



DESIGN CONCEPT

 NEXVOLT

HomeFlow 22

Power, beautifully connected.

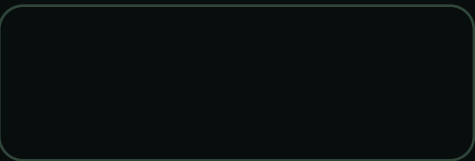
22 kW AC / BIDIRECTIONAL DC CONCEPT / NEXVOLT APP

Germany. Three-phase. Product and app design concept.

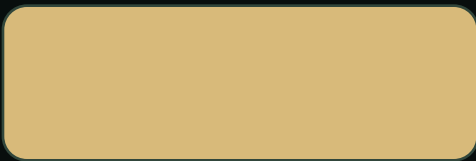
A signature for intelligent home energy.

One identity. Every touchpoint.

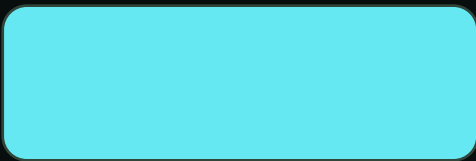
The gold NV emblem unites the charger, app, meter interface and home energy system.



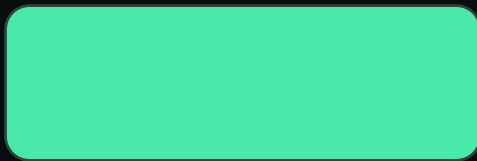
Obsidian



Champagne

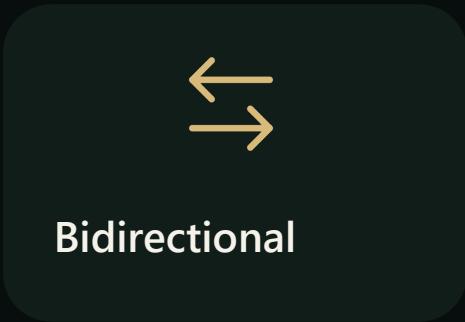
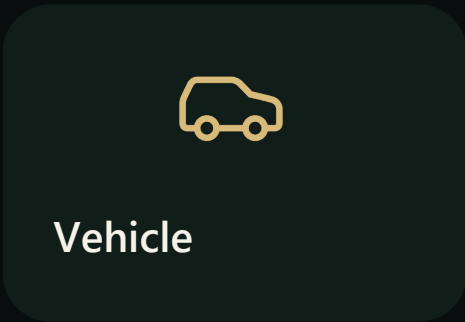
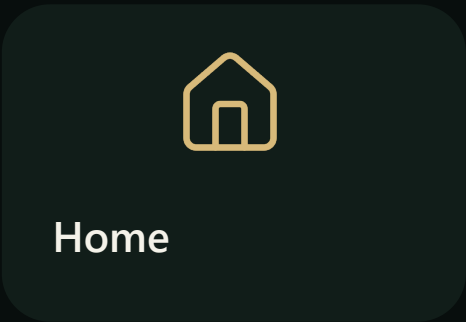
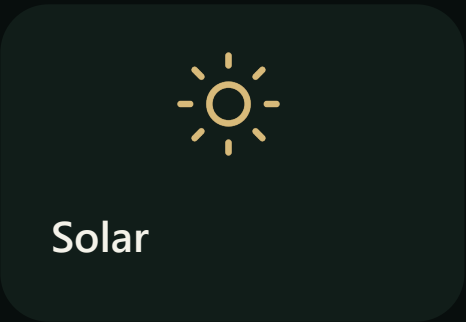


