

METRO POWER CORPORATION

The AMPERE Protocol

Advanced Metering Program for Energy Reliability & Efficiency

A decision-gated framework for planning, piloting, deciding on, deploying, and operating Advanced Metering Infrastructure in Philippine distribution utilities and electric cooperatives

Version 5.1

September 2026

Structured for utility use and for national or sector-wide adoption

Developed and maintained by Metro Power Corporation. Structured for use by individual utilities and for adoption by government agencies, regulators, and sector bodies. It has no legal force of its own: any mandatory effect arises only from an adopting body's own instrument. It does not replace any law, rule, or approval of the Energy Regulatory Commission, the Department of Energy, the National Electrification Administration, the National Privacy Commission, or any other government agency.

Document Control

Field	Detail
Document	The AMPERE Protocol: Advanced Metering Program for Energy Reliability & Efficiency
Version	5.1
Release date	September 22, 2026
Status	Issued. Approved for use by utilities and for submission to prospective Adopting Bodies.
Owner	Metro Power Corporation
Approved by	Chris Cobo, Founder, Metro Power Corporation, September 22, 2026
Supersedes	All earlier versions, including drafts 4.0 to 5.0 (September 2026) and Version 3.2 (May 25, 2026)
Next scheduled review	Within 12 months of issue, or earlier when the Energy Regulatory Commission issues supplemental AMI guidelines (see Section 14)
Regulatory references current as of	September 2026. Every issuance is cited as amended or superseded. Users must confirm that each referenced issuance, and its current text, is in force before relying on it (Section 14).
License	Free to use, adapt, and reissue under the terms in Section 30.4

Revision History

Version	Date	Summary of change
3.2	May 25, 2026	Comprehensive edition: 14 sections and 17 annexes (A–Q) organized around 13 implementation phases.
4.0–4.2 (drafts)	September 2026	Restructured around six decision-gated stages and four continuous workstreams; corrected technical requirements; added regulatory citations, independent gate reviews, the Five Case business case, benefit mapping, pilot analysis rules, component-life modeling, NIST CSF 2.0 alignment, tailoring, conformance, and conflict-of-interest rules; introduced the companion Toolkit and the framework alignment annex.
5.0 (draft)	September 2026	Restructured into three parts: Foundations, Utility Framework, and National and Sector Adoption. Added the adoption model, roles of an Adopting Body, sector minimum baseline and companion specification, sector reporting and benchmarking, shared services and aggregated procurement, competency framework and reviewer accreditation, sector monitoring and evaluation, and framework governance, validation, licensing, and Metro Power’s commitments. Added Annexes H and I, the Sector Toolkit, and templates T13–T15.

Version	Date	Summary of change
5.1	September 22, 2026	Issued. Quality review for national and sector adoption. Licensing made perpetual and irrevocable with a right to reissue; revision authority for adopted editions given to the Adopting Body; general advisor conflict-of-interest rules (Section 13.3) and independent specification review for every tender. Statistical pass rule replaced with a pre-set non-inferiority rule, with finite-population and census rules for small strata. Security gate rule based on remediation deadlines; key lifecycle, supply-chain, and multi-tenant controls. Regulatory register updated and dated; disconnection windows made configurable. Added consumer and member consultation and a Workforce Transition Plan at Gate 4, conditional rollout contracts, off-grid and missionary areas, conformance and certification regime, peer-group benchmarking, sector data definitions, and a staged validation plan.

Summary of Changes from Version 3.2

Area	Version 3.2	Version 5.1
Structure	13 “phases” mixing one-time stages with ongoing functions; business case after scaling	Six stages (Assess, Model, Pilot, Evaluate, Roll Out, Evolve), each ending in a decision gate, plus four continuous workstreams
Decisions	Classifications not tied to measurable criteria	Gate criteria, evidence, decision owners, allowed outcomes, independent review at Gates 2 and 4, and rules for conditions, failure, pause, and exit
Evidence	No pilot hypotheses, sizing, or duration rules	Pre-approved evaluation and analysis plans, stratified sampling, per-stratum pass rules, register-read reconciliation, and an amendment log
Business case	Generic cost-benefit guidance	Five cases; function-to-benefit-to-beneficiary mapping; component-life replacement; rate impact; non-monetary effects
Technical	Class 0.2S for all meters; every module to support every technology; universal signal threshold	Accuracy by segment; technology-neutral requirements; measurable KPI definitions; firmware, logistics, and in-service testing controls
Consumers and regulation	General references	Specific issuances; disconnection and prepaid safeguards; theft enforcement under RA 7832; meter-test turnaround
Format	223 pages with embedded templates	Rules in the Protocol; all forms, registers, and calculators in the companion Toolkit
Sector use	Utility-level guidance only	Part III: adoption model, sector baseline, reporting, shared services, reviewer accreditation, governance, and licensing

About This Protocol

The AMPERE Protocol is Metro Power Corporation's structured approach to helping Philippine distribution utilities (DUs) and electric cooperatives (ECs) decide whether, where, how, and how fast to invest in Advanced Metering Infrastructure (AMI) and to operate it well once it is installed.

It starts from a lesson repeated in published reviews of large AMI programs, such as the United States Department of Energy's Smart Grid Investment Grant results (Annex G.6): most AMI difficulties are not caused by the meter. They come from decisions made without evidence, systems that were never integrated, pilots that proved nothing, consumers who were not prepared, and organizations that treated go-live as the finish line. AMPERE is designed to prevent those failures by making every major commitment pass through a defined decision gate with defined evidence.

Status and Authority

- This Protocol is developed and maintained by Metro Power. It is written for two uses: by an individual utility for its own AMI program, and for adoption by a government agency, regulator, supervising body, or association as a national or sector-wide framework (Part III).
- It has no legal force of its own and is not issued or endorsed by any government agency unless an agency adopts it by its own instrument. Any mandatory effect comes only from such an instrument (Section 23.2).
- It is designed to be consistent with the issuances of the Energy Regulatory Commission (ERC), the Department of Energy (DOE), the National Electrification Administration (NEA), the National Privacy Commission (NPC), the Department of Information and Communications Technology (DICT), and the National Telecommunications Commission (NTC). Where this Protocol and any law, regulation, or regulatory approval differ, **the law, regulation, or approval prevails.**
- It does not replace utility engineering judgment, procurement rules, legal advice, or regulatory approval, and it is not a procurement specification or a certification standard.
- Metro Power offers it as a contribution to the Philippine electric power industry. It may be used, adapted, and reissued free of charge under the license in Section 30.4, and it is provided without warranty.

Independence and Technology Neutrality

AMPERE is technology-neutral. It does not prefer any manufacturer, communication technology, or software platform. Metro Power and its technology partners also offer AMI solutions. The conflict-of-interest rules in Section 13.3 apply to every advisor, including Metro Power, and Metro Power's own additional commitments are set out in Section 30.5. At the start of every engagement, Metro Power gives the utility a written disclosure naming its technology partners and any commercial interest in the outcome, and it publishes its current list of technology partners. Every gate criterion in this Protocol applies to Metro Power's solutions exactly as it applies to any other.

Companion AMPERE Toolkit

This Protocol sets out what a utility must decide and what evidence it needs. The companion AMPERE Toolkit provides the working instruments to do it:

- **Toolkit workbook (.xlsx):** readiness scoring with automatic gate checks and an optional maturity survey, baseline KPIs, workforce matrix, communication technology scoring, business case model with component-life replacement scheduling, benefit mapping, assumptions register, requirements compliance evaluation, pilot KPI tracker, pilot analysis plan and amendment log, site selection and

sample-size calculator, pilot budget, program plan, acceptance test catalog, defect and security-finding log, risk register, gate log, tailoring and deviation register, document register, sector submission, stakeholder plan, complaint log, consumer education plan, cybersecurity and privacy tracker mapped to NIST CSF 2.0, reporting cadence, rollout cohort tracker with installation-quality checks, meter logistics register, failure and warranty tracker, benefits tracker, and regulatory register.

- **Sector Toolkit workbook (.xlsx)**, for an Adopting Body (Part III): utility program register, concurrence log, sector submissions, anonymized benchmark, reviewer pool, shared-services register, lessons repository, change requests, and sector indicators.
- **Toolkit document templates (.docx)**: T1 Gate Decision Paper; T2 Pilot Evaluation Report; T3 Regulatory Application Package Outline; T4 AMI Requirements Specification and Tender Outline; T5 Consumer Pre-Installation Notice; T6 First AMI Bill Explanation Insert; T7 Field Installation and Safety Checklist; T8 Wave Completion Report; T9 Independent Gate Review Report; T10 Advisor Conflict-of-Interest Disclosure; T11 AMPERE Conformance Statement and Transition Mapping; T12 Program Exit Checklist; T13 Reviewer Accreditation Application and Conflict Declaration; T14 Framework Change Request; and T15 Adoption Checklist for an Adopting Body.

How to Read This Document

If you are...	Read first
A Board member or General Manager	Section 1 (Executive Summary), Section 3 (Principles), Section 5 (Stage-Gate Model), Section 13 (Decision Rights), Section 19 (Business Case)
A program or project manager	Sections 2.5, 5–12, and 22; Annexes A–D; and the AMPERE Toolkit
An engineering, metering, or IT lead	Sections 7, 8, 10, 15, 18, and 20; Annex E
A finance or regulatory lead	Sections 14 and 19; Toolkit sheets M2 and Regulatory Register
A government agency, regulator, or association considering adoption	Part III (Sections 23–30), Section 5, Section 2.5 (minimum mandatory set), and Annexes H and I
A funder, lender, or external reviewer	Section 5 (Stage-Gate Model and independent review), Section 19 (Five Cases), and Annex G (alignment with recognized frameworks)
A consumer services or data privacy lead	Sections 16 and 17

Conventions

- **Must** (in running text, “must”) indicates a requirement for a utility to claim that it is following the AMPERE Protocol. In gate tables, a **Must criterion** is one that has to be met before the gate can be passed (Section 5.1).
- **Should** indicates a strong recommendation; departures should be documented with the reason. A **Should criterion** at a gate may be waived by the decision owner with the reason recorded.
- **May** indicates an option.
- Numerical targets in this Protocol are **Metro Power recommended defaults**: starting points set by Metro Power for discussion, not regulatory standards or measured benchmarks. A utility must confirm or adjust them in its own approved plans. They are provisional: they will be calibrated during field validation (Section 30.3). They are not service standards, and when the ERC or another authority issues performance or service standards for AMI, those standards prevail over any default in this document.
- References to laws and issuances mean those instruments as amended or superseded.

Contents

Document Control.....	2
Revision History.....	2
Summary of Changes from Version 3.2.....	3
About This Protocol.....	4
Status and Authority.....	4
Independence and Technology Neutrality.....	4
Companion AMPERE Toolkit.....	4
How to Read This Document.....	5
Conventions.....	5
Part I: Foundations.....	12
1. Executive Summary.....	12
2. Purpose, Scope, and Use.....	14
2.1 Purpose.....	14
2.2 Scope.....	14
2.3 Who Should Use It.....	14
2.4 Scaling the Protocol to the Utility.....	14
2.5 Tailoring and the Minimum Mandatory Set.....	15
3. The AMPERE Principles.....	17
4. AMI in Brief: What Utilities Are Actually Buying.....	18
4.1 The AMI Value Chain.....	18
4.2 Typical Functional Capabilities.....	18
4.3 What AMI Does Not Do on Its Own.....	18
Part II: Utility Framework.....	19
5. The AMPERE Stage-Gate Model.....	19
5.1 Gate Rules.....	19
5.2 Continuous Workstreams.....	20
5.3 Indicative Roadmap.....	20
5.4 Independent Gate Review.....	21
5.5 Gate Failure, Pause, Restart, and Exit.....	22
6. Stage A: Assess.....	23
6.1 Purpose.....	23
6.2 Key Questions.....	23
6.3 Core Activities.....	23
6.4 Deliverables.....	23
6.5 Gate 1: Proceed to Model.....	24
7. Stage M: Model.....	25
7.1 Purpose.....	25
7.2 Key Questions.....	25
7.3 Core Activities.....	25
7.4 Deliverables.....	25
7.5 Gate 2: Pilot Approval.....	26
8. Stage P: Pilot.....	28
8.1 Purpose.....	28

8.2 Key Questions.....	28
8.3 Core Activities.....	28
8.4 Deliverables.....	28
8.5 Gate 3: Technical Acceptance.....	29
8.6 Designing a Pilot That Produces Evidence.....	29
9. Stage E1: Evaluate.....	32
9.1 Purpose.....	32
9.2 Key Questions.....	32
9.3 Core Activities.....	32
9.4 Deliverables.....	32
9.5 Gate 4: Investment Decision.....	32
9.6 Decision Rules.....	33
9.7 Approvals Before Rollout Commitments.....	34
10. Stage R: Roll Out.....	35
10.1 Purpose.....	35
10.2 Key Questions.....	35
10.3 Core Activities.....	35
10.4 Deliverables.....	35
10.5 Gate 5: Cohort Checks and Program Handover.....	35
10.6 Pause Triggers.....	36
10.7 Change Control After Gate 4.....	36
10.8 Deployment Prioritization.....	37
10.9 Installation Quality and Contractor Management.....	37
10.10 Meter Logistics and Asset Management.....	37
11. Stage E2: Evolve.....	38
11.1 Purpose.....	38
11.2 Core Activities.....	38
11.3 Annual Board Review.....	38
12. Continuous Workstreams.....	39
12.1 Workforce Transition Plan.....	39
13. Governance, Roles, and Decision Rights.....	40
13.1 Governance Bodies.....	40
13.2 Decision Rights Matrix.....	40
13.3 Advisor Conflicts of Interest.....	41
14. Regulatory and Legal Alignment.....	43
14.1 Regulatory Coordination Across the Stages.....	45
15. Technology, Standards, and Interoperability.....	46
15.1 Meter Accuracy by Customer Segment.....	46
15.2 Reference Standards.....	46
15.3 Interoperability and Lock-In Protection.....	47
15.4 Communication Technology Selection.....	47
15.5 Tamper and Theft Detection.....	48
15.6 Procurement and Contract Protections.....	48
15.7 Missionary, Off-Grid, and Island Areas.....	49
16. Cybersecurity and Data Privacy.....	50
16.1 Minimum Security Controls.....	50
16.2 Data Privacy.....	51

16.3 Regulatory Cybersecurity Obligations.....	51
16.4 Alignment with NIST CSF 2.0.....	51
16.5 Resilience and Business Continuity.....	52
17. Consumer Protection.....	53
17.1 Communication Before, During, and After Installation.....	53
17.2 Remote Disconnection Safeguards.....	53
17.3 Prepaid Service.....	53
17.4 Access to Usage Data.....	54
17.5 Complaints, Disputes, and Meter Testing.....	54
17.6 Vulnerable Consumers.....	54
17.7 Consumer and Member Consultation.....	54
18. Data Quality, VEE, and Billing Integrity.....	56
18.1 Principles.....	56
18.2 Validation.....	56
18.3 Estimation.....	56
18.4 Editing Controls.....	56
18.5 Register-Read Reconciliation.....	56
18.6 Master Data Quality and Migration.....	57
18.7 Time Synchronization.....	57
19. Business Case and Investment Planning.....	58
19.1 Structure: The Five Cases.....	58
19.2 Cost Structure.....	58
19.3 Benefits, Beneficiaries, and Attribution.....	59
19.4 Non-Monetary Effects.....	60
19.5 Financial Evaluation.....	60
19.6 Funding and Approval.....	60
20. Operating AMI After Go-Live.....	61
20.1 Operating Model Options.....	61
20.2 Minimum Operating Functions.....	61
20.3 Lifecycle Management and In-Service Performance.....	61
20.4 Use-Case Catalog: Turning Data into Decisions.....	62
20.5 From Detection to Enforcement.....	63
20.6 Firmware and Configuration Governance.....	63
21. Performance Measurement.....	64
21.1 Core Pilot KPIs.....	64
21.2 Rollout and Operating KPIs.....	65
21.3 Measuring Loss Reduction.....	66
21.4 Reporting Cadence.....	66
21.5 Definitions for Consumer and Security Reporting.....	67
22. Worked Example: A Fictional Cooperative Through the Gates.....	68
22.1 Starting Point.....	68
22.2 Stage A and Gate 1.....	68
22.3 Stage M and Gate 2.....	68
22.4 Stage P and Gate 3.....	68
22.5 Stage E1 and Gate 4.....	69
22.6 What the Example Shows.....	69
Part III: National and Sector Adoption.....	70

23. Adoption Model.....	70
23.1 Two Levels of Use.....	70
23.2 Forms of Adoption.....	70
23.3 Core and Localizable Content.....	70
23.4 Programs Already Under Way.....	71
24. Roles of an Adopting Body.....	72
24.1 Adopting Body Responsibilities.....	72
24.2 Operating Model and Phasing for an Adopting Body.....	72
24.3 When a Utility Does Not Conform.....	73
25. Sector Minimum Baseline.....	74
25.1 Sector Companion Specification.....	74
25.2 Conformance and Certification.....	75
25.3 Sector Data Services.....	75
26. Sector Reporting and Benchmarking.....	76
26.1 Reporting Dataset and Frequency.....	76
26.2 Data Quality.....	76
26.3 Confidentiality and Publication.....	76
26.4 Annual Sector Report.....	76
27. Shared Services and Aggregated Procurement.....	77
27.1 Conditions for Any Shared Model.....	77
27.2 Shared Specialist Services.....	77
28. Capacity Building, Competency, and Reviewer Accreditation.....	78
28.1 Competency Framework.....	78
28.2 Independent Reviewer Accreditation.....	78
28.3 Training Delivery.....	78
29. Sector Monitoring, Evaluation, and Knowledge Management.....	79
29.1 Sector Indicators.....	79
29.2 Evaluation of the Framework.....	79
29.3 Knowledge Sharing.....	79
30. Framework Governance, Validation, and Licensing.....	80
30.1 Ownership and Stewardship.....	80
30.2 Revision Process.....	80
30.3 Validation Status and Plan.....	80
30.4 Licensing and Attribution.....	80
30.5 Metro Power's Commitments.....	81
30.6 Maintenance.....	82
Annexes.....	83
Annex A: Readiness Assessment Method.....	83
A.1 Categories and Scoring.....	83
A.2 Knockout Items.....	83
A.3 Minimum Scores by Gate.....	84
Annex B: Gate Outcomes and Decision Paper Contents.....	85
B.1 Allowed Outcomes by Gate.....	85
B.2 Decision Paper Contents.....	85
Annex C: Pilot Evaluation Plan Requirements.....	87
C.1 Standard Hypotheses.....	87

C.2 Required Contents.....	87
Annex D: KPI Reference Definitions.....	89
D.1 Baseline KPIs (Stage A).....	89
D.2 Pilot and Operating KPIs.....	89
Annex E: Technical Requirements.....	90
E.1 Smart Meters.....	90
E.2 Communications.....	90
E.3 Head-End System.....	91
E.4 Meter Data Management and Billing Integration.....	91
E.5 Outage and Network Integration.....	91
E.6 Supply Chain and Vendor Access.....	91
Annex F: Glossary and Acronyms.....	93
Annex G: Alignment with Recognized Frameworks.....	97
G.1 UK Gateway Review Process.....	97
G.2 HM Treasury Five Case Model.....	97
G.3 EU Joint Research Centre Guidelines for Smart-Metering Cost-Benefit Analysis (2012).....	98
G.4 NIST Cybersecurity Framework 2.0.....	98
G.5 SPIRIT 2025 Guideline for Trial Protocols.....	98
G.6 Other Sources Drawn On.....	99
Annex H: Sector Reporting Dataset.....	100
Annex I: Minimum Data Exchange Profile.....	101

Part I: Foundations

Part I explains what AMPERE is for, what it covers, the principles behind it, and what an AMI investment actually involves.

