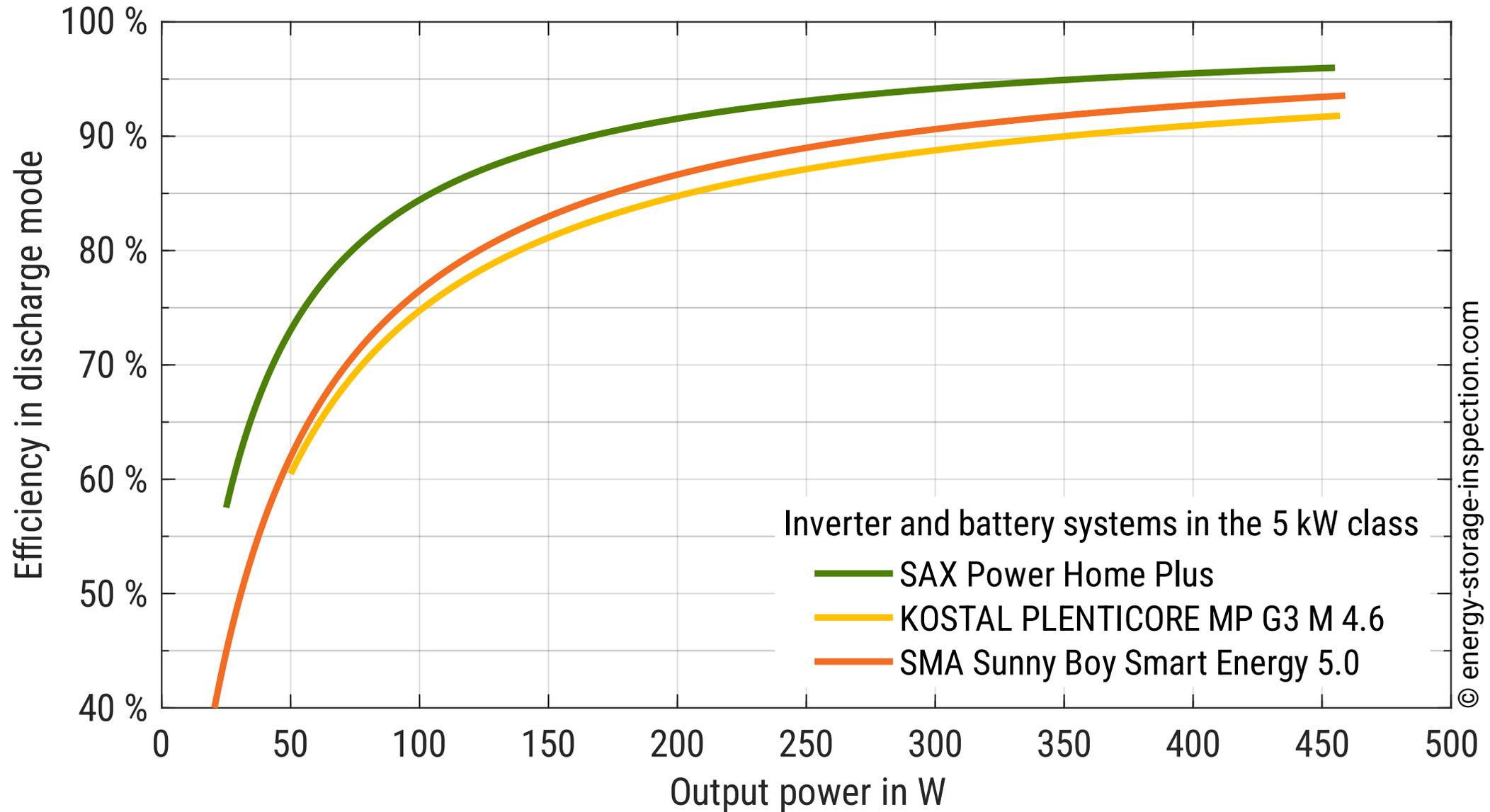
Conversion efficiency at partial load of 200 W



Conversion efficiency at partial load of 100 W

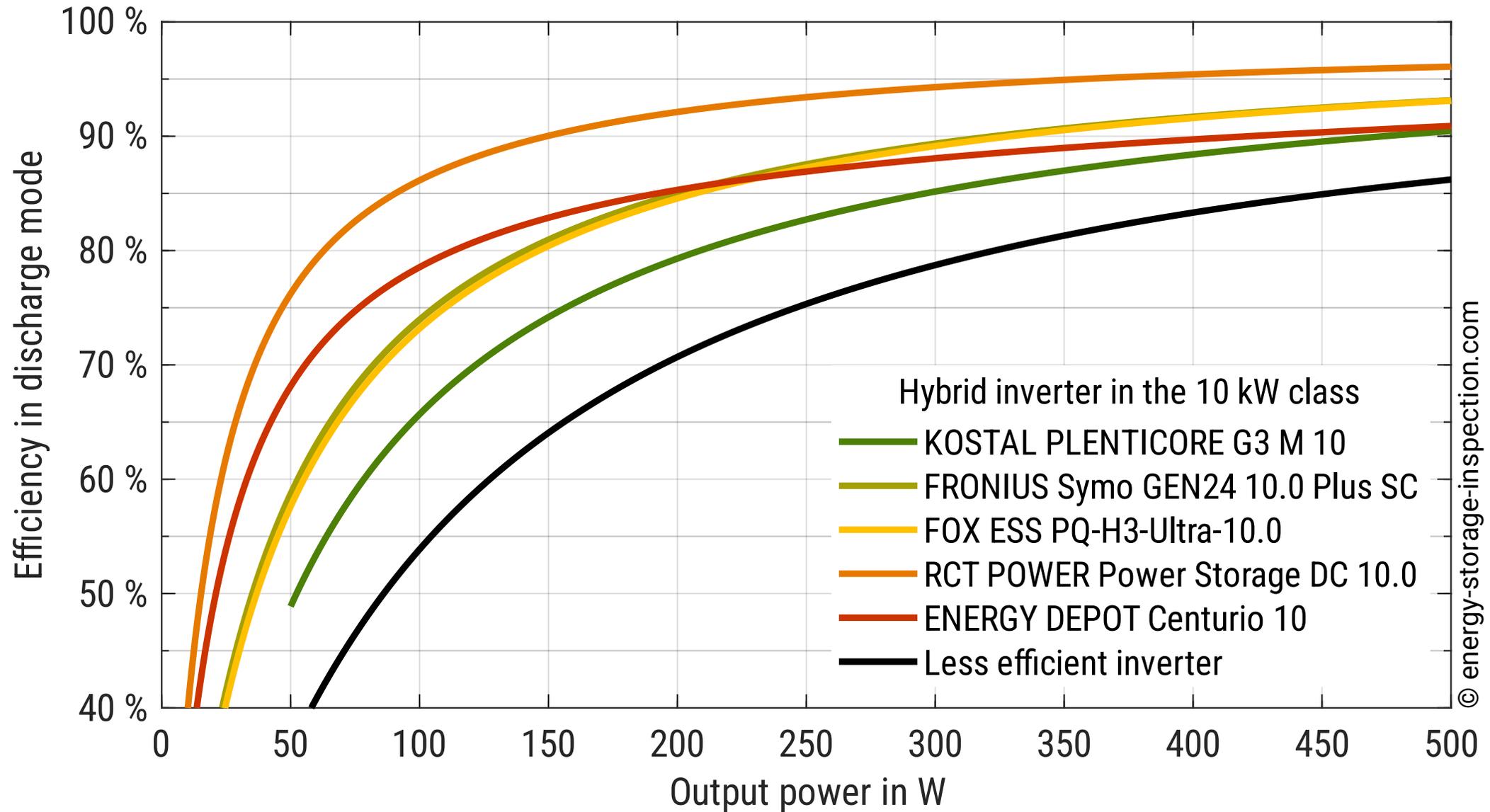


Partial load efficiencies in the 5 kW class

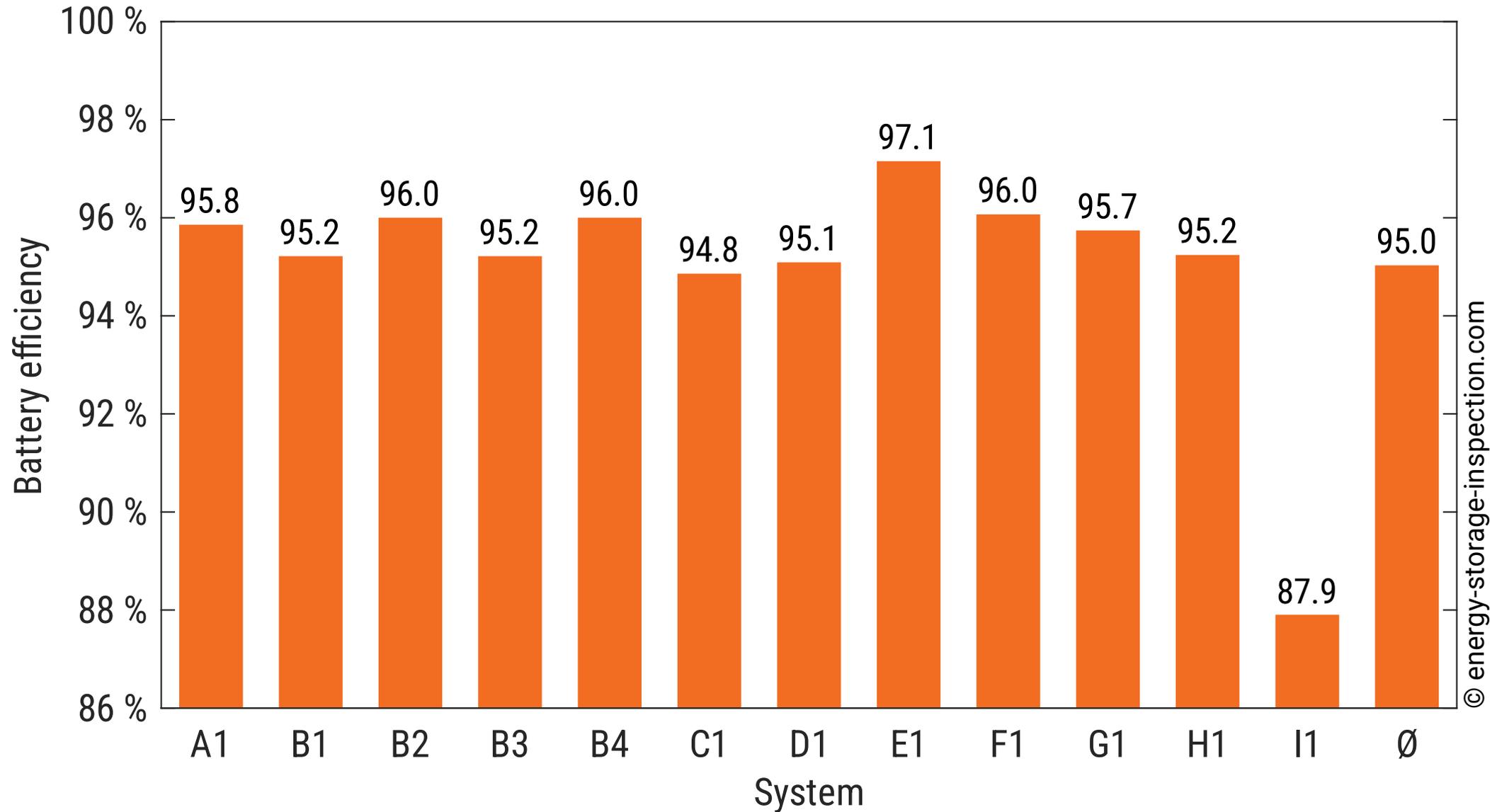


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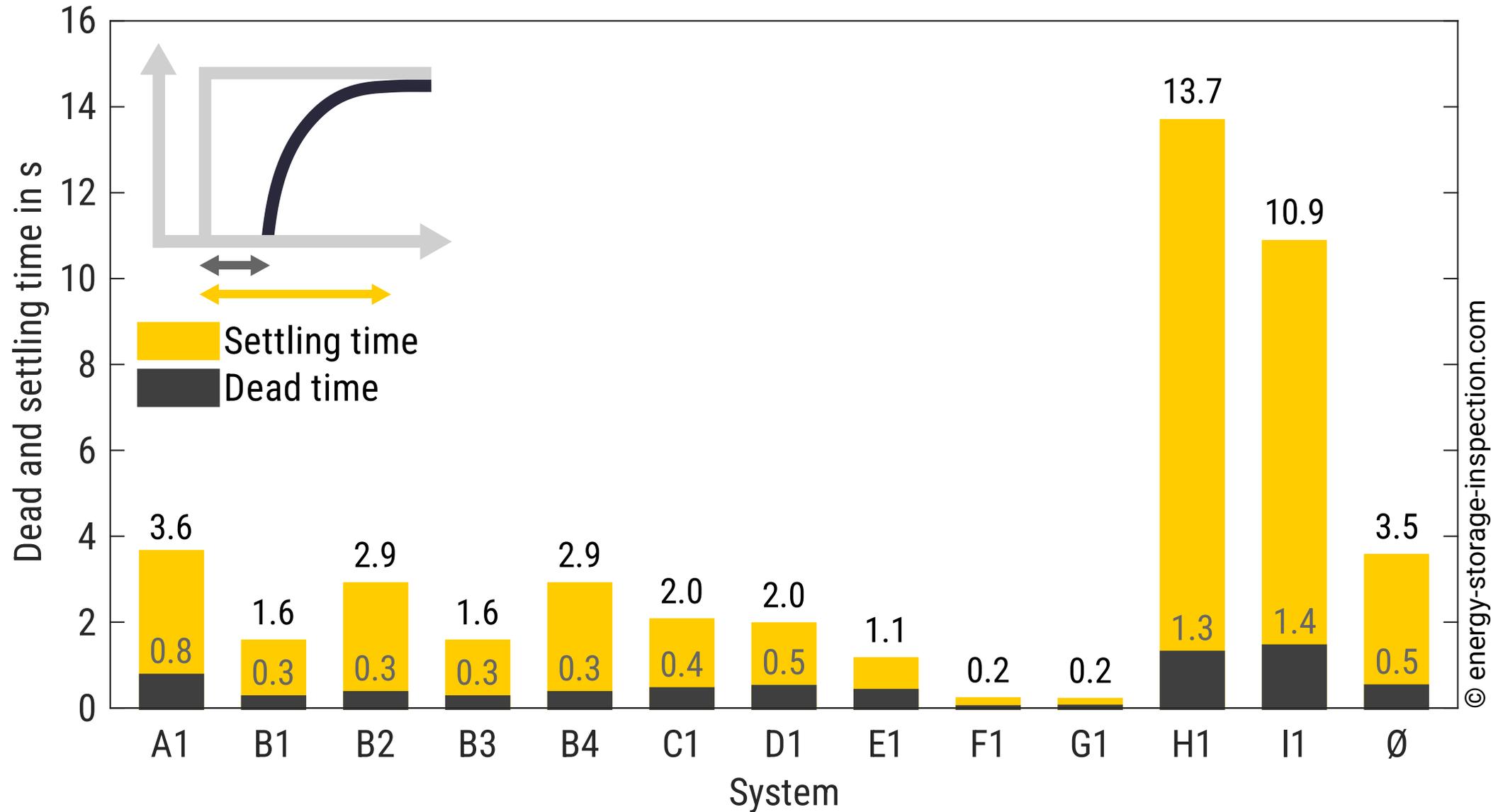
Partial load efficiencies in the 10 kW class



Average battery efficiencies



Dynamic control deviations: dead and settling time



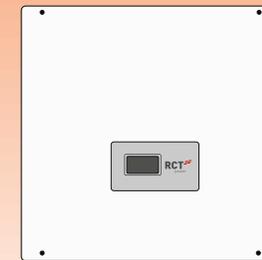
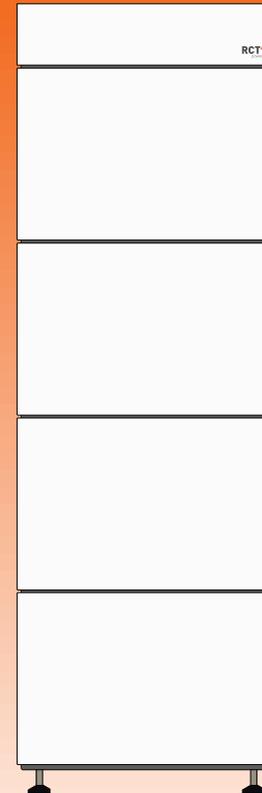
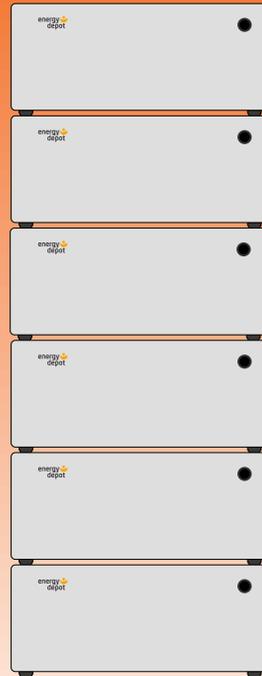
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0.2 seconds response time: The fastest storage systems of 2026



energy depot

Centurio 10 and
DOMUS 2.5

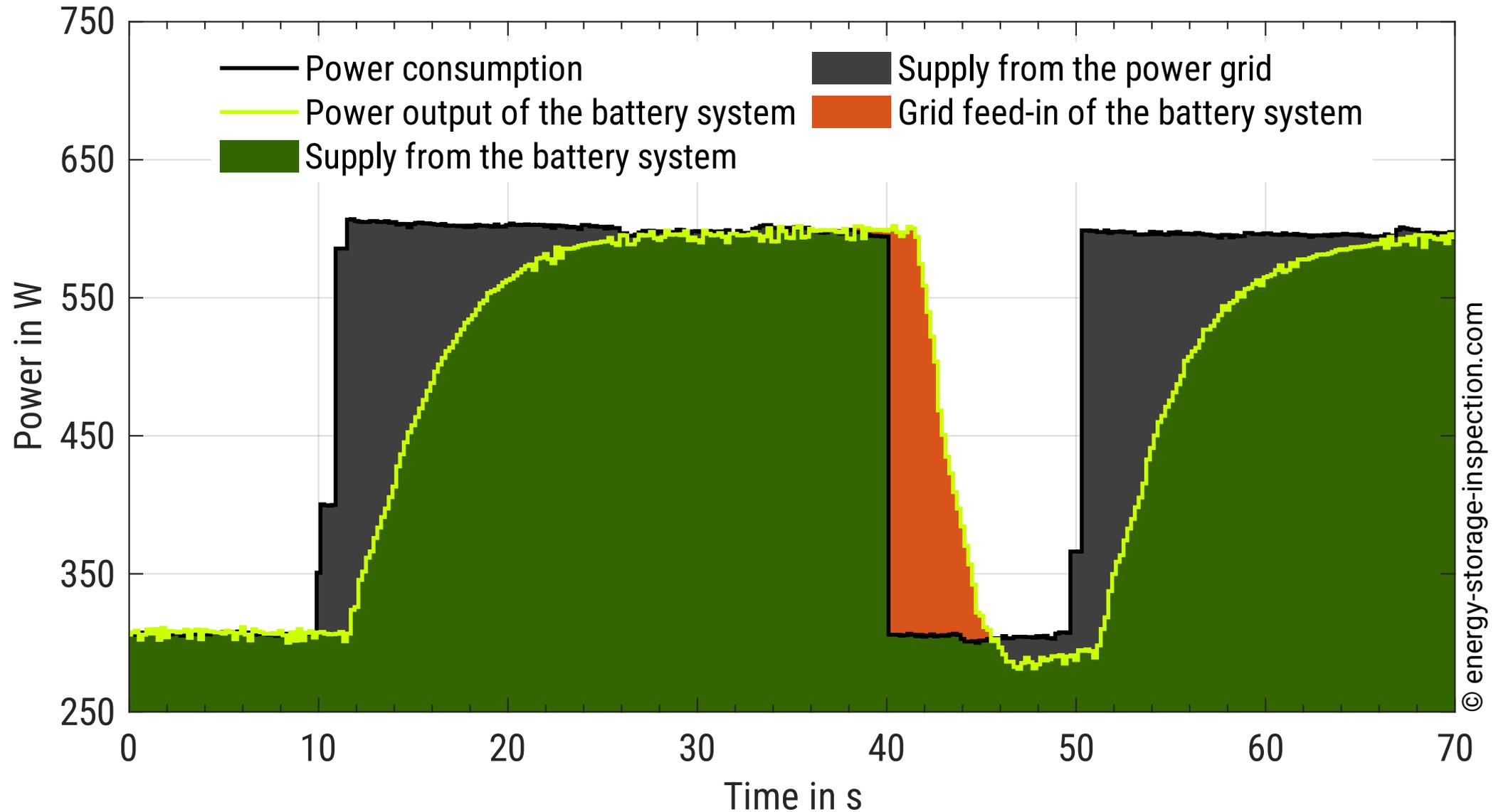


RCT
power

Power Storage DC 10.0
and Power Battery 11.5

Average settling time in accordance with the DIN VDE V 0510-200 standard
All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