Power cyan

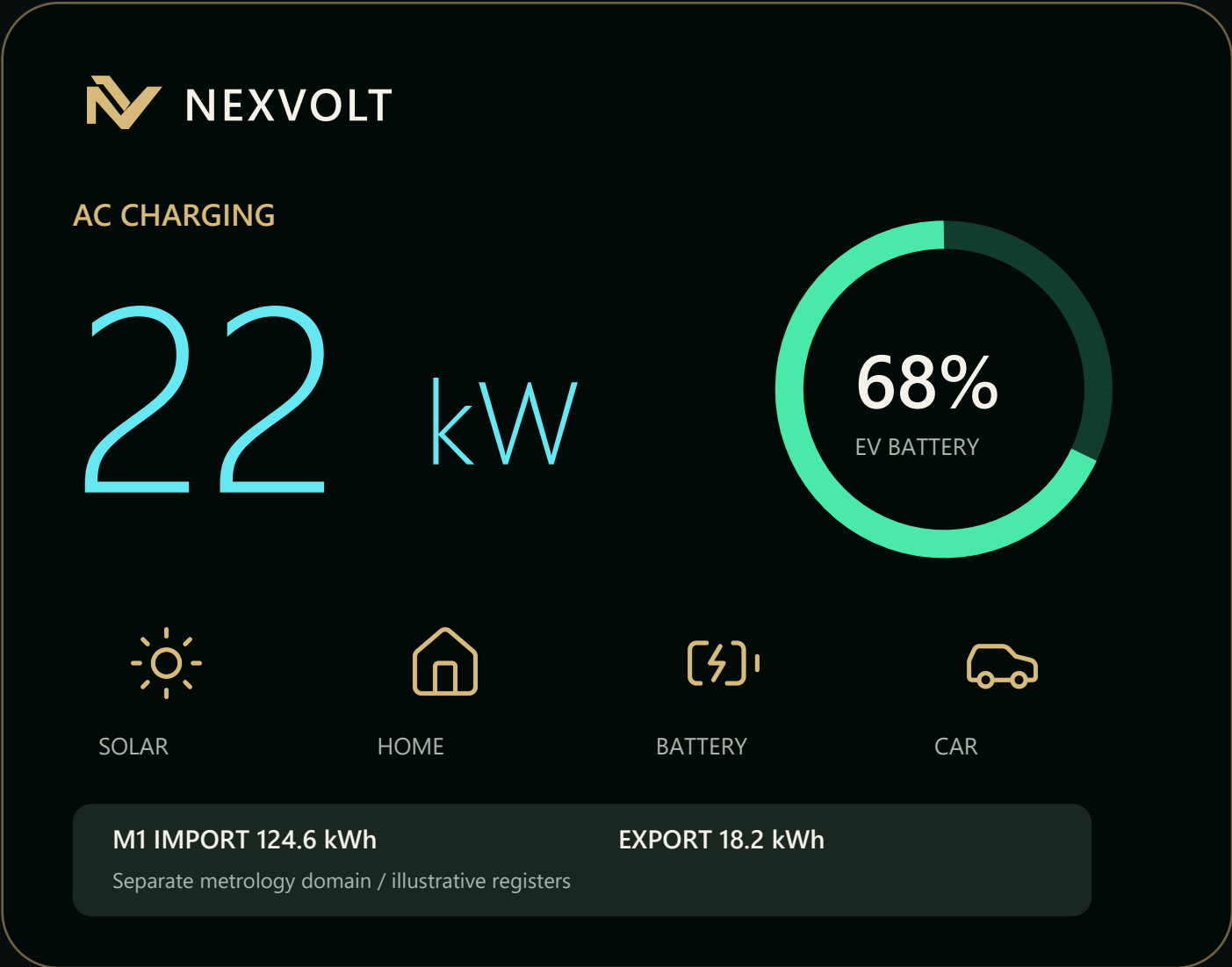


Energy green

NEXVOLT APP



The power is clear. The detail is considered.



22 kW in colour

Large cyan AC power readout. Clear mode label and readable units.



Vehicle status

Emerald state-of-charge ring. Availability depends on the connected vehicle.



Independent meter

A dedicated meter display keeps energy records separate from app controls.