1. Executive Summary

AMI is not a meter purchase. It is a connected operating system for the utility, made up of meters, a communication network, head-end and meter data management software, billing integration, security controls, business processes, and the people who run them. Once it is installed, it is a long-term operating commitment that the utility carries for the life of the assets.

For a Philippine utility, the investment case usually rests on a small number of outcomes: lower non-technical losses, fewer estimated and disputed bills, lower meter-reading and field-visit costs, faster outage detection and restoration, and better information for network planning. Each of those outcomes depends as much on process, data quality, and organizational discipline as on technology. That is why AMI programs that look sound on paper can fail in practice.

The AMPERE Protocol organizes an AMI program into six stages. Each stage ends in a decision gate with defined evidence and a named decision owner:

Stage	Question it answers	Gate decision
A: Assess	Are we ready, and what is our true starting point?	Gate 1: Proceed to Model, or close gaps first
M: Model	What solution fits our network, consumers, and finances, and is a pilot worth funding?	Gate 2: Approve pilot scope, budget, and procurement
P: Pilot	Does the solution work under our real operating conditions?	Gate 3: Technical acceptance of the pilot system
E1: Evaluate	Did the pilot prove the investment case?	Gate 4: Scale, scale with conditions, extend and correct, re-scope, or stop
R: Roll Out	Are we deploying in controlled waves and realizing the benefits?	Gate 5: Rolling cohort checks and program handover
E2: Evolve	Are we operating, securing, and extracting value from AMI over its life?	Annual performance and benefits review

Four workstreams run through every stage: governance and program management; cybersecurity and data privacy; consumer protection and engagement; and data quality and billing integrity.

AMPERE works at two levels. A single utility can apply Parts I and II to its own program. A government agency, regulator, or association can adopt the framework for many utilities, adding the sector layer in Part III: common minimum requirements, comparable reporting, shared services for smaller utilities, accredited independent reviewers, and a governed process for revising the framework.

What a Board receives under AMPERE

At each gate, the Board or its delegate receives a short decision paper stating the decision requested, the evidence against each gate criterion, the risks that remain, the cost of proceeding and of not proceeding,

and the recommended option. No stage begins, and no significant money is committed, without an explicit decision recorded at the preceding gate.

2. Purpose, Scope, and Use

2.1 Purpose

This Protocol gives utilities a practical and repeatable method for making AMI investment decisions on evidence, implementing AMI with controlled risk, protecting consumers and their data, meeting regulatory requirements, and realizing measurable value over the life of the system.

2.2 Scope

The Protocol covers the full AMI lifecycle from initial readiness assessment through pilot, investment decision, phased deployment, and long-term operation. It covers:

- Smart meters for residential, commercial, and industrial customers, including prepaid and net-metered installations
- Field and backhaul communication networks
- Head-End Systems (HES) and Meter Data Management Systems (MDMS)
- Integration with customer information and billing systems (CIS), geographic information systems (GIS), outage management systems (OMS), and SCADA or distribution management systems where present
- Consumer data access, including the Consumer Meter Data Channel (CMDCh) required under the ERC Amended AMI Rules
- The governance, security, privacy, consumer-protection, workforce, and financial arrangements needed to run AMI

Broader smart grid capabilities, such as distribution automation, distributed energy resource management, battery storage, and EV charging integration, are addressed only to the extent that AMI decisions made today should keep those options open.

Part III adds the sector layer needed when AMPERE is adopted nationally or across a group of utilities.

2.3 Who Should Use It

The Protocol is written for utility Boards, General Managers, and the teams that plan and run AMI: engineering, metering, IT, billing, consumer services, finance, regulatory affairs, and internal audit. Consultants, system integrators, and technology providers working with a utility may use it to align their work with the utility's decision process.

Government agencies, regulators, supervising bodies, and associations of utilities may use Part III to adopt AMPERE as a common framework for the programs they fund, supervise, or represent.

2.4 Scaling the Protocol to the Utility

A small electric cooperative with tens of thousands of consumers and a large distribution utility with millions face the same decisions but not the same resources. The stages and gates apply to every utility; the depth of work within each stage should be proportionate.

Element	Smaller utility (lean path)	Larger utility (full path)
Governance	Steering Committee of the GM and 3–5 department heads; TWG may double as the program team	Separate Steering Committee, Program Management Office, and TWG

Element	Smaller utility (lean path)	Larger utility (full path)
Assessment	Facilitated workshop plus document and data review	Formal assessment across all categories with field sampling
Pilot	Single technology in one or two representative areas	Multiple technologies or vendors, stratified across representative areas
Business case	Structured spreadsheet model with sensitivity analysis	Full financial model with scenario analysis and independent review
Operations	Managed-service or co-sourced model often more practical	In-house or co-sourced operations center

The lean path is not a shortcut around evidence. It changes how much work is done, not whether the evidence exists.

2.5 Tailoring and the Minimum Mandatory Set

A utility may tailor this Protocol to its size and circumstances, but every tailoring decision must be recorded, justified, and approved by the Steering Committee in the Toolkit sheet “W1 Tailoring & Deviations” before the gate it affects. The following cannot be tailored away:

- All five gates, with written decision records
- Knockout items and minimum readiness scores (Annex A)
- A measured operational baseline
- A Pilot Evaluation Plan with Must-Pass KPIs fixed before procurement, judged by stratum
- Register-read reconciliation
- Consumer safeguards for disconnection, prepaid service, complaints, and consultation (Section 17)
- A designated DPO and a Privacy Impact Assessment
- No open Critical security findings, and no High finding past its remediation deadline or without an approved compensating control, at Gates 3 and 4 (Section 16.1)
- Independent review at Gates 2 and 4
- Advisor conflict-of-interest disclosures and independent review of every AMI procurement specification (Section 13.3)

May be tailored with approval	Typical lean-path choice
Pilot precision	±2 percentage points (about 280 meters per stratum) instead of ±1
Number of strata	Two or three, combining similar areas
Form of independent review at Gate 2	Peer reviewer with a three-level rating
Business case depth at Gate 2	Short-form five cases on the Toolkit template
Key custody arrangement	A utility-controlled partition in a shared or cloud hardware security module instead of a dedicated one (keys must still never be held by a supplier alone; Section 16.1)
Reporting frequency	Combine monthly reports into one Steering Committee pack

May be tailored with approval	Typical lean-path choice
Optional Toolkit sheets	Maturity survey, workforce matrix, communication scoring

The Toolkit's lean core is fourteen sheets: A1, A2, M2, M3, P1, P2, P5, P6, P7, W1 Gate Log, W1 Tailoring & Deviations, W2 Cyber & Privacy, W3 Complaint Log, and R Rollout Cohorts, plus K2 Sector Submission where a sector framework applies. A utility claiming to follow AMPERE records its conformance and any deviations using Toolkit template T11.

3. The AMPERE Principles

Eight principles guide every decision under this Protocol. When a situation is not covered by a specific requirement, these principles decide it.

Principle	What it means in practice
1. AMI is an operating ecosystem, not a meter purchase.	Value comes from meters, networks, software, integration, processes, and people working together. A proposal that prices only meters and installation is incomplete.
2. Fit the solution to the utility.	Technology must suit the utility's geography, network topology, consumer mix, existing systems, capabilities, and finances. There is no universally best AMI technology.
3. A pilot exists to produce decision evidence.	A pilot is not a demonstration. It tests stated hypotheses against pre-agreed criteria so that the Board can make an informed investment decision, including the decision not to proceed.
4. Governance matters as much as technology.	Clear ownership, decision rights, and disciplined execution determine outcomes more often than product features do.
5. Deployment begins a long-term commitment.	Go-live is the start of years of operation, maintenance, security, firmware management, and asset renewal, all of which must be planned and funded before scaling.
6. Data has value only when it changes decisions.	Every AMI data stream should be linked to a named decision, a responsible owner, and a measurable outcome for the utility and its member-consumer-owners.
7. Consumer trust is a precondition.	Accurate bills, transparent communication, fair treatment, and protected personal data are requirements for deployment, not activities to add later.
8. Keep options open.	Open standards, data portability, and contractual protections should prevent lock-in to any single vendor or technology.

4. AMI in Brief: What Utilities Are Actually Buying

4.1 The AMI Value Chain

Each layer below must work for the layer above it to deliver value. A weakness at any layer, such as poor meter-to-transformer mapping or an unreliable billing interface, limits the value of the whole system.

Layer	Components	What it must deliver
Field devices	Smart meters, communication modules, service switches, data concentrators, transformer meters	Accurate measurement; event and tamper detection; secure remote operation
Communications	Field area network (PLC, RF mesh, or cellular) and backhaul (cellular, fiber, microwave, or satellite)	Reliable, secure delivery of data and commands within defined time windows
Head-End System	Device communication, command execution, firmware and key management	Complete, timely collection; controlled execution of remote operations
Meter Data Management	Data store, validation, estimation, and editing (VEE), aggregation, analytics	Billing-quality data with a full audit trail
Enterprise integration	CIS and billing, GIS, OMS, SCADA or DMS, CMDC and consumer channels	Correct bills; outage visibility; network insight; consumer access
Decisions and outcomes	Operating processes, analytics, and people	Measurable reductions in losses, costs, disputes, and outage duration

4.2 Typical Functional Capabilities

- Remote register and interval (load profile) reading
- Remote connection, disconnection, and reconnection, subject to the consumer safeguards in Section 17
- Event and alarm reporting, including power outage (“last gasp”) and restoration, tamper, and voltage events
- Prepaid metering and net-metering (bidirectional) measurement where offered
- Over-the-air firmware and configuration management
- Voltage and power-quality monitoring, depending on meter capability
- Consumer access to usage data through the CMDC and other channels

4.3 What AMI Does Not Do on Its Own

- It does not reduce losses by itself. Loss reduction requires accurate meter-to-transformer mapping, transformer-level energy balancing, investigation capacity, and enforcement.
- It does not fix billing by itself. Billing accuracy depends on VEE rules, CIS data quality, interface reliability, and exception handling.
- It does not detect every form of theft. A bypass wired ahead of a meter is invisible to that meter and can only be found by comparing metered consumption against energy supplied to the transformer or feeder.
- It does not improve outage response unless outage events are integrated into dispatch and restoration processes.

Part II: Utility Framework

Part II sets out the stage-gate model, the six stages, the continuous workstreams, governance, and the domain requirements a utility applies to its own AMI program.

5. The AMPERE Stage-Gate Model

AMPERE divides an AMI program into six stages. Stages are sequential: a stage does not formally begin until the gate before it has been passed. Work within a stage can overlap with preparation for the next stage, but no significant financial or contractual commitment for the next stage may be made before the gate decision.

Stage	Main work	Ends with	Decision owner
A: Assess	Readiness assessment, smart grid maturity, operational and metering baseline	Gate 1: Proceed to Model	General Manager, on Steering Committee recommendation
M: Model	Requirements, communication feasibility, architecture, privacy impact assessment, preliminary business case, pilot and procurement plan	Gate 2: Pilot approval	Board of Directors
P: Pilot	Procurement, factory and site acceptance testing, installation, integration, pilot operation	Gate 3: Technical acceptance	Steering Committee, on TWG recommendation
E1: Evaluate	Evaluation against the pre-approved plan, final business case, rollout plan, regulatory application	Gate 4: Investment decision	Board of Directors
R: Roll Out	Deployment in waves, legacy meter retirement, benefits tracking	Gate 5: Rolling cohort checks and program handover	Steering Committee (cohort checks); Board (handover)
E2: Evolve	Operation, maintenance, security, lifecycle management, use-case expansion	Annual review	Board of Directors

5.1 Gate Rules

- Each gate has **Must** criteria, all of which must be met, and **Should** criteria, any of which may be waived by the decision owner with the reason recorded. A Must criterion is either met or not met; it is never waived.
- A gate may be passed **with conditions** only when every Must criterion is met and the conditions concern Should criteria, gap-plan items, or Minor defects. Each condition has an owner and a deadline no later than the next gate or 90 days, whichever is sooner. Unmet conditions are reported at the next Steering Committee meeting. At Gate 4, “Scale with conditions” may also impose program conditions on rollout pace, commercial protections, or benefit milestones; each has an owner and a date set in the Board resolution and is tracked in the W1 Gate Log.
- Vendor claims that have not been verified by testing, certificates from accredited laboratories, or reference sites cannot be the sole evidence for a Must criterion or for a benefit counted in the business case.
- Each gate has its own allowed outcomes, listed with its criteria and in Annex B.

- Evidence for each criterion is documented in a gate decision paper (contents in Annex B; form in Toolkit template T1) and retained in the program record.
- Gates 2 and 4 require an independent gate review (Section 5.4) before the decision owner decides. Independent review is recommended at the other gates.
- Evidence older than six months at the date of the gate decision is refreshed or re-confirmed before it is relied on (Metro Power recommended default). This is the single evidence-validity rule for all gates.
- A gate decision is recorded in writing with the date, the decision owner, the outcome, and any conditions. Where the Board of Directors is the decision owner, the record is a Board resolution. A decision that has not been recorded has not been made.
- “Submitted,” “reviewed,” and “approved” are different states. A deliverable counts toward a gate only when it has been approved by its designated approver.
- A gate may result in a decision to stop. Stopping on evidence is a successful use of the Protocol, not a failure.

5.2 Continuous Workstreams

Four workstreams run across all stages and are described in Section 12:

- W1: Governance and Program Management
- W2: Cybersecurity and Data Privacy
- W3: Consumer Protection and Engagement
- W4: Data Quality, VEE, and Billing Integrity

Each workstream has specific outputs that feed the gate criteria. A gate cannot be passed if a workstream criterion attached to it is unmet.

5.3 Indicative Roadmap

The durations below are Metro Power planning assumptions built from the steps each stage requires. They are not measured benchmarks or commitments. Actual durations depend on the utility’s size, procurement rules, import lead times, Board calendars, and regulatory approval times, which are outside the utility’s control.

Stage	Indicative duration	Main drivers
A: Assess	2–4 months	Availability and quality of records; time to measure the baseline and verify mapping samples
M: Model	3–6 months	Field surveys; integration design; business case; Board scheduling
P: Pilot (procurement)	3–9 months	Procurement rules; bid periods; contract negotiation; manufacturing and import lead times
P: Pilot (installation and SAT)	2–4 months	Pilot size; consumer notification; integration readiness
P: Pilot (measurement)	At least 3 billing cycles	Longer if the wet season or typhoon months must be included; billing accuracy needs 90 days after the bills measured
E1: Evaluate	2–3 months, plus regulatory approval time	Data review; final business case; application preparation; regulator’s review period

Stage	Indicative duration	Main drivers
R: Roll Out	Typically 2–5 years	Number of meters; funding; installation capacity; wave results
E2: Evolve	Life of the assets	Continuous

On these assumptions, a utility should plan for roughly 15 to 30 months from the start of Stage A to the Gate 4 investment decision, before regulatory approval time. Shortening Stage A or the pilot measurement period moves problems into rollout, where they affect more consumers and cost more to fix.

5.4 Independent Gate Review

People who prepare gate evidence cannot also be its only reviewers. Before the decision owner decides at Gates 2 and 4, an independent reviewer examines the evidence and gives a delivery confidence rating. The review is short and focused: it tests whether the evidence really supports the decision, not whether documents exist. It is not a checklist exercise.

Element	Requirement
Who may review	Someone who did not prepare the evidence and has no stake in the outcome: the utility's internal audit, a peer from another utility or electric cooperative, or an external reviewer. No advisor engaged on the program may act as its reviewer (Section 13.3), and Metro Power is never an independent reviewer under this Protocol (Section 30.5).
When	Required before Gates 2 and 4. Recommended before Gates 1, 3, and 5, and whenever a program is in difficulty.
Inputs	The draft gate decision paper and the deliverables it relies on; access to the program team
Output	A short review report (Toolkit template T9) with a delivery confidence rating, the main findings, and prioritized recommendations
Use	The rating and recommendations are attached to the gate decision paper. The decision owner records how each Critical recommendation was addressed.

Delivery confidence rating	Meaning
Green	Successful delivery appears highly likely; no major issues threaten delivery
Green/Amber	Successful delivery appears probable; issues need attention but should not threaten delivery
Amber	Successful delivery is feasible, but significant issues need management attention now
Amber/Red	Successful delivery is in doubt; major issues must be resolved urgently
Red	Successful delivery appears unachievable without major changes to scope, plan, or approach

On the lean path (Section 2.5), the Gate 2 reviewer may use a three-level rating: Green, Amber, or Red. Gate 4 reviews use the five-level rating.

Recommendations are classed as **Critical** (address before the decision), **Essential** (address soon, with an owner and date), or **Recommended** (would improve the program). A Red or Amber/Red rating does not by itself stop a program, but the decision owner must record why it is proceeding.

5.5 Gate Failure, Pause, Restart, and Exit

Situation	Rule
Gate not passed	The decision paper records which criteria were not met. The team returns with evidence only for those criteria, plus any evidence that has passed its six-month validity. A new independent review is required at Gates 2 and 4 if more than three months have passed or the proposal has materially changed.
Program paused	The decision owner records the reason, the expected duration, and what continues during the pause: security monitoring and patching, consumer support, and meter reading for installed meters. Restart requires a check of every gate criterion the pause may have affected.
Program stopped	A stop is a recorded gate decision. The utility completes the exit checklist (Toolkit template T12) before closing the program.

The exit checklist covers: notice to affected consumers; the future of installed meters (continue operating them, with manual reading if needed, or replace them); retention or deletion of personal data under the Data Privacy Act; contract termination and exit assistance; data export from vendor systems; asset accounting; notice to the ERC and, for electric cooperatives, the NEA where required; and a lessons-learned review.

6. Stage A: Assess

6.1 Purpose

Establish whether the utility is ready to undertake AMI, identify the gaps that must be closed first, and measure the operational baseline against which every future benefit will be judged. Without a measured baseline, benefits cannot be proven and the business case cannot be defended before the Board or the regulator.

6.2 Key Questions

- Do we have the leadership commitment, governance, and capacity to run an AMI program?
- What are our actual current levels of losses, billing accuracy, estimated bills, meter-reading cost, complaints, and outage performance?
- How reliable are our customer, meter, and network records, especially meter-to-transformer mapping?
- Which constraints (financial, geographic, workforce, systems) will shape the solution?
- What must be fixed before a pilot can produce trustworthy evidence?

