NFE metering strategy + Glen Street-EMS

> Authoritative page for NFE's role in the IEEE Smart Village meshEMS / Street-EMS initiative. Compiled 2026-08-10 from the Element room "Smart Village Energy Interest Group" (full history back to 2026-04-24), the ISV Dev Kit BOM sheet, isv.wiki, and the Rev B/C line diagrams. No customer PII or financial ledgers on this page by policy.

What it is

Not a standalone NFE product. It is NFE's seat in an IEEE Smart Village (ISV) open-source initiative called **meshEMS**, hardware-branded **Street-EMS**, started at an IEEE / NESL hackathon in April 2026. Hardware and firmware are led by Glenn Algie (10power.com / NESL); the software and standards side is led by Adam Sauer (ISV Tech Committee chair). The working venue is the Element/Matrix room "Smart Village Energy Interest Group".

meshEMS is open-source firmware on an ESP32-S3 / ESP32-P4 module doing **OpenAMI two-way metering and control over secure MQTT into OpenEMS**. Deployed as a street-pole or pedestal **low-voltage feeder cabinet** that meters AND controls every tenant, it is designed to replace the per-tenant DIN-rail meters and the OpenEMS Raspberry Pi with a single integrated 9x15 cm EMS board.

Three related code bases (grown by 10power.com with two grad EE engineers on a 90-day sprint): **Street-EMS**, **BUILD-EMS**, **DTM-EMS**. GitHub org: `github.com/energy-iot` (`ems-dev` = Street-Pole EMS, `nesl-meshems` = the board, `openami-smart-village`, `meshems-openami-metering`).

How it fits NFE

- **Today (pilot):** CHINT DDSU666 smart meters plus a Raspberry Pi gateway over Modbus RTU / RS485, feeding OpenEMS. Current pedestal cabinet is roughly 80 x 60 x 25 cm, about USD 150 locally.
- **Next generation:** the Street-EMS cabinet folds the 3-phase meter, the per-tenant meters and the Pi into one EMS board plus an SSR bank, shrinking the cabinet (cheaper, fits indoor locations, easier to secure from theft and weather) and adding per-tenant remote

control and local energy-policy automation.

The cabinet (Rev C, 9-tenant, 3-phase LV feeder)

Signal flow left to right:

- **Incoming LV feeder** L1/L2/L3 + N + PE. Each phase: a 63A main breaker (QF1/QF2/QF3), a mains-usage CT (CT4/CT10/CT16), then a UKK80 terminal block fanning out to up to 6 tenant ways per phase.
- **Three Ivy RCMs** (RCM1/2/3), one residual-current monitor per phase, for continuous leakage and neutral insight. Modbus UART to RS485 adaptor.
- **Nine contactors K1..K9** (3 tenants per phase) for per-tenant remote connect/disconnect, each with a tenant-usage CT (CT1,2,3,7,8,9,13,14,15).
- **Controller on the cabinet door:** "Street-EMS w RGBW" = 3 stacked CircuitSetup 6-channel CT meters = 18 channels (9 tenant + 3 mains + 6 spare).
- **Two 8-channel opto-isolated zero-crossing SSRs** drive the 9 contactor coils (9 control lines, 3x3 per phase, 240 Vac sensitive).
- **Backplate Power PCB:** fused, TVS surge protected, 3x Myrra 44122 240-to-9 Vac, giving 5V 2A and 12V 1A.

Legend (Rev B with legend): QF circuit breaker, CT current transformer, K contactor, UKK80 distribution terminal block, RCM residual current monitor, SSR solid-state relay, PCB printed circuit board, EVSE EV charger. 1P+N one phase plus neutral. RS485 / Modbus UART / I2C communications.

Decisions ratified in the room (2026-07-25):

- **1P over 1P+N** for tenant breakers and contactors (1P is cheaper; do not switch neutral except for EV).
- **80A over 63A** rating, chosen to leave room for a future EV station at a new location later this year.
- Rev B to Rev C added the legend; the diagram is deemed complete with only a few unlabelled wires to clarify at the workshop.

