

CODE IS THE FLOOR. STANDARD IS THE CEILING.

Scope: Battery backup, solar PV, smart panels, and geothermal heat pumps for luxury residential builds. Tesla Powerwall 3 · FranklinWH · Enphase IQ · SPAN Panel · Lumin · WaterFurnace 7 Series · ClimateMaster Trilogy 45 · NEC 706 · NFPA 855 · UL 9540 · NJ SuSI · IRA 30% ITC.

§01

OPERATING PRINCIPLES

■

Energy systems are framing decisions — pad, pathway, and panel location locked at rough-in.

■

Sizing precedes selection — Manual J, load study, and production model before brand commitment.

■

Code-first — NEC 706 (ESS), NEC 690 (PV), NEC 408 (panels), NFPA 855, UL 9540 are the floor.

■

Whole-system orchestration — battery, panel, inverter, and HVAC pull from one playbook.

■

Owner-controlled monitoring — circuit-level data lives on owner devices, not vendor cloud-only.

■

NJ-grounded — SuSI program, 1:1 net metering, BPU interconnection, IRA 30% ITC alignment.

§02

BATTERY BACKUP TIER MATRIX

■

Tier 1 Whole-Home: 40-54 kWh (3-4x Powerwall 3 or 4x FranklinWH aPower 2) · 200A panel backup.

■

Tier 2 Critical Load: 13.5-27 kWh (1-2 batteries) · 100A sub-panel · kitchen, network, theater.

■

Tier 3 Resilience: 5-13 kWh (Enphase IQ Battery 5P × 2-3) · life-safety + comms only.

■

Tesla Powerwall 3: 13.5 kWh · integrated solar inverter · 6 MPPT · 11.5 kW continuous.

■

FranklinWH aPower 2: 15 kWh · 10 kW continuous · time-of-use orchestration.

■

Enphase IQ Battery 5P: 5.0 kWh modular · 6 embedded microinverters · IQ8 ecosystem.

§03

ESS CODE & PLACEMENT

■

NFPA 855: indoor 40 kWh max per dwelling unit · garage 80 kWh · 3 ft separation.

■

NEC 706: disconnect within sight, marking, working space per 110.26.

■

UL 9540 listing required · UL 9540A fire propagation testing for indoor placement.

■

NJ climate: garage placement preferred · ambient -4°F to 122°F operating range checked.

■

Outdoor wall-mount: NEMA 3R or 4 enclosure · solar exposure shading per spec.

■

Service disconnect labeling per NEC 706.7 · arc-flash signage where required.

§04

SOLAR PV STRATEGY

■

NJ baseline production: ~1,382 kWh per kW DC installed annually.

■

Premium modules: REC Alpha Pure-RX 22.6% · Maxeon 6/7 up to 24.9% · Q.TRON 22.5%.

■

Inverter strategy: Enphase IQ8 microinverter (default luxury) · SolarEdge DC-optimized · Tesla integrated.

■

Roof-integrated: GAF Energy Timberline Solar ES2 · Tesla Solar Roof for hidden array.

■

NEC 690.12 rapid shutdown: module-level required since 2017 NEC, updated 2023.

■

Mounting: IronRidge XR rails · S-5! standing-seam clamps · engineer stamp >5 kW typical.

§05

SMART ELECTRICAL PANEL

■

SPAN Panel: 32 controllable circuits · ANSI ±0.5% metering · NEMA 3R · UL 1741 PCS.

■

Lumin Smart Panel: retrofit overlay · up to 60A per circuit · SoC-triggered load shedding.

■

Schneider Square D Energy Center: 200A, 61 circuits · Wiser ecosystem integration.

■

Why luxury needs it: dynamic backup prioritization · circuit-level analytics · app-based control.

■

Sub-panel hierarchy: theater, kitchen, EV, mechanical room, AI rack — each on its own.

■

NEC 110.26 working space: 36 in depth · 30 in width · 6 ft 6 in height — non-negotiable.

§06

GEO THERMAL SELECTION

■

WaterFurnace 7 Series: full-load COP 3.2-4.5 · part-load EER up to 52.0 open-loop.

■

ClimateMaster Trilogy 45: up to 45 EER · variable-speed compressor · communicating controls.

■

Bosch Greensource CDi: 52 dB · desuperheater for DHW preheat · scroll compressor.

■

Closed-loop vertical: 200-450 ft per ton NJ depth · 15-20 ft bore spacing.

■

Sizing: Manual J load calc · 4-8 ton typical luxury install · oversize discouraged.

■

Loop fluid: propylene glycol 20-30% for NJ freeze protection · annual flush schedule.

§07

EV + GENERATOR COORDINATION

■

NEC 625: dedicated 40-60A circuit per L2 EVSE · GFCI required · V2G provisions emerging.

■

Smart EVSE: Wallbox Pulsar Plus · Tesla Wall Connector · ChargePoint Home Flex · load mgmt.