6.3 Core Activities

- Readiness assessment across eight categories using the scoring method in Annex A
- Smart grid maturity review of customer service, network visibility, analytics, and workforce capability
- Operational baseline measured from at least 12 months of records where available (see Section 21 and Annex D for definitions)
- Meter population census: type, age, accuracy class, reading method, condition, and known defects
- Data quality sampling of CIS, GIS, and meter-to-transformer mapping in candidate pilot areas, including multipliers, phase, and tariff codes
- Where the business case depends on loss reduction, install meters on a sample of candidate pilot-area transformers early enough to record at least two months of transformer-level losses before AMI installation (Section 21.3)
- Review of existing IT systems, interfaces, and the ability to export and import billing data
- Initial regulatory review against the Regulatory Register in the Toolkit
- Stakeholder interviews and an executive workshop to agree on objectives

6.4 Deliverables

ID	Deliverable	Content
A-1	Readiness Assessment Report	Category scores with evidence; knockout items; gaps and closure actions
A-2	Operational Baseline Report	Measured values for every baseline KPI in Annex D, with data sources and data-quality notes
A-3	Meter and Systems Inventory	Meter census; systems and interfaces; data export capability
A-4	AMI Objectives Statement	The three to five outcomes the utility wants, expressed as measurable targets and approved by the General Manager

ID	Deliverable	Content
A-5	Gap Closure Plan	Actions, owners, and dates for gaps that must be closed before Stage M or Stage P

6.5 Gate 1: Proceed to Model

Gate 1 confirms that the utility understands its starting point and has the minimum foundations to design a solution.

#	Gate criterion	Type
1	Executive sponsor named and Steering Committee constituted with written terms of reference	Must
2	Readiness assessment completed with no unresolved knockout items (Annex A)	Must
3	Every readiness category scores at least 2	Must
4	Operational baseline measured for all Must baseline KPIs, with data sources documented	Must
5	AMI objectives approved and expressed as measurable targets	Must
6	Data Protection Officer designated	Must
7	Gap closure plan approved, with owners and dates	Should
8	Budget authority for Stage M confirmed	Must
9	Tailoring decisions, if the lean path is used, recorded and approved (Section 2.5)	Must

Decision owner	Allowed outcomes
General Manager, on Steering Committee recommendation	Proceed to Stage M; Proceed with conditions (only Should criteria or gap-plan items outstanding, each with an owner and date); Hold until gaps are closed

7. Stage M: Model

7.1 Purpose

Design the solution that fits the utility, test whether it is likely to be worth the investment, and prepare a pilot that will produce decision-grade evidence. This is where the most consequential design choices are made, including communication technology, integration approach, operating model, and contract structure.

7.2 Key Questions

- Which functions do we need now, and which do we need to keep available for later?
- Which communication technology or combination fits our terrain, density, transformer configuration, and budget?
- How will AMI integrate with our billing system and other enterprise systems?
- Is there a plausible business case, and what must the pilot prove for that case to hold?
- How will we buy, contract, and avoid lock-in?
- What privacy and security risks do we create, and how will we control them?

7.3 Core Activities

- Functional and non-functional requirements, including a functional scope for the pilot and for full deployment
- Communication feasibility study, including field propagation or signal surveys in representative areas and a technology comparison (Section 15.4)
- Reference architecture and integration design (HES–MDMS–CIS interfaces, CMDC, OMS and GIS where relevant)
- Security architecture and key-management design; Privacy Impact Assessment (Section 16)
- Preliminary business case with lifecycle costs, benefit hypotheses tied to baseline values, and sensitivity analysis (Section 19)
- Operating model options for after go-live (Section 20)
- Pilot Evaluation Plan with hypotheses, success criteria, sample design, and duration (Section 8.6 and Annex C)
- Procurement strategy, evaluation criteria, and contract protections (Section 15.6)
- Consumer engagement plan for pilot areas (Section 17)
- Early engagement with the ERC and, for electric cooperatives, the NEA, on the intended approach

7.4 Deliverables

ID	Deliverable	Content
M-1	Requirements Specification	Functional, performance, security, interoperability, and service requirements (Annex E)
M-2	Communication Feasibility Report	Survey results, technology comparison, recommended architecture, and design link margins
M-3	Solution Architecture	Components, interfaces, data flows, security zones, and key ownership
M-4	Privacy Impact Assessment	Data inventory, lawful basis, risks, and controls, reviewed by the DPO

ID	Deliverable	Content
M-5	Preliminary Business Case	Costs, benefits, sensitivities, rate impact, and the assumptions the pilot must test
M-6	Pilot Evaluation Plan	Hypotheses, KPIs, Must-Pass thresholds, sample design, duration, and decision rules
M-7	Procurement Package	Specifications, evaluation criteria, draft contract, and service levels
M-8	Pilot Consumer Engagement Plan	Notification, education, support, and complaint handling for pilot consumers
M-9	Data Migration and Cleansing Plan	Master data fields to cleanse (Section 18.6), migration and cut-over approach, reconciliation checks, and owners

7.5 Gate 2: Pilot Approval

Gate 2 authorizes spending on the pilot. The Board is not approving AMI; it is approving an experiment designed to tell it whether to approve AMI.

#	Gate criterion	Type
1	All Must readiness gaps from Gate 1 closed; governance, cybersecurity and privacy, operations and billing (VEE), consumer engagement, and data and baseline categories score at least 3; all others at least 2 (Annex A.3)	Must
2	Pilot Evaluation Plan and analysis plan approved, with Must-Pass KPIs and thresholds fixed before procurement	Must
3	Every benefit on which the business case depends has a Must-Pass KPI in the pilot plan (Section 8.6)	Must
4	Preliminary business case shows a plausible case under base assumptions and states which assumptions the pilot will test	Must
5	Business case presented under the five cases (Section 19.1) at outline level; short form permitted on the lean path	Must
6	Privacy Impact Assessment completed and reviewed by the DPO	Must
7	Security architecture reviewed; the draft contract requires utility ownership of cryptographic keys and data	Must
8	The specification requires ERC type-approved meters, or a documented path to type approval before installation	Must
9	The draft contract requires data portability, open interfaces, acceptance testing, service levels, and exit assistance	Must
10	The specification requires communication technology selected on survey evidence, not assumption	Must
11	Data Migration and Cleansing Plan (M-9) approved	Must

#	Gate criterion	Type
12	Pilot budget and funding source confirmed, together with any regulatory approval and any clearance required by the utility's supervising agency (for electric cooperatives, the NEA) or lenders	Must
13	Conflict-of-interest disclosure received from every advisor (Section 13.3)	Must
14	Procurement package reviewed for vendor bias by a qualified party that did not prepare it, before it is issued (Section 13.3)	Must
15	Independent gate review completed; its rating and Critical recommendations addressed in the decision paper	Must
16	Operating model options for full deployment identified	Should

Decision owner	Allowed outcomes
Board of Directors, on General Manager recommendation	Approve pilot as proposed; Approve with changes; Return for further design; Stop

8. Stage P: Pilot

8.1 Purpose

Procure, install, integrate, test, and operate the pilot system under real conditions, and collect the evidence defined in the Pilot Evaluation Plan. The pilot must be run as a controlled experiment, not as a showcase.

8.2 Key Questions

- Does the system meet its technical and security requirements when tested before and after installation?
- Does it perform in our terrain, weather, and network conditions across the full pilot duration?
- Do bills produced from AMI data match what the meters actually registered?
- How do consumers respond, and does our support model cope?
- What does it actually cost to install, operate, and support?

8.3 Core Activities

- Procurement in line with the approved package and the utility's procurement rules
- Factory Acceptance Testing (FAT) of meters, modules, HES, and MDMS before shipment or installation
- Consumer notification and education in pilot areas before installation
- Installation with photographic and GPS records, verified meter-to-transformer mapping, and seal records
- Site Acceptance Testing (SAT) and end-to-end integration testing (meter to bill to CMDC)
- Security testing, including vulnerability assessment and penetration testing by a qualified independent party
- Pilot operation for the approved duration, with monthly KPI reporting against the evaluation plan
- Register-read reconciliation and complaint monitoring throughout

8.4 Deliverables

ID	Deliverable	Content
P-1	FAT and SAT Reports	Test cases, results, defects, and retest evidence
P-2	Installation Records	Asset, location, mapping, and seal records for every pilot meter
P-3	Security Test Report	Findings by severity and closure evidence
P-4	Monthly Pilot Performance Reports	KPIs against thresholds; issues and corrective actions
P-5	Pilot Cost Record	Actual capital and operating costs, including internal labor
P-6	Technical Acceptance Recommendation	TWG recommendation with evidence against Gate 3 criteria

8.5 Gate 3: Technical Acceptance

Gate 3 confirms that the pilot system works as specified and can be accepted from the vendor. It is not the investment decision; that is Gate 4.

#	Gate criterion	Type
1	FAT and SAT completed with no open Critical or Major functional defects	Must
2	All Must-Pass KPIs assigned to Gate 3 in the evaluation plan passed (Section 8.6) in every stratum proposed for acceptance, for the full measurement period; other strata are retested or returned	Must
3	Register-read reconciliation meets its threshold, and every mismatch has been root-caused	Must
4	No open Critical security findings, and no High finding past its remediation deadline or without an approved compensating control (Section 16.1)	Must
5	All minimum security controls in Section 16.1 in place for the pilot environment	Must
6	Master data for all pilot accounts reconciled: multipliers, phase, tariff, and transformer ID (Section 18.6)	Must
7	End-to-end process tested: read to validated data to bill to consumer access	Must
8	Remote disconnection, if used, operated only under the safeguards in Section 17.2	Must
9	Operations staff trained and able to run daily operations without vendor intervention for routine tasks	Should

Decision owner	Allowed outcomes
Steering Committee, on TWG recommendation	Accept; Accept with listed corrective actions (Minor defects only); Retest after correction; Reject

8.6 Designing a Pilot That Produces Evidence

The Pilot Evaluation Plan (deliverable M-6) is approved at Gate 2, before any vendor is selected. Must-Pass KPIs and their thresholds may be changed after Gate 2 only by the Board, with reasons, and never after results for that KPI are known. Monitor KPIs may be changed by the Steering Committee with reasons. Every change is entered in the amendment log. The plan must include the following elements.

Element	Requirement
Hypotheses	Each benefit in the preliminary business case is stated as a testable hypothesis, for example: “AMI reduces estimated bills in the pilot area from the baseline rate to 1% or less.”
KPIs and thresholds	Each KPI has a definition, formula, data source, a Must-Pass or Monitor designation, and the gate at which it is judged (Gate 3 or Gate 4). Section 21 lists the core Must-Pass KPIs.
Business-case KPIs	Every benefit on which the business case depends, meaning that without it the base-case net present value would be negative, must have a Must-Pass KPI with a threshold set from the business case. A benefit that is only monitored cannot carry an investment decision.

Element	Requirement
Judged by stratum	Must-Pass KPIs are judged separately in each stratum, and Gates 3 and 4 may be decided stratum by stratum: passing strata proceed, and failing strata are retested, extended, or re-scoped. A pooled average must not hide a failing stratum.
Pass rule	For each Must-Pass KPI the plan fixes, at Gate 2, a threshold and a non-inferiority margin (Metro Power recommended default: equal to the precision used to size the stratum, that is, 1 percentage point for the default sample and 2 points on the lean path; margins for KPIs with other denominators are set in the plan). A KPI passes in a stratum when (1) the measured result meets the threshold and (2) the one-sided 95% confidence bound, allowing for clustering, is no worse than the threshold minus the margin. If the result meets the threshold but the bound does not, the result is inconclusive: extend the measurement period or enlarge the sample. A result below the threshold fails. KPIs measured on a full census, or with a target of 100% or zero, are judged on the result alone. Each KPI's bound uses its own denominator: meters, bills, or commands.
Comparison basis	Results are compared with the measured Stage A baseline for the same area and, where practical, with a comparable non-pilot area over the same period to separate AMI effects from seasonal or other effects.
Sample design	The pilot covers each customer segment, meter type, and communication technology that full deployment would use, and includes difficult areas (terrain, vegetation, low signal, high loss), not only easy ones.
Sample size	Size each stratum so that its key rates can be estimated with useful precision. To measure a read success rate of about 98% within ± 1 percentage point at 95% confidence, about 750 meters are needed if failures are independent. Because failures usually cluster by area or concentrator, AMPERE applies a default design effect of 1.5, giving about 1,130 meters per stratum. On the lean path, a precision of ± 2 percentage points may be approved, which needs about 280 meters per stratum with the same design effect. Where a stratum has few meters, the finite-population correction reduces the sample; where the corrected sample would exceed about 70% of the stratum, or the stratum has fewer than 300 meters, meter the whole stratum (census). The Toolkit sheet P2 performs these calculations.
Low-volume segments	Segments too small for a statistical sample, such as CT-connected industrial meters or boundary meters, are judged by functional testing of every meter and 100% register-read reconciliation rather than by a sampled rate.
Pooled sector evidence	Under a sector framework, verified pilot results for the same meter model, firmware, and communication technology from another utility's comparable stratum may replace up to half of a stratum's sample, if the Adopting Body has confirmed the comparability and the evidence is less than two years old. The confidence bound is then computed on the combined sample, and the stratum's own result must still meet the threshold.
Duration	At least three full billing cycles of stable operation after SAT, and wherever possible including months of heavy rain and typhoon season, which affect RF propagation, PLC noise, and equipment resilience.
Calamities	Days in which a stratum lies in a declared calamity area, or has a widespread supply outage confirmed by operations, are excluded from read-performance KPIs and the measurement period is extended by the same number of days. Recovery is judged instead by the resilience KPI (Section 21.2): at least 95% of affected meters back to daily reads within 3 days of power restoration. These are the only calamity exclusions permitted.

Element	Requirement
Register-read reconciliation	For a sample of pilot meters each cycle (Metro Power recommended default: at least 50 meters per stratum per billing cycle), compare the register value delivered by the HES, MDMS, and CIS with a physical display reading taken at a recorded time, adjusted for consumption between the two timestamps. Values match when they agree within one unit of the least significant displayed register digit. Any mismatch is treated as a defect and root-caused.
Analysis plan	State before the pilot starts how each KPI will be calculated, which records are excluded and why, how missing data are handled, how the comparison area is analyzed, and who calculates and who independently verifies results (Annex C.2; Toolkit P7).
Amendment log	Record every change to the plan after Gate 2 with its date, reason, and approver (Toolkit P7). Changes made after results are known are flagged as such.
Consumer-owner involvement	Involve consumer representatives, such as member-consumer-owner or barangay representatives, in reviewing the consumer engagement plan, pilot area selection, and consumer-facing KPIs. For electric cooperatives this reflects member ownership.
Transparency	Share a summary of pilot results, including results that fell short, with the Board and, for electric cooperatives, with members.
Decision rules	State in advance which result leads to which Gate 4 outcome (see Section 9.6).

9. Stage E1: Evaluate

9.1 Purpose

Judge the pilot against the plan that was approved before it started, update the business case with actual costs and measured results, and give the Board a clear investment decision.

9.2 Key Questions

- Which hypotheses were confirmed, which were not, and why?
- What did the pilot actually cost, and what will full deployment cost on that evidence?
- Does the business case still hold under realistic and adverse assumptions?
- What must change in technology, process, contract, or organization before scaling?
- What is the right deployment sequence, pace, and funding route?

9.3 Core Activities

- Independent review of pilot data quality before evaluation
- Evaluation against each hypothesis and Must-Pass threshold
- Lessons-learned review with field, billing, IT, consumer services, and the vendor
- Final business case using pilot actuals, with sensitivity and scenario analysis
- Rollout strategy: sequencing, wave size, resourcing, and procurement approach
- Preparation of the regulatory application through the applicable ERC process, and NEA coordination for electric cooperatives

9.4 Deliverables

ID	Deliverable	Content
E-1	Pilot Evaluation Report	Results against each hypothesis and threshold; data-quality statement; lessons learned
E-2	Final Business Case	Lifecycle costs and benefits based on pilot actuals; sensitivities; rate impact
E-3	Rollout Strategy	Wave plan, prioritization criteria, resources, and risks
E-4	Regulatory Application Package	Documents required for the applicable ERC approval route
E-5	Board Decision Paper	Recommendation and options for Gate 4

9.5 Gate 4: Investment Decision

Gate 4 is the decision the entire Protocol is built to support.

#	Gate criterion	Type
1	Gate 3 technical acceptance obtained	Must
2	All Must-Pass KPIs met in every stratum proposed for rollout; strata that failed are excluded from the rollout decision or returned for extension (Section 9.6)	Must

#	Gate criterion	Type
3	Every readiness category scores at least 3 (Annex A.3)	Must
4	Final business case positive under base assumptions, presented under all five cases (Section 19.1), with downside scenarios understood and accepted by the Board	Must
5	Consumer rate impact quantified and considered	Must
6	Operating model, staffing, and lifecycle costs for full deployment defined and funded	Must
7	Cybersecurity and privacy controls proven in the pilot and scalable	Must
8	Rollout strategy approved, with benefits tracking, change-control thresholds (Section 10.7), and pause triggers (Section 10.6) defined	Must
9	Regulatory approval route confirmed; rollout supply contracts are conditional on ERC approval and on any clearance required by the supervising agency or lenders (Section 9.7)	Must
10	Consumer consultation completed on the proposed program and its rate impact (Section 17.7)	Must
11	Workforce Transition Plan approved after consultation with affected employees and, where present, their union (Section 12.1)	Must
12	No open Critical security findings, and no High finding past its remediation deadline or without an approved compensating control listed in the decision paper (Section 16.1)	Must
13	Any rollout procurement package reviewed for vendor bias before issue (Section 13.3)	Must
14	Independent gate review completed; its rating and Critical recommendations addressed in the decision paper	Must

Decision owner	Allowed outcomes
Board of Directors	Scale; Scale with conditions; Extend the pilot and correct; Re-scope or re-procure; Stop

9.6 Decision Rules

Pilot result	Recommended outcome
All Must-Pass KPIs met; business case positive with acceptable downside	Scale, beginning with Stage R wave planning and regulatory filing
All Must-Pass KPIs met; business case marginal or highly sensitive to one assumption	Scale with conditions, such as a smaller first wave, contract price protections, or a benefit milestone before later waves
One or more Must-Pass KPIs missed, with a clear and correctable cause	Extend the pilot and correct; retest the failed KPIs before returning to Gate 4
Must-Pass KPIs met in some strata but not others	Scale only in the strata that passed; extend and correct, or re-scope, the others and return them to Gate 4 separately

Pilot result	Recommended outcome
Technology fails in part of the service area	Re-scope: a hybrid architecture or a different technology for that area; test before scaling there
Repeated failures without a correctable cause, or business case negative	Stop or re-procure. Record lessons learned and protect the investment already made.

9.7 Approvals Before Rollout Commitments

A Gate 4 decision to scale is an investment decision by the utility; it is not regulatory approval. No rollout supply or service contract is signed, and no rollout-scale order is placed, before the ERC has approved the investment through the applicable route and any clearance required by the utility's supervising agency or lenders has been obtained, unless the contract is expressly conditional on those approvals and can be ended without material cost if they are refused. The Board resolution at Gate 4 records the approvals still pending.