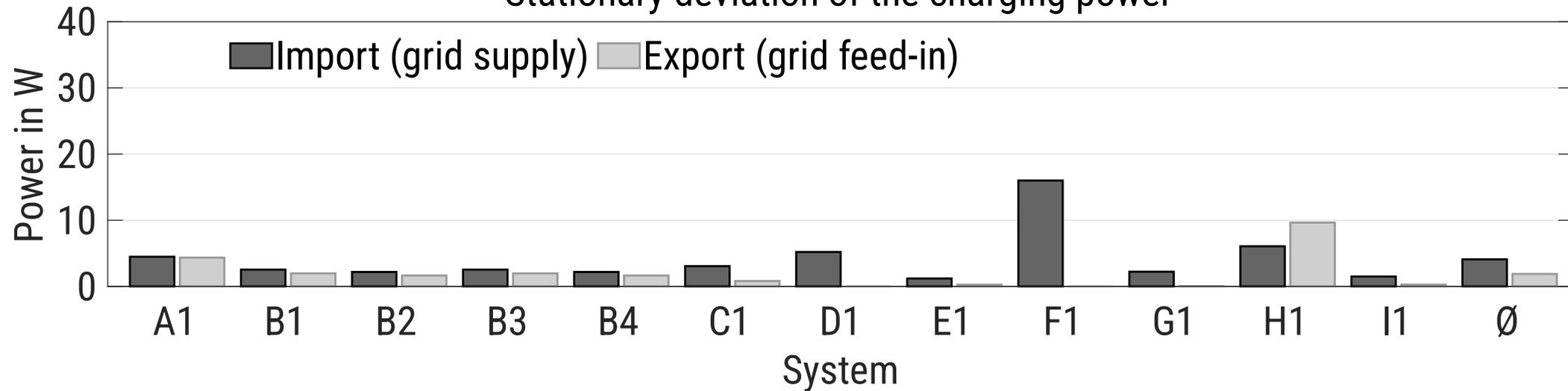
Dynamic control deviations of a slow battery system



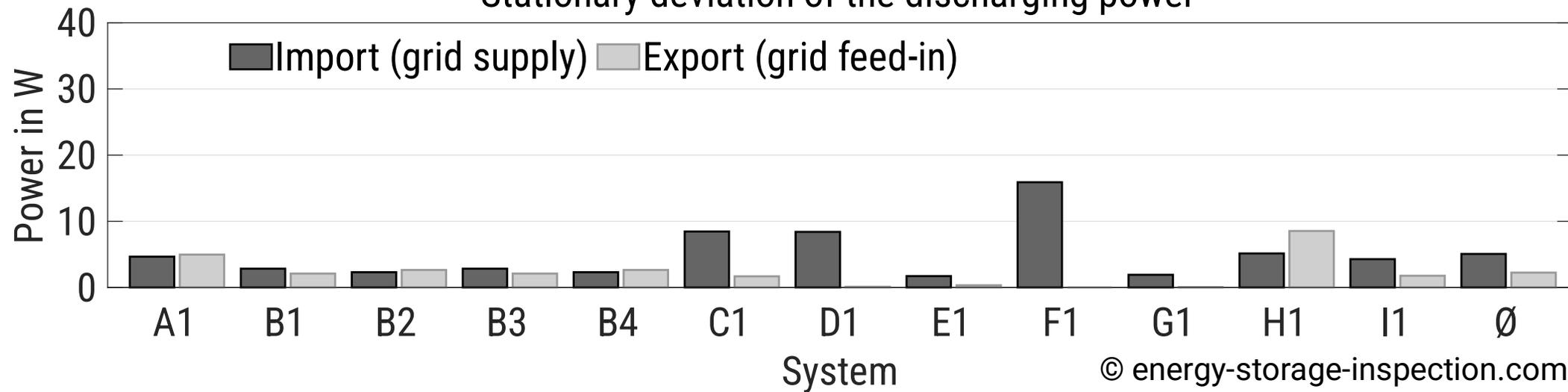
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Stationary control deviations

Stationary deviation of the charging power

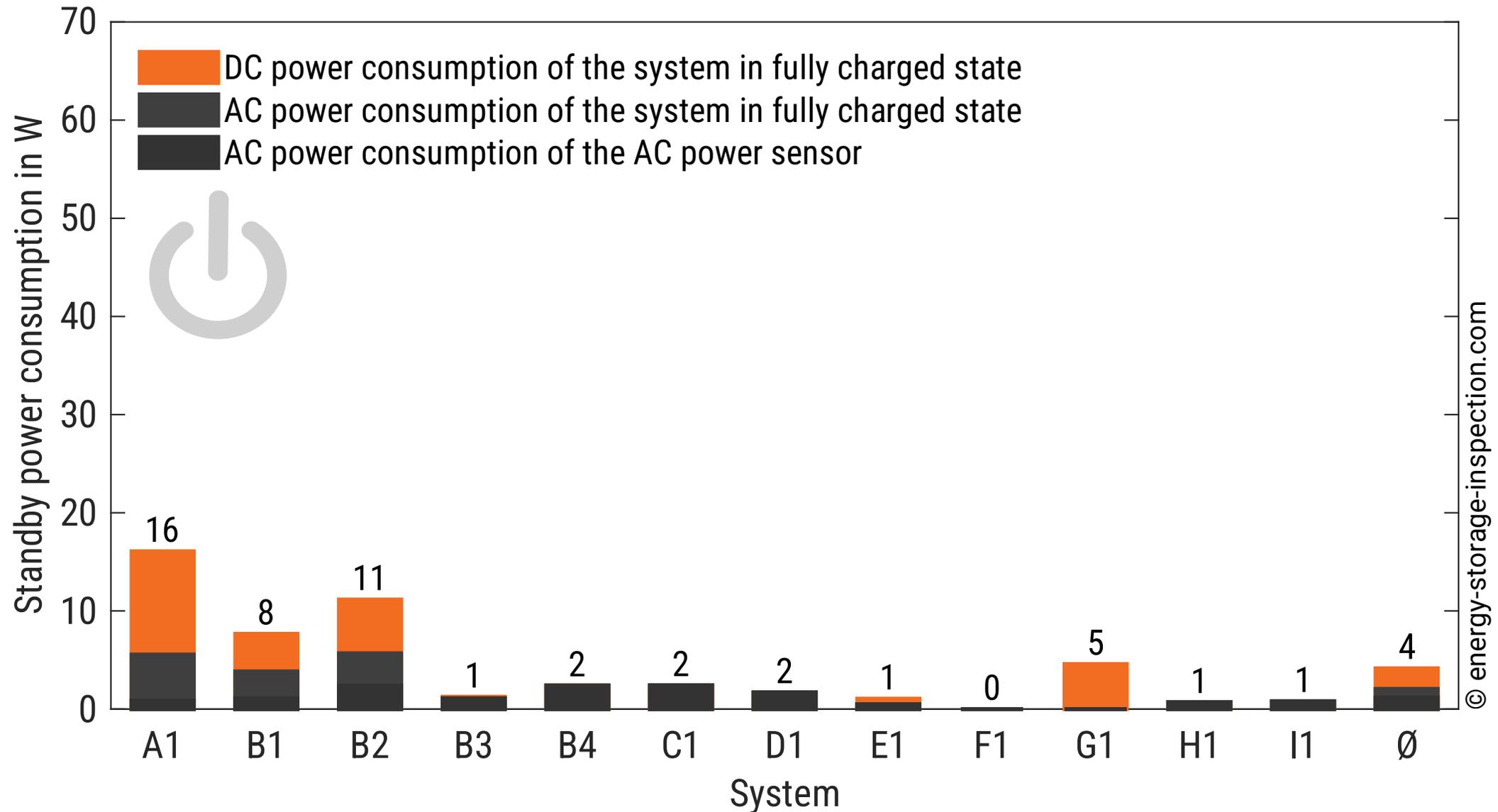


Stationary deviation of the discharging power

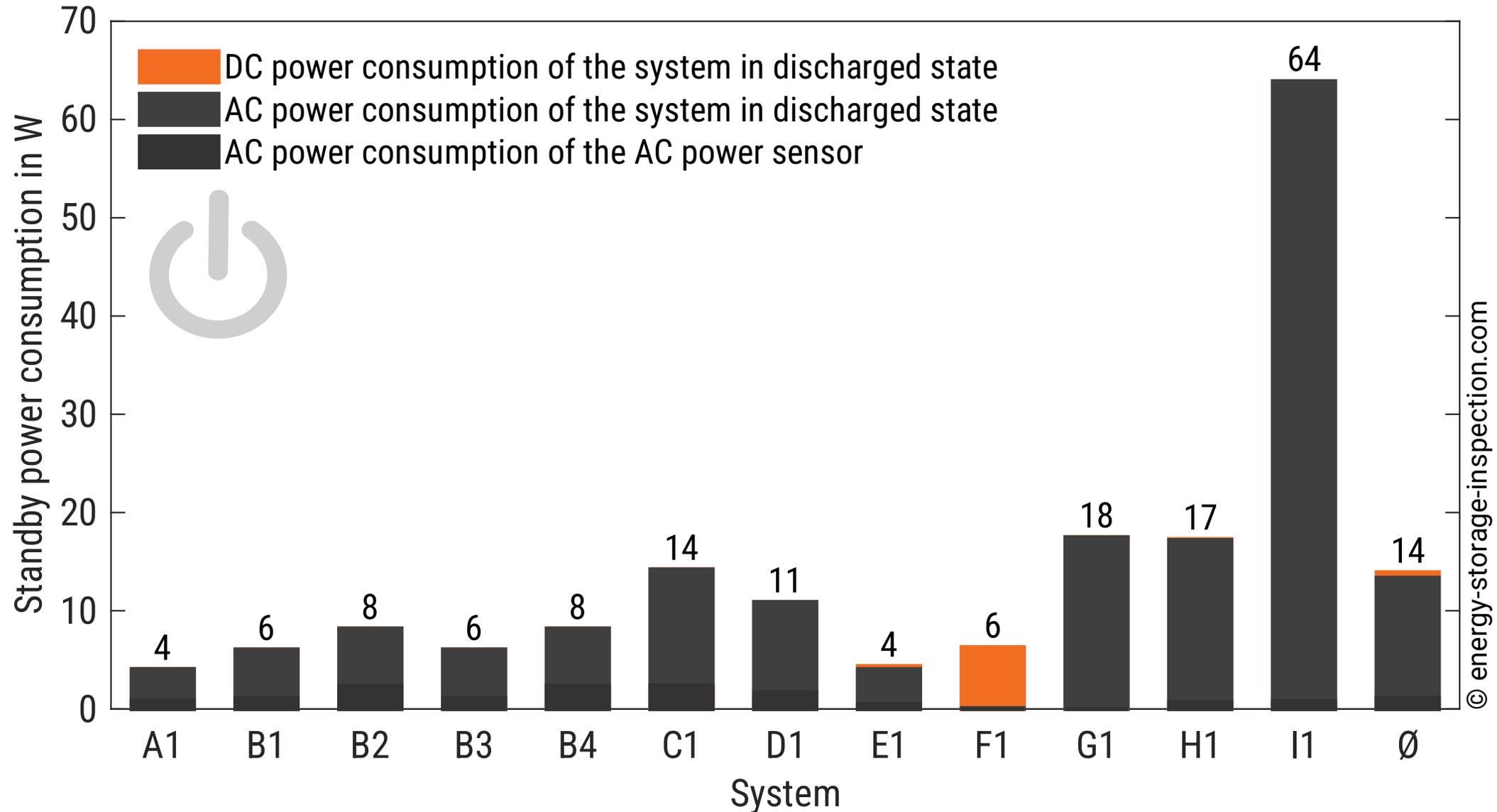


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Standby power consumption with fully charged battery



Standby power consumption with discharged battery



Less than 6 watts in standby: The most efficient systems of 2026

AC-coupled systems



DC-coupled systems



4 watts



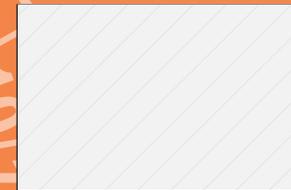
SAX Power GmbH
Home Plus



6 watts

KOSTAL

PLENTICORE MP G3



4 watts



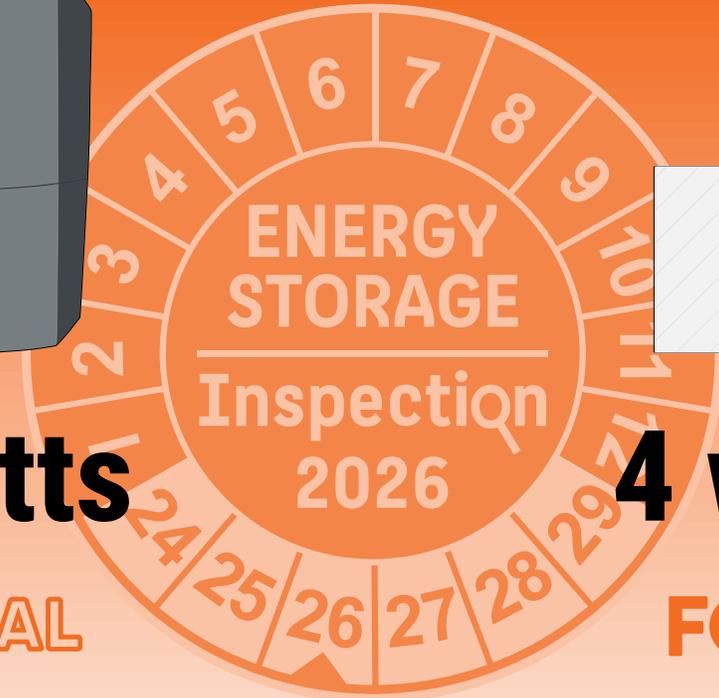
PQ-H3-Ultra-10.0



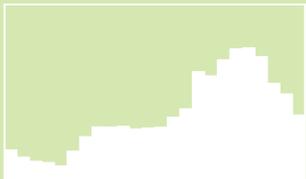
6 watts

KOSTAL

PLENTICORE MP G3

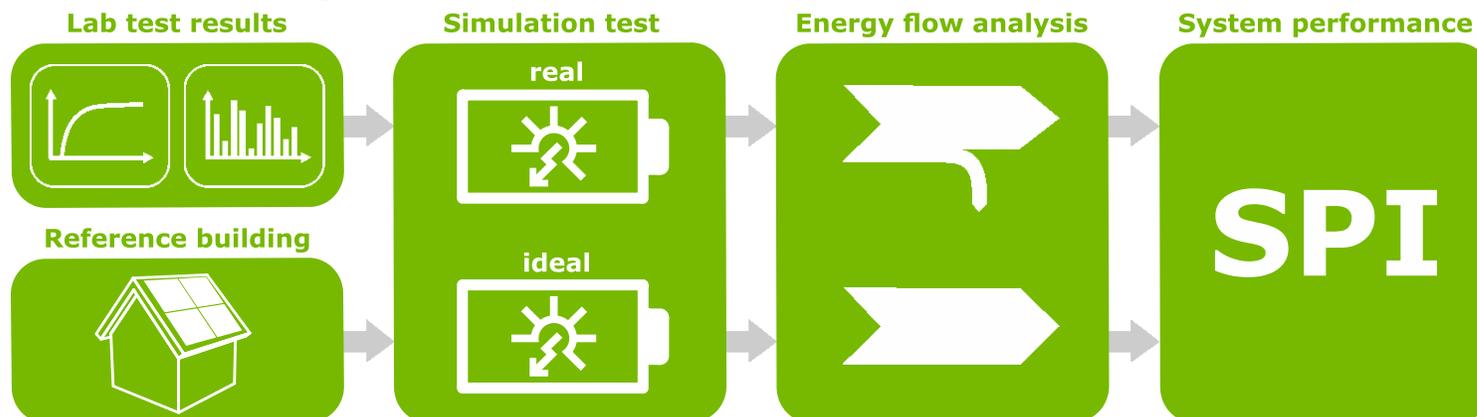


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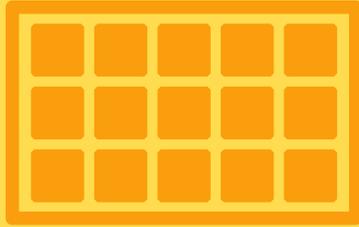
Methodology of the simulation-based system evaluation

- **Simulation of the behavior** of the tested PV-battery systems over a year.
- The System Performance Index (SPI) is used to evaluate the systems based on the energy flows at the **grid connection point**. It considers the different economic values of the energy fed into the grid at 8 ct/kWh and the energy supplied by the grid at 40 ct/kWh.
- Parameterization of the simulation model „**PerMod**“ (version 2.2) based on the laboratory measurement results determined following the efficiency guideline.
- The **sizing, conversion, control, and standby losses** are taken into account based on laboratory measurements.



System Performance Index SPI (5 kW) und SPI (10 kW)

1st reference case for the System Performance Index SPI (5 kW)



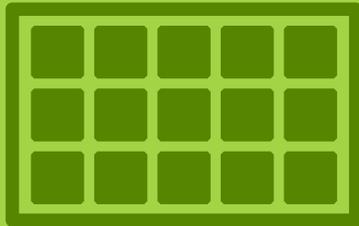
PV system
(5 kW)

+



Appliances
(5010 kWh/a)

2nd reference case for the System Performance Index SPI (10 kW)



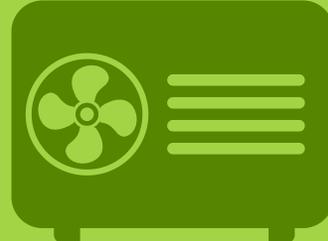
PV system
(10 kW)

+



Appliances
(5010 kWh/a)

+



Heat pump
(2664 kWh/a)

+



Electric vehicle
(1690 kWh/a)

Please note: SPI (5 kW) and SPI (10 kW) are not comparable due to the different characteristics of the two reference cases.

Assignment of the systems to the reference cases

- Depending on the size of the **power electronics** and **battery storage**, the efficiency rating is conducted with the **SPI (5 kW)** or **SPI (10 kW)**.
- Only systems with a usable capacity below **8.0 kWh** were rated with the SPI (5 kW).
- For a rating with the SPI (10 kW), a usable capacity below **16.0 kWh** was required.
- The classification was based on the usable storage capacity determined in the **laboratory test**.
- 4 systems were rated with the SPI (5 kW), and 8 systems were assessed with the SPI (10 kW).