Local control

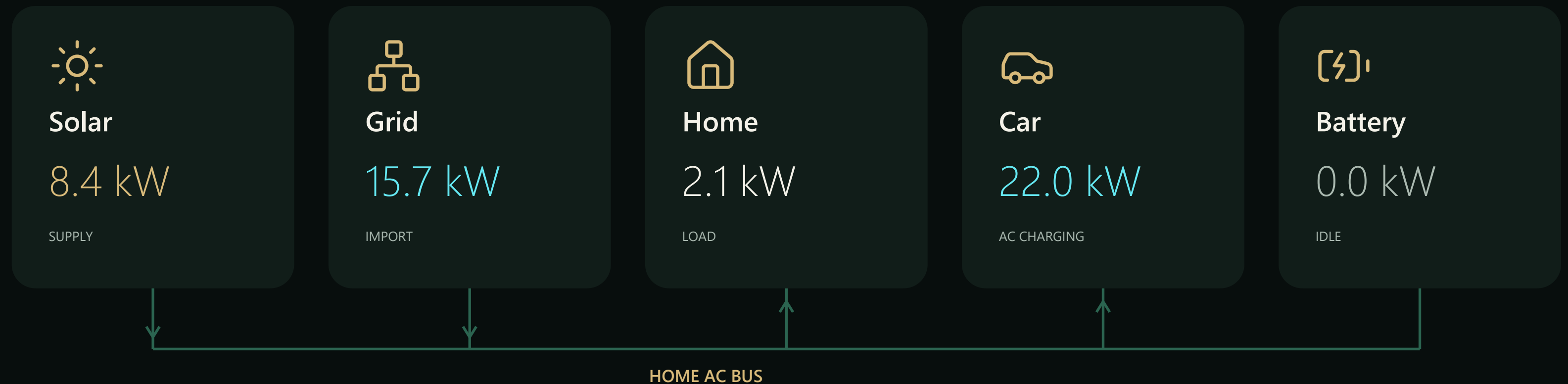
Touch, NFC and physical control access, with a clear connection status.

Your home energy, in one beautifully clear app.



Solar. Home. Storage. Car. In balance.

ILLUSTRATIVE AC CHARGING SCENARIO



8.4 kW solar + 15.7 kW grid = 2.1 kW home + 22.0 kW car. Battery idle.

In a supported DC bidirectional session, the car can supply the home or grid. App control preserves departure needs, battery reserve and site limits.

A smarter core. A more considered product.

PATENT-INSPIRED DEVELOPMENT BENEFITS / VALIDATION REQUIRED



Galvanic isolation

An isolated conversion stage is the foundation for the proposed DC architecture.



Component economy

Evaluate fewer conversion parts and simpler integration against a validated reference design.



Efficiency focus

Optimise both directions across real operating loads, including auxiliary consumption.



Integrated magnetics

Explore PCB magnetics and compact packaging from the Current Booster concept.



Cost-down potential

Target lower assembly and material cost. Confirm savings through a costed design.



Energy in both directions

Develop and verify the full charger path for named vehicles and approved grid operation.

Luxury you can see. Engineering you can inspect.



OBSIDIAN GLASS / CHAMPAGNE METAL

Proposed cabinet envelope: 700 x 450 x 220 mm. Packaging, cooling and environmental ratings require prototype validation.



Colour touchscreen

A larger visual canvas with cyan power, emerald progress and clear energy icons.



Sealed meter access

Independent metrology window with controlled service access and mode labels.



Two vehicle connections

Type 2 AC socket plus CCS2 DC tether. One vehicle connection active at a time.



Sculptural cooling

Protected cooling path, side ribs, cable storage and installer mounting provision.

Built around how a home uses energy.



Solar priority

Use available solar while observing site and vehicle limits.



Ready when you are

Set departure time and preserve the chosen battery reserve.



Home and grid support

Enable verified DC energy export for supported vehicles and installations.



Backup option

Add a qualified transfer gateway and validated island operation.

Design ambition. Defined engineering boundaries.

22 kW AC charging. 20 kW continuous EV-side DC charging target on a 22 kW connection. Bidirectional compatibility, metering approval and German grid acceptance are release gates.

Technical requirements, test gates and source references follow in the appendix.