Still open: the make-before-break 80A neutral / phase-transfer balancer ("neutral rebalancer transfer method and apparatus") and the EVSE port are marked spare-room / in-progress.

Firmware and energy-policy vision (Glenn)

Local, IFTTT-style per-tenant automation in C/C++ on the ESP32, not just remote on/off:

- **Triggers:** prepaid-token expiry, over-voltage, over-current, over-kW, over-kWh, over-generation, over-storage.
- **Actions:** SSR disconnect (normally-closed contactor coil), SMS alert, RGBW LED or e-paper warning at the tenant box, a flash-warning cadence before cutoff, and a graceful post-sunset lighting-only allowance (about 10-20 W for a few hours from battery when storage allows).
- **Policy model:** each tenant has a JSON "mode" (safety vs prepaid-shutdown automations) stored in ESP32 SPIFFS or SD as a persistent energy-model cache.
- **Grid insight:** continuous per-phase leakage detection, neutral-imbalance alerts, phase-loss detection.

Cloudless village

An ESP32-P4 with its own Ethernet NIC acts as a per-feeder aggregation node. Street-EMS units LAN-hop along the feeder ("feeder hops") to run an in-village pay-go portal and full UX with no broadband. Optional LoRa / Meshtastic mesh and power-line communication on top; optional low-cost village camera / audio snapshots.

Standards and interoperability (OpenAMI)

OpenAMI is the "actionable energy telemetry" layer, the utility-facing layer above a village feeder. Built on DLMS/COSEM (IEC 62056), SunSpec Modbus/JSON, MQTT, IEEE 1547-2018 (DER interconnection) and IEEE 2030.5 (Smart Energy Profile). Village Metering goals: billing, remote disconnect, theft detection. EnAccess Foundation is extending the OpenAMI codeset. Reference: isv.wiki (repo `github.com/overview-solutions/isv-ai-wiki`, MIT).

The workshop (immediate driver of the ISV Dev Kit BOM)

IEEE ISV awarded Glenn and Adam a **4-session, 9-hour hands-on workshop** (assemble an EMS in about 15 minutes each, assemble a cabinet, run code challenges). **IEEE funds the parts BOM.** Plan: build 15-20 EMS units and 3-5 multitenant cabinets for participants to take home (about USD 50 each). Parts pre-ship to Albert, the ISV lead in Nairobi (AliExpress China to Nairobi direct; small PCB parts hand-carried, PSUs prebuilt on site). BOM total about USD 2,377 per batch (see the ISV Dev Kit BOM sheet).

Venues: PAC2026 Nairobi (September) and OSEAS Kigali, Rwanda (October, about EUR 50).

NFE attendance (as of 2026-08-10): Dansturn and Dismas are going to Kenya (Nairobi). Aaron, now back in Uganda, could join them. Kigali remains a possibility. Glenn asked NFE to co-lead the cabinet builds.

People and orgs

Glenn Algie (10power.com / NESL / IEEE ISV, hardware + firmware; also WMAC.CLOUD New Zealand, REI Cameroon). Adam Sauer (ISV Tech Committee chair, meshems software + OpenAMI, runs isv.wiki). Aaron Tushabe, Hillary Arinda, Dansturn, Dismas (NFE). Albert (ISV Nairobi lead). Abiodun Okunola (ISV Africa regional lead). EnAccess Foundation, EPRI Open Source, NESL.

Sources

- Element room "Smart Village Energy Interest Group" (`#smartvillage:matrix.nearlyfreeenergy.com`), full history from 2026-04-24.
- ISV Dev Kit BOM (Google Sheet `1AeAUrfL-Fu_j3xsBPjY555B0huxV0nnMtRjkDTFPjTE`).
- Line diagrams saved at `NFE/smart village energy interest group/` (Rev B with legend, Rev C editable + PDF).
- isv.wiki; `github.com/energy-iot` .

Open items

- Confirm the Rev C legend back to Glenn (he asked).
- Decide and mobilize the NFE workshop attendance (Nairobi confirmed for Dansturn + Dismas; Aaron + Kigali possible).
- Fill the detailed per-tenant "Behind the Meter" companion page.

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