10. Stage R: Roll Out

10.1 Purpose

Deploy AMI at scale in controlled waves, keep performance at pilot levels or better, retire legacy meters properly, and start proving the benefits the Board approved.

10.2 Key Questions

- Is each cohort performing to standard, and is any pause trigger active?
- Are benefits appearing as the business case predicted?
- Are consumers informed and complaints under control?
- Are legacy meters being retired, recorded, and accounted for correctly?

10.3 Core Activities

- Wave planning using the prioritization criteria in Section 10.8
- Consumer notification and education ahead of each wave
- Installation quality control, including sample audits of mapping, seals, and commissioning
- Performance monitoring of each cohort against Must-Pass KPIs and pause triggers
- Benefits tracking against the baseline, by area
- Legacy meter removal, testing where required, storage, disposal, and asset write-off records
- Transition of operations from project team to operating organization

10.4 Deliverables

ID	Deliverable	Content
R-1	Wave Plans	Scope, schedule, resources, and readiness checks for each wave
R-2	Wave Completion Reports	KPIs, defects, complaints, and lessons for each wave
R-3	Benefits Realization Report	Measured benefits against the business case, updated quarterly
R-4	Legacy Meter Disposition Record	Removed meters, test results where applicable, disposal, and accounting treatment
R-5	Operations Handover Package	Procedures, trained staff, support contracts, and open issues

10.5 Gate 5: Cohort Checks and Program Handover

Rollout proceeds continuously in cohorts, usually a month's installations in an area. Each cohort is checked at its first full billing cycle after installation. Installation continues while checks pass; a pause trigger stops new installations until the cause is corrected. The final gate hands the system over from program to operations.

#	Gate criterion	Type
1	Cohort meets the Must-Pass KPIs measurable at its first full billing cycle (daily read success, remote command success, register-read reconciliation sample, and no Critical or High security finding past its remediation deadline); a cohort that misses goes on watch with corrective action and is rechecked at the next cycle	Must (each cohort)
2	No pause trigger active (Section 10.6)	Must (each cohort)
3	Installation audit defect rate within threshold (Section 10.9)	Must (each cohort)
4	Consumer notification completed before installation in the next area	Must (each cohort)
5	Benefits tracking in place and reported	Must (handover)
6	Operations handover package accepted by the operating organization	Must (handover)

Decision owner	Allowed outcomes
Steering Committee (each cohort); Board of Directors (program handover)	Cohort: Continue; Continue on watch (recheck next cycle); Pause and correct; Re-plan remaining rollout. Handover: Accept handover; Accept with conditions; Defer

10.6 Pause Triggers

New installations stop, and the Steering Committee decides how to proceed, if any of the following occurs (Metro Power recommended defaults):

- A cohort on watch misses a Must-Pass KPI again at its recheck (two consecutive cycles)
- Estimated bills or billing corrections in a cohort exceed their thresholds in any single cycle (billing accuracy itself is confirmed 90 days after bills are issued)
- A Critical security finding without an approved compensating control within 72 hours, a High finding past its remediation deadline, or a security incident affecting AMI
- A serious safety incident
- Installation audit defect rate above its threshold in a cohort (Section 10.9)
- Complaints in rollout areas more than double the pre-installation baseline for the same areas
- A batch or firmware failure pattern (Section 20.3)

10.7 Change Control After Gate 4

Changes to the approved program go back to the Board when they exceed any of these thresholds (Metro Power recommended defaults; the Board may set its own): a cost increase of more than 10% of the approved budget; a delay of more than six months; a change of technology, main vendor, or deployment areas; a change of more than 15% in the number of meters; or any change affecting consumers' tariffs, prepaid terms, or disconnection practices. Smaller changes are approved by the Steering Committee and recorded in the change log.

10.8 Deployment Prioritization

Waves should normally be sequenced by expected value and feasibility. Typical criteria are: high-loss feeders and transformers where energy balancing is possible; areas with high meter-reading cost or high estimated-bill rates; areas with proven communication coverage; high-consumption accounts; and operational readiness of the local district or area office.

10.9 Installation Quality and Contractor Management

- **Accreditation:** installers and contractors are trained, safety-briefed, identified with utility ID, and approved before working
- **Audit sampling:** field audits of at least 5% of each crew's installations each week, covering mapping, seals, photographs, connections, and commissioning. The audit defect rate (Critical or Major defects ÷ installations audited) must not exceed 2% per cohort (Metro Power recommended defaults). Crew-level results are kept in the contractor quality records; the Toolkit sheet "R Rollout Cohorts" aggregates them by cohort. After a Critical defect, audit all of that crew's work until 50 consecutive installations pass
- **Metrics:** installations per crew-day, first-time-right rate, audit defect rate, and rework rate, reported weekly (Section 21.2)
- **Pre-existing tampering:** installers who find evidence of tampering stop, photograph it, and call the loss-reduction team; they do not remove the meter (Section 20.5)

10.10 Meter Logistics and Asset Management

- Register every meter, module, and concentrator by serial number on receipt, and track it through warehouse, installer, installation, and removal
- Inspect incoming lots by sampling before acceptance, using a recognized acceptance-sampling method (for example, the IEC 62058 series for electricity meters)
- Secure warehouse storage with controlled issue to named installers, daily reconciliation of issued, installed, and returned stock, and investigation of losses
- Maintain spares at a level set from failure rates and lead times
- Manage returns and warranty claims with root-cause records (Section 20.3)
- Hold removed legacy meters as evidence for the dispute period before testing or disposal, and dispose of them under applicable environmental rules

11. Stage E2: Evolve

11.1 Purpose

Operate AMI securely and reliably for the life of the assets, and keep increasing the value extracted from it. This stage never ends. It is where the Board learns whether the investment is paying off.

11.2 Core Activities

- Daily operations: read collection, exception handling, VEE, and command management
- Network and device health management, including firmware and security patching
- Security monitoring, incident response, and annual security assessments
- Lifecycle management of meters, modules, batteries, concentrators, and software (Section 20)
- Expansion of use cases through the catalog in Section 20.4
- Contract and vendor performance management
- Annual performance and benefits review for the Board

11.3 Annual Board Review

At least once a year the Board should receive a report covering: KPI performance against targets; benefits realized against the business case; operating and lifecycle costs; security incidents and findings; consumer complaints and satisfaction; regulatory compliance status; and the priorities and investments proposed for the next year.

12. Continuous Workstreams

Workstream	Purpose	Key outputs by stage
W1: Governance and Program Management	Decision rights, planning, risk, change control, and document control	A: governance charter. M: program plan, risk register. P: change control, issue log. E1: decision papers. R: wave control. E2: annual review.
W2: Cybersecurity and Data Privacy	Protect systems and personal data; meet NPC, DICT, and DOE obligations	A: security and privacy baseline. M: PIA, security architecture. P: security testing. E1: scalability of controls. R: monitoring. E2: annual assessment and reporting.
W3: Consumer Protection and Engagement	Keep consumers informed, treated fairly, and able to resolve concerns	A: complaint and consumer baseline. M: engagement plan. P: pilot communications and support. E1: consumer findings. R: wave communications. E2: satisfaction and education.
W4: Data Quality, VEE, and Billing Integrity	Ensure every bill reflects correct, validated data with a full audit trail	A: data quality baseline. M: VEE rules, interface design. P: reconciliation. E1: billing results. R: exception management. E2: VEE tuning and audit.

Workforce development and organizational change run inside W1. Every stage should state the roles affected, the training required, and changes to job descriptions, procedures, and performance measures, particularly for meter readers whose work will change or be redeployed.

12.1 Workforce Transition Plan

AMI changes or removes some jobs, especially meter reading and manual disconnection. Before Gate 4, the utility prepares and approves a Workforce Transition Plan that:

- Identifies each affected role, the number of employees and contracted workers, and the timing of the change by rollout wave
- States the options offered, such as retraining and redeployment to installation audit, field investigation, data exception handling, or consumer support, and the training each needs
- Records consultation with affected employees and, where present, their union or employee association, and any collective bargaining obligations
- Complies with the Labor Code and other applicable labor rules on any separation, with the utility's counsel reviewing the plan
- Is costed in the final business case (Section 19) and tracked through rollout

13. Governance, Roles, and Decision Rights

13.1 Governance Bodies

Body or role	Accountability
Board of Directors	Approves pilot investment (Gate 2), full investment (Gate 4), and program handover; receives the annual review
General Manager / Executive Sponsor	Accountable for program outcomes; chairs or appoints the Steering Committee chair; owns Gate 1
Steering Committee	Directs the program; resolves cross-department issues; owns Gates 3 and 5; recommends Board decisions
Program Manager	Day-to-day planning, coordination, reporting, risk and issue management, and vendor coordination
Technical Working Group (TWG)	Requirements, design authority, testing oversight, and technical recommendations at each gate
Data Protection Officer (DPO)	Privacy compliance, PIA review, breach response coordination, NPC liaison
Cybersecurity lead	Security architecture, testing, monitoring, incident response, and regulatory cybersecurity reporting
Finance	Business case, funding, asset accounting, and benefits tracking
Billing and Consumer Services	VEE and billing integration, consumer communication, complaints
Field Operations and Metering	Installation, mapping, commissioning, maintenance, and loss investigation
Internal Audit / Quality Assurance	Independent assurance of gate evidence, data, and controls; may act as independent gate reviewer
Independent gate reviewer	Internal audit, a peer utility, or an external reviewer with no stake in the outcome (Section 5.4)
External advisor (e.g., Metro Power)	Supports the utility as engaged; bound by the conflict-of-interest rules in Section 13.3
Vendors and System Integrators	Deliver to contract; support testing; correct defects

13.2 Decision Rights Matrix

R = Responsible for preparing; A = Accountable for the decision; C = Consulted; I = Informed. “Advisor” means an external advisor such as Metro Power; R* means the advisor may prepare the item if engaged to, subject to Section 13.3.

Decision or deliverable	Board	GM	SteerCo	PM	TWG	DPO	Finance	Audit	Advisor
Gate 1: Proceed to Model	I	A	R	R	C	C	C	I	C
Pilot Evaluation Plan	I	C	A	R	R	C	C	C	R*

Decision or deliverable	Board	GM	SteerCo	PM	TWG	DPO	Finance	Audit	Advisor
Privacy Impact Assessment	I	I	C	C	C	A	I	C	C
Requirements and procurement package	I	A	C	R	R	C	C	I	R*
Gate 2: Pilot approval	A	R	R	R	C	C	C	C	C
Vendor selection	I	A	R	R	R	C	C	C	C*
Gate 3: Technical acceptance	I	C	A	R	R	C	I	C	C
Pilot Evaluation Report (E-1)	I	C	A	R	R	C	C	C	R*
Independent gate review (Gates 2 and 4)	I	I	I	C	C	C	C	R†	None
Gate 4: Investment decision	A	R	R	R	C	C	R	C	C
Gate 5: Cohort checks	I	C	A	R	R	C	I	I	C
Gate 5: Program handover	A	R	R	R	C	C	C	C	C
Annual review	A	R	R	R	C	C	R	C	C

* An advisor that bids for supply has no role in bid evaluation or vendor selection; an advisor that delivered or supplied the pilot does not prepare or approve the Pilot Evaluation Report (Section 13.3). † The independent reviewer is whichever independent party is appointed: internal audit, a peer utility, or an accredited external reviewer. An advisor engaged on the program is never the independent reviewer.

For smaller utilities, one person may hold several roles, but the person who prepares gate evidence must not be the only person who approves it. Where internal audit cannot act as independent reviewer, the utility may use a peer from another utility or an external reviewer (Section 5.4).

13.3 Advisor Conflicts of Interest

These rules apply to every consultant, advisor, and system integrator that helps a utility plan or evaluate its AMI program, whether or not it also sells products or services. They are part of the AMPERE core (Section 23.3).

- **Disclosure:** at the start of the engagement, and whenever anything changes, the advisor gives the utility a written disclosure (Toolkit template T10) of its technology partners, commissions, exclusivity arrangements, and any other interest in the outcome, and of the roles it will and will not seek.
- **Specification review:** every AMI procurement package is reviewed for vendor bias by a qualified party that did not prepare it, before it is issued. On the lean path this may be internal audit or a peer utility. Where an advisor that prepared the package also intends to bid, the reviewer must be external to both the advisor and the utility.
- **Bidding:** an advisor that bids, or is affiliated with a bidder, has no role in preparing evaluation criteria after the package is issued, in evaluating bids, or in selecting the vendor.
- **Evaluation:** an advisor that delivered or supplied the pilot does not prepare or approve the Pilot Evaluation Report; the utility prepares it, with independent verification of the results.
- **Independent review:** an advisor engaged on the program is never its independent gate reviewer.

- **Breach:** an advisor that breaches these rules is excluded from the affected procurement, and the breach is recorded in the gate log and reported to the decision owner.

14. Regulatory and Legal Alignment

AMI touches metering, rates, consumer rights, personal data, cybersecurity, and radio equipment, so several regulators are involved. The register below lists the instruments most relevant to AMI as of September 2026, and each is cited as amended or superseded. It is a dated reference, not legal advice, and the Adopting Body or the utility should re-issue it whenever an instrument changes. Each item must be confirmed as current, including its exact issuance number and text, and the utility's counsel and regulatory team should determine how each applies to it. The Toolkit sheet "Regulatory Register" holds the full register with owners and review dates.

Instrument	Why it matters for AMI
ERC Amended Rules to Govern the Implementation of AMI (approved November 2025; resolution number to be cited from the issuance)	Primary AMI rules. As publicly reported at approval, they allow implementation through a single CAPEX application or through the rate reset process; require near real-time consumer access to usage data through the Consumer Meter Data Channel (CMDC); and update technical, cybersecurity, and data-privacy requirements. The ERC indicated it would issue supplemental guidelines on accreditation, performance standards, and reporting. Utilities must work from the issued text and any supplemental guidelines, not from this summary.
ERC Resolution No. 16, Series of 2017: type approval of smart meters for AMI	Smart meters must hold ERC type approval, supported by accredited laboratory certificates against IEC 62052/62053 or ANSI C12 standards, and must demonstrate two-way communication and remote connect/disconnect/reconnect. Approvals are revalidated every five years.
Magna Carta for Residential Electricity Consumers (ERC, as amended), and any revised consumer charter the ERC issues	Consumer rights, including notice and timing rules for disconnection for non-payment. At the time of writing these rules require written notice at least 48 hours before disconnection and prohibit disconnection on weekdays after 3:00 p.m. and on Saturdays, Sundays, and official holidays. The ERC was reviewing amendments to its consumer rules in 2025–2026, so the current text must be confirmed. The rules in force apply equally to remote disconnection, and the HES must be configurable to match them (Section 17.2).
ERC rules on meter testing, calibration, and sealing	Meters are tested and sealed as required by ERC rules before installation, and consumers may request tests. Confirm current procedures, including any ERC witnessing, sampling, and sealing requirements for AMI meters.
ERC Resolution No. 15, Series of 2009: Rules for Prepaid Retail Electric Service	Governs prepaid service using prepaid metering. Confirm any later amendments before designing prepaid offerings.
ERC Resolution No. 15, Series of 2025: 2025 Amended Net-Metering Rules	Affects bidirectional metering, credit banking and rollover, and interconnection timelines for net-metered customers.
Republic Act No. 9136 (EPIRA) and the Philippine Distribution Code	Framework for distribution service, ERC authority, rates, and technical standards, including metering.
Republic Act No. 7832 (Anti-Pilferage of Electricity Act) and ERC system loss rules	Two roles. First, the enforcement framework for electricity theft: prima facie evidence must be personally witnessed and attested to by an officer of the law or a duly authorized representative of the regulator, and differential billing follows the Act's methods and limits (Section 20.5). Second, the system loss framework, which was under active policy review in 2026; business cases should model alternative scenarios (Section 19).
Republic Act No. 10531 (NEA Reform Act)	NEA's supervisory role over electric cooperatives, including technical and financial oversight relevant to EC AMI investments.

Instrument	Why it matters for AMI
Republic Act No. 11039 (Electric Cooperatives Emergency and Resiliency Fund Act)	A possible source of support for restoring electric cooperative facilities after calamities; confirm whether AMI assets are eligible.
Republic Act No. 11646 (Microgrid Systems Act) and missionary electrification rules	Relevant to AMI in unserved, underserved, and off-grid areas and to how their costs are recovered (Section 15.7).
Republic Act No. 10173 (Data Privacy Act of 2012), its implementing rules, and NPC issuances	Lawful processing, DPO designation, privacy notices, security measures, registration of data processing systems where required, agreements with personal information processors, cross-border transfer safeguards, and personal data breach notification to the NPC and affected individuals within 72 hours.
DOE Department Circular No. DC2025-01-0001 : Cybersecurity and Cyber Resilience Framework for the Energy Sector	For energy entities designated as Critical Information Infrastructure: annual Cybersecurity Assessment Framework results and Cyber Resilience Scorecard (due April 30, externally validated), vulnerability assessment and penetration testing reports, quarterly reporting, and an organizational computer emergency response team. Confirm whether and how the utility is covered.
Republic Act No. 10844 (DICT Act) and DICT issuances on critical information infrastructure and incident reporting	The DICT and its national computer emergency response team (CERT-PH) set national cybersecurity policy, protection requirements for critical information infrastructure, and incident reporting channels. Confirm the current DICT requirements that apply alongside the DOE circular.
Executive Order No. 58 : National Cybersecurity Plan 2023–2028; Republic Act No. 10175 (Cybercrime Prevention Act)	National cybersecurity direction and the legal basis for reporting and prosecuting cyber offenses.
Republic Act No. 9513 (Renewable Energy Act of 2008)	Legal basis of the net-metering program.
Republic Act No. 11058 (Occupational Safety and Health Standards) and DOLE rules	Safety of installation and field work by utility staff and contractors.
Labor Code of the Philippines and DOLE rules	Consultation, redeployment, and any separation of employees whose roles AMI changes (Section 12.1).
Republic Act No. 10535 (Philippine Standard Time Act)	Philippine Standard Time is kept by PAGASA; AMI time sources must be traceable to it (Section 18.7).
Procurement rules that apply to the utility , which may include Republic Act No. 12009 (New Government Procurement Act) for some entities, and NEA procurement guidelines for electric cooperatives	Govern how AMI goods and services are procured. Counsel must confirm which rules apply to each utility.
Republic Act No. 11032 (Ease of Doing Business and Efficient Government Service Delivery Act)	Processing-time limits for government agencies; relevant where an Adopting Body that is a government agency reviews or concurs in utility submissions (Section 24.1).
Rules on Electronic Evidence (Supreme Court)	Governs use of electronic records, including AMI data, as evidence. Admissibility of AMI data in theft and billing disputes should be confirmed by counsel.

Instrument	Why it matters for AMI
NTC rules on radio equipment and spectrum	Radio frequency and cellular communication modules and network equipment must comply with NTC equipment authorization and frequency-use rules.
ERC rules on Retail Competition and Open Access	The eligibility threshold was lowered in 2025. More contestable customers increases the need for accurate interval data and for defined data-sharing with retail suppliers.