A German home charger with two distinct vehicle paths

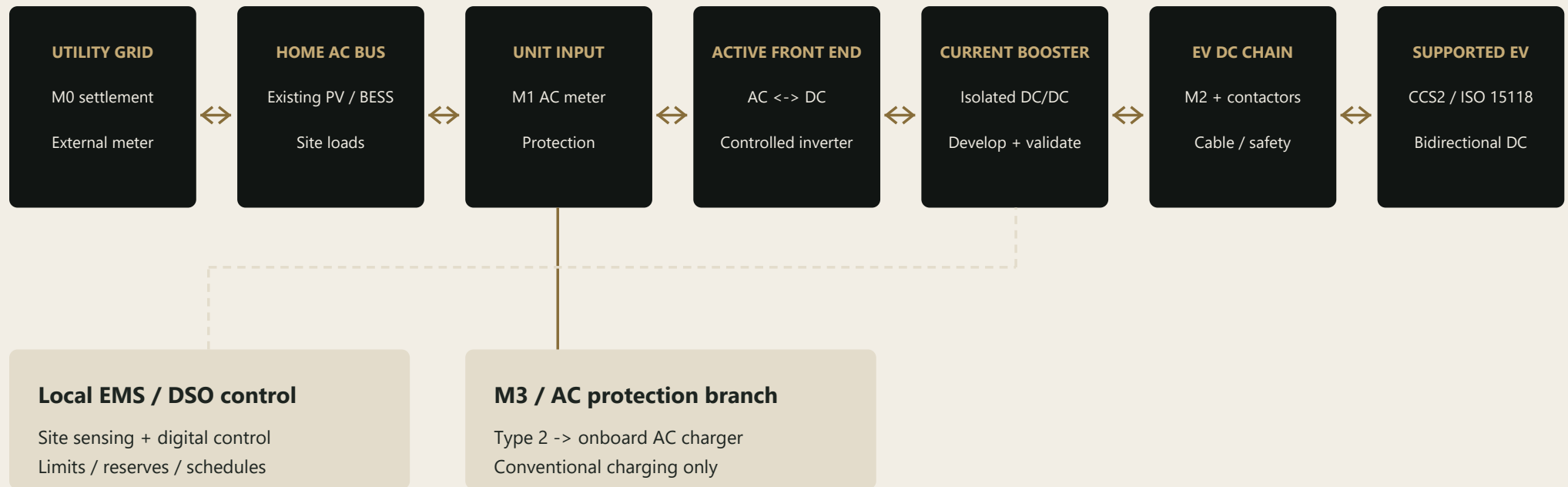
Product	NexVolt HomeFlow 22 - proposed product name; private-home hybrid AC/DC EV energy hub.
Grid connection	400 V AC, 3-phase, 50 Hz, 3P+N+PE; installation configured for up to 32 A per phase.
AC vehicle mode	Type 2 socket; up to 22 kW, subject to site and onboard-charger limits. 11 kW installation setting supported.
DC charging target	20 kW continuous EV-side target on a 22 kW connection. Loss-aware AC input control is authoritative.
DC export target	Up to 22 kW at the grid-side AC boundary, limited by EV discharge rating, thermal design, site approval and aggregate export cap.
EV DC envelope	200-920 V DC design envelope, 75 A maximum target. Power derates at low voltage: min(power limit, 75 A x EV voltage).
Energy routes	CCS2 bidirectional DC + conventional Type 2 AC. One active vehicle connection at a time; hardware/software interlock.
Metering	Separate AC unit import/export, EV-side energy and utility settlement measurement. Legal-energy display remains independent of the app.
Communications	PLC / ISO 15118-20; normal charge fallback for supported legacy EVs. Ethernet-first, EEBUS, isolated RS-485; optional Wi-Fi.
Enclosure target	700 H x 450 W x 220 D mm; charcoal + satin aluminium + champagne-gold accents. CAD/package validation pending.
Environmental target	IP65 sealed electronics, separate cooling duct, IK10 front target. -25 to +50 C operation target with thermal derating.
Thermal / efficiency	Size cooling initially for at least 1.2 kW nominal conversion heat, then revise from worst-case tests. >=95% nominal full-system efficiency is a development target only.
Backup option	Separate qualified transfer/backup gateway + validated grid-forming firmware/hardware. No outage power from the grid-following base configuration.

Charge the car. Use its energy. Respect the grid.

Solar to car	Local EMS follows PV surplus measured at the site; takes household loads, battery priorities and EV limits into account.
Scheduled / tariff charging	Reach a user-selected departure state of charge within site limits; local schedule works without a cloud subscription.
Car to home, grid-connected	CCS2 discharge offsets home demand. Closed-loop no-export control uses site feedback; it is not an exemption from applicable grid approval.
Car to grid	Enable only after OEM interoperability, inverter/grid evidence, DSO settings and settlement/aggregator arrangements are established.
Grid balancing	Accept authenticated, bounded power requests from an approved aggregator. Preserve departure reserve and do not promise market access or revenue.
Section 14a control	Observe the permitted net grid-import limit; coordinate surplus PV through the EMS. Export uses separate generation controls.
Conventional AC charging	Type 2 powers the car's onboard charger. Generic AC charging does not provide V2H/V2G; verified AC-BPT would be a separate variant.
Outage backup, accessory	Open and verify the grid transfer boundary first, then form an isolated critical-load bus with approved neutral/earthing design. Reconnect only through the approved sequence.