Systems rated with the System Performance Index (SPI)

A1 SAX POWER Home Plus

B1 KOSTAL PLENTICORE MP G3 M 4.6 (AC) and **BYD** Battery-Box HVS+ 7.7

B2 KOSTAL PLENTICORE G3 M 10 (AC) and **BYD** Battery-Box HVS 12.8

B3 KOSTAL PLENTICORE MP G3 M 4.6 (DC) and **BYD** Battery-Box HVS+ 7.7

B4 KOSTAL PLENTICORE G3 M 10 (DC) and **BYD** Battery-Box HVS 12.8

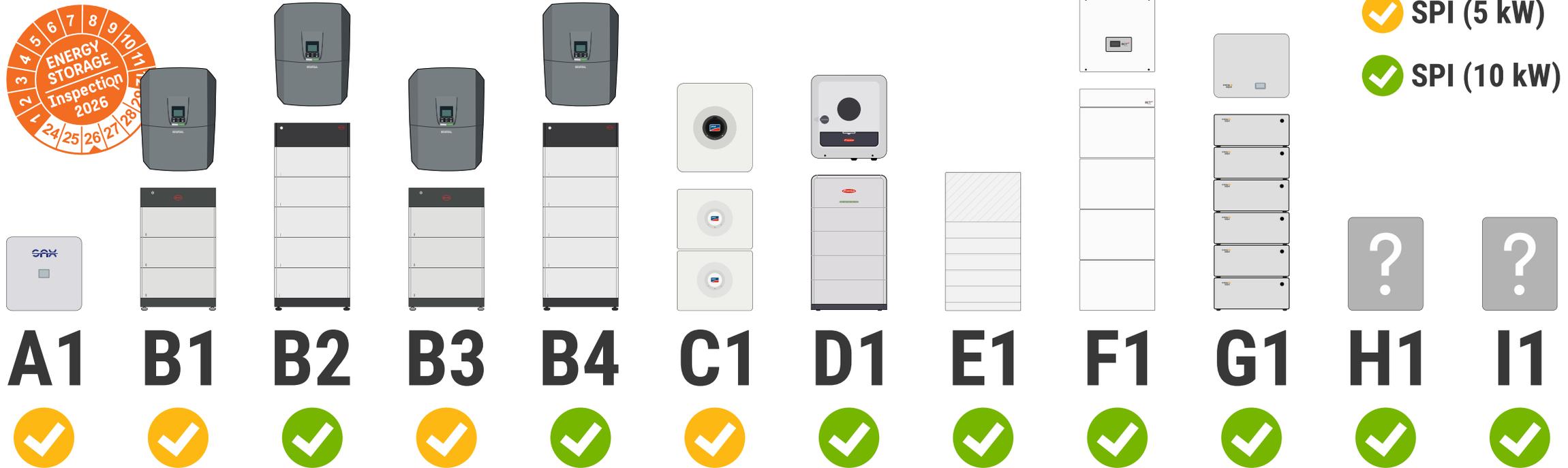
C1 SMA Sunny Boy Smart Energy 5.0 and Home Storage 6.5

D1 FRONIUS Symo GEN24 10.0 Plus SC and Reserva 12.6

E1 FOX ESS PQ-H3-Ultra-10.0 and EQ3300-5

F1 RCT POWER Power Storage DC 10.0 and Power Battery 11.5

G1 ENERGY DEPOT Centurio 10 and DOMUS 2.5



✓ SPI (5 kW)

✓ SPI (10 kW)

A1

B1

B2

B3

B4

C1

D1

E1

F1

G1

H1

I1



AC-coupled

DC-coupled with a hybrid inverter

Definition of the efficiency classes for PV-battery systems

- Due to the different SPI values, the **threshold values** for reaching the individual **efficiency classes** vary.

Class	Rating	SPI (5 kW)	SPI (10 kW)
A	very good	$\geq 92.5 \%$	$\geq 94.5 \%$
B	very good	$\geq 90.5 \%$	$\geq 93.5 \%$
C	good	$\geq 88.5 \%$	$\geq 92.5 \%$
D	good	$\geq 86.5 \%$	$\geq 91.5 \%$
E	satisfactory	$\geq 84.5 \%$	$\geq 90.5 \%$
F	satisfactory	$\geq 82.5 \%$	$\geq 89.5 \%$
G	inadequate	$< 82.5 \%$	$< 89.5 \%$

THE MOST EFFICIENT HOME STORAGE SYSTEMS IN 2026

5 kW class

SPI (5 kW)



SAX POWER
Home Plus

93.2 %



SMA Sunny Boy Smart Energy 5.0
and Home Storage 6.5

92.8 %

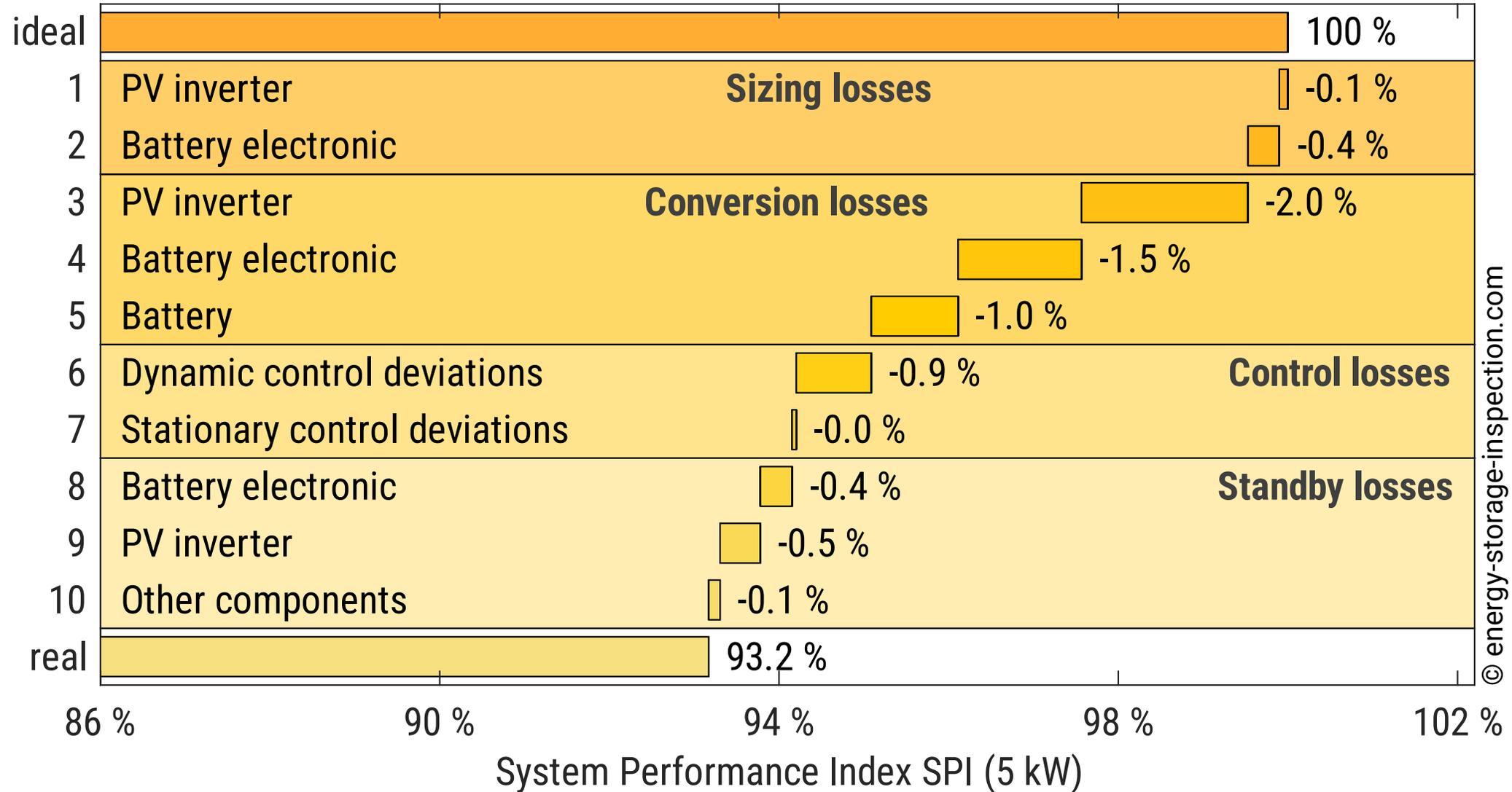


KOSTAL PLENTICORE MP G3 M 4.6
and **BYD** Battery-Box HVS+ 7.7

92.7 %

Influence of different losses on the SPI (5 kW)

Battery system with multi-level-topology: SAX Power Home Plus



Loss analysis of the systems assessed with the SPI (5 kW)

	A1	C1	B3	B1
SPI (5 kW) in %	93.2	92.8	92.7	91.9
Efficiency class	A	A	A	B
Sizing losses in %	0.5	0.6	0.6	0.4
Conversion losses in %	4.4	5.0	6.0	6.4
Control losses in %	0.9	0.5	0.2	0.2
Standby losses in %	1.0	1.2	0.5	1.1
Total losses in %	6.8	7.2	7.3	8.1

THE MOST EFFICIENT HOME STORAGE SYSTEMS IN 2026

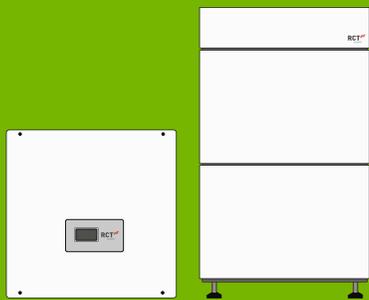
10 kW class

SPI (10 kW)



FOX ESS
PQ-H3-Ultra-10.0 and EQ3300-5

97.0 %



RCT POWER Power Storage DC 10.0
and Power Battery 11.5

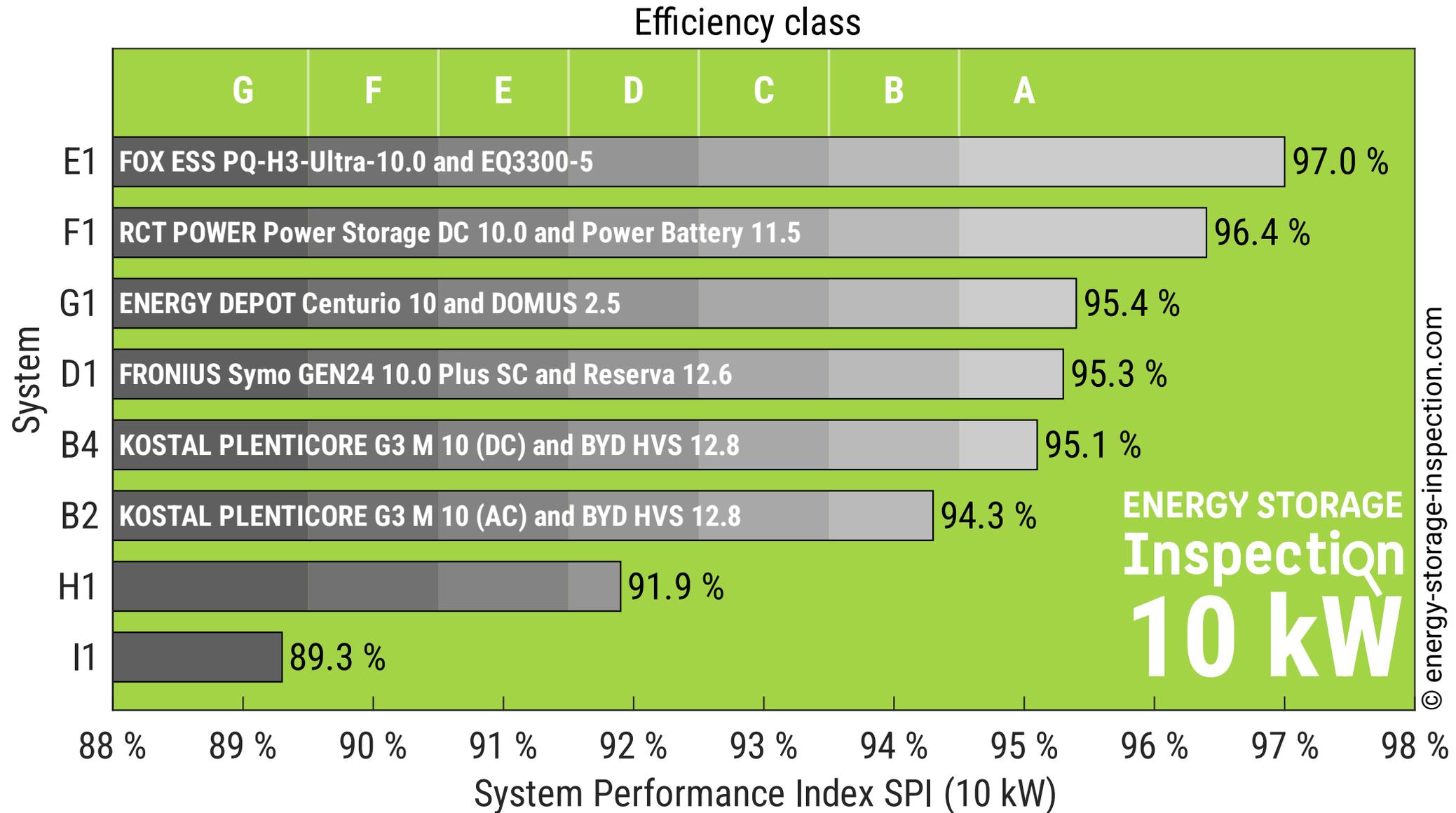
96.4 %



ENERGY DEPOT
Centurio 10 and DOMUS 2.5

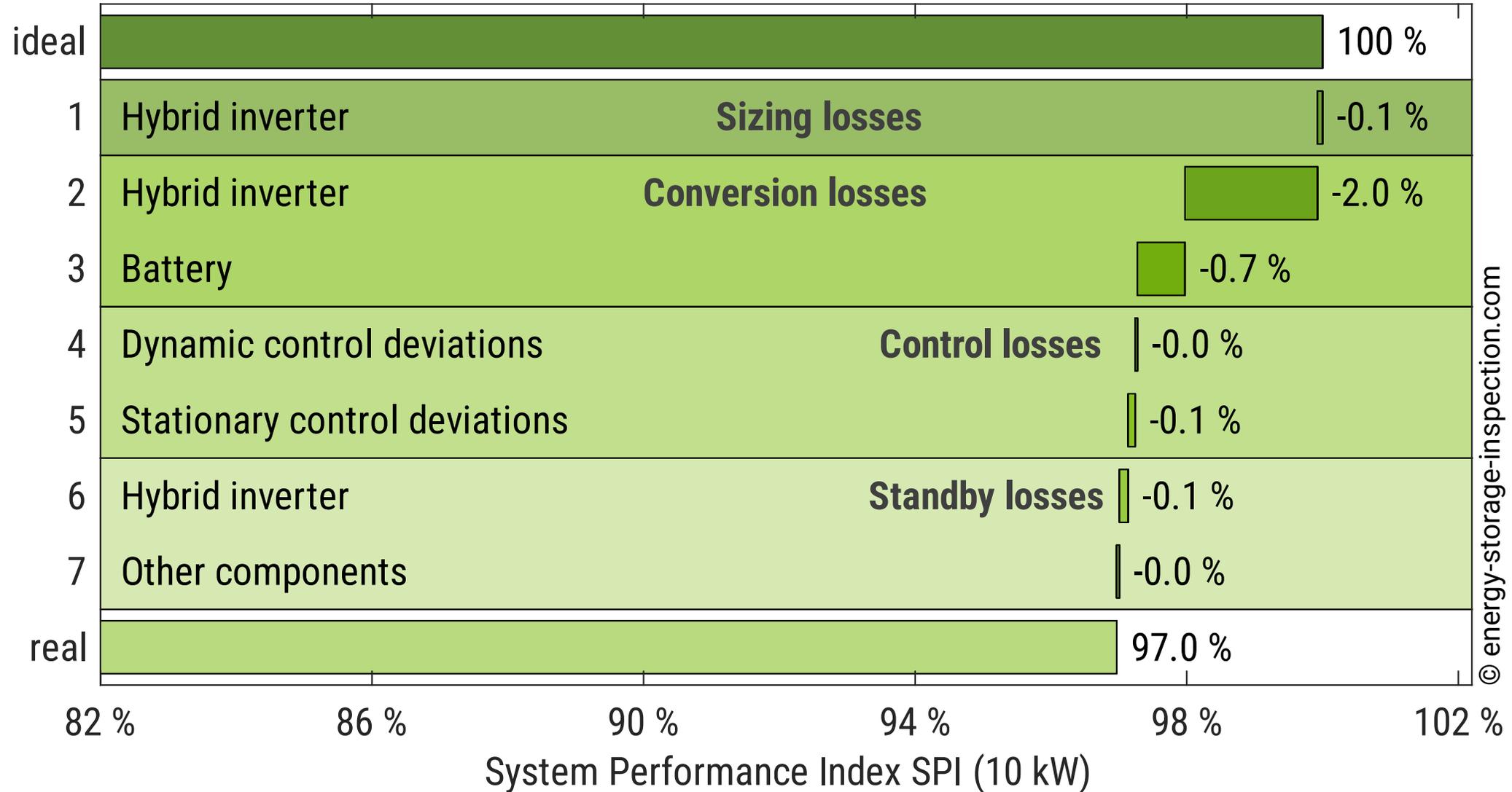
95.4 %

SPI (10 kW) and efficiency classes of the analyzed systems



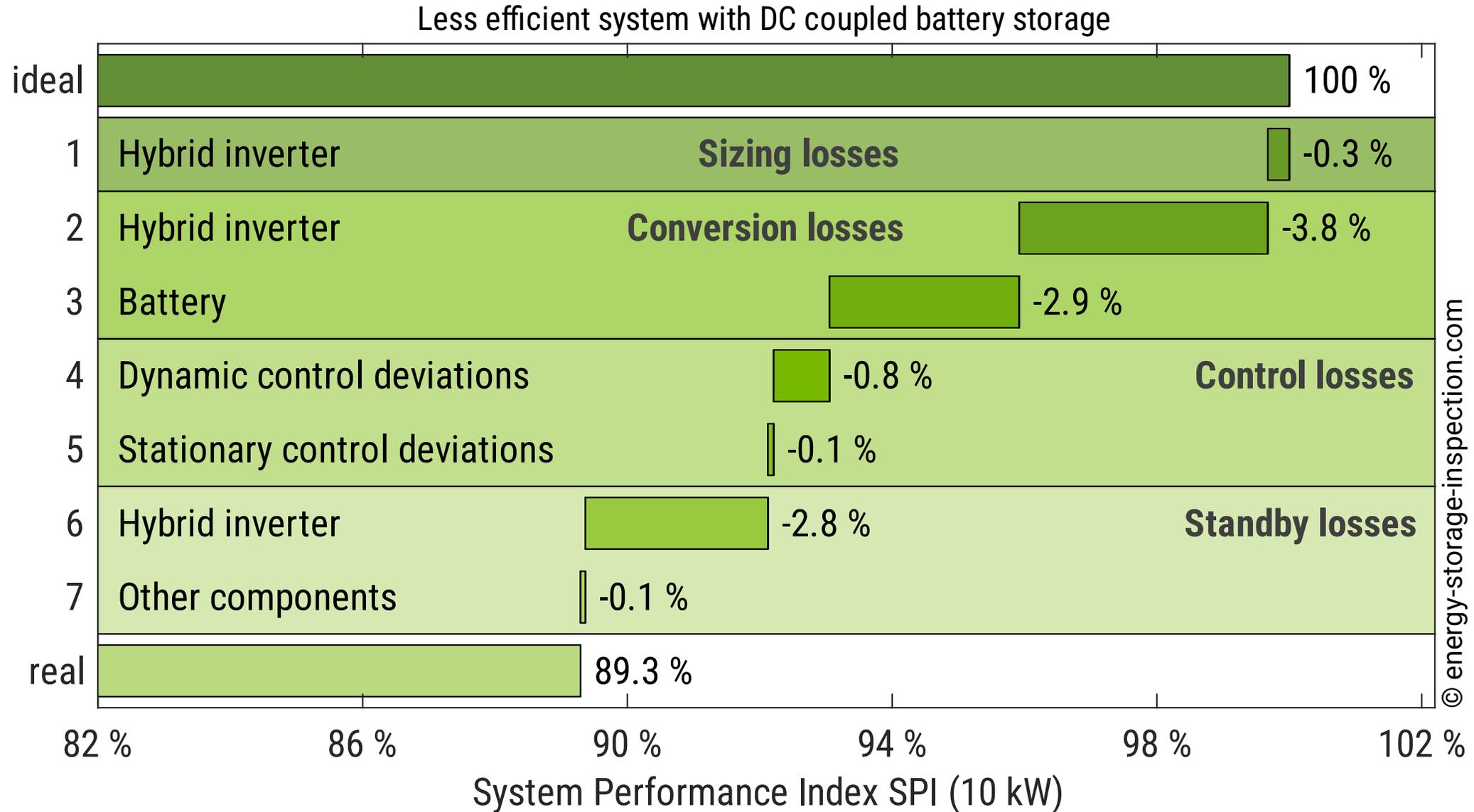
Influence of different losses on the SPI (10 kW)