14.1 Regulatory Coordination Across the Stages

- **Stage A:** confirm which instruments apply and identify any pending ERC guidelines that could change requirements.
- **Stage M:** confirm the approval route for the pilot and the evidence the ERC will expect in a later application; for electric cooperatives, coordinate with the NEA.
- **Stage P:** collect evidence in the form the regulator will need, so that the pilot record can support the application.
- **Stage E1:** prepare the application; do not sign unconditional rollout contracts before the required approvals (Section 9.7).
- **Stages R and E2:** meet reporting obligations, track new issuances, and update the register.

15. Technology, Standards, and Interoperability

15.1 Meter Accuracy by Customer Segment

Accuracy class must suit the application. Specifying the highest class for every meter raises cost without improving billing for ordinary residential service. The final specification must comply with ERC type-approval requirements and the Philippine Distribution Code.

Segment	Typical connection	IEC option	ANSI option (see note)
Residential and small commercial	Direct-connected, single-phase or three-phase	Class 1 (IEC 62053-21) or better	Class 0.5 (ANSI C12.20)
Larger commercial, direct-connected	Direct-connected three-phase	Class 1 or Class 0.5 (IEC 62053-21)	Class 0.5 (ANSI C12.20)
Commercial and industrial, CT-connected	CT-connected (low voltage)	Class 0.5S (IEC 62053-22)	Class 0.5 (ANSI C12.20)
High-voltage customers, boundary and bulk metering	CT/VT-connected	Class 0.2S (IEC 62053-22)	Class 0.2 (ANSI C12.20)
Distribution transformer and feeder meters (energy balancing)	CT-connected	Class 0.5S (IEC 62053-22)	Class 0.5 (ANSI C12.20)

IEC and ANSI classes are specified differently and are not exact equivalents. For the other segments the options are of comparable accuracy, except that ANSI Class 0.5 is stricter than IEC Class 1 for larger commercial meters. For residential meters, ANSI C12.20 has no class as broad as IEC Class 1, so the ANSI option is stricter. For CT- and VT-connected meters, the instrument transformers must be of at least the same accuracy class as the meter (for example, CTs of class 0.5S or better to IEC 61869-2, and VTs to IEC 61869-3); otherwise instrument-transformer error, not the meter, will dominate the balancing result. Reactive energy, where billed, is measured to IEC 62053-23 or IEC 62053-24.

15.2 Reference Standards

The standards below are commonly used for AMI. A utility should specify the standards that apply to its chosen architecture and require compliance evidence from accredited laboratories where testing is involved.

Area	Standards
Meter accuracy and general requirements	IEC 62052-11, IEC 62053-21/-22/-23/-24; IEC 62052-31 (product safety); ANSI C12.1, ANSI C12.20
Instrument transformers	IEC 61869-2 (current transformers); IEC 61869-3 (voltage transformers)
Acceptance inspection and in-service testing	IEC 62058 series (acceptance inspection of electricity meters)
Payment metering	IEC 62055-31 (static payment meters); IEC 62055-41 (Standard Transfer Specification)
Time keeping	IEC 62054-21 (time switches, clock accuracy); Republic Act No. 10535 (Philippine Standard Time)

Area	Standards
Meter data exchange and protocols	IEC 62056 (DLMS/COSEM), including IEC 62056-5-3 (application layer); ANSI C12.18, C12.19, C12.22
Field area networks	IEEE 802.15.4g / Wi-SUN FAN (RF mesh); ITU-T G.9903 (G3-PLC); ITU-T G.9904 (PRIME); 3GPP NB-IoT and LTE-M (cellular)
Enterprise integration	IEC 61968 (including Part 9, meter reading and control) and IEC 61970 Common Information Model; MultiSpeak
Substation and automation integration	IEC 61850
Cybersecurity	IEC 62443 (industrial automation and control systems); IEC 62351 (power system communications); ISO/IEC 27001; ISO/IEC 27019 (information security controls for the energy utility industry); NIST Cybersecurity Framework 2.0; NISTIR 7628 (smart grid cybersecurity)
Interoperability guidance	IEEE 2030

15.3 Interoperability and Lock-In Protection

Interoperability is achieved through specification and contract, not through vendor assurances. The utility should require:

- Standards-based meter protocols and documented, openly available application programming interfaces (APIs) for HES and MDMS
- Export of all meter data, event data, configuration, and asset records in documented, non-proprietary formats at any time and at no additional charge
- Utility ownership and control of cryptographic keys, certificates, and all data
- Software source code or configuration escrow, or equivalent continuity arrangements, for critical systems
- Transition assistance obligations at contract end or termination
- Multi-vendor meter support in the HES where the architecture allows, demonstrated in testing rather than promised

15.4 Communication Technology Selection

No communication technology is best everywhere. Philippine service areas combine dense urban districts, rural feeders, mountainous terrain, heavy vegetation, and islands, and a hybrid architecture is often needed. The selection must be based on field survey evidence from Stage M.

Technology	Strengths	Constraints	Often suits
Narrowband PLC (e.g., G3-PLC, PRIME)	Uses existing lines; no spectrum or telco dependency; works where radio is obstructed	Line noise; signals generally do not pass distribution transformers, so each transformer needs a concentrator or repeater. Where many small transformers serve few customers each, cost per meter rises sharply.	Areas with larger transformers serving many customers; dense clusters

Technology	Strengths	Constraints	Often suits
RF mesh (e.g., Wi-SUN)	Utility-controlled network; self-forming; low recurring cost; supports distribution automation devices	Needs sufficient node density; terrain and vegetation reduce range; collector siting, power backup, and typhoon hardening needed; NTC compliance	Urban and suburban areas with moderate to high meter density
Cellular (NB-IoT, LTE-M/Cat-M, 4G)	Fast to deploy; no field network to build; good for scattered or high-value meters	Recurring data charges; coverage gaps in rural and island areas; dependence on carrier service levels; risk of network shutdown (for example 2G/3G). Specify multi-carrier capability or eSIM, a replaceable communication module, and a private APN or VPN; power-saving modes lengthen command latency (Section 21.1)	Scattered, remote, or commercial and industrial meters; early pilots
Fiber, microwave, or satellite backhaul	High capacity and reliability (fiber); reach to remote sites (microwave, satellite)	Cost and lead time (fiber); recurring charges (satellite)	Backhaul from concentrators and collectors; islands and remote substations

Design link margins must be defined for each technology from the vendor's validated receiver sensitivity plus a fade margin appropriate to local conditions. A single signal-strength value such as a fixed dBm threshold should not be applied across different technologies.

15.5 Tamper and Theft Detection

Meters can detect cover opening, magnetic interference, reverse or unbalanced current, neutral disturbance, and similar events at the meter. They cannot detect a bypass connected ahead of the meter. That type of theft is detected by comparing the energy measured at the distribution transformer or feeder with the total of the downstream customer meters, which requires accurate meter-to-transformer mapping and transformer metering. Loss-reduction benefits in the business case should assume only the detection methods actually in the design. Detection is only the first step; Section 20.5 covers enforcement.

15.6 Procurement and Contract Protections

- Evaluate on lifecycle cost, not purchase price alone (Section 19)
- Require evidence: laboratory certificates, type approval, and reference sites with verifiable performance data
- Tie payments to acceptance milestones (FAT, SAT, pilot acceptance) rather than delivery
- Specify service levels for HES and MDMS availability, read performance, defect response, and security patching, with remedies
- Include the lock-in protections in Section 15.3
- Require the vendor to disclose third-party and cloud components, hosting locations, and subcontractors with access to data
- Fix pricing or price-adjustment rules for later deployment waves, including foreign-exchange treatment

15.7 Missionary, Off-Grid, and Island Areas

Utilities serving small islands and off-grid or missionary areas face conditions that the default KPIs do not assume: supply for only part of the day, no terrestrial backhaul, and very small meter populations. In those areas:

- Read-performance KPIs are measured over the hours when supply is available, not over the calendar day, and the analysis plan states the supply schedule
- Store-and-forward collection, satellite (VSAT) backhaul, or scheduled cellular sessions are acceptable if billing and event data reach the MDMS before billing cut-off
- Small strata are metered by census (Section 8.6) and may use pooled sector evidence where a sector framework applies
- The business case accounts for how costs are recovered in those areas, including missionary electrification subsidies and any rules under the Microgrid Systems Act, and confirms eligibility with the ERC
- Backup power and hardening at collectors reflect longer outages and harsher exposure

16. Cybersecurity and Data Privacy

AMI adds hundreds of thousands of connected devices, a remote-disconnect capability, and detailed consumption data about households. It must therefore be designed and operated as critical infrastructure. The minimum controls below apply to any utility following AMPERE. The Toolkit sheet “W2 Cyber & Privacy” tracks them.

16.1 Minimum Security Controls

Control area	Minimum requirement
Governance	Named cybersecurity lead; security policy covering AMI; risk assessment updated at each gate
Architecture	Network segmentation between AMI, corporate IT, and operational systems; no direct internet exposure of HES or MDMS; cellular meters on a private APN or VPN, never on public addressing
Asset inventory	Complete inventory of meters, modules, concentrators, network equipment, servers, and software versions, reconciled at each cohort
Device security	Signed firmware; secure boot where supported; unique per-device credentials; physical tamper events logged
Cryptography and key lifecycle	Encryption of data in transit and at rest using current recognized algorithms (for example, AES-128 or stronger). Keys are generated and held under utility control in a hardware security module, dedicated or as a utility-controlled partition of a shared or cloud module. Keys loaded at manufacture are transferred only in wrapped (encrypted) form under a documented procedure, and device keys are replaced with utility-generated keys after commissioning. No supplier retains usable copies of utility keys
Access control	Role-based access; multi-factor authentication for all privileged and remote access; quarterly access reviews; segregation of duties for remote-disconnect and VEE edits
High-impact commands	Remote disconnect and firmware changes subject to authorization rules, rate limits, and alerting, so that a compromised account cannot disconnect large numbers of customers; on a shared platform, a platform-wide cap applies in addition to each utility's cap (Section 27.1)
Training	Security awareness training for all AMI staff and contractors; role-based training for privileged users and operators
Monitoring	Centralized logging of security events from HES, MDMS, and network devices; defined alert response
Testing	Independent vulnerability assessment and penetration testing before pilot acceptance and at least annually thereafter
Incident response	Tested incident response plan, including regulatory notification requirements and consumer communication
Recovery	Backups of HES, MDMS, and configuration taken and restore tested at least annually; recovery time known
Third parties and supply chain	Security requirements, audit rights, and incident notification duties in all vendor and cloud contracts; supply-chain controls in Annex E.6

Security findings are rated Critical, High, Medium, or Low, using a recognized scoring method such as CVSS. This scale is separate from the functional defect scale (Critical, Major, Minor, Cosmetic) used in testing. Each finding has a remediation deadline from the date it is found (Metro Power recommended defaults: Critical 15 days, High 30 days, Medium 90 days, Low at the next scheduled release).

Gate rule: at Gates 3 and 4, no Critical finding may be open, and a High finding may be open only if it is within its remediation deadline, a compensating control approved by the cybersecurity lead is in place, and it is listed in the decision paper. At each Gate 5 cohort check, no Critical or High finding may be past its deadline. For systems in service, a new Critical finding must have an approved compensating control within 72 hours, or the affected function, such as remote disconnection or firmware distribution, is suspended until it does.

16.2 Data Privacy

Interval consumption data can reveal when a household is occupied and how it lives. It is personal data and must be processed under the Data Privacy Act.

- Designate a DPO and involve the DPO from Stage A
- Complete a Privacy Impact Assessment in Stage M and update it before scaling
- Collect only the data needed for defined purposes, and set the interval resolution to match those purposes
- Publish a clear privacy notice covering data collected, purposes, retention, sharing, and consumer rights
- Define retention periods for each data category and delete or anonymize data when they expire
- Share consumer-level data with third parties, including retail suppliers, only on a lawful basis and under data-sharing agreements
- Bind every vendor, hosting provider, and shared-platform operator that processes consumer data by a written processing agreement; on a shared platform the operator is a processor for each utility, which remains the personal information controller
- Register data processing systems with the NPC where its rules require it, and apply cross-border transfer safeguards where data is hosted or accessed outside the Philippines
- Retain billing-related meter data (registers, billing determinants, estimates, and edits) for at least five years, so that records cover the longest period for which differential billing or disputes may reach back, or longer where another rule requires it
- Maintain a breach response procedure that can notify the NPC and affected individuals within 72 hours

16.3 Regulatory Cybersecurity Obligations

Utilities should confirm whether they are designated as Critical Information Infrastructure under DOE Department Circular No. DC2025-01-0001 and the applicable DICT issuances. If they are, the AMI environment should be included in the annual assessment, scorecard, penetration testing, and quarterly reporting required by that circular. Security incidents are reported through the channels those issuances require, including CERT-PH where applicable, in addition to NPC breach notification.

16.4 Alignment with NIST CSF 2.0

The minimum controls map to the six functions of the NIST Cybersecurity Framework 2.0. CSF 2.0 uses two different tools, and AMPERE uses each for its intended purpose. **Profiles** describe outcomes: the Toolkit sheet “W2 Cyber & Privacy” records, for each control, its current and target state (Not achieved, Partially, Largely, or Fully achieved). **Tiers** describe the rigor of the organization’s cybersecurity risk governance and management as a whole: the utility records one current and one target tier for its AMI program (Tier 1 Partial, Tier 2 Risk Informed, Tier 3 Repeatable, Tier 4 Adaptive).

CSF 2.0 function	AMPERE controls
Govern (GV)	Cybersecurity lead and policy; cybersecurity risk management strategy and risk appetite for AMI; roles and segregation of duties; supplier and supply-chain requirements; regulatory obligations
Identify (ID)	Asset inventory of meters, network, and systems; risk assessment at each gate; Privacy Impact Assessment; vulnerability assessment
Protect (PR)	Segmentation; multi-factor authentication and role-based access; per-device credentials; encryption and key lifecycle; signed firmware and secure boot; controls on high-impact commands; training
Detect (DE)	Centralized logging and alerting; physical tamper event logging; monitoring of command and access anomalies
Respond (RS)	Tested incident response plan; NPC and affected-individual notification within 72 hours; DOE and DICT reporting where applicable
Recover (RC)	Tested backup and restore of HES and MDMS; recovery communications to consumers

16.5 Resilience and Business Continuity

Typhoons, floods, and long power outages are normal operating conditions in much of the Philippines. The AMI design and operating plan must include:

- **Disaster recovery for HES and MDMS:** a documented recovery point objective and recovery time objective, a tested failover or restore, and off-site or cloud backups
- **Backup power at collectors and concentrators:** a minimum duration set in the specification and tested at SAT
- **A post-typhoon recovery playbook:** restore backhaul and collectors first, confirm restoration by pinging meters, reconcile missed reads, and report network status to operations
- **Billing after mass outages:** estimation rules for extended communication loss, a cap on consecutive estimated bills, and consumer messaging explaining delayed or estimated bills
- **Disconnection during calamities:** suspend disconnections as required by ERC or government directives for declared calamity areas; the HES must support a one-step suspension by area (confirm the directives that apply)
- **Recovery performance:** measure post-calamity recovery with the resilience KPI (Section 21.2): at least 95% of affected meters back to daily reads within 3 days of power restoration (Metro Power recommended default)

17. Consumer Protection

17.1 Communication Before, During, and After Installation

- Notify consumers before installation: why meters are being replaced, when, what to expect, and whom to contact
- Explain billing changes, including why a first AMI bill may differ from previously estimated bills
- Explain honestly how the program is paid for: AMI costs are recovered through rates only as approved by the ERC
- Explain what data is collected, why, and how it is protected
- Use channels suited to the community: barangay coordination, printed advisories, SMS, social media, and in-person sessions, in the local language
- Coordinate with local government units and barangays before field work

17.2 Remote Disconnection Safeguards

Remote disconnection is efficient, but it removes the field visit that often served as the last human check before a household lost power. The following safeguards are required:

- Every remote disconnection for non-payment must satisfy the notice and timing rules of the Magna Carta and other ERC rules in force (Section 14), exactly as a field disconnection would
- The HES must technically block disconnection commands outside permitted days and hours, and the permitted windows, notice periods, and holiday calendar must be configurable parameters so that they can be updated promptly when the rules change
- Accounts flagged as life-support or medically dependent, and other protected categories defined by the utility, must be excluded from automated disconnection and require documented human review
- Disconnection commands must be verified against the correct meter and account before execution, and confirmed afterward
- Reconnection after payment should be executed promptly, with the target time published
- Failed commands must be reconciled before the consumer is told the action occurred

17.3 Prepaid Service

Prepaid service must follow the ERC prepaid rules. It should be offered on terms that consumers understand, with accessible top-up channels, low-balance warnings, and clear treatment of arrears.

- **Standards:** token-based prepaid systems should use the Standard Transfer Specification (IEC 62055-41), Edition 2 or later, or an equivalent open standard. Vending keys are obtained through the STS Association's Key Management Centre under utility control, and supply group codes are assigned and recorded by the utility. Meters must already support the token identifier range that took effect when the original range rolled over in November 2024; meters that cannot are not procured
- **Emergency credit and friendly hours:** configure emergency credit, and set "friendly" periods so that credit exhaustion does not cut supply at night, on weekends, or on holidays, consistent with the ERC prepaid rules
- **Monitoring:** track how often and for how long prepaid consumers lose supply because credit ran out (the self-disconnection rate), particularly among low-income households, and report it at every Steering Committee meeting
- **Choice:** consumers must not be converted to prepaid without the consent or process required by the ERC prepaid rules

- **Low-credit safeguards for vulnerable consumers:** apply the protections in Section 17.6 to prepaid accounts, including longer emergency credit where the rules allow

17.4 Access to Usage Data

Consumers must be able to access their own usage data through the Consumer Meter Data Channel and the channels required by the ERC Amended AMI Rules. Access should work for consumers without smartphones, for example through SMS summaries or printed information on request.

17.5 Complaints, Disputes, and Meter Testing

- The utility must log every AMI-related complaint with a category, so that trends can be analyzed
- Acknowledge at least 95% of complaints within 24 hours; resolve standard complaints within 5 working days and complex complaints within 15 working days; update consumers on open complaints at least every 3 working days (Metro Power recommended defaults, not service standards; any regulatory service standard prevails)
- Protect personal data in complaint records: limit access to consumer services staff and use account numbers, not names, in reports
- The utility must inform consumers of their right to request a meter test under applicable ERC rules, and must complete requested tests and report results to the consumer within a published turnaround time (Metro Power recommended default, not a service standard: 10 working days from request; any regulatory timeline prevails)
- The utility must escalate automatically any complaint suggesting a systematic defect, such as a cluster of high-bill complaints on one transformer or firmware version

Escalation trigger	Escalate to
Billing dispute above a utility-set amount	Billing review committee
Repeat complaint from the same account within 60 days	Management review
Possible security or privacy incident	Cybersecurity lead and DPO, immediately
Several similar complaints on one transformer, firmware version, or area within a week	TWG, for systematic defect review
Vulnerable or medically dependent consumer affected by a disconnection	Consumer services supervisor, immediately
Complaint filed with a regulator or involving legal action	Regulatory and legal

The Toolkit sheet “W3 Complaint Log” tracks service levels and these triggers.