Bidirectional operation needs a supported EV/OEM combination. A protocol label, CCS2 plug or patent feature does not establish interoperability.

Keep vehicle energy and utility energy distinct



Base system: AC-coupled PV and stationary battery remain on the home AC bus through their existing approved inverters. No raw PV/battery DC inputs are included. Optional backup requires a separate validated transfer gateway at the site boundary and a compatible grid-forming configuration.

Functional architecture, not installation wiring. Solid lines: power routes. Dashed line: control/data. AC and DC vehicle branches are interlocked.

Measure the right energy at the right boundary

M0 - utility boundary	External utility/settlement meter and, as deployed by the meter operator, iMSys/SMGW. Measures whole-site import/export; the unit does not replace it.
M1 - unit AC boundary	Bidirectional active-energy meter upstream of both charger branches. Separate cumulative import/export registers; unit consumption includes conversion and auxiliary losses.
M2 - CCS2 vehicle boundary	Dedicated DC measuring chain for energy delivered to and received from the EV. Design MI-011 assessment around the transfer point, including cable treatment.
M3 - Type 2 branch	Separate AC EV-energy channel for the conventional branch. Required when legal billing is based on AC energy delivered to the vehicle; do not substitute M1.
Legal recording / display	Use mode, direction, meter ID, session ID, time, start/end counters, signed results and software identification. Do not net import and export into one number.
Billing variant	Select a metrology supplier / assessment body early. Assess the complete measuring system and German billing workflow; an MID-marked component alone is insufficient.

Declare the measurand and operating range for each channel. The UI may show M1 and M2 side-by-side; their readings legitimately differ due to losses.

2027 interoperability and the 2028 metrology transition

2025/656 - AFIR	New/renovated private Mode 3/4 points from 1 Jan 2027 need EN ISO 15118-20:2022. Implement and test relevant functions, not only a PLC modem. Hardware BPT is a distinct requirement. [S01, S18]
2024/1275 - EPBD	Article 14 addresses relevant building charging installations: smart charging and bidirectional capability where appropriate. Determine site applicability under German implementation. [S03]
2026/706 - new MID	MI-011 covers EVSE energy in either direction at the vehicle transfer point. Member-State measures apply from 10 Oct 2028; national-law EVSE transition extends to 10 Apr 2030. Plan the assessed system now. [S02]
CE product legislation	Establish the applicable LVD 2014/35/EU, EMC 2014/30/EU, RoHS 2011/65/EU and radio RED 2014/53/EU obligations. Use current harmonised EN references, technical file and EU declaration. [S13, S14]
Cybersecurity / radio	Internet-connected radio variants face applicable RED cybersecurity rules during the transition. Regulation 2026/339 repeals 2022/30 from 11 Dec 2027. CRA full product duties apply from that date. [S14, S15]
CRA reporting / lifecycle	Reporting obligations started 11 Sep 2026 for in-scope products. Build vulnerability intake, SBOM, updates, incident response and secure product support into the release process. [S15, S16]
Environmental / personal data	Plan WEEE registration/take-back and RoHS evidence. Apply GDPR to account, charging and vehicle-related personal data; minimise collection and offer local operation. [S13, S17]

Interoperability rules are separate from mandatory bidirectional hardware. AFIR public-payment provisions are outside this private-home concept.

Consumption control and export approval are separate

Grid connection	Notify the DSO before commissioning; NAV section 19 sets prior consent above 12 kVA aggregate charging capacity. Coordinate the 22 kW installation and bidirectional export with the DSO. [S04]
Controllable consumption	New private chargers above 4.2 kW fall within the section 14a regime. Direct control allows reduction of grid draw to 4.2 kW; multi-device EMS allocation follows its own rules. PV can contribute separately. [S05]
Digital control interface	Design to VDE-AR-N 4100:2026-04 and the DSO TAB. Use the required digital control interface based on VDE-AR-E 2829-6-1; EEBUS is the recommended interoperable minimum. [S07, S08]
Generation / reverse transfer	Use VDE-AR-N 4105:2026-03 evidence for the export-capable system: protection, grid behaviour, settings, unit/system documentation and applicable bidirectional verification route. [S06]
German energy billing	For legal third-party energy billing, assess MessEG/MessEV and the complete meter/record/display process with the assessment body. Provide validated transparency where required. Private self-monitoring is a different use. [S09]
Settlement / commercial service	Agree meter configuration, import/export contracts and aggregator responsibility. The integrated EV meter does not authorise export settlement or substitute a utility meter. Avoid mixing PV subsidy accounting with grid-charged EV energy.