System E1: FOX ESS PQ-H3-Ultra-10.0 and EQ3300-5



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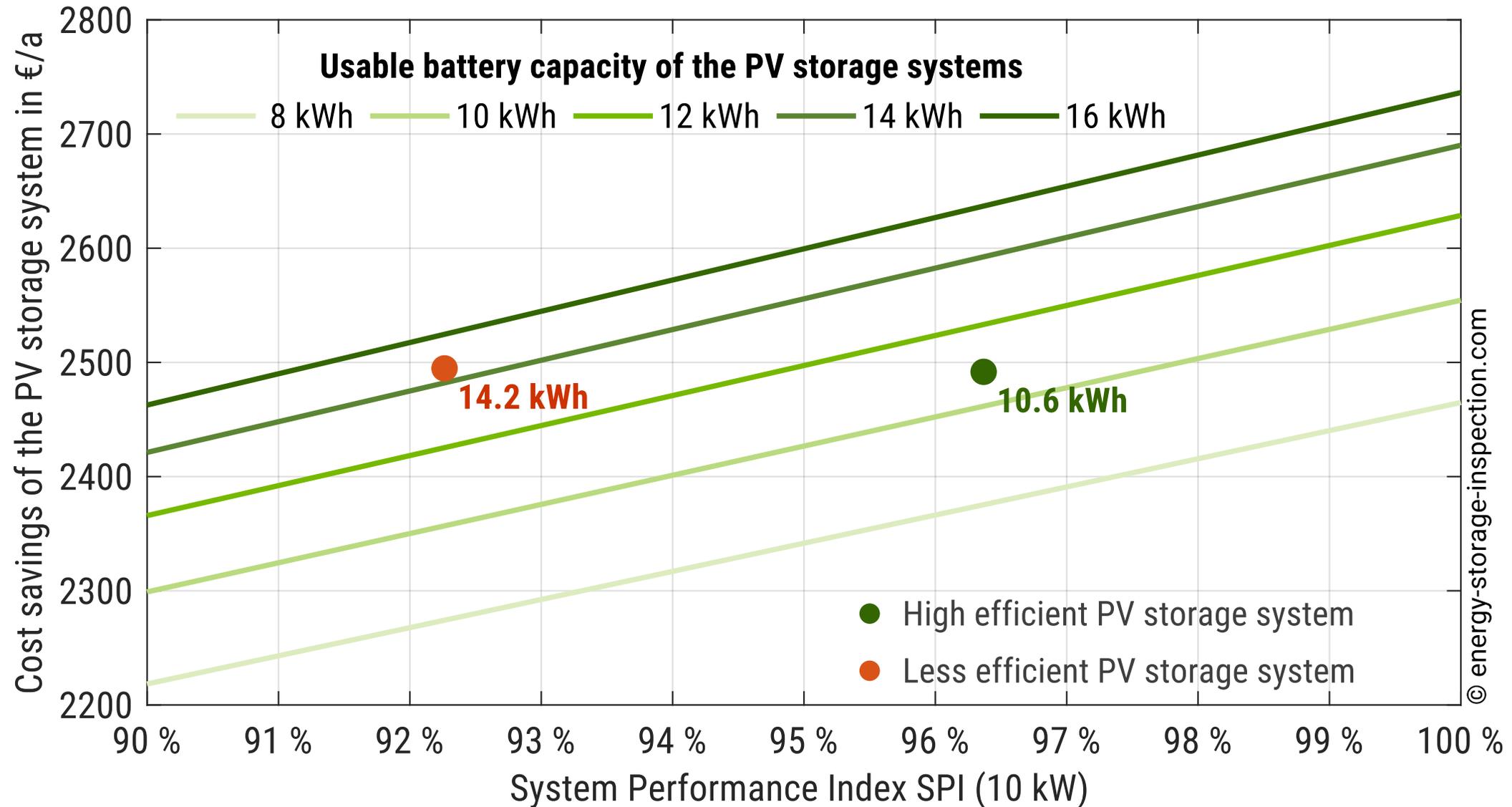
Influence of different losses on the SPI (10 kW)



Loss analysis of the systems assessed with the SPI (10 kW)

	E1	F1	G1	D1	B4	B2	H1	I1
SPI (10 kW) in %	97.0	96.4	95.4	95.3	95.1	94.3	91.9	89.3
Efficiency class	A	A	A	A	A	B	D	G
Sizing losses in %	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3
Conversion losses in %	2.7	2.8	3.7	3.8	4.1	4.6	5.9	6.6
Control losses in %	0.1	0.6	0.1	0.4	0.3	0.3	1.0	0.9
Standby losses in %	0.2	0.2	0.6	0.5	0.4	0.8	0.8	2.8
Total losses in %	3.0	3.6	4.6	4.7	4.9	5.7	8.1	10.7

Cost savings of storage systems with different levels of efficiency



The storage capacity of the highly efficient system, which has an SPI (10 kW) of 96.4 %, is 3.6 kWh lower than that of the less efficient system from the Energy Storage Inspection 2025, which achieves an SPI (10 kW) of only 92.3 %. Both systems can save approximately 2,500 € per year.

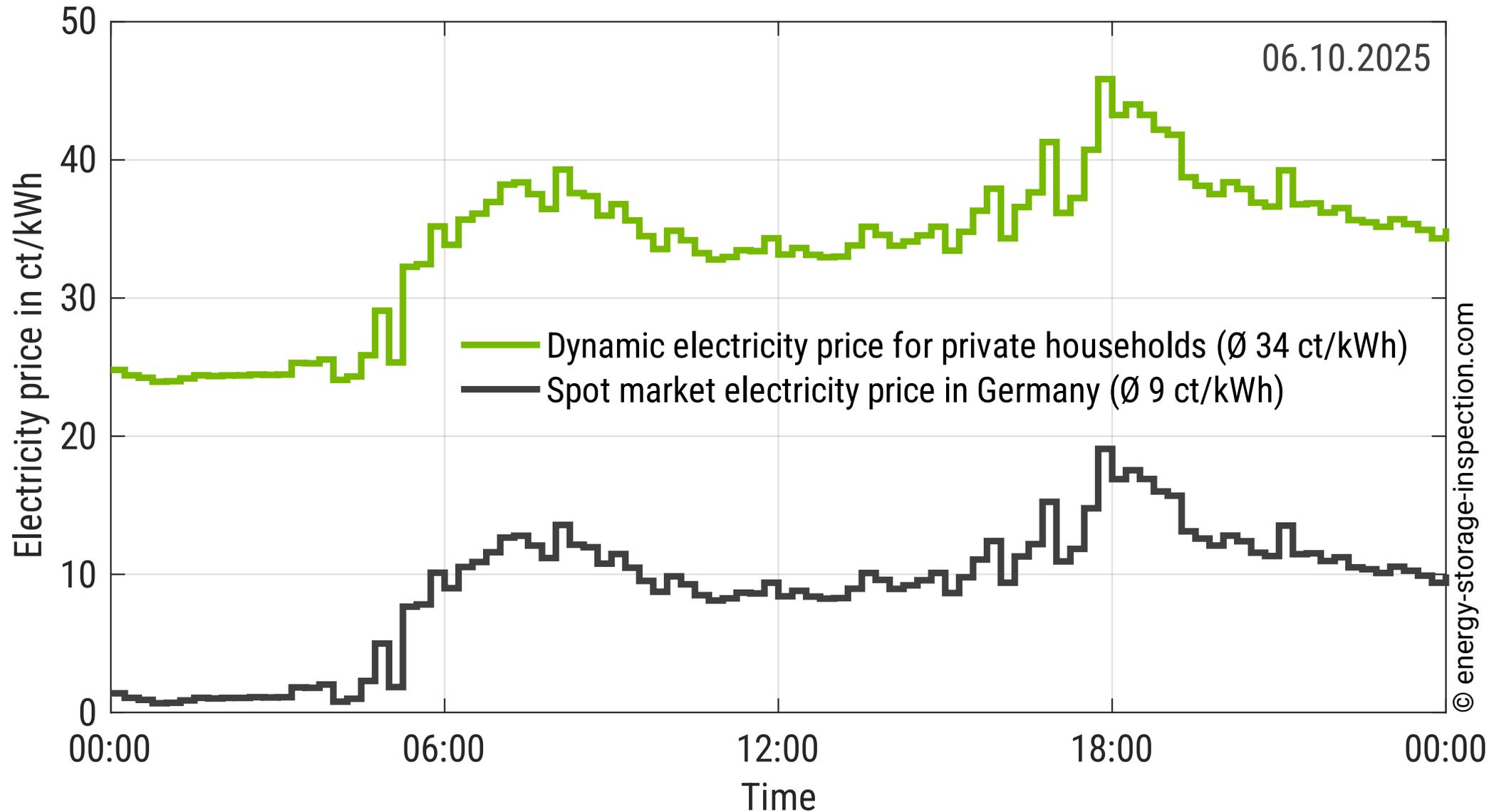
Summary of the results of the SPI assessment

- The Energy Storage Inspection 2026 assessed the energy efficiency of **12 battery systems** using the System Performance Index (SPI).
- In the **reference case up to 5 kW** the AC-coupled system Home Plus from SAX Power came out on top with an SPI (5 kW) of **93.2 %**. It was closely followed by the SMA Sunny Boy Smart Energy 5.0 and Home Storage 6.5 as well as the KOSTAL PLENTICORE MP G3 M 4.6 (DC) and BYD Battery-Box HVS+ 7.7.
- The system FOX ESS PQ-H3-Ultra-10.0 and EQ3300-5 achieved the highest **SPI (10 kW)** with a value of **97.0 %** and set a new record. RCT Power and Energy Depot were ranked second and third.
- 10 of the 12 systems tested scored with a **very good system efficiency** and achieved either the efficiency classes A or B.
- However, the range of system efficiency is still **very wide** – the least efficient system only achieved the **efficiency class G**.

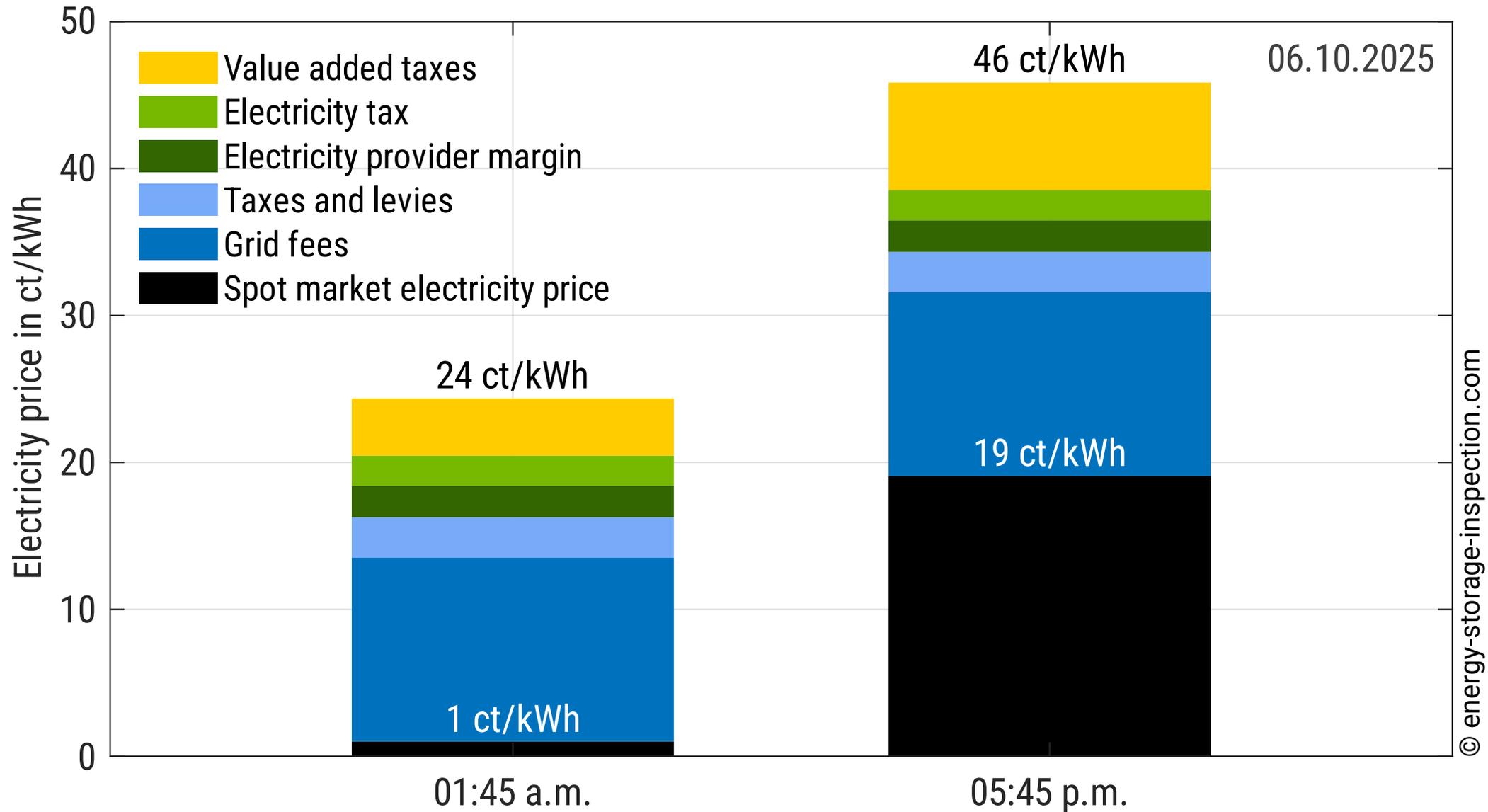
Main topics of the Energy Storage Inspection 2026

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Differences between dynamic electricity and spot market prices

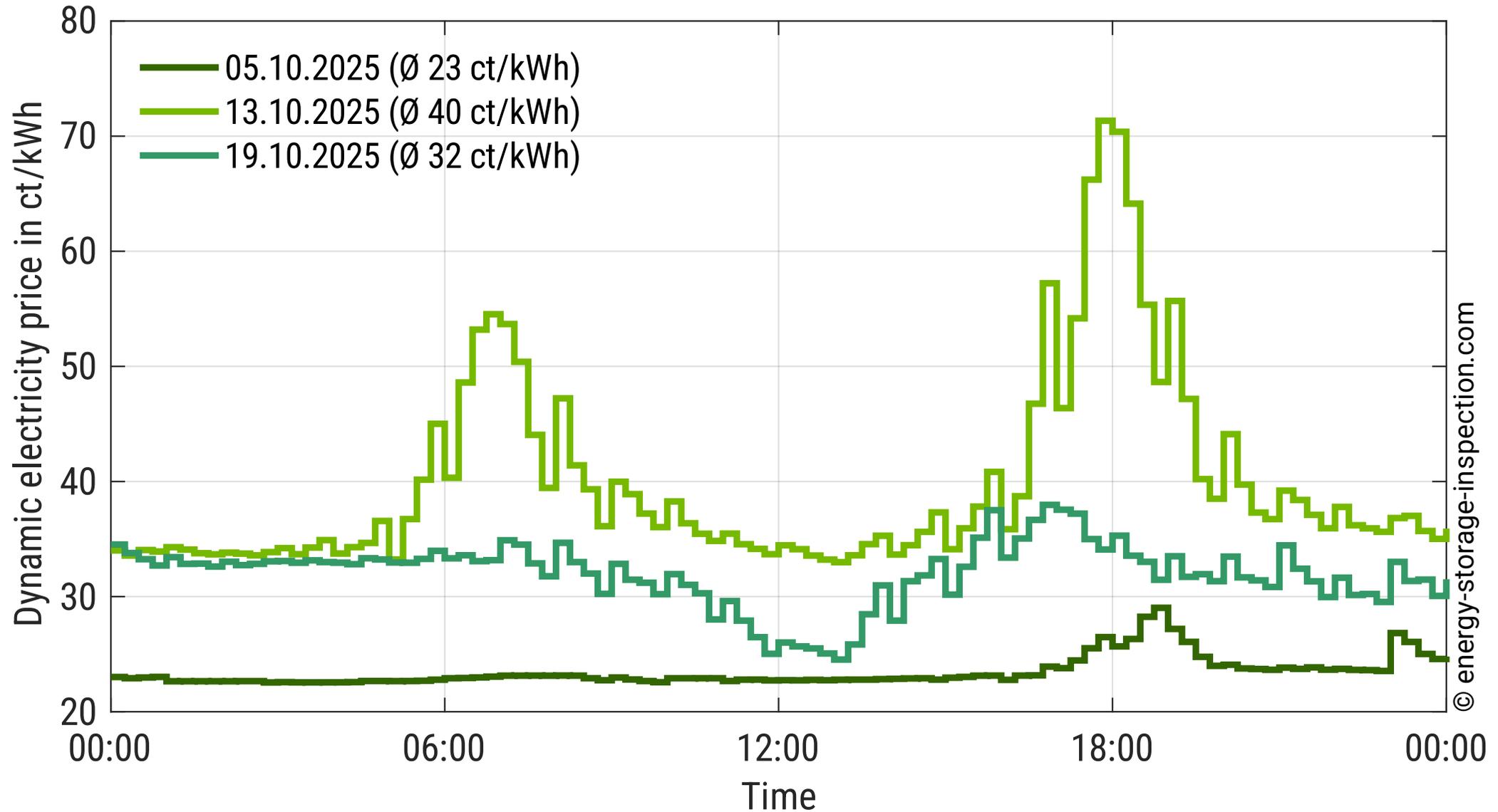


Differences between dynamic electricity and spot market prices



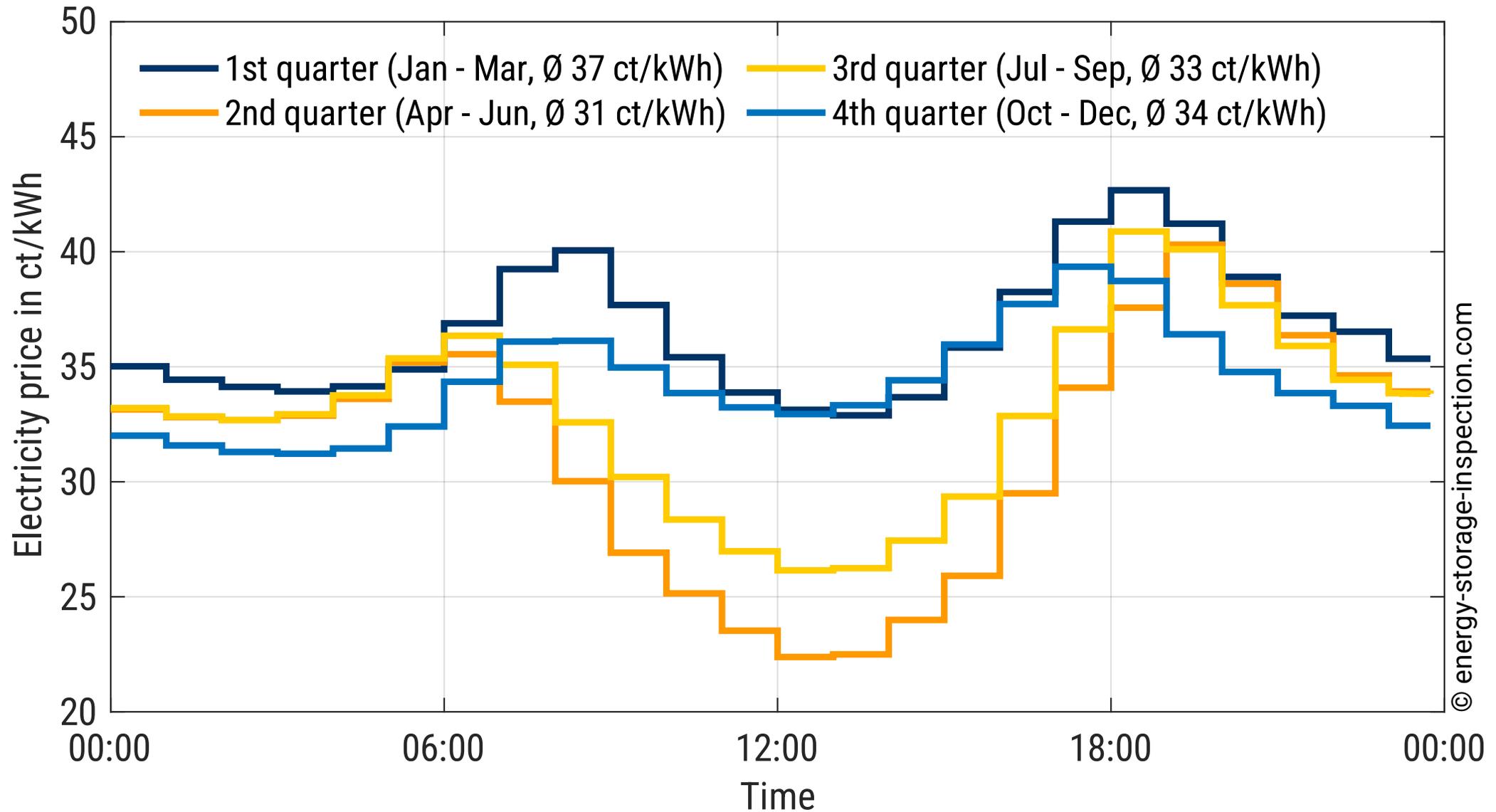
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Fluctuation of dynamic electricity prices on different days