■

Generator backup: Generac Guardian 22-26 kW · Kohler 14RESA · Cummins RS20A QuietConnect.

■

Transfer switch coordination: ATS sized for backup load · interlocked with battery system.

■

Load-side vs supply-side tap: per NEC 705.12 · 120% rule for solar + battery + main.

■

Documented runtime: 8-12 hr battery · 72+ hr generator on natural gas · combined plan.

§08

WHOLE-SYSTEM ORCHESTRATION

■

Tesla stack: Powerwall 3 + Tesla solar inverter + Tesla app · single ecosystem.

■

Enphase stack: IQ8 micro + IQ Battery 5P/10C + IQ Combiner + IQ Gateway · grid-forming.

■

Hybrid: SPAN Panel + Powerwall + third-party solar · circuit-level intelligence layer.

■

Time-of-use: peak shaving · solar self-consumption · grid-charging when rates favor.

■

Storm watch: NWS alert pulls battery to 100% before event · documented owner-facing.

■

Integration with Crestron / Lutron: read-only telemetry to home dashboard, no control.

§09

ENERGY MONITORING

■

Sense Energy Monitor: ML disaggregation · main panel CT install · cloud-dependent.

■

Emporia Vue 3: 16 circuit-level CTs · local data option · open API.

■

SPAN dashboard: native circuit-level · web + iOS · no third-party CT needed.

■

Owner data posture: prefer local-first · cloud as backup · export to owner archive quarterly.

■

Integration to project knowledge base: monthly export · annual baseline review with owner.

■

Alert posture: anomaly thresholds set at commissioning · owner notification rules locked.

§10

PRE-POWER ROUGH-IN STANDARD

■

Service entrance: panel location with 36×30 in working space pre-framed · 6 ft 6 in clear.

■

ESS pad: garage or mechanical room · 4 ft × 2 ft × 6 ft tall envelope · level concrete.

■

Conduit homeruns: 1-1/4 in EMT main panel to ESS · 3/4 in to inverter · spare tube to roof.

■

Cat6A backbone: every battery, panel, inverter on data VLAN · labeled BLUE 'ENERGY-LAN'.

■

Geothermal: 4 in supply/return sleeves through foundation · loop manifold rough-in pad.

■

Solar pathway: 1 in EMT roof to inverter · J-box at attic · rapid-shutdown initiator near service.

§11

WITHOUT WRITTEN DIRECTION

■

Indoor ESS over 40 kWh: requires AHJ variance and UL 9540A fire propagation documentation.

■

Battery in conditioned living space: NFPA 855 separation rules govern; default to garage.

■

Solar without rapid shutdown: NEC 690.12 mandates module-level since 2017.

■

Generator load tap on supply side: per NEC 705.12 sizing rules; default to load-side 120% rule.

■

Geothermal open-loop in well-water-only sites: water-quality testing required first.

■

Smart panel firmware auto-update: paused; updates scheduled with owner-approved windows.

§12

NJ INCENTIVES & TAX POSTURE

■

IRA Section 25D: 30% federal residential clean energy credit through 2032.

■

NJ SuSI: ADI track ~\$90 per SREC-II · 15-year term · property-tax-exempt for solar.

■

NJ Clean Energy Program: GeoIncentive rebates for ground-source heat pumps.

■

Net metering: 1:1 retail-rate credit on PSEG, JCP&L, ACE, RECO.

■

Battery: ITC pairs with solar; standalone battery 30% ITC effective 2023+.

■

EV charger: federal Section 30C credit · NJ Clean Energy EV charger rebate.

§13

QC · AUDIT · CLOSEOUT

■

ESS commissioning: SoC test cycle · transfer test under load · all circuits backed up verified.

■

Solar AHJ inspection: rough electrical · final electrical · interconnection signoff archived.

■

Geothermal: pressure test loops · flow rate per ton verified · DHW desuperheater confirmed.

■

Smart panel: every circuit named, mapped, and labeled · backup priority list owner-signed.

■

Generator: load-bank test at 80% capacity · ATS transfer time recorded · gas pressure verified.

■

Owner walkthrough: outage sim · monitoring dashboard tour · annual maintenance schedule signed.

QC GATE — VERIFY BEFORE CLOSE-IN

- ☐ Manual J on file — heat loss/gain matched to system tonnage
- ☐ Battery pad poured — level, conduit stubbed, NFPA 855 clearance
- ☒ Solar array stamped — wind/snow load engineer signoff archived
- ☐ Smart panel chassis set — interior wired before drywall closes
- ☐ NEC 110.26 working space verified — 36 in front, 30 in width
- ☐ Geothermal loop pressure-tested — flow per ton recorded
- ☐ AHJ rough inspection passed — electrical, mechanical, structural
- ☐ Backup priority list signed — owner approval on circuit selection
- ☐ Generator load-bank tested — 80% capacity, ATS transfer recorded
- ☒ Closeout package — Manual J, datasheets, AHJ, monitoring keys filed