The 4.2 kW value is a grid-consumption control rule, not a universal EV-output limit. Final settings depend on the installation and DSO.

Isolation, supervision and a verified disconnect path

Power-stage safety	Independent supervisory MCU, hardware current/voltage limits, gate-driver protection, precharge, monitored contactors and safe DC-link discharge.
Isolation / protection	Validate protective insulation, PE continuity, clearances, creepage, touch current, insulation monitoring, residual-current response and overtemperature shutdown.
AC branch protection	Design its RCD arrangement and DC residual-current detection to the applicable installation/EVSE requirements. Select the arrangement after the complete topology is reviewed.
DC branch sequencing	No accessible hazardous voltage before authorisation, cable lock and safety checks. Monitor the coupler/cable, discharge path and contactor state before unlock.
Islanding boundary	Transformer galvanic isolation is not grid disconnection. The optional backup gateway must provide validated transfer, neutral/earthing handling and reconnection logic.
Failure behaviour	Power-stage fault -> stop transfer and open the validated safety path. Lost export/site feedback -> suspend export. Lost cloud -> retain local safety and authorised DSO/site limits.
CCS BPT test basis	IEC 61851-23:2023 is the DC baseline but its full reverse/BPT electrical requirements do not cover System C/CCS. Agree a supplemental test/risk basis with the lab and OEM. ISO 15118-20 alone does not close that gap. [S10-S12]

Use current licensed EN/IEC/DIN-VDE editions, applicable harmonised references and the lab-agreed assessment basis before design freeze.

Local control, clear energy records and secure updates

Home screen	Show route (solar/grid/car), instantaneous EV power, EV state of charge when supplied, departure target, reserve and grid-control status. Label illustrative values as demonstration data.
Always-readable meter	Dedicated display with EV delivered/received kWh, active AC/DC mode and meter identity. Separate sealed metrology software from convenience UI and remote updates.
Control priority	Electrical safety > grid/DSO limits > OEM/BMS limits > battery reserve and thermal limits > home energy priorities > tariff/aggregator optimisation.
Secure architecture	Secure boot, signed firmware, rollback prevention, unique credentials/keys, TLS, least privilege and signed audit records. No default shared administrator password.
Interoperability	Full ISO 15118-20 stack and relevant amendment review; compatibility list by EV model and software version. OCPP 2.0.1 can serve monitoring, while richer BPT control needs an agreed profile/backend.
Local integration	Ethernet EEBUS for EMS/DSO-facing control, isolated RS-485 for meters, published local API for authorised home systems. Local stop/reserve controls remain available offline.
Commissioning / ownership	Installer-only grid profiles and power limits; owner can choose schedule and reserve but cannot override protection. Maintain update support and exportable records over the declared service life.

Modular power electronics with an assessed meter chain

Grid assembly	Input terminals, coordinated surge/EMC filtering, disconnect/contactors assembly, precharge and M1 AC meter. Ratings follow fault and installation studies.
AC/DC stage	Four-quadrant, three-phase active front end; DC link and sensing. If backup is offered, select and validate a suitable neutral-capable grid-forming topology.
NexVolt conversion core	Evaluate Current Booster-derived isolated DC/DC modules. Patent isolation, switching and PCB magnetics are design ideas; complete bidirectional EV performance must be demonstrated.
Vehicle assembly	CCS2 tether/lock/sensors and M2 DC measurement; Type 2 socket with a separate M3 measuring/protection branch and branch interlock.
Controls / networking	Safety MCU separate from application processor; PLC modem, secure element, Ethernet/EEBUS, isolated meter interface and optional RED-assessed radio module.
Thermal / enclosure	Replaceable fan module outside the sealed electronics cavity, conductive heat path, touch-safe fins, cable saddle, installer bracket and segregated service/metrology access.
Site accessories	EMS-compatible site sensing, meter-operator-approved control chain and optional qualified backup transfer gateway. No raw solar or battery DC terminal in the first release.