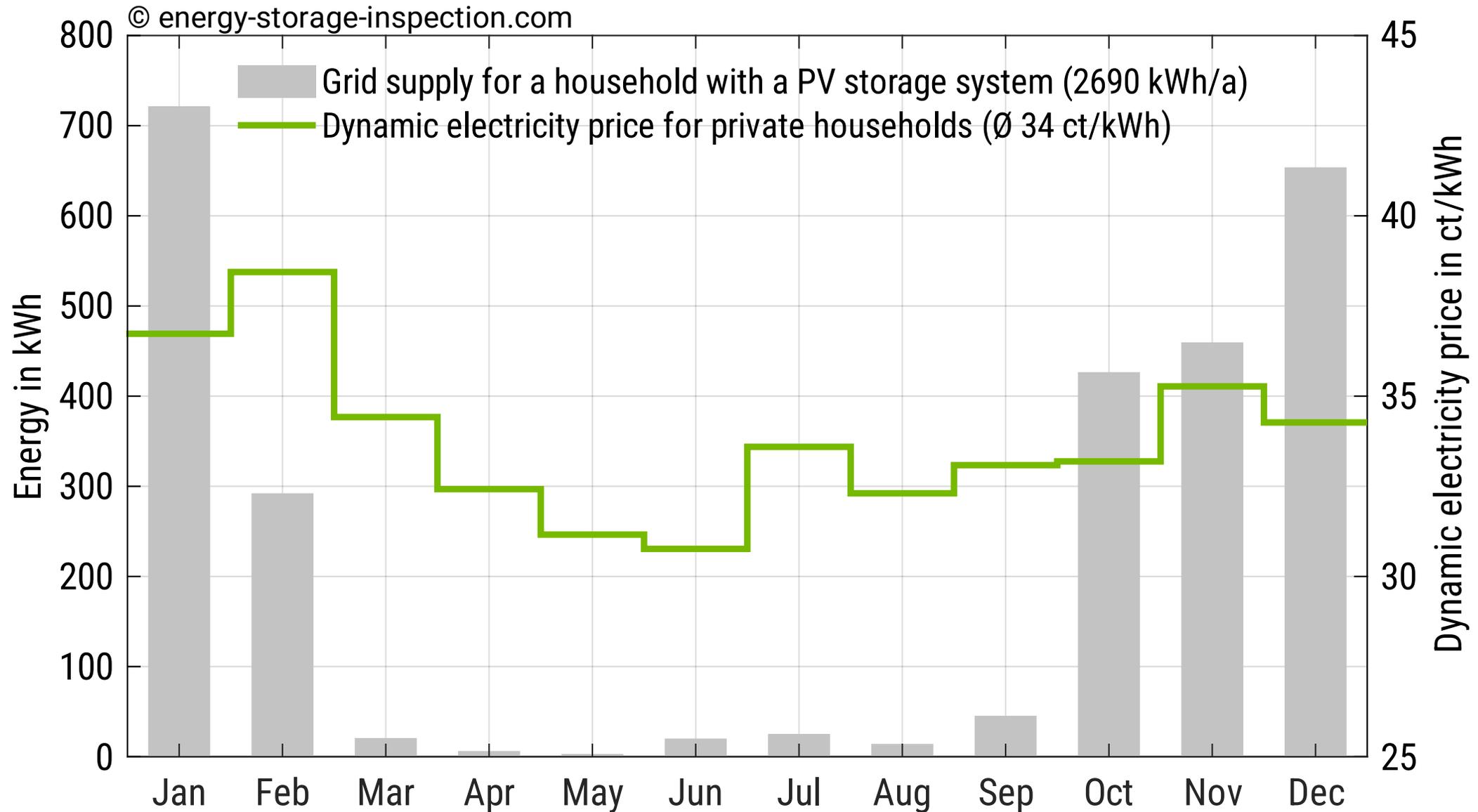
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Variation of dynamic electricity prices over the annual cycle



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Dynamic electricity prices for households with PV-battery system



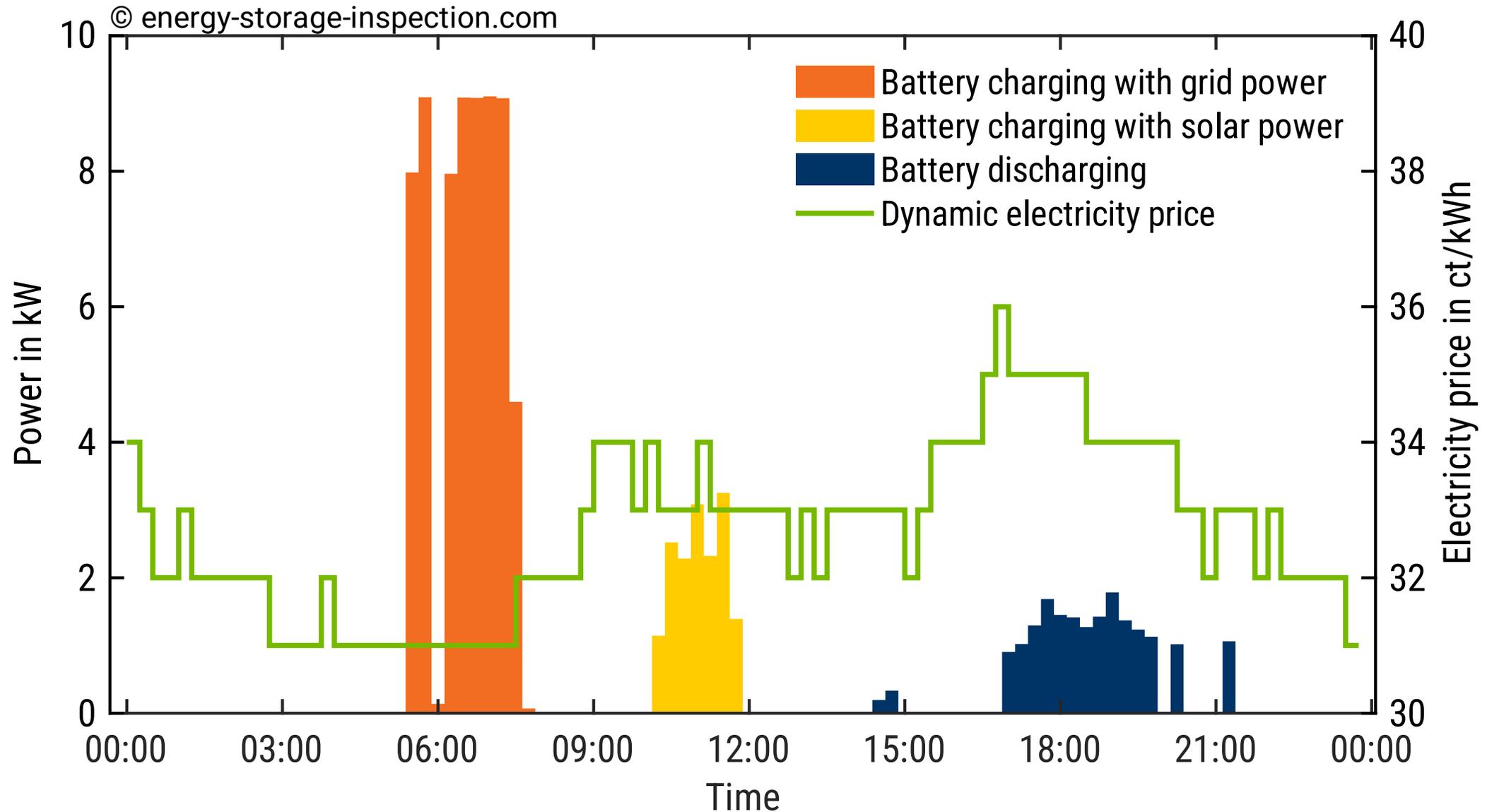
Can the battery storage system be charged using grid power?

- Yes. Battery systems used in combination with a PV system can be charged using electricity from the grid. However, for households with energy storage systems, this can only result in an economic benefit if
 - they have signed up for a **dynamic electricity tariff**
 - the battery storage system draws electricity from the grid during **off-peak hours**, and
 - the stored grid electricity is then supplied to the household's electrical appliances during **peak-price periods**.
- To achieve this, households must be equipped with a so-called **smart metering system (iMSys)**. When electricity from the grid is stored in the battery, the temporarily stored grid electricity may not currently be fed back into the grid.

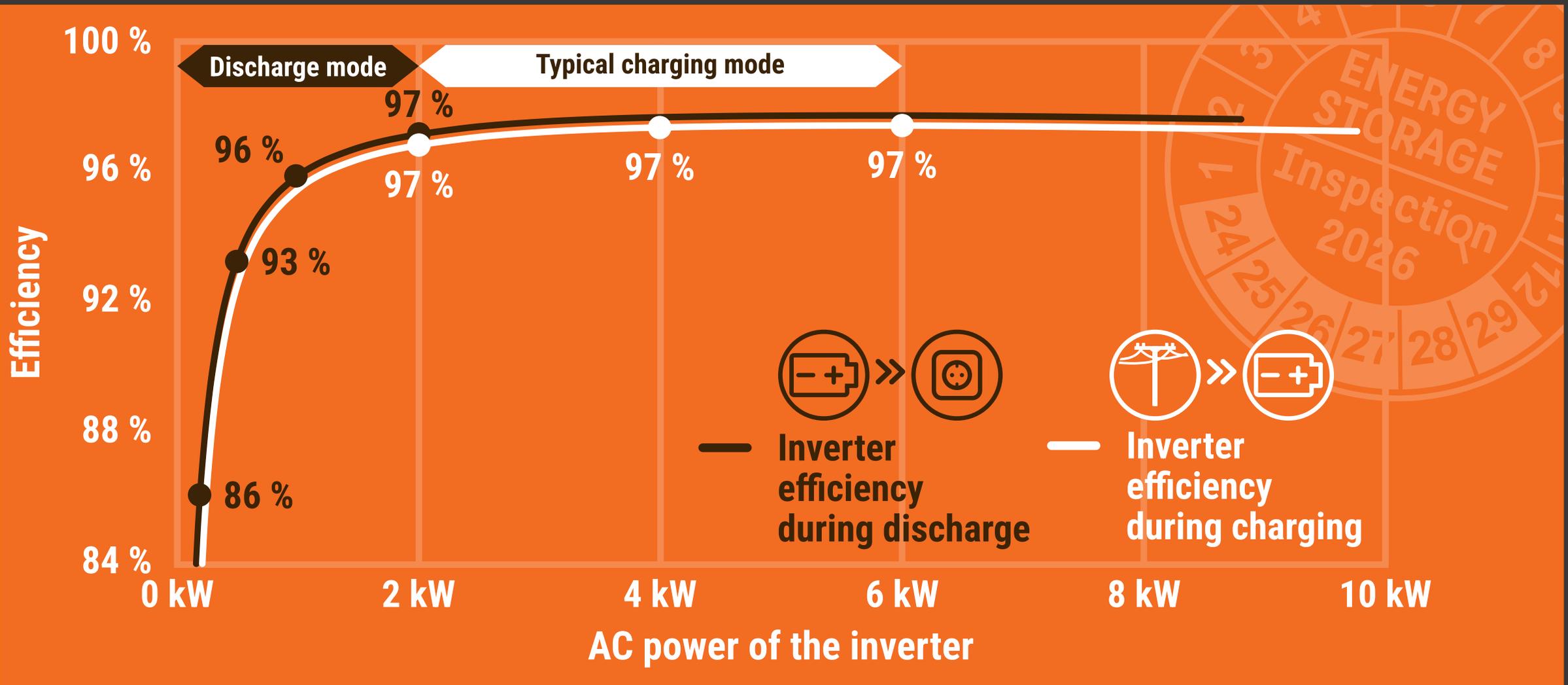
What is needed to charge the battery with power from the grid?

- Prerequisite is an **intelligent energy management system** that automatically generates a cost-optimized **operating schedule** for the battery storage system for the coming hours and continuously updates it. This requires at least the following data or forecasts:
 - **State of charge**: Information on the current battery charge level and therefore the available energy capacity of the battery storage system.
 - **Consumption forecast**: Forecast of the household's individual electricity consumption over the next one to two days.
 - **PV forecast**: Forecast of the PV system's generation profile for the next one to two days, taking weather conditions into account.
 - **Price forecast**: Forecast of the electricity price at 15-minute intervals for the current day and the following day.

Charging the battery storage system during off-peak periods

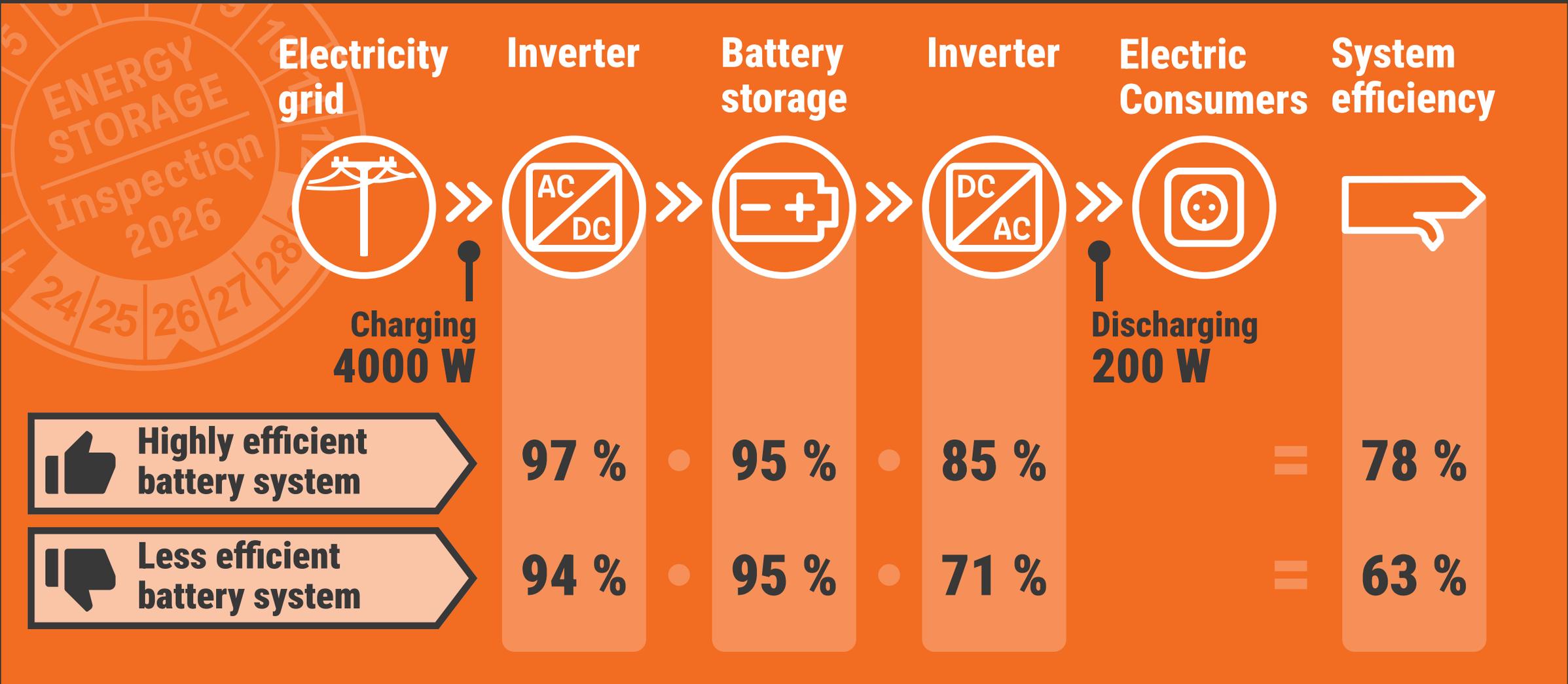


THIS IS HOW EFFICIENT CHARGING WITH GRID POWER CAN BE



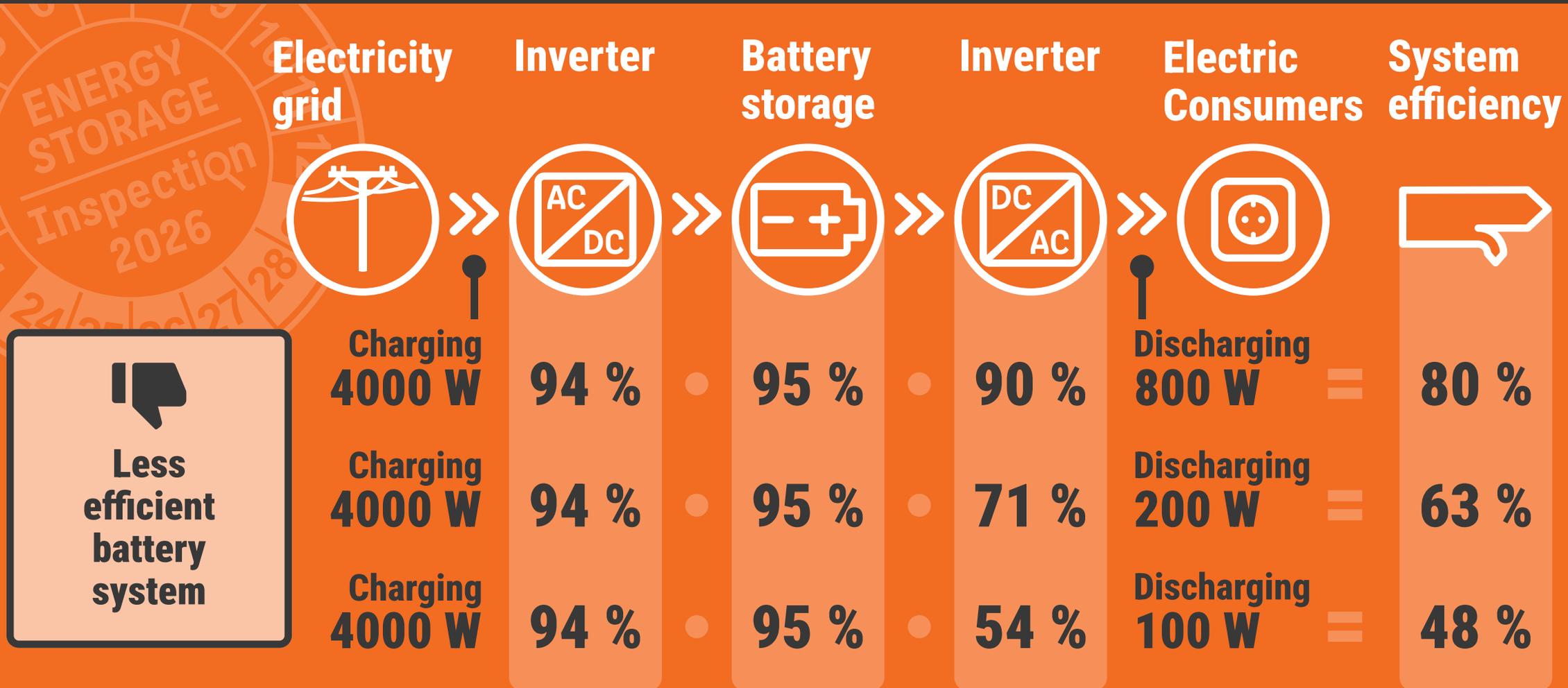
Conversion efficiencies for the highly efficient battery system: FRONIUS Symo GEN24 10.0 Plus SC and Reserva 12.6
All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