17.6 Vulnerable Consumers

Identify and support senior citizens, persons with disabilities, low-income households, medically dependent consumers, and consumers without digital access. The utility must maintain a register of consumers who have asked for or qualify for support, and support should include assisted communication, exclusion from automated disconnection where appropriate, and non-digital access to usage and billing information.

17.7 Consumer and Member Consultation

Consumers pay for AMI through their rates and, in electric cooperatives, they own the utility. Before Gate 4 the utility must consult consumers on the proposed program:

- Present the program, its expected benefits, the consumer safeguards, and the rate impact in pesos per kWh and on an average residential bill (Section 19.5)
- For electric cooperatives, consult through district meetings or member fora; for private utilities, through public information sessions and consumer or barangay representatives; report the results to the next annual general membership assembly where there is one
- Record the questions raised and the utility's responses, and include a summary in the Gate 4 decision paper
- Consultation informs the Board's decision; it does not replace the ERC's own public hearing process

18. Data Quality, VEE, and Billing Integrity

18.1 Principles

- Bills should be based on actual, validated reads. Estimation is an exception, never a routine.
- Every estimate and every manual edit must be traceable to a rule, a person, and a reason.
- The consumer should be able to tell from the bill whether it is based on actual or estimated data.

18.2 Validation

MDMS validation rules should detect, at a minimum: missing reads or intervals; duplicate reads; register rollback or negative consumption; consumption outside expected ranges for the customer class; sudden sustained changes; zero consumption on active accounts; clock and timestamp errors; and mismatches between register reads and the sum of interval data. It should also detect: CT/VT multiplier errors (for example, consumption inconsistent with the connected load or transformer loading); reverse energy on accounts that are not net-metered; breaks in continuity at a meter exchange (the old meter's final read must reconcile with the new meter's first read); and zero consumption during known outages, which should be treated as an outage, not as a validation failure.

18.3 Estimation

Method	Use when	Control
Interpolation from adjacent actual reads	Short gaps within a billing period	Automatic; flagged on the bill
Same-customer history (same period, prior cycle or year)	Longer gaps with adequate history	Automatic with limits; flagged
Class profile or similar-customer profile	New accounts or insufficient history	Requires review; flagged
Manual estimate	Exceptional cases only	Supervisor approval; reason recorded

An account should not be estimated for more than two consecutive billing cycles without a field investigation. Estimated consumption must be trued up against the next actual read.

18.4 Editing Controls

- Only authorized roles may edit data; every edit records the original value, new value, user, time, and reason
- Edits above a defined threshold require a second approver
- Edit volumes by user and reason are reviewed monthly by an independent function

18.5 Register-Read Reconciliation

During the pilot and on a sampling basis afterward, compare register values delivered through HES, MDMS, and CIS with physical display readings taken at recorded times. This test confirms the whole data chain, not only the meter, and is the most direct evidence that AMI bills are correct.

18.6 Master Data Quality and Migration

AMI exposes every error in customer, premise, and meter records. Before and during the pilot, and before each rollout cohort, the utility must cleanse and reconcile at least these fields: meter serial number and type; CT/VT ratios and billing multipliers; phase; tariff and rate class; premise and GPS location; transformer and feeder ID; net-metering and prepaid status; and account status. The Data Migration and Cleansing Plan (M-9) sets owners, methods, and reconciliation checks, and the cut-over from legacy reading to AMI reading is controlled account by account.

18.7 Time Synchronization

Interval data, time-of-use billing, event sequencing, and evidence all depend on correct time. The HES must take its time from a source traceable to Philippine Standard Time as kept by PAGASA under Republic Act No. 10535, or from GNSS-disciplined time distributed by authenticated network time protocol, and synchronize meter clocks on a defined schedule. Meter clocks should drift no more than 0.5 seconds per day between synchronizations (IEC 62054-21). Timestamps are exchanged in UTC, with Philippine Standard Time (UTC+8) used for display and billing. Clock drift is monitored as a KPI (Section 21.2), and clock synchronization is tested at SAT.

19. Business Case and Investment Planning

The business case is built three times: as a preliminary case in Stage M, as a final case using pilot actuals in Stage E1, and as a benefits realization record in Stages R and E2. Each version must show its assumptions and their sources, separating measured values, vendor quotations, and estimates.

19.1 Structure: The Five Cases

AMPERE business cases are organized under the Five Case Model, which originated in HM Treasury guidance in the United Kingdom and has been adopted in other public-sector systems, such as New Zealand's Better Business Cases. The same five headings are used at each version of the case; only the depth changes.

Case	Question it answers	AMPERE content
Strategic	Is there a compelling case for change?	AMI objectives (A-4); baseline (A-2); regulatory drivers (Section 14); fit with the utility's strategy
Economic	Which option offers the best value, including benefits to consumers and society?	Options compared, including doing nothing; costs, benefits, and beneficiaries (Sections 19.2–19.4); sensitivity (19.5)
Commercial	Can a viable, protective deal be secured and sustained?	Procurement strategy; contract protections (Section 15.6); operating model and service levels (Section 20); vendor risks
Financial	Is it affordable, and how will it be funded and recovered?	Funding route, cash flows, rate impact, treatment of legacy meters, regulatory approval route (Sections 19.5–19.6)
Management	Can the utility deliver it and realize the benefits?	Governance and decision rights (Section 13); plan and roadmap (Section 5.3); risks; benefits realization plan; independent gate reviews (Section 5.4)

Version	When	Five Case equivalent	Depth
Objectives statement and baseline	Stage A (Gate 1)	Strategic outline	Strategic case in full; other cases in outline
Preliminary business case	Stage M (Gate 2)	Outline business case	All five cases; options appraised; pilot designed to test key assumptions
Final business case	Stage E1 (Gate 4)	Full business case	All five cases using pilot actuals, negotiated commercial terms, and a confirmed funding route
Benefits realization record	Stages R and E2	Post-implementation review	Measured benefits and costs against the full business case

Every figure must show its source type: measured, supplied by the utility, regulatory, estimate, vendor quotation, or unverified vendor claim. Unverified vendor claims may inform options but cannot support a counted benefit or a Must criterion.

19.2 Cost Structure

Cost the whole life of the system, not only the purchase. The Toolkit sheet “M2 Business Case” covers:

- **One-time costs:** meters, modules, concentrators or collectors, network build, HES and MDMS, integration, installation, testing, project management, consumer engagement, training
- **Recurring costs:** software licenses or subscriptions, hosting, cellular data, maintenance contracts, network operations, security monitoring and testing, internal staff, and vendor support
- **Lifecycle costs:** scheduled replacement of components whose lives are shorter than the analysis period (Section 20.3), meter and module failures, batteries, firmware and software upgrades, and communication technology refresh (for example, forced by carrier network shutdowns)
- **Transition costs:** legacy meter removal and disposal, and the write-off of legacy meters that are not yet fully depreciated, which can be material and must be addressed with the regulator
- **Financial exposure:** foreign exchange on imported equipment and software, and financing costs

19.3 Benefits, Beneficiaries, and Attribution

Benefits are identified by tracing each AMI asset to the functions it enables, each function to the benefits it produces, and each benefit to who receives it: the utility, consumers, or society. This follows the method in the EU Joint Research Centre guidelines for smart-metering cost-benefit analysis, and the Toolkit sheet “M4 Benefit Mapping” records it.

A benefit may be counted only if (1) its baseline was measured in Stage A, (2) the function that produces it is present in the design, and (3) a named owner is responsible for delivering it.

Benefit	Enabling function	Main beneficiary	Measured by
Non-technical loss reduction	Transformer energy balancing; tamper events; field enforcement	Utility; paying consumers through lower system loss charges	Estimated non-technical loss rate on balanced transformers against the transformer-level baseline, with technical losses netted out (Section 21.3)
Meter-reading cost reduction	Remote reading	Utility; consumers through rates	Reading cost per account; redeployment of reading staff
Field visit reduction	Remote disconnect and reconnect; remote diagnostics	Utility; consumers (faster reconnection)	Field visits avoided per month
Billing accuracy and fewer disputes	Actual reads; VEE	Consumers; utility	Estimated-bill rate; billing adjustments; billing complaints
Collection improvement	Timely bills; prepaid options; disconnect efficiency within safeguards	Utility	Collection efficiency; days sales outstanding
Outage performance	Last-gasp and restoration events integrated with OMS	Consumers; utility	Outage detection time; restoration verification; reliability indices
Asset and planning value	Transformer loading and voltage data	Utility; consumers through deferred costs	Transformer failures avoided; deferred capital
Consumer information and choice	Usage data through the CMDC; prepaid and time-of-use options	Consumers	Usage-data access; program participation

19.4 Non-Monetary Effects

Some effects matter to Boards, members, and regulators but cannot be reliably priced. They are assessed and reported alongside the financial results, never added to them.

Effect	What to assess
Safety	Field-worker and public safety during installation and operations; fewer manual disconnections
Privacy	Residual privacy risk after controls (from the PIA)
Consumer acceptance and trust	Complaint trends, survey results, community feedback
Fairness	Effects on low-income, vulnerable, and prepaid consumers
Workforce	Roles changed or redeployed; skills gained
Environment and energy transition	Support for net metering, rooftop solar, and future demand response
Resilience	Outage visibility during typhoons and restoration verification

19.5 Financial Evaluation

- Net present value, internal rate of return, and payback over the asset life, using the utility's approved discount rate
- Sensitivity of results to the main drivers: meter and installation cost, loss-reduction achieved, recurring software and data costs, component lives, exchange rate, deployment pace, and benefit ramp-up time
- Scenarios for regulatory changes, including changes in system loss caps or pass-through treatment, which were under policy review in 2026
- **Rate impact:** the effect on the average residential bill and in pesos per kWh, which the Board and the regulator will both ask for

19.6 Funding and Approval

Funding options include internal funds, loans, vendor or lease financing, managed-service (AMI-as-a-service) models that shift capital to operating cost, and any government programs available at the time. Each option changes the regulatory treatment and the lifecycle cost and should be compared on the same basis. For managed-service contracts, payments should be linked to measured service levels, with deductions for shortfalls. The regulatory approval route under the ERC Amended AMI Rules, and NEA requirements for electric cooperatives, must be confirmed before full-scale commitments (Section 9.7).

Electric cooperatives should also consider the funding mechanisms available to them, such as ERC-approved capital expenditure programs and the Reinvestment Fund for Sustainable Capital Expenditures, loans from government and private lenders, and, for eligible restoration work after calamities, the Electric Cooperatives Emergency and Resiliency Fund (Republic Act No. 11039). The eligibility of AMI costs under each must be confirmed with the ERC, the NEA, or the lender concerned.

20. Operating AMI After Go-Live

20.1 Operating Model Options

Model	Description	Considerations
In-house	Utility staff run HES, MDMS, network, and security operations	Full control; requires scarce skills and continuous investment in them
Co-sourced	Utility owns and decides; a vendor or integrator provides specified operations and support	Balances control and capability; needs strong service levels and knowledge transfer
Managed service	Provider operates the system to service levels, often with hosted software	Lower capital and faster start; watch data ownership, exit terms, and long-term cost

20.2 Minimum Operating Functions

- Daily monitoring of read performance and exception queues
- Device and network health management, including concentrator and collector power and backup
- Firmware and configuration management under change control
- Security monitoring, patching, and access review
- VEE and billing exception handling within the billing calendar
- Field response for failed meters, communication faults, and investigations
- Vendor and contract management against service levels
- Performance reporting (Section 21)

20.3 Lifecycle Management and In-Service Performance

The utility should maintain a lifecycle plan covering expected failure rates and spares; battery replacement where applicable; firmware support periods; software version support; communication technology obsolescence; and the timing and funding of eventual meter replacement. Lifecycle costs should be reflected in operating budgets from the first year of deployment.

AMI components do not wear out together. A meter body may be expected to last far longer than its communication module, battery, or the cellular network it relies on; carriers decide when older networks are shut down, and utilities have no control over that timing. The business case must therefore use a component-life table rather than a single asset life, and schedule replacement costs within the analysis period.

Component	Life to record	Typical driver of replacement
Meter body and metrology	Expected service life; type-approval revalidation	Wear; accuracy drift; regulatory change
Communication module	Expected life of the module and its network	Technology or carrier network shutdown
Battery (where fitted)	Expected life under local temperature	Heat; usage pattern
Concentrators, collectors, backhaul	Expected life; vendor support period	Weather exposure; obsolescence

Component	Life to record	Typical driver of replacement
HES, MDMS, and other software	Version support period; contract term	Vendor roadmap; security support ending
Servers and hosting	Refresh cycle or subscription term	Performance; support ending

Lives must come from vendor commitments, carrier notices, and the utility's own experience, recorded in the assumptions register. The Toolkit sheet "M2 Business Case" schedules replacements automatically from these lives.

In service, the utility should:

- Track the annualized failure rate by meter model, manufacturing batch, and firmware version (Toolkit sheet "E2 Failure Tracking"), and investigate any batch whose rate is materially above the rest
- Test samples of installed meters for accuracy by lot, at intervals required by ERC rules or set by the utility, so that drift is found before it affects many bills
- Manage warranty claims with root-cause records
- Include a serial (batch-wide) failure clause in supply contracts: if failures in a batch exceed an agreed rate, the supplier replaces the whole batch at its cost (Toolkit template T4)

20.4 Use-Case Catalog: Turning Data into Decisions

Each use case links AMI data to a specific decision and an owner. Utilities should start with a few use cases that support the business case and add others as capability grows.

Use case	Decision it improves	Data required	Typical owner
Transformer energy balancing	Where to send loss investigation crews	Transformer meter data; customer interval data; accurate mapping	Loss reduction unit
Tamper and anomaly analytics	Which accounts to inspect	Events; consumption patterns	Loss reduction unit
Outage detection and restoration verification	Crew dispatch; confirming all customers are restored	Last-gasp and restoration events; network model	Operations
Transformer loading	Transformer replacement and load transfer	Aggregated interval data by transformer	Engineering
Voltage compliance	Tap changes, conductor upgrades, and complaint response	Voltage data from meters	Engineering
Load research and tariff design	Tariff proposals and demand forecasts	Interval data by customer class	Planning and regulatory
Collections and credit	Disconnection and payment arrangements, within safeguards	Billing and payment history; prepaid balances	Commercial
Net-metering and DER visibility	Hosting capacity and interconnection decisions	Import and export data	Engineering

20.5 From Detection to Enforcement

AMI finds suspected theft; it does not by itself prove it. Enforcement must follow RA 7832 and its implementing rules, and the utility's procedure should be reviewed by counsel before rollout.

- **Targeting:** analytics produce a ranked inspection list; inspections, not analytics, establish the facts
- **Witnessed discovery:** under RA 7832, discovery of the circumstances that constitute prima facie evidence must be personally witnessed and attested to by an officer of the law or a duly authorized representative of the regulator; plan inspections so that such a witness is present
- **Evidence:** photographs, seal records, and the removed meter are kept under documented chain of custody; AMI event and interval data are preserved as supporting records, and their use as electronic evidence is confirmed by counsel
- **Differential billing:** calculated only by the methods and within the period limits set by RA 7832 and its rules, with the calculation documented and explained to the consumer
- **Consumer rights:** disconnection after discovery, notices, and dispute handling follow the Act and ERC rules
- **Measurement:** report inspection hit rate and energy recovered (Section 21.2)

20.6 Firmware and Configuration Governance

- Keep a register of the approved firmware version and configuration for every device type
- Maintain a reference test lab of representative meters, modules, and network equipment for the life of the system
- Regression-test every firmware or configuration change in the lab before deployment, then deploy in stages with rollback ready
- Treat metrology firmware and communication firmware separately; confirm with the ERC whether a metrology firmware change affects type approval before deploying it
- Approve changes through the utility's change control, with the vendor's release notes and security fixes reviewed

21. Performance Measurement

KPIs are used for three purposes: to measure the baseline (Stage A), to decide at gates (Stages P, E1, and R), and to manage operations (E2). Each KPI has a single definition used for all three purposes. Must-Pass KPIs are few on purpose: they are the results without which the investment should not proceed. All other KPIs are monitored and managed.

So that results are comparable across utilities, the following rules apply to every KPI. **Exclusions** are limited to: meters not yet commissioned; accounts disconnected for the whole period; days excluded under the calamity rule (Section 8.6); and, in areas without 24-hour supply, hours outside the supply schedule stated in the analysis plan (Section 15.7). No other exclusion applies to a Must-Pass KPI unless it was fixed in the analysis plan before Gate 2. **Availability** = (scheduled service minutes – unplanned outage minutes – planned outage minutes above the allowance) ÷ scheduled service minutes. **Latency classes** for remote commands: Class A, 5 minutes, for RF mesh and always-connected cellular; Class B, 60 minutes, for PLC and power-saving cellular modes (Metro Power recommended defaults).

21.1 Core Pilot KPIs

KPI	Definition	Default target	Designation	Judged at
Daily read success rate	Commissioned meters for which at least 95% of the previous day's expected intervals are received by 06:00, divided by commissioned meters; averaged over the measurement period	≥ 98%	Must-Pass	Gate 3
Register-read reconciliation	Sampled meters whose system register value matches the physical display reading within one unit of the least significant displayed digit, adjusted for consumption between the two timestamps, divided by sampled meters (at least 50 per stratum per cycle)	100%; every mismatch root-caused and corrected	Must-Pass	Gate 3
Remote command success	Connect and disconnect commands confirmed executed on the first attempt within the latency class of the technology (5 or 60 minutes), divided by commands issued	≥ 95%; 100% of failures reconciled	Must-Pass if remote switching is in scope	Gate 3
Unresolved security findings	At Gates 3 and 4: open Critical findings, plus open High findings past their remediation deadline or without an approved compensating control. At Gate 5 cohort checks: Critical or High findings past their remediation deadline (Section 16.1)	Zero	Must-Pass	Gates 3, 4, 5
Billing accuracy	Bills issued in the period that needed no correction within 90 days of issue because of a metering, data, or billing-system error, divided by bills issued. For Gate 4, measure bills issued at least 90 days before the evaluation date.	≥ 99.5%	Must-Pass	Gate 4
Estimated-bill rate	Bills whose billing determinants (energy or demand) were estimated, divided by bills issued; interval gaps filled without changing billing determinants are excluded	≤ 1%	Must-Pass	Gate 4

KPI	Definition	Default target	Designation	Judged at
Business-case KPI(s)	The measure of each benefit on which the business case depends, for example the reduction, in percentage points, in the estimated non-technical loss rate on balanced transformers against the transformer-level baseline (Section 21.3)	Set from the business case	Must-Pass	Gate 4
Billing-read availability	Accounts with a validated actual read at billing cut-off, divided by accounts billed	≥ 99%	Monitor	Not gated
HES and MDMS availability	Availability formula above, with a planned-outage allowance of 8 hours a month	≥ 99.5%	Monitor	Not gated
Firmware update success	Devices updated in a campaign, divided by devices targeted (only if a campaign runs during the pilot)	≥ 95%; 100% signed firmware	Monitor	Not gated
Outage event capture	Verified outages for which last-gasp events were received, divided by verified outages	Set by technology in the pilot plan (defaults: ≥ 95% for RF mesh and always-connected cellular; ≥ 80% for PLC, where last-gasp messages depend on the concentrator's own backup)	Monitor	Not gated
Complaint handling	Share acknowledged within 24 hours; average working days to resolve standard complaints; meter-test turnaround	≥ 95%; ≤ 5 days; ≤ 10 days	Monitor	Not gated
Consumer satisfaction	Share of surveyed pilot consumers rating the service positively, using a consistent survey method	≥ 85%	Monitor	Not gated

These are Metro Power recommended defaults. A utility confirms them in its Pilot Evaluation Plan. When the ERC issues AMI performance standards, those standards prevail wherever they are stricter or different.