Do not transfer historical NexVolt 96%+ source-reported figures to this complete charger. Establish measured curves for both directions and auxiliary loads.

Evidence required before a production compliance claim

G1 - requirements freeze	Confirm first EV/OEM compatibility, DSO, meter/billing model, date of market placement, backup scope and the actual harmonised standards/test basis.
G2 - power prototype	Prove transfer in both directions across the voltage/current envelope; measure efficiency, standby draw, ripple, touch current, faults and thermal margin.
G3 - vehicle / protocol	Pass protocol and interoperability tests on named EV software versions, including session failure, reserve, direction changes and certificate lifecycle.
G4 - grid / Germany	Demonstrate section 14a digital control, site limits, no-export failure behaviour, VDE 4105 protection and accepted DSO/settlement configuration.
G5 - metrology	Assess both directional energy channels, cable/replacement rules, sealed software, display, signed records and transparency; validate the planned MID transition.
G6 - product compliance	Complete safety, EMC, environmental, radio/cybersecurity and applicable conformity procedures. Compile the technical file, declaration, markings and German manuals.
G7 - backup accessory	Run transfer, neutral/earthing, island fault-clearing, critical-load overload and controlled reconnection tests. Keep backup disabled until that configuration passes.
G8 - production release	End-of-line safety and metrology tests, calibration traceability, serialisation, supplier evidence, field-update process and installer commissioning records.

No CE, MID, Eichrecht, VDE, vehicle compatibility or military qualification claim is established by this design document.

Sources and assessment basis - 1 of 2

S01 AFIR amendment: private Mode 3/4 communication from 1 January 2027

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32025R0656>

S02 MID amendment 2026/706: EVSE measuring systems MI-011 and transition dates

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202600706

S03 EPBD 2024/1275, Article 14: smart charging and bidirectional where appropriate

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024L1275>

S04 Germany NAV section 19: notification and approval above 12 kVA

https://www.gesetze-im-internet.de/nav/__19.html

S05 Bundesnetzagentur: section 14a scope and control of grid consumption

https://www.bundesnetzagentur.de/DE/Vportal/Energie/SteuerbareVBE/BetroffeneAnlagen_table.html

S06 VDE-AR-N 4105:2026-03: generation and bidirectional charging

<https://www.vde.com/de/fnn/themen/tar/tar-niederspannung/erzeugungsanlagen-am-niederspannungsnetz-vde-ar-n-4105-2018>

S07 VDE-AR-N 4100:2026-04: low-voltage installation requirements

<https://www.vde.com/de/fnn/themen/tar/tar-niederspannung/tar-niederspannung-vde-ar-n-4100>

S08 VDE FNN: digital control interface and EEBUS recommendation

<https://www.vde.com/en/press/press-releases/fnn-technical-connection-rules-low-voltage-niederspannungsnetze>

S09 PTB: transparency software for charging-energy billing

<https://www.ptb.de/cms/ptb/fachabteilungen/abt2/fb-23/ag-234/info-center-234/via-234000.html>

Sources and assessment basis - 2 of 2

S10 IEC 61851-23:2023: DC safety scope and CCS reverse-transfer gap

<https://webstore.iec.ch/en/publication/32973>

S11 IEC 61851-24:2023: DC charging communications

<https://webstore.iec.ch/en/publication/32582>

S12 ISO 15118-20:2022 and 2026 amendment listing

<https://www.iso.org/standard/77845.html>

S13 EU electrical product legislation: LVD, EMC and RoHS

https://single-market-economy.ec.europa.eu/single-market/goods/new-legislative-framework_en

S14 Radio Equipment Directive and cybersecurity transition

https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/radio-equipment-directive-red_en

S15 CRA summary: full application from 11 December 2027

<https://digital-strategy.ec.europa.eu/en/policies/cra-summary>

S16 CRA reporting: obligations from 11 September 2026

<https://digital-strategy.ec.europa.eu/en/policies/cra-reporting>

S17 WEEE: collection, treatment and producer responsibility

https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en

S18 CharIN 2026 AFIR implementation position: protocol and hardware distinction

https://www.charin.global/media/pages/technology/knowledge-base/06a76f7571-1777821309/20260428_position-paper-clarifying-iso-15118-implementation-under-afir.pdf