EFFICIENCY LOSSES WHEN STORING GRID POWER



Conversion efficiencies for the highly efficient battery system: FRONIUS Symo GEN24 10.0 Plus SC and Reserva 12.6
 All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

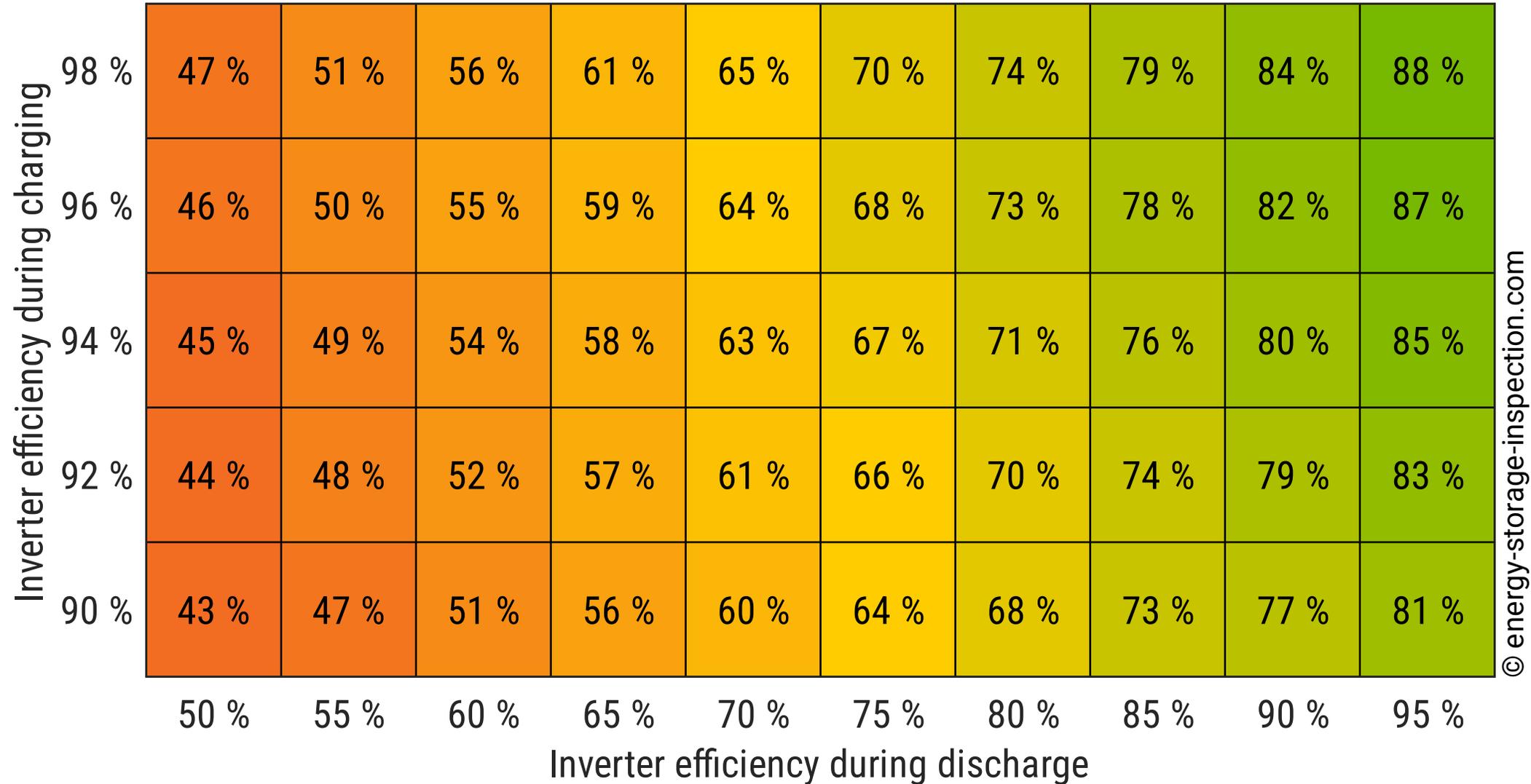
HOW MUCH DOES THE DISCHARGE POWER AFFECT EFFICIENCY?



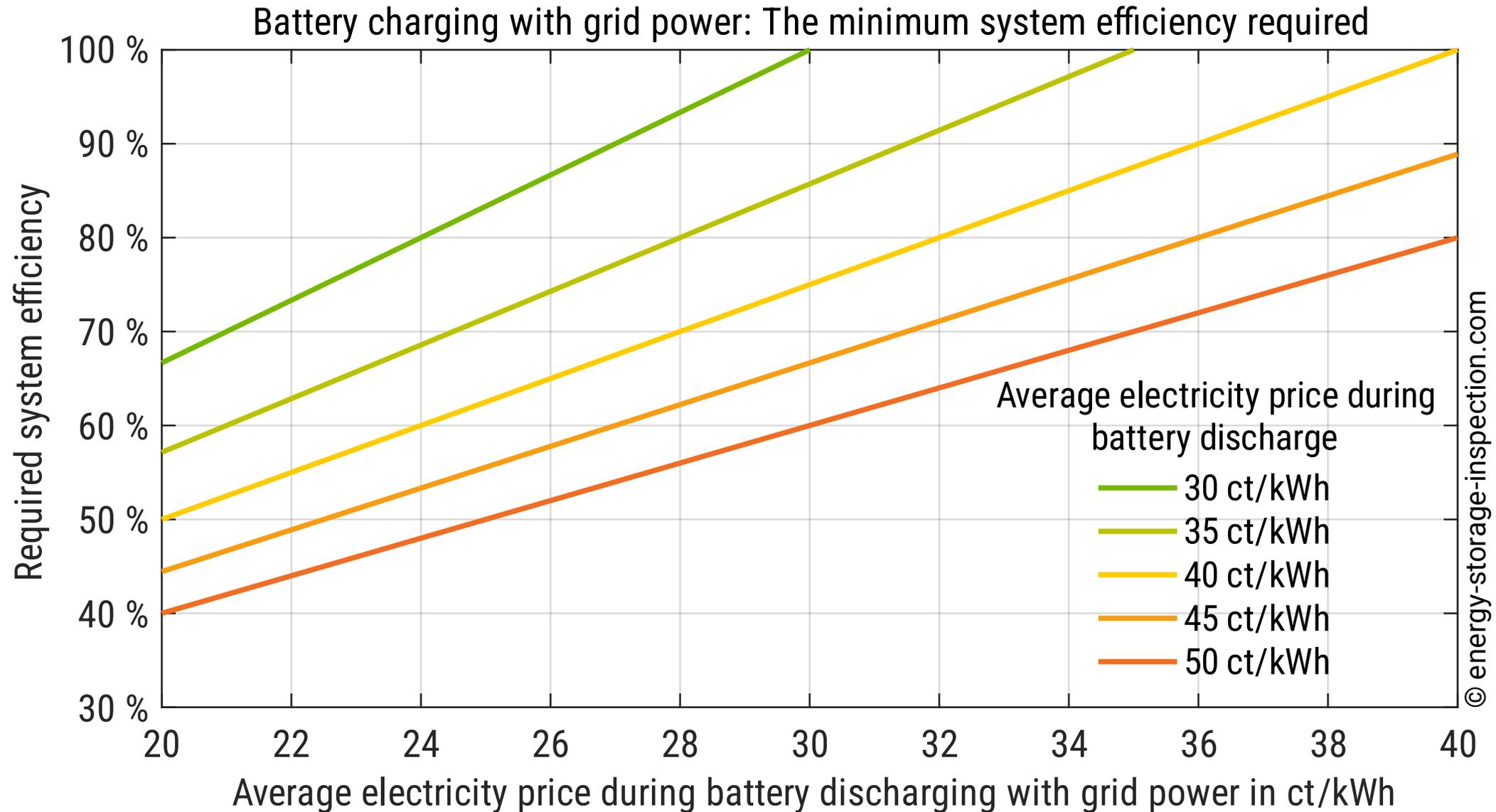
Exemplary values for a less efficient battery system with a low inverter efficiency during discharge
 All test results from the Energy Storage Inspection 2026: www.energy-storage-inspection.com

System efficiency of storing power from the grid

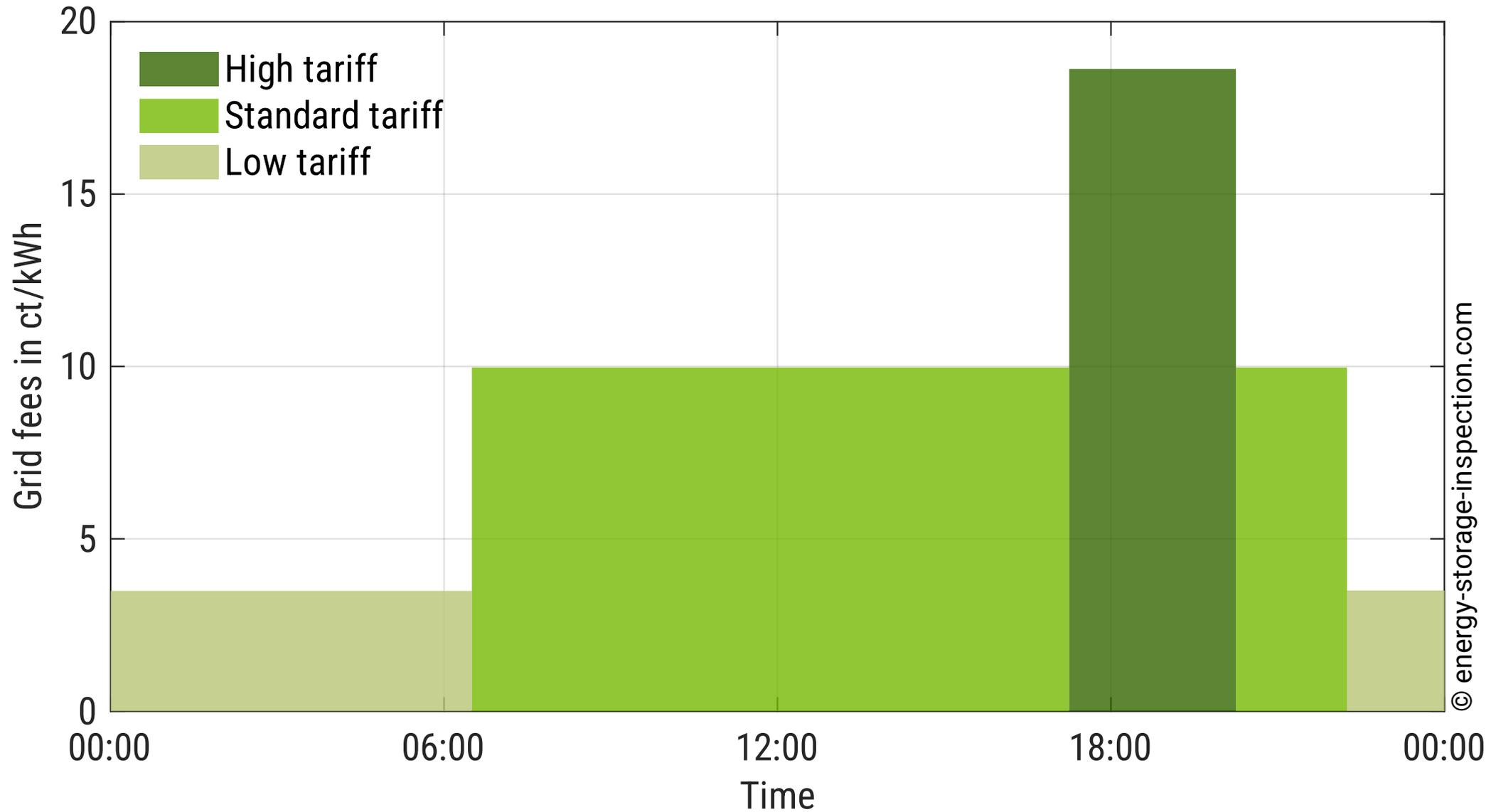
System efficiency of grid power storage (including battery storage losses)



Required system efficiency of storing power from the grid

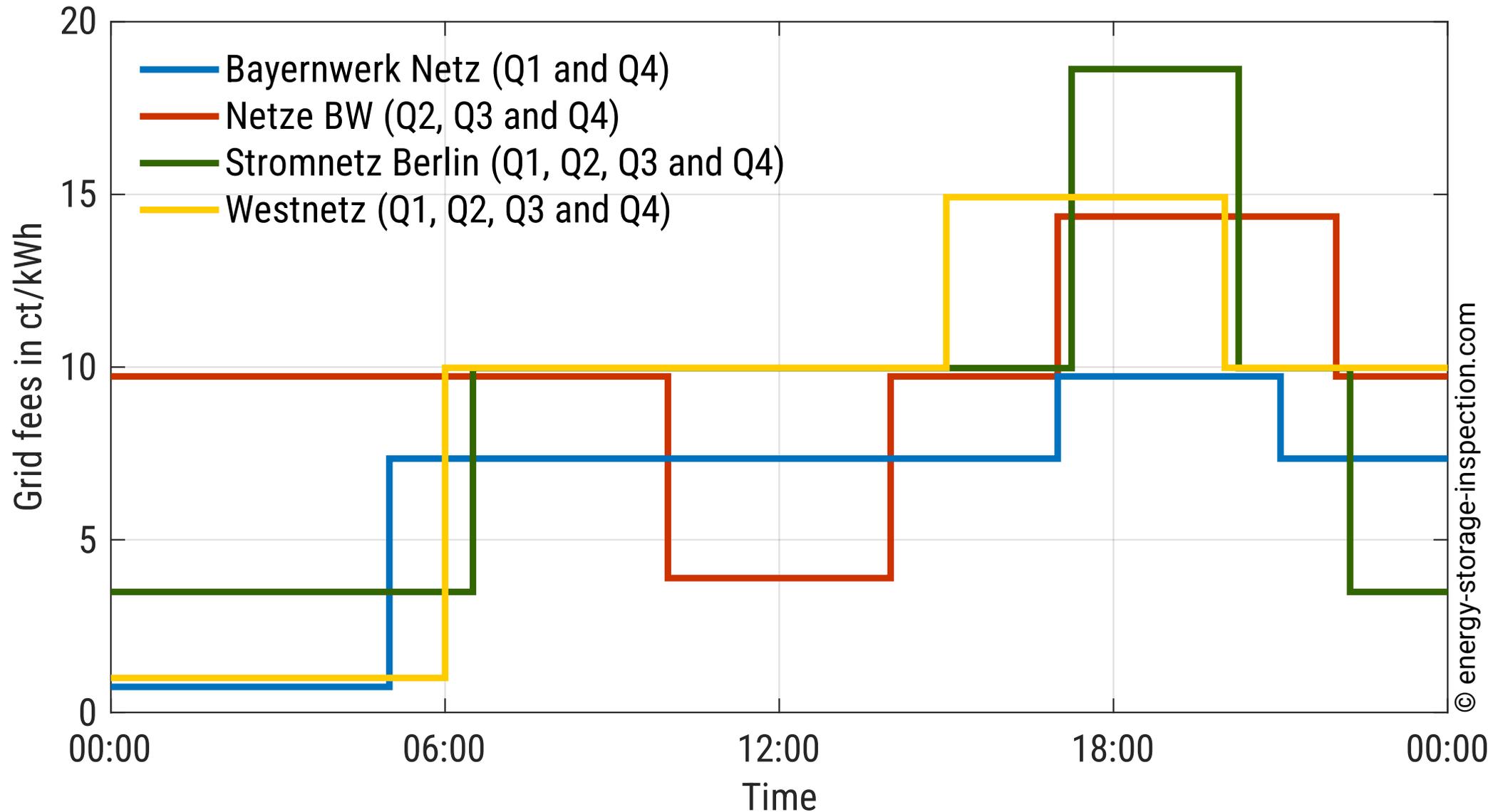


Time-of-use grid fees throughout the day



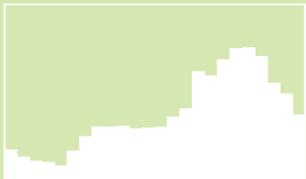
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Time-of-use grid fees charged by different grid operators



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Glossary – Warranty terms for energy storage systems

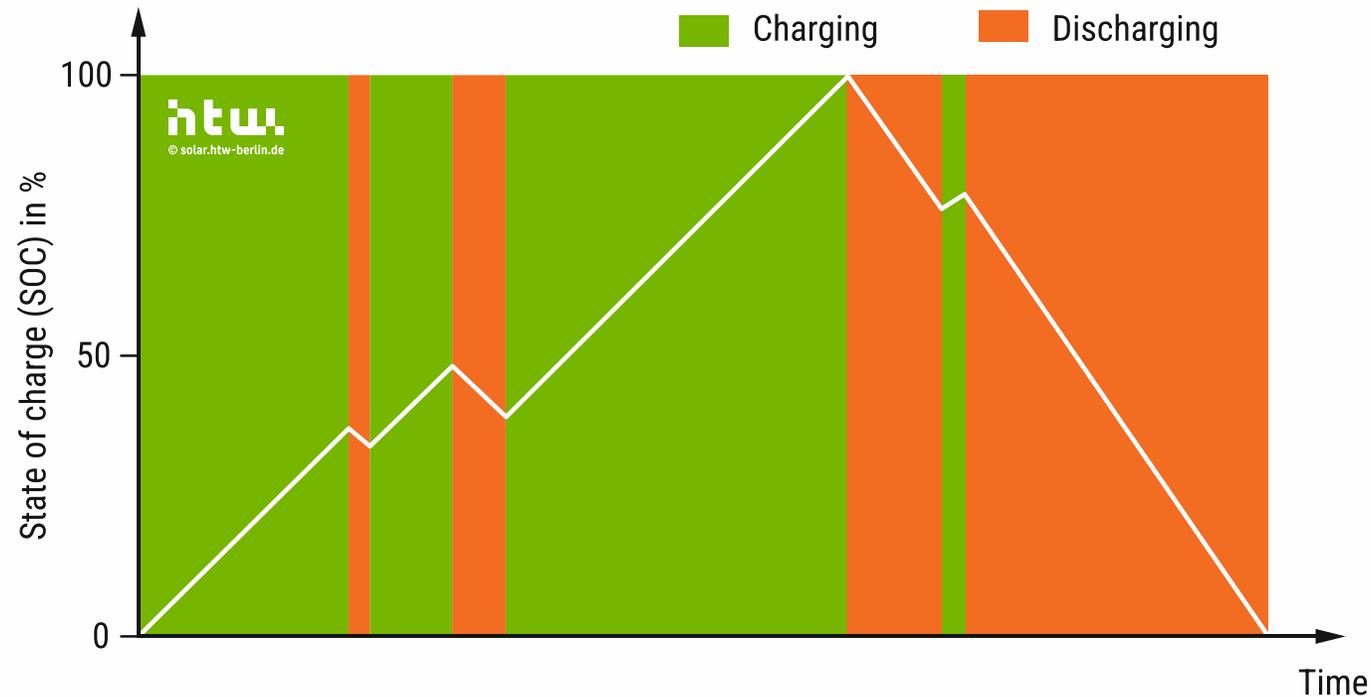
Manufacturer's warranty: This warranty is an additional, voluntary benefit provided by the manufacturer. The terms and limitations of the warranty are determined by the warranty providers, so the warranty conditions can vary significantly in practice. The manufacturer's warranty applies in addition to the statutory warranty and does not limit the rights arising therefrom. For PV-battery systems and their components, a product warranty is generally provided, and for the battery, an additional capacity or performance warranty is granted.