21.2 Rollout and Operating KPIs

KPI	Definition	Default target
Installation productivity	Installations per crew-day	Set in wave plan
First-time-right rate	Installations needing no return visit, divided by installations	≥ 97%
Audit defect rate	Audited installations with a Critical or Major defect, divided by installations audited	≤ 2% (pause trigger)

KPI	Definition	Default target
Wrong-account disconnections	Disconnections executed on the wrong account	Zero; each one investigated as a serious incident
Annualized meter failure rate	Failures in the last 12 months, divided by average installed base, by model, batch, and firmware	Below the contractual or warranty rate
Clock accuracy	Meters within ± 5 seconds of reference after synchronization, divided by meters checked	$\geq 99\%$
Inspection hit rate	Loss inspections confirming an irregularity, divided by inspections	Trend upward
Energy recovered	kWh and pesos recovered through enforcement and billing correction	Tracked against business case
Prepaid self-disconnection	Share of prepaid consumers losing supply because credit ran out, and average duration	Trend downward
CMDC availability	Availability formula above, applied to the consumer data channel	$\geq 99\%$
Post-calamity recovery (resilience)	Meters in an area affected by a calamity or widespread outage that return to daily reads within 3 days of power restoration, divided by affected meters	$\geq 95\%$
Remote reconnection time	Time from payment posting to confirmed reconnection, for remote reconnections	Published target, met for $\geq 95\%$

21.3 Measuring Loss Reduction

The loss benefit is measured at transformers that have a transformer meter and verified mapping:

Estimated non-technical loss rate = (energy measured at the transformer – sum of customer energy for the same interval-aligned period – estimated technical loss) ÷ energy measured at the transformer.

Technical loss (transformer and secondary losses) is estimated with a stated engineering method using loading data, and the method is fixed in the analysis plan. The baseline is taken from transformer meters installed on a sample of pilot-area transformers at least two months before AMI installation (Section 6.3). Where that is not possible, the utility uses a feeder-level baseline, records the limitation, and sets a more conservative threshold for the business-case KPI.

21.4 Reporting Cadence

Report	Frequency	Audience
Operations dashboard (reads, exceptions, failed commands, alarms)	Daily	Operations team
Pilot status	Weekly during the pilot	Program team and TWG
Technical performance; billing and VEE; consumer and complaints; cybersecurity and privacy	Monthly	Function leads and Steering Committee

Report	Frequency	Audience
Benefits realization and financial performance (R-3)	Quarterly	Management and Board
Steering Committee pack	Monthly during the pilot, quarterly afterward	Steering Committee
Annual review (Section 11.3)	Annual	Board of Directors
Regulatory reports (ERC, NEA, DOE where applicable)	As required	Regulators
Independent gate review report	Before Gates 2 and 4	Decision owner
Personal data breach notification	Within 72 hours of knowledge	NPC and affected individuals

The Toolkit sheet “K Reporting Cadence” assigns preparers and approvers for each report.

21.5 Definitions for Consumer and Security Reporting

Measure	Definition
Complaints per 1,000 AMI accounts	AMI-related complaints received in the period (all categories in the complaint log) ÷ AMI accounts at the end of the period × 1,000, stated per month. The billing and meter categories are also reported separately, so that they can be compared with the baseline measure in Annex D
Disconnection-safeguard breach	Any disconnection that did not comply with Section 17.2: executed outside permitted windows or without the required notice, on a protected account without documented review, on the wrong account, or not confirmed; each counts once
Security incident	An event that actually compromised, or was confirmed to have attempted to compromise, the confidentiality, integrity, or availability of the AMI system or its data and required incident response; routine blocked scans are not counted
Personal data breach	As defined under the Data Privacy Act and NPC rules; counted when notified to the NPC

22. Worked Example: A Fictional Cooperative Through the Gates

Illustration only

ABC Electric Cooperative is fictional. Its figures are invented to show how the Protocol works in practice and are not benchmarks or results from any real utility.

22.1 Starting Point

ABC Electric Cooperative serves about 60,000 connections: a lowland town, upland barangays with heavy vegetation, and two small islands. Meters are read manually each month. The Board wants to reduce system loss, which is above its cap, and to reduce estimated bills.

22.2 Stage A and Gate 1

The readiness assessment scored most categories at 2. Cybersecurity and privacy scored 1, and no Data Protection Officer had been designated, which is a knockout item. The General Manager held Gate 1. Within two months a DPO was designated and a security policy adopted, and the category was re-scored at 2 on that evidence. The baseline showed accurate meter-to-transformer mapping for only part of the town sample, so mapping cleanup went into the gap closure plan, and transformer meters were installed on a sample of town transformers to record pre-AMI losses. Gate 1 then passed with conditions covering the mapping-cleanup milestones, which were gap-plan items.

22.3 Stage M and Gate 2

Field surveys showed that RF mesh performed well in the town but poorly in the upland areas. PLC was costly because many small transformers each served only a few customers. Cellular coverage was adequate on one island and weak on the other. The TWG proposed a hybrid design and deliberately included the upland area in the pilot, because that was where the design was least certain.

Without loss reduction in the town, the preliminary business case was negative, so the estimated non-technical loss rate on balanced town transformers became a Must-Pass business-case KPI, with its threshold taken from the business case. The two islands were treated as separate strata because their communications differed. Using the sampling rule in Section 8.6 (design effect 1.5), the town and upland strata were sized at about 1,130 meters each. The two islands had only about 400 and 250 connections, so each was metered in full (census). The pilot therefore covered about 2,900 meters in four strata, and the Pilot Evaluation Plan fixed a non-inferiority margin of 1 percentage point for the daily read success rate. A peer reviewer from another cooperative rated the proposal Amber and made one Critical recommendation: add CIS multiplier cleansing to the Data Migration and Cleansing Plan. It was added. By then the gap closure plan had raised governance, cybersecurity and privacy, operations and billing, consumer engagement, and data and baseline to 3, meeting the Gate 2 minimums, and the Board approved the pilot.

22.4 Stage P and Gate 3

- Factory testing found clock drift in one meter batch; the vendor corrected the firmware before shipment.
- Upland read success in the first billing cycle was 94% against a 98% threshold. Repeaters were added, and the upland measurement period restarted and ran for the full three billing cycles. Upland still reached only 97.1%.
- The penetration test found an exposed HES administration interface. It was closed before acceptance.

- Register-read reconciliation found mismatches caused by wrong multipliers in the CIS. The multiplier cleansing already in the plan was completed for all pilot accounts, and the reconciliation then matched fully.

As the evaluation plan allowed, the Steering Committee decided Gate 3 by stratum. It accepted the town and both island strata with minor corrective actions, and returned the upland stratum for retest with an alternative communication design.

22.5 Stage E1 and Gate 4

Before Gate 4 every readiness category was re-scored at 3 or higher. The town and island strata met every Must-Pass KPI, with billing accuracy measured on bills at least 90 days old. The estimated non-technical loss rate on balanced town transformers fell by more percentage points than the threshold, although by less than the business case's central estimate. The final business case was positive under base assumptions but negative when costs rose 20% and benefits fell 25% at the same time. The independent reviewer rated the proposal Green/Amber. Before the vote, the cooperative presented the program and its rate impact at district meetings, and the Board approved a Workforce Transition Plan, prepared after consulting affected employees and their employee association, that moved most meter readers into installation audit and field investigation roles.

The Board chose **Scale with conditions** for the town and island areas: smaller first cohorts, price protection for later purchases, and a measured benefit milestone before rollout passes the halfway point. For the upland area it chose **Extend the pilot and correct**, with the alternative design to return to Gate 4 separately. The rollout contract was signed conditional on ERC approval of the investment.

22.6 What the Example Shows

- Knockout items and minimum scores stopped the program from starting without basic privacy governance, and the fix was evidenced, not assumed.
- Making the loss benefit a Must-Pass KPI meant the investment decision rested on measured results, not on the business case's assumptions.
- Judging by stratum let the Board scale where the design worked and keep testing where it did not.
- The pilot surfaced a hidden cost, CIS data cleansing, before it became a rollout problem.
- Independent review caught a gap before money was committed.

Part III: National and Sector Adoption

Parts I and II are written for a single utility. Part III sets out how the same framework works when a government agency, regulator, supervising body, or association of utilities adopts AMPERE as a common framework for many utilities, nationally or across a sector. Part III adds a sector layer; it does not change the utility-level rules.

23. Adoption Model

23.1 Two Levels of Use

Level	Who uses it	What applies
Utility level	A distribution utility or electric cooperative applying AMPERE to its own AMI program	Parts I and II and the utility Toolkit
Sector level	An Adopting Body : a government agency, regulator, supervising body, or association that adopts AMPERE for the utilities it funds, supervises, or represents	Parts I, II, and III, the utility Toolkit, and the Sector Toolkit

23.2 Forms of Adoption

Form	Description	Effect
Reference	The Adopting Body recommends AMPERE as good practice	Voluntary for utilities
Reissue	The Adopting Body reissues AMPERE, whole or in part, as its own guideline, with attribution (Section 30.4)	As stated in the Adopting Body's instrument
Condition of support	The Adopting Body requires AMPERE for programs it funds, lends to, or supervises	Mandatory for those programs, as stated in its instrument

This Protocol has no legal force of its own. Any mandatory effect comes only from the instrument by which an Adopting Body with the necessary authority adopts it. Laws, regulations, and the rules and approvals of the Energy Regulatory Commission always prevail.

23.3 Core and Localizable Content

An Adopting Body may localize AMPERE to its mandate, but the following **core** must be kept unchanged for its framework to be described as AMPERE:

- The six stages and five gates, with written decision records and independent review at Gates 2 and 4
- The minimum mandatory set (Section 2.5)
- The evidence rules: measured baseline, pre-approved pilot evaluation plan, per-stratum Must-Pass KPIs, and register-read reconciliation
- The consumer safeguards in Section 17: every requirement stated there with “must” is core, while numeric targets such as response times are localizable
- The advisor conflict-of-interest rules (Section 13.3)

May be localized	Examples
Default targets and thresholds	KPI targets, change-control thresholds, audit rates
Roles and concurrence steps	Where the Adopting Body reviews or concurs (Section 24)
Sector baseline values	Interval length, retention periods above the minimum, cybersecurity outcome targets (Section 25)
Reporting formats and frequency	Submission channel and schedule (Section 26)
Templates and language	Forms in the Adopting Body's format; translations of consumer materials

Localized versions must be identified as adaptations, state the AMPERE version they are based on, and list their changes (Section 30.4).

23.4 Programs Already Under Way

When a sector framework is adopted, a single transition rule applies. A utility with an AMI program already under way maps its current position to the nearest AMPERE stage, records any gaps against that stage's gate criteria on template T11, and applies AMPERE from its next gate onward. A gate already passed in substance is not repeated. Earlier decisions are not reopened unless a gap affects consumer protection, security, or billing accuracy; such gaps are closed within a period the Adopting Body sets. A program already under a signed rollout contract applies the Stage R cohort checks and the Stage E2 controls from its next cohort.

Nothing in this Protocol limits the review, approval, audit, or enforcement powers of regulators, supervising agencies, or auditors under their own mandates.

24. Roles of an Adopting Body

Under a sector framework, the utility remains the decision owner at every gate. The Adopting Body sets common rules, provides assurance, and, where it funds or supervises a program, gives or withholds its concurrence. It does not take the utility's decisions or accountability.

Gate	Typical Adopting Body role
Gate 1: Proceed to Model	Informed; may provide readiness assessment support
Gate 2: Pilot approval	Concurrence where it funds, lends to, or supervises the program; checks conformance with the sector baseline
Gate 3: Technical acceptance	Informed; receives acceptance results through sector reporting
Gate 4: Investment decision	Concurrence where it funds, lends to, or supervises the program; confirms independent review and sector baseline conformance
Gate 5: Cohort checks and handover	Monitors cohort results and pause triggers through sector reporting; informed of pauses
E2: Annual review	Receives annual performance and benefits data; includes it in the sector report

24.1 Adopting Body Responsibilities

- Publish the adoption instrument, the localized content, and the sector baseline values
- Maintain the pool of accredited independent reviewers (Section 28.2)
- Operate sector reporting and publish an annual sector report (Sections 26 and 29)
- Decide concurrence requests within a published processing time, consistent with Republic Act No. 11032 where the Adopting Body is a government agency (at the time of writing, 20 working days for highly technical applications), so that it does not become a bottleneck
- Keep utility-identifiable information confidential and share only aggregated, anonymized results (Section 26.3)
- Coordinate with the regulator, so that AMPERE evidence can support regulatory applications without duplicating them

24.2 Operating Model and Phasing for an Adopting Body

An Adopting Body needs a small standing capability to run a sector framework. A typical arrangement, which each body adapts to its mandate and resources, is:

- **A framework secretariat** that maintains the adopted edition, receives sector submissions, and prepares the annual sector report
- **A technical committee** of utility, regulatory, consumer, privacy, cybersecurity, and independent experts that advises on revisions (Section 30.2)
- **A reviewer pool coordinator** who maintains accreditation and assigns reviewers (Section 28.2)
- **Phased adoption:** begin by reference adoption; apply the framework to a small group of volunteer utilities of different sizes; consult; revise; and only then consider making it a condition of support (Section 30.3)

24.3 When a Utility Does Not Conform

If a utility in a program the Adopting Body funds or supervises proceeds without meeting a gate's Must criteria, or a pause trigger is ignored, the Adopting Body may withhold concurrence, require an independent review, or suspend support under its own rules. Non-conformance is recorded in the sector register with the utility's response.

25. Sector Minimum Baseline

A sector baseline sets the minimum that every AMI program under the framework must meet, so that systems can interoperate, data can be compared, and consumers receive equivalent protection wherever they live. It sets minimums and interfaces, never a technology or a vendor.

Area	Minimum baseline	Protocol reference
Metering	ERC type approval before installation; accuracy class by segment; meters tested and sealed as ERC rules require	Sections 14, 15.1
Interoperability	Standards-based meter protocol; documented, openly available interfaces; full data export in documented formats; utility ownership of keys and data; conformance to the sector companion specification once issued	Sections 15.3, 25.2
Common data profile	Minimum data items, identifiers, event types, time reference, and quality flags in Annex I, until the Adopting Body issues a sector companion specification	Annex I
Consumer data access	Consumer Meter Data Channel and other channels required by the ERC	Section 17.4
Cybersecurity	All minimum controls in place and independently verified, reported as control outcomes aligned where applicable with the DOE Cybersecurity Assessment Framework and Cyber Resilience Scorecard; the security gate rule on remediation deadlines. The program's CSF tier is reported for information and is not a pass or fail test	Section 16
Key management	Utility-controlled keys in a dedicated or partitioned hardware security module; wrapped key transfer; replacement of manufacturing keys after commissioning	Section 16.1
Privacy	Designated DPO; Privacy Impact Assessment; processing agreements with every processor; breach notification within 72 hours	Section 16.2
Data retention	Billing-related meter data kept for at least five years	Section 16.2
Time	Time traceable to Philippine Standard Time; UTC exchange; drift limit	Section 18.7
Consumer safeguards	All requirements stated with "must" for disconnection, prepaid service, complaints, meter testing, and consultation	Section 17
Resilience	Disaster recovery objectives, backup power, calamity suspension of disconnections	Section 16.5
Reporting	Sector reporting dataset	Annex H

25.1 Sector Companion Specification

Interoperability across many utilities needs more than a list of standards. The Adopting Body should issue, with technical input from utilities and suppliers, a sector companion specification that fixes: the meter data model and object identifiers (for example, a DLMS/COSEM profile under IEC 62056); the interval lengths and channels to be recorded; the standard event list; the head-end to MDMS and MDMS to CIS message profiles (for example, IEC 61968-9 or MultiSpeak); time synchronization; the CMDC interface; and a national meter

identifier scheme, so that every meter can be identified uniquely across utilities (for example, a manufacturer code and serial number). Annex I gives the minimum content until such a specification exists.

25.2 Conformance and Certification

A specification protects interoperability only if conformance is tested. Once a companion specification is issued, the Adopting Body should establish, in coordination with the ERC:

- Conformance testing against the companion specification by laboratories accredited to ISO/IEC 17025 by the Philippine Accreditation Bureau or an equivalent signatory of international mutual recognition arrangements
- A public register of conforming products, identified by model and by metrology and communication firmware version; a firmware change that affects conformance requires retesting
- An interoperability test in which each meter model is shown to work with at least two independent head-end systems before it is listed
- Recognition of results already obtained for ERC type approval, so that the same test is not paid for twice

25.3 Sector Data Services

Over time, an Adopting Body may consider shared data services, such as a sector consumer data access hub that implements the CMDC for utilities that choose to use it, or a common interface for data exchange with retail suppliers under Retail Competition and Open Access and with the wholesale electricity market. Any such service must be approved by the competent authorities, keep each utility as personal information controller for its consumers, and meet Sections 16 and 27.1.

26. Sector Reporting and Benchmarking

26.1 Reporting Dataset and Frequency

Each utility in the sector framework submits the dataset in Annex H using the Toolkit sheet “K2 Sector Submission”: quarterly from Gate 2 until program handover, then annually. Definitions are those of Section 21, including Section 21.5, so that results are comparable across utilities. Reporting rests on the Adopting Body’s legal authority to require it; where that authority does not extend to a utility, reporting is by data-sharing agreement with that utility.

26.2 Data Quality

The utility’s General Manager or delegate certifies each submission. The Adopting Body may audit a sample of submissions against the utility’s records each year. Figures that cannot be verified are marked as such and excluded from benchmarks.