Product warranty: The product warranty guarantees that the system components will be free of defects and fully functional for a specified period of time. It can be viewed as a type of extension of statutory warranty claims. The product warranty may cover various components of PV-battery systems, such as the power electronics or the battery.

Residual capacity: Remaining capacity refers to a specific percentage of the usable or nominal battery capacity that should still be available at the end of the warranty period.

Glossary – Warranty terms for energy storage systems

Full and partial cycles: In the field of batteries, a cycle refers to the combination of a charge and a discharge. A full cycle occurs when a fully discharged cell is fully charged and then fully discharged again. Incomplete discharge and charge are referred to as partial cycles. In practice, full and partial cycles overlap. Manufacturer warranties generally refer to full cycles or so-called equivalent full cycles. In the latter case, the partial cycles are added together to form full cycles.



Glossary – Warranty terms for energy storage systems

Energy throughput: This term describes the total energy delivered by the battery storage system over a specific time interval. In the context of the warranty terms, this value refers to the warranty period. The energy throughput may be specified per kilowatt hour of storage capacity or may refer to the total storage capacity.

Performance warranty: The performance warranty is intended to assure buyers that the battery storage system

- will not fall below the residual capacity defined by the manufacturer during the warranty period,
- will achieve a specified minimum energy throughput, or
- will reach a guaranteed number of cycles.

In other words: If the specified energy throughput or number of cycles is exceeded before the end of the warranty period, a warranty claim based on the residual capacity subsequently falling below the specified level is excluded. Higher guaranteed values are therefore advantageous for end users.

Glossary – Warranty terms for energy storage systems

Current value warranty: Product or performance warranties are sometimes supplemented by a current value warranty. Instead of repairing or replacing the product, the manufacturer may also choose to provide a refund equal to the current market value at the time the warranty takes effect. This value may be defined differently depending on the manufacturer. In some warranty terms, it is predetermined and calculated by deducting a fixed percentage of the original purchase price each year. The current market value is often calculated based on a linear annual depreciation assumed over a 10 year period. The loss in value is thus distributed evenly over the years. In other cases, the manufacturer determines, at its own discretion, what market value the product would have had at the time the warranty took effect if it were not deficient.

Time in years	1	2	3	4	5	6	7	8	9	10
Replacement value in %	100	90	80	70	60	50	40	30	20	10

What do battery manufacturers guarantee?

System provider	1	2	3	4	5	6	7	8	9
Product warranty in a	10	15	15	10	10	10	10	10	5
Performance warranty in a	12	15	15	10	10	10	10	10	10
Energy throughput in MWh/kWh	-	4.1	4.2	3.0	8.5	2.9	-	-	2.6
Maximum number of full cycles	6000	-	-	-	10000	-	-	-	
Remaining capacity in %	70	60	60	85	80	80	80	-	70

Key points to consider when comparing warranty terms

Start of warranty: The warranty does not always begin at the time of purchase or when the system is put into operation. In some cases, the start date may already have passed, as it coincides with the manufacturer's delivery.

Duration of warranty: The warranty period may vary depending on the manufacturer. Registration is often required to extend the warranty period. In addition, the registration period is usually limited.

Warranty coverage : The key question here is: "Which costs are covered in the event of damage?" Some manufacturers only provide a replacement unit or replacement parts under warranty. Costs for installation, removal, or travel may sometimes have to be covered by the customer.

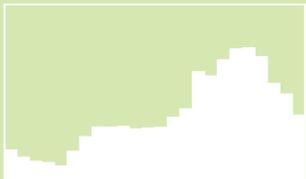
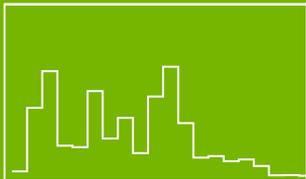
Key points to consider when comparing warranty terms

Warranty exclusions: All manufacturers list criteria that exclude warranty claims. In addition to certain installation and operating requirements, a permanent internet connection may be necessary. The burden of proof imposed may be difficult to meet under certain circumstances.

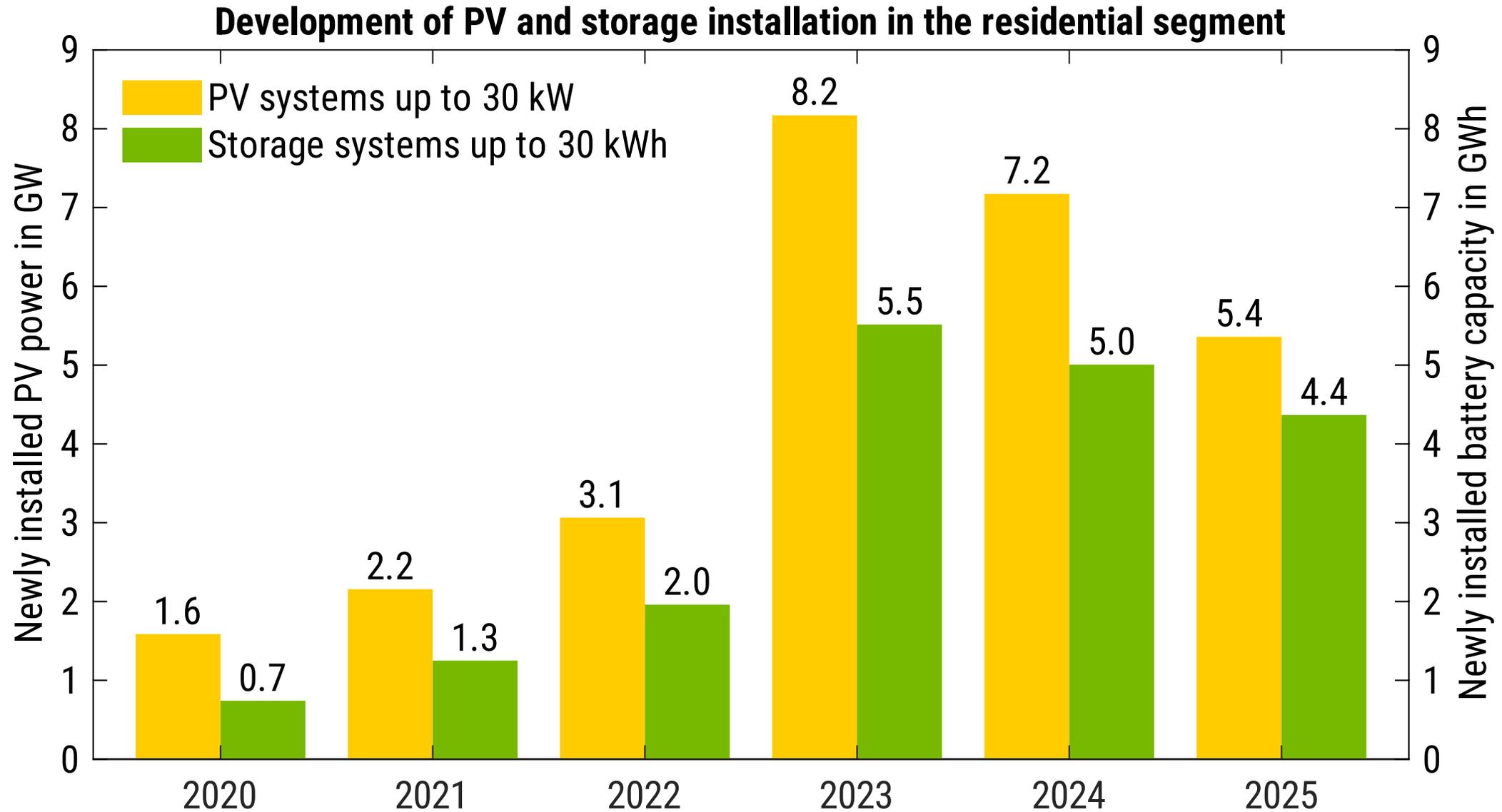
Report a warranty claim: Some manufacturers require that damage be reported within a few business days. The deadline should be determined immediately upon the occurrence of the damage. It is helpful if the warranty claim process is described in the warranty terms and conditions.

Warranty transferability: The warranty cannot always be transferred when the operator or installation location changes.

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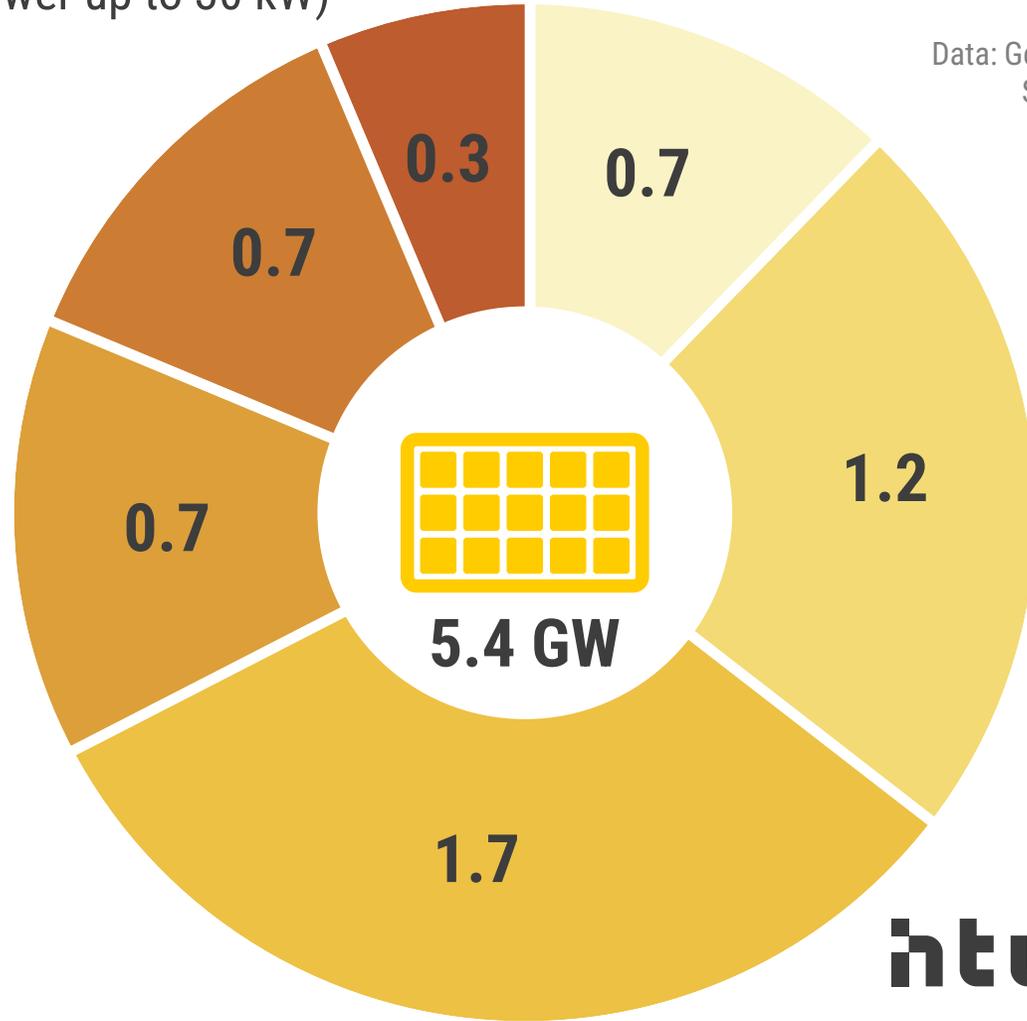
Development of the PV-battery market in Germany



The residential PV and battery market in Germany 2025

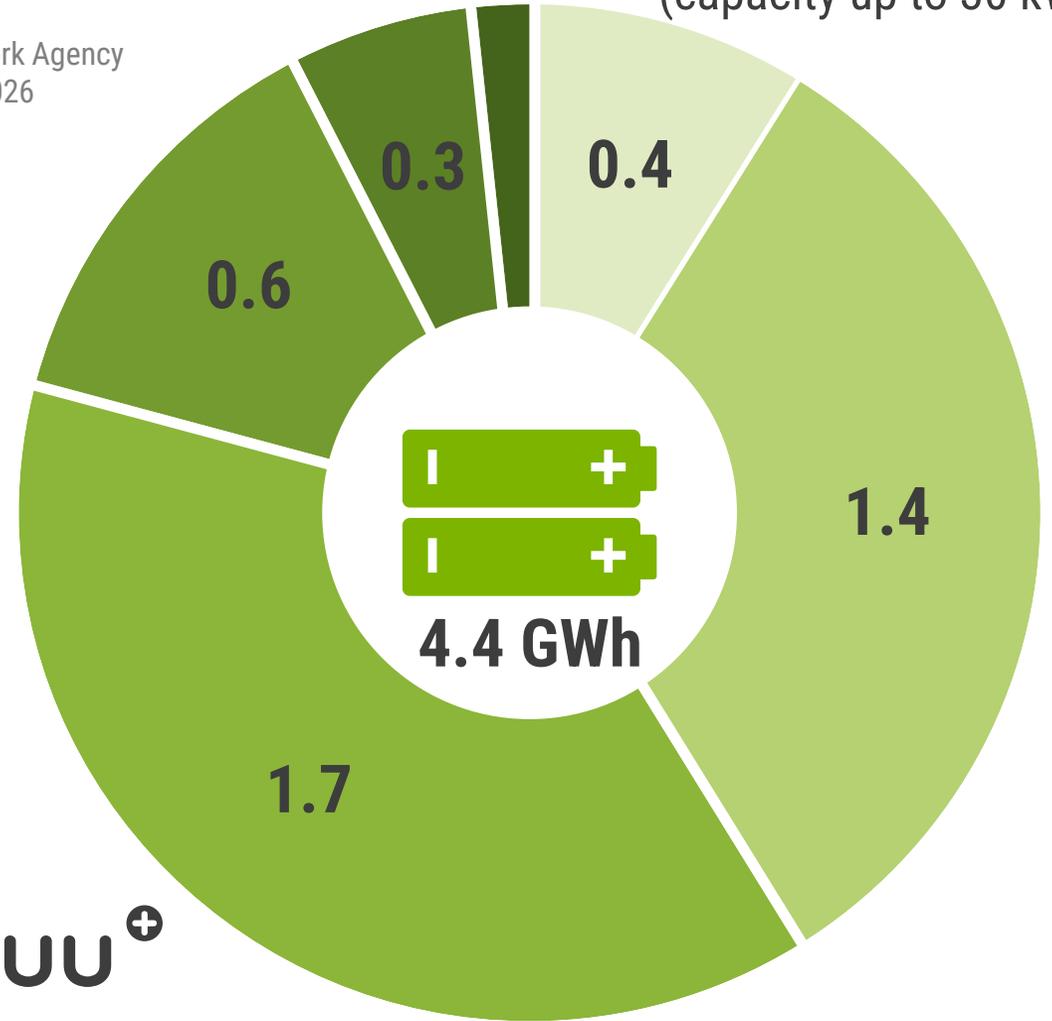
PV systems

(power up to 30 kW)



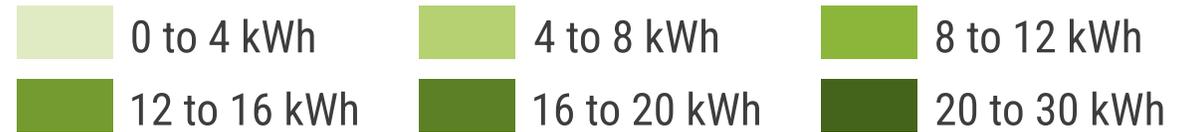
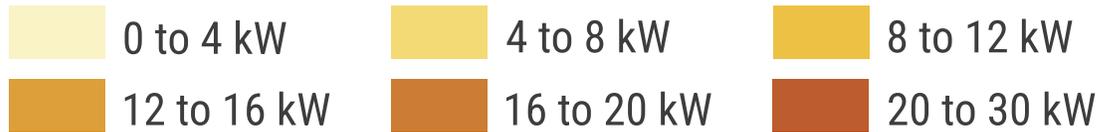
Battery systems

(capacity up to 30 kWh)



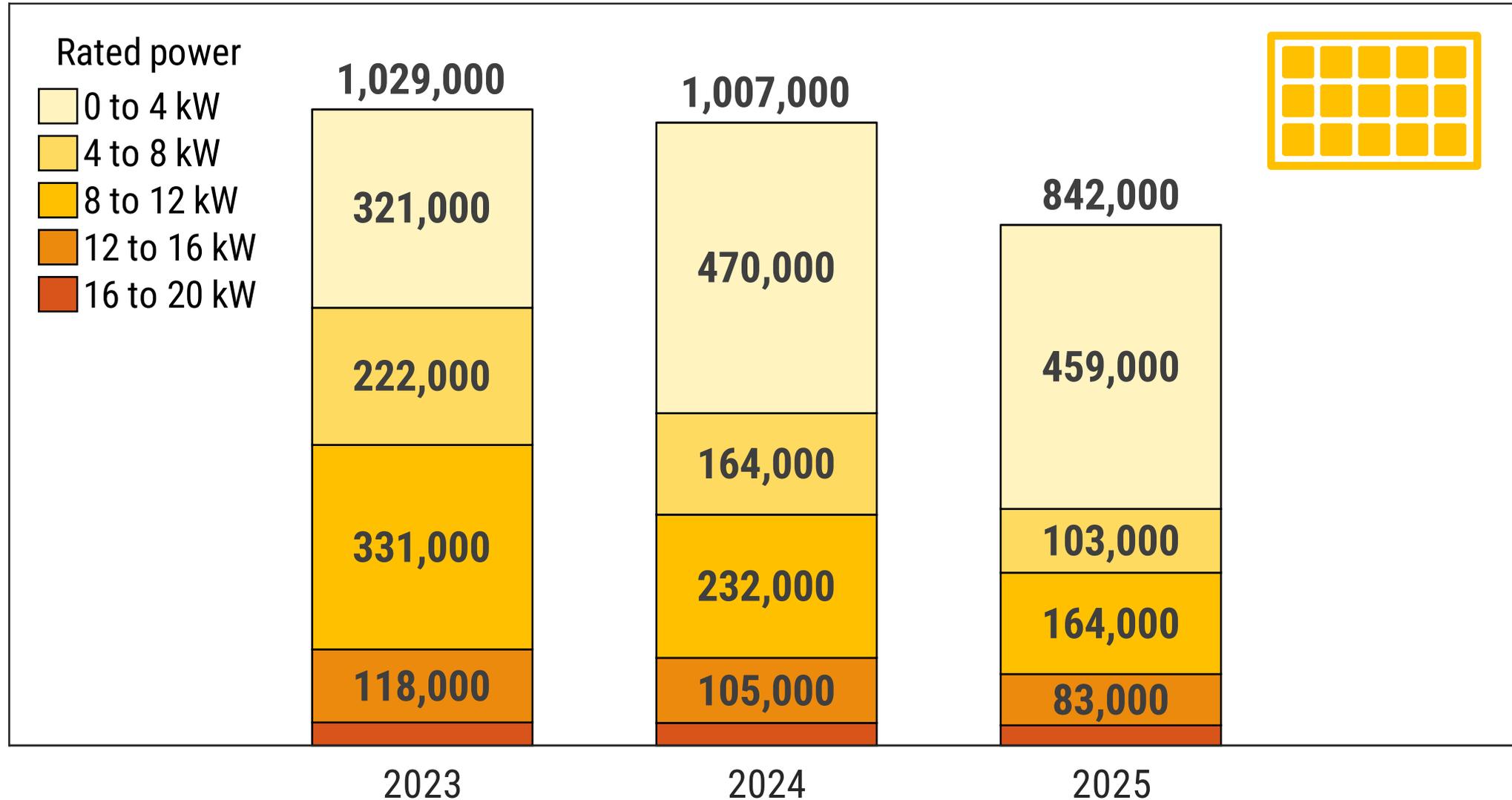
Data: German Federal Network Agency
Status: February 1, 2026

ntw aquu⁺



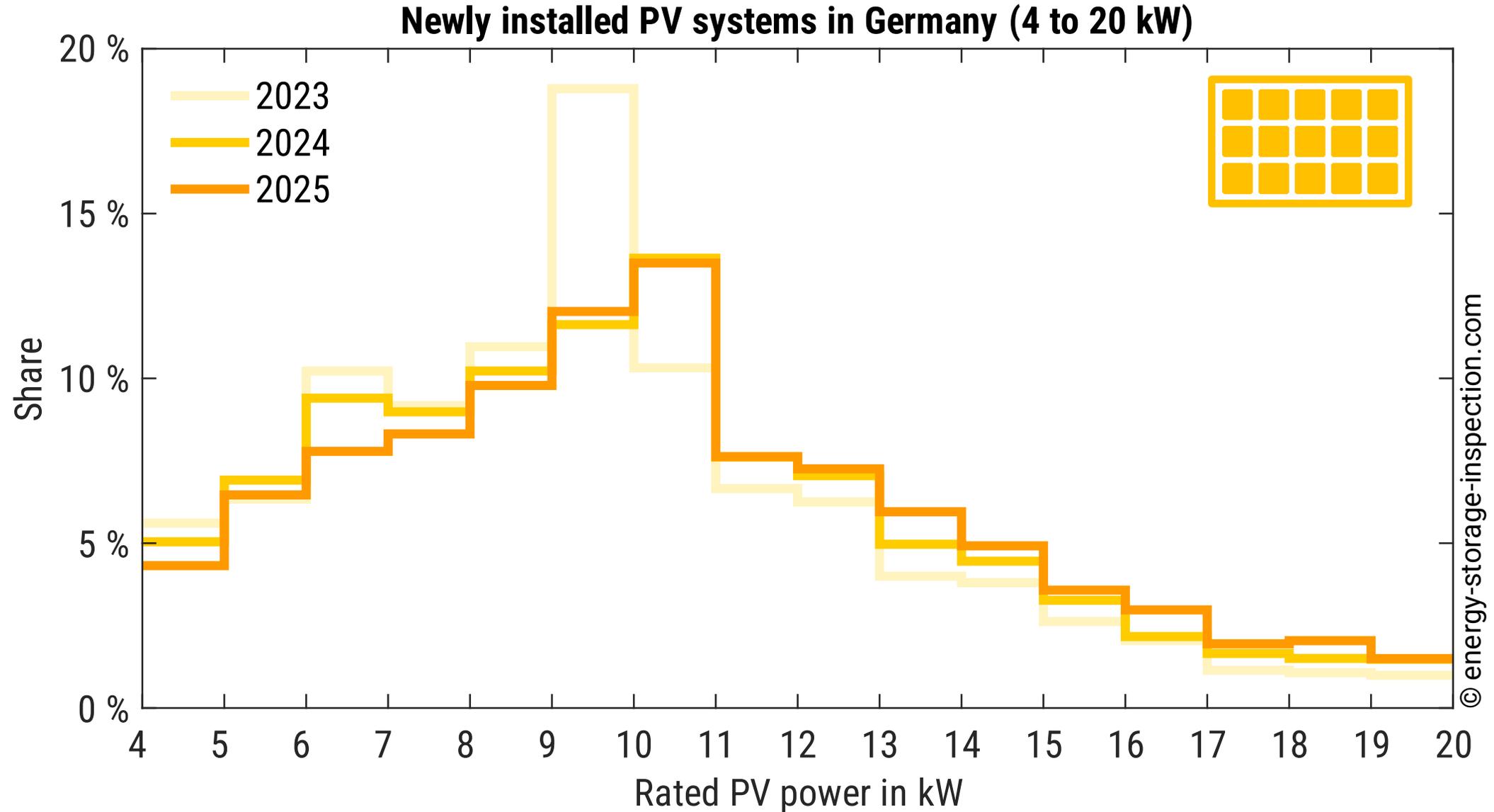
The residential photovoltaic market in Germany

Newly installed PV systems in Germany (0 to 20 kW)



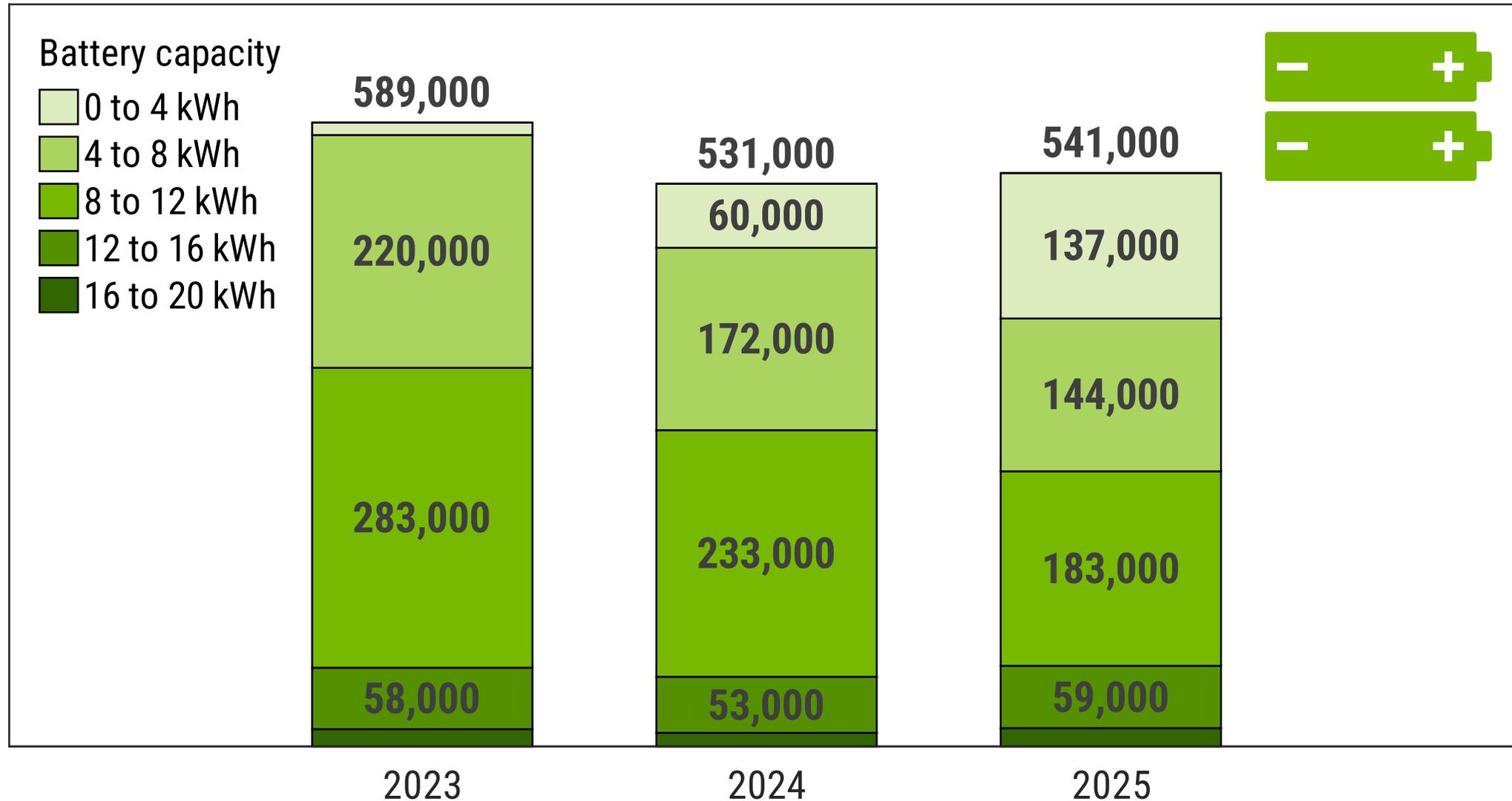
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Rated power of the PV-systems between 4 kW and 20 kW



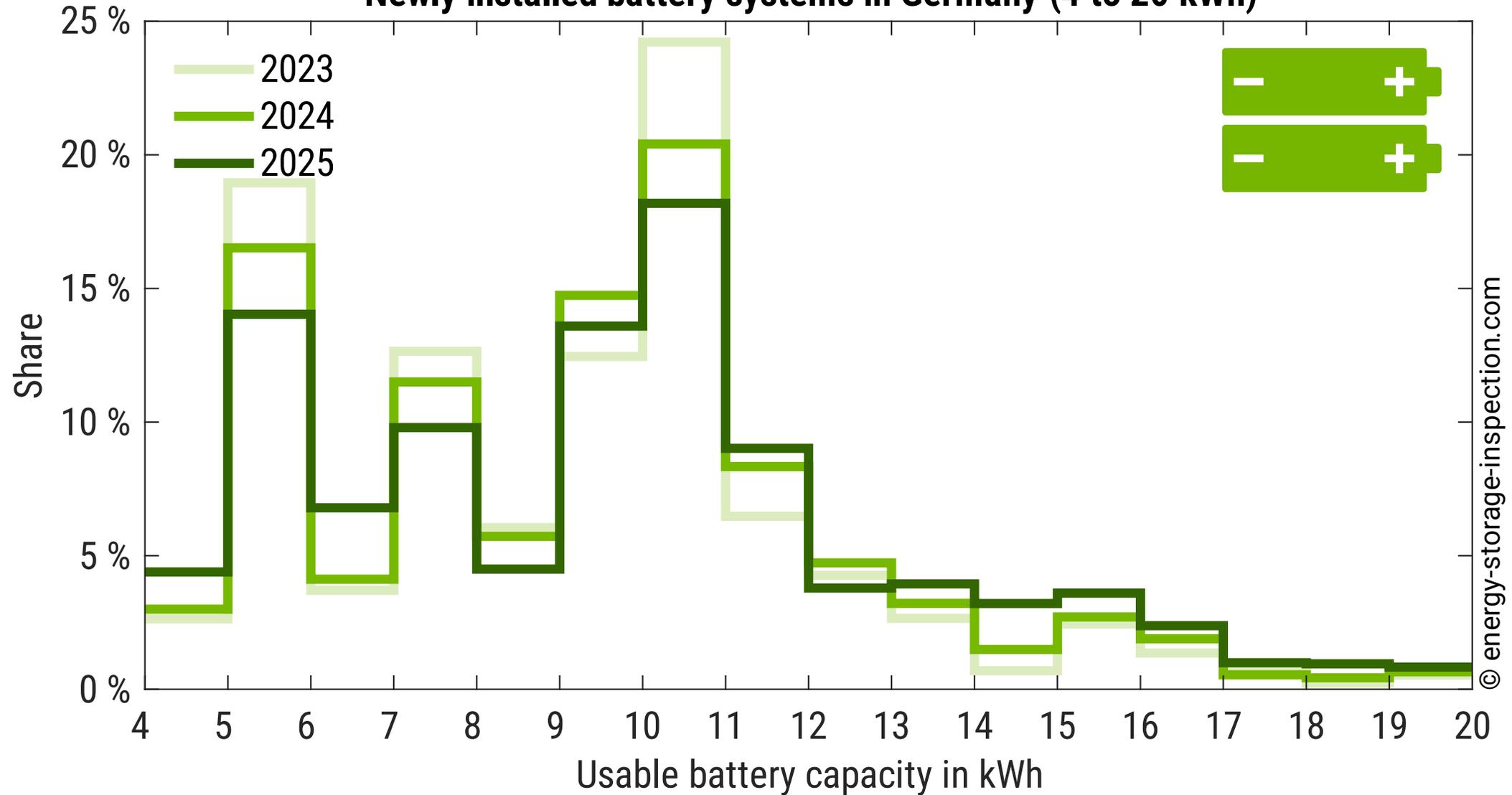
The residential battery system market in Germany

Newly installed battery systems in Germany (0 to 20 kWh)

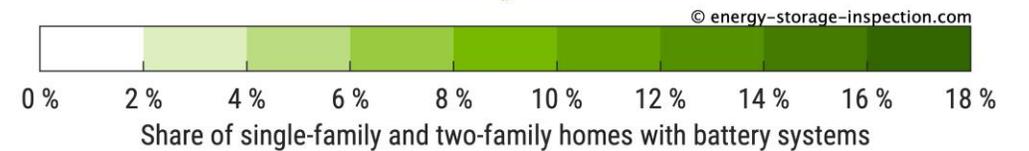
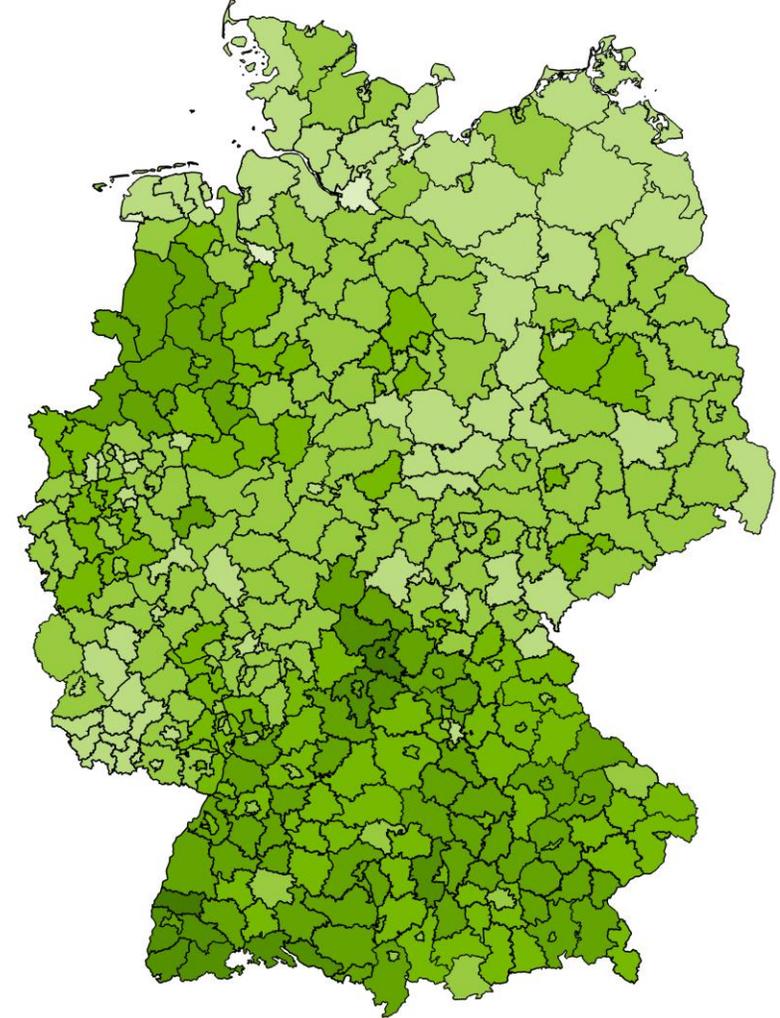
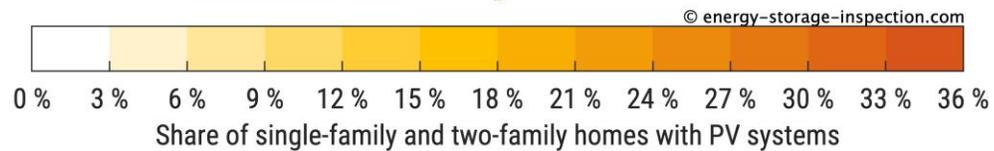
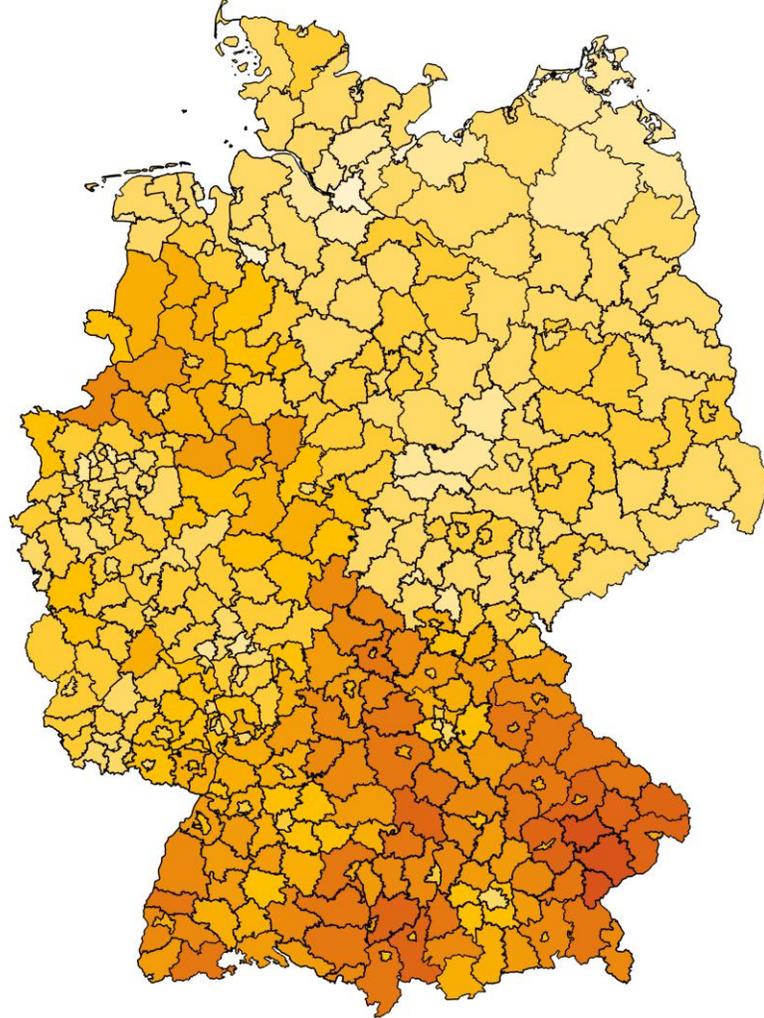


Usable capacity of the battery systems between 4 kWh and 20 kWh

Newly installed battery systems in Germany (4 to 20 kWh)



Percentage of private homes with solar and battery systems



Percentage penetration of PV systems (4 to 20 kW) and battery systems (4 to 20 kWh) in private homes across Germany's districts and independent cities (Data: German Federal Network Agency and DESTATIS, Status: February 1, 2026).



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