26.3 Confidentiality and Publication

- Submissions contain no personal data; only aggregated utility-level figures are reported
- Utility-identifiable data is shared only between the utility and the Adopting Body, under a data-sharing agreement or the Adopting Body’s own authority. An Adopting Body that is a government agency must also apply freedom-of-information rules and Commission on Audit requirements, and should state in its instrument which submitted data it will treat as confidential
- Published benchmarks are aggregated and anonymized, with no group smaller than five utilities (Metro Power recommended default)
- Benchmarks are shown by peer group, such as utility size band, grid-connected or off-grid, and dominant communication technology, where each group has at least five utilities; otherwise only the sector-wide figure is shown
- Each utility receives its own position against the anonymized benchmark

26.4 Annual Sector Report

The Adopting Body publishes an annual report covering: utilities at each stage and gate outcomes; meters installed and commissioned against plans; sector medians for the core KPIs; security incidents in aggregate; consumer complaint and disconnection-safeguard results; benefits realized against approved business cases; and lessons learned. The Sector Toolkit produces the core tables.

27. Shared Services and Aggregated Procurement

Many smaller utilities cannot justify a full head-end, meter data management system, and security operation of their own. Sharing them can cut cost and raise capability, provided each utility keeps control of its data, keys, and decisions.

Model	Description	Best suited to
Joint procurement	Utilities procure together under common specifications and framework agreements, then contract individually	Utilities of any size wanting price and specification benefits
Lead-utility host	A larger utility hosts HES and MDMS services for smaller neighbours under service agreements	Clusters with one capable utility
Shared multi-tenant platform	A shared HES and MDMS, operated for a group of utilities, with separate tenants for each	Groups of smaller utilities using compatible technology
Managed service for a cluster	A provider operates the AMI system for a group of utilities to service levels	Groups with limited in-house capability

27.1 Conditions for Any Shared Model

- Each utility owns its data and cryptographic keys, and its data is logically separated from other tenants; separation is tested at SAT
- A cost-allocation formula is agreed before commitment
- A cluster governance board, with a seat for each utility, approves changes, service levels, and budgets
- Each utility can exit with its data in documented formats and with transition assistance
- Tenant isolation is tested independently at least once a year, and cellular traffic runs on a private APN or VPN
- A platform-wide cap on remote disconnection commands applies in addition to each tenant's own cap, so that a compromised operator account cannot disconnect consumers across several utilities
- The platform operator acts as personal information processor for each utility under a written processing agreement (Section 16.2)
- Each utility still passes its own gates; a shared platform does not replace a utility's pilot evidence for its own service area
- Procurement follows the rules that apply to each participating utility

27.2 Shared Specialist Services

Even utilities that run their own AMI systems may share the specialist services that small utilities cannot sustain alone: independent penetration testing; security logging and monitoring (a shared security operations center); a reference test lab for firmware regression testing (Section 20.6); meter testing and in-service accuracy sampling; and transformer metering for energy balancing. The conditions in Section 27.1 apply where a shared service handles a utility's data or systems.

28. Capacity Building, Competency, and Reviewer Accreditation

28.1 Competency Framework

Role	Core competencies	Recommended learning
Board members and General Managers	Reading gate decision papers; business case and risk judgment; consumer and regulatory obligations	AMPERE Foundation (executive level)
Program Manager	Stage-gate planning; evidence management; vendor and contract management; reporting	AMPERE Practitioner
TWG lead and engineers	Requirements; communication design; testing; KPI measurement; loss analytics	AMPERE Practitioner plus technology-specific training
DPO and cybersecurity lead	Privacy Impact Assessment; minimum controls; incident response; CSF profiles and tiers	AMPERE Practitioner plus privacy and security certification
Field supervisors and installers	Installation standards; safety; tamper handling; data capture	Field training on template T7 and utility procedures
Independent reviewers	Gate criteria; evidence assessment; confidence rating; conflict-of-interest discipline	AMPERE Reviewer, with accreditation

28.2 Independent Reviewer Accreditation

Under a sector framework, the Adopting Body maintains a pool of accredited independent reviewers so that every utility, including the smallest, can obtain the Gate 2 and Gate 4 reviews.

- **Eligibility:** relevant utility, engineering, finance, or audit experience; completion of AMPERE Reviewer training; a signed conflict-of-interest declaration (Toolkit template T13)
- **Independence:** no commercial interest in the program reviewed, including no affiliation with bidding suppliers or advisors, and no role in preparing the evidence
- **Assignment and rotation:** the Adopting Body assigns reviewers; no reviewer reviews the same utility more than three times in a row
- **Quality:** review reports are sampled each year for consistency; accreditation is renewed every two years (Metro Power recommended defaults)
- **Author exclusion:** no one employed or contracted by Metro Power now or in the past two years is accredited as an independent reviewer (Section 30.5)

28.3 Training Delivery

Curricula based on this Protocol are open: any competent trainer may teach them. Under a sector framework the Adopting Body sets and accredits the training standard, and training may be delivered by the Adopting Body, by universities, utility associations, or other trainers it accredits, or by Metro Power. Metro Power is not the sole or accrediting trainer. Delivering training confers no role in any utility's gate decisions.

29. Sector Monitoring, Evaluation, and Knowledge Management

29.1 Sector Indicators

Indicator	Purpose
Utilities at each stage; gate outcomes, including stops	Program pipeline and discipline
Meters installed and commissioned against approved plans	Delivery
Sector medians for daily read success, billing accuracy, estimated-bill rate, and availability	Technical and billing performance
Complaints per 1,000 AMI accounts; meter-test turnaround; disconnection-safeguard breaches	Consumer protection
Security incidents and unresolved security findings, in aggregate	Cyber resilience
Benefits realized against approved business cases; costs against approved budgets	Value for money
Deviations from the minimum mandatory set and open conditions	Framework conformance

29.2 Evaluation of the Framework

The Adopting Body should commission an independent evaluation of how the framework is working at least every three years. Metro Power may contribute information but does not conduct or direct the evaluation. The evaluation examines whether gates are improving decisions, whether consumer outcomes are protected, and what should change. Findings feed the next revision (Section 30.2).

29.3 Knowledge Sharing

- A lessons-learned repository, with entries anonymized unless the utility agrees otherwise (Sector Toolkit)
- Sharing of security incidents and vulnerabilities through the appropriate national computer emergency response channels, not through general reports
- Publication of anonymized case studies, with the consent of the utilities involved

30. Framework Governance, Validation, and Licensing

30.1 Ownership and Stewardship

Metro Power Corporation is the author of the AMPERE Protocol and Toolkit and maintains the Metro Power edition. An Adopting Body that reissues AMPERE owns and maintains its own edition: revision authority for that edition rests with the Adopting Body, advised by its technical committee (Section 24.2), on which Metro Power may serve as one member among utility representatives, regulators, consumer representatives, and independent experts. Metro Power will offer improvements from its own edition to Adopting Bodies but cannot change an adopted edition.

30.2 Revision Process

This process governs the Metro Power edition. An Adopting Body applies its own process to its edition and may adopt this one.

- Anyone may submit a change request (Sector Toolkit sheet “S9 Change Requests”)
- **Minor revisions** (clarifications, corrections, reference updates) are made by the edition owner and noted in the revision history
- **Major revisions** (changes to the core in Section 23.3, gates, Must criteria, or safeguards) are published in draft for consultation with users and Adopting Bodies for at least 30 days before issue (Metro Power recommended default)
- Each revision states how programs under way transition to it; a program may continue under the version in force at its last gate until its next gate

30.3 Validation Status and Plan

As of this version, the Protocol has been benchmarked against recognized frameworks (Annex G) and reviewed for internal consistency. It has **not yet been applied end to end in a utility program**, and it has not yet been the subject of public consultation. Its numeric defaults are provisional. Metro Power recommends that adoption proceed in stages, with each stage completed before the next:

1. **Reference adoption:** the Adopting Body recommends AMPERE as good practice, and utilities apply it voluntarily
2. **Field validation:** two or three utilities of different sizes and conditions, including at least one electric cooperative with island or upland service areas, apply it through at least Gate 4; the defaults are calibrated against their results
3. **Consultation and peer review:** consultation with utilities and their associations, the regulator and relevant government agencies, data-privacy and cybersecurity authorities, consumer representatives, labor representatives, and technology providers, including competitors of Metro Power; and an independent technical peer review
4. **Revision:** a revised edition incorporating the results
5. **Optional mandatory use:** only then, and only by an Adopting Body with the authority to do so, as a condition of support

30.4 Licensing and Attribution

Metro Power grants every utility, Adopting Body, and other user a perpetual, irrevocable, worldwide, royalty-free, non-exclusive license to use, reproduce, translate, adapt, publish, and distribute this Protocol and its Toolkit, in whole or in part. An Adopting Body may also sublicense these rights to the utilities it funds, supervises, or represents. Metro Power retains copyright in the original text. The conditions are:

- **Attribution:** state that the work is based on the AMPERE Protocol by Metro Power Corporation and give the version used
- **Adopted editions:** an Adopting Body may reissue the work under its own name and number, for example as “[Body] AMI Framework, based on the AMPERE Protocol Version 5.1 by Metro Power Corporation,” and owns its adaptations and has sole revision authority for its edition (Section 30.1)
- **Use of the name:** an edition may be called “AMPERE” only if it keeps the core unchanged (Section 23.3); otherwise it is described as “based on” AMPERE
- **Identification of changes:** adaptations are identified as such and list their changes, and do not suggest that Metro Power endorses an adaptation it has not reviewed
- **No resale:** the Protocol and Toolkit are not sold as products; charging for services that use them, such as training or advice, is permitted

A user that breaches these conditions must correct the breach; until it does, it may not describe its edition as AMPERE or as based on AMPERE. The license to use the content is not otherwise withdrawn.

The Protocol and Toolkit are provided “as is,” without warranty of any kind, express or implied, including fitness for a particular purpose. They are guidance, not engineering, legal, or financial advice. To the extent permitted by law, Metro Power is not liable for loss arising from their use; each user remains responsible for its own decisions and for compliance with the law.

30.5 Metro Power’s Commitments

Metro Power may advise on AMI programs and, separately, offer solutions to them. It is bound by the advisor rules in Section 13.3, like any other advisor. To protect the decisions of utilities and Adopting Bodies, it also commits to the following:

- **Disclosure:** at the start of every engagement, Metro Power gives the utility a written disclosure (Toolkit template T10) naming its technology partners and any commission, exclusivity, or other commercial interest relevant to the program, and stating which roles it will and will not seek. It updates the disclosure if anything changes, and it keeps a current list of its technology partners on its public website.
- **Bidding:** if Metro Power intends to bid for supply, it has no role in preparing evaluation criteria after the package is issued, in evaluating bids, or in selecting the vendor, and the reviewer of any specification it prepared must be external to both Metro Power and the utility (Section 13.3).
- **Evaluation:** Metro Power does not prepare or approve the Pilot Evaluation Report for a pilot it delivered or supplied. The utility prepares it, with independent verification of the results.
- **Independent review:** Metro Power is never an independent gate reviewer, and its staff are not accredited to the reviewer pool.
- **Sector data:** Metro Power does not hold or receive utility-identifiable sector reporting data unless the utility concerned agrees in writing; otherwise it sees only published, anonymized results.
- **Training:** Metro Power does not claim to be the sole or accrediting trainer for AMPERE, and its training materials follow the open curricula (Section 28.3).
- **Breach:** if Metro Power breaches Section 13.3 or these commitments on a program, it withdraws from the affected procurement, and the utility records the breach in its gate log.
- **Framework neutrality:** Metro Power will not use its stewardship of the framework to favor its own products; the sector baseline sets minimums and interfaces, never a technology or vendor.
- **Decision rights:** every gate decision remains with the utility, and every concurrence with the Adopting Body.

30.6 Maintenance

- Metro Power reviews this Protocol at least every 12 months and whenever a relevant regulatory issuance changes requirements, including ERC supplemental AMI guidelines.
- Each version records its changes in the revision history. Metro Power withdraws superseded versions from its own distribution; licenses already granted and adopted editions are unaffected.
- Utilities, Adopting Bodies, and partners may send comments and lessons learned to Metro Power in writing. Metro Power acknowledges each submission, treats utility information as confidential unless the utility agrees otherwise, and records how each was considered in the next revision.
- Utilities applying the Protocol record the version they follow and their conformance and deviations using Toolkit template T11.

Annexes

Annexes A to E support Part II. Annex F is the glossary. Annex G maps AMPERE to recognized frameworks. Annexes H and I support Part III.

Annex A: Readiness Assessment Method

A.1 Categories and Scoring

Score each category from 1 to 4 using the descriptors below. A score must be supported by evidence (documents, data, or observed practice), not by self-assessment alone. Use whole numbers only. The Toolkit sheet “A1 Readiness Scoring” applies these rules automatically.

Category	1: Initial	2: Developing	3: Pilot-ready	4: Scale-ready
Governance	No sponsor or structure	Sponsor named; structure informal	Steering Committee and TWG chartered; decision rights documented	Proven program governance on comparable projects
Organization and workforce	No AMI skills or plan	Some skills; training needs known	Core team assigned; training plan funded	Trained staff across operations, IT, billing, and field
Technology and systems	Legacy systems; no export capability	Systems documented; integration uncertain	CIS can exchange data through defined interfaces; environments available for testing	Integrated enterprise systems with proven interfaces
Communications	No information on coverage	Desk-based coverage information	Field survey completed for pilot areas	Surveyed architecture for full service area
Cybersecurity and privacy	No policy; no DPO	Policy drafted; DPO designated	Controls in Section 16.1 planned and resourced; PIA started	Controls operating and independently tested
Operations and billing (VEE)	Manual processes; no exception handling	Procedures partly documented	VEE rules and billing exception process defined for pilot	VEE operating with audit and reconciliation
Consumer engagement	No plan or channels	Channels exist; no AMI plan	Pilot engagement plan and complaint process ready	Proven engagement and complaint analytics
Data and baseline	Records unreliable; baseline not measurable	Baseline partly measurable	Baseline KPIs measured; mapping verified in pilot areas	Baseline and mapping verified across service area

A.2 Knockout Items

Any of the following blocks Gate 1 regardless of scores:

- No executive sponsor with authority over the departments involved
- No designated Data Protection Officer
- No ability to extract customer, meter, and billing data from the CIS

- No commitment to measure the operational baseline
- No budget authority for Stage M

A.3 Minimum Scores by Gate

Gate	Minimum scores
Gate 1 (proceed to Model)	No knockout items; every category at least 2
Gate 2 (pilot approval)	Governance, cybersecurity and privacy, operations and billing, consumer engagement, and data and baseline at least 3; all others at least 2
Gate 4 (investment decision)	All categories at least 3; the pilot evidence determines the rest

An average score may be reported for information, but it is never used to pass a gate, because a high average can hide a critical weakness.

The Toolkit sheet “A1 Readiness Scoring” records scores, evidence, gaps, and closure actions, and applies these rules automatically. An optional smart grid maturity survey on the same sheet supports longer-term planning but is not a gate test.

Annex B: Gate Outcomes and Decision Paper Contents

B.1 Allowed Outcomes by Gate

Gate	Decision owner	Allowed outcomes
Gate 1: Proceed to Model	General Manager	Proceed; Proceed with conditions (Should criteria or gap-plan items only); Hold
Gate 2: Pilot approval	Board of Directors	Approve as proposed; Approve with changes; Return for further design; Stop
Gate 3: Technical acceptance (may be decided by stratum)	Steering Committee	Accept; Accept with corrective actions (Minor defects only); Retest after correction; Reject
Gate 4: Investment decision (may be decided by stratum)	Board of Directors	Scale; Scale with conditions; Extend the pilot and correct; Re-scope or re-procure; Stop
Gate 5: Cohort check	Steering Committee	Continue; Continue on watch (recheck next cycle); Pause and correct; Re-plan remaining rollout
Gate 5: Program handover	Board of Directors	Accept handover; Accept with conditions; Defer

B.2 Decision Paper Contents

Keep each paper short: normally no more than four pages plus attachments. Toolkit template T1 provides the form, and the Toolkit sheet “W1 Gate Log” records every decision.

Section	Content
1. Decision requested	The gate, the decision requested, and the date needed
2. Recommendation	The recommended outcome from the list in B.1 and the main reason
3. Evidence against gate criteria	Each criterion, Must or Should, status (Met / Not met / Should criterion waived), and the evidence reference
4. Remaining risks	The top risks, with owner and mitigation
5. Business case	At Gates 2 and 4, a summary under the five cases (Section 19.1); short form permitted on the lean path at Gate 2
6. Cost and commitment	What will be spent or committed if approved; the cost of delay or of not proceeding
7. Conditions	Any conditions proposed, each with an owner and a deadline (Section 5.1)
8. Independent review	At Gates 2 and 4: the reviewer's rating and how each Critical recommendation was addressed (Section 5.4)
9. Consultation and approvals	At Gate 4: summary of consumer consultation (Section 17.7), the Workforce Transition Plan, and the regulatory, supervising-agency, and lender approvals obtained or pending (Section 9.7)
10. Attachments	Deliverables relied on, with version and approval status

Section	Content
11. Decision record	For Board decisions, the Board resolution number and date; otherwise the signed record of the decision owner

Annex C: Pilot Evaluation Plan Requirements

The Pilot Evaluation Plan is approved at Gate 2. Must-Pass KPIs and thresholds may be changed only by the Board, with reasons, and never after results for that KPI are known; Monitor KPIs may be changed by the Steering Committee. Every change is entered in the amendment log. The Toolkit sheets “P1 Pilot KPI Tracker,” “P2 Site & Sampling,” and “P7 Analysis & Amendments” are the forms for this plan.

C.1 Standard Hypotheses

#	Hypothesis	KPIs (designation, gate)
H1	AMI delivers interval data reliably in every stratum	Daily read success rate (Must-Pass, Gate 3); billing-read availability (Monitor)
H2	AMI bills are correct	Register-read reconciliation (Must-Pass, Gate 3); billing accuracy (Must-Pass, Gate 4)
H3	AMI removes routine estimation	Estimated-bill rate (Must-Pass, Gate 4)
H4	Remote operations are reliable and safe	Remote command success (Must-Pass if in scope, Gate 3); firmware update success (Monitor)
H5	Systems are secure and available	Unresolved security findings, as defined for each gate in Section 21.1 (Must-Pass, Gates 3, 4, and 5); HES and MDMS availability (Monitor)
H6	Outages are detected	Outage event capture (Monitor)
H7	Consumers are served well	Complaint acknowledgement, resolution time, and meter-test turnaround; consumer satisfaction (Monitor)
H8	AMI supports loss reduction	Reduction in estimated non-technical loss rate on balanced transformers against the baseline, in percentage points (Must-Pass if the business case depends on it, Gate 4)
H9	Operating costs fall	Meter-reading cost per account (Monitor, or Must-Pass if the business case depends on it)

C.2 Required Contents

- Hypotheses, KPIs, thresholds, designations, and the gate at which each is judged
- Strata, sample sizes and their basis (including design effect, finite-population correction, and census strata), low-volume segments, and comparison areas
- For each Must-Pass KPI: threshold and non-inferiority margin (Section 8.6)
- Calamity and outage exclusions, limited to those in Section 21
- Installation period, SAT date, and a measurement period of at least three full billing cycles, including wet-season months where possible
- Register-read reconciliation sample size per cycle (at least 50 per stratum) and match tolerance
- Decision rules linking result patterns to Gate 3 and Gate 4 outcomes (Section 9.6)
- Analysis plan: calculation methods, exclusions, missing-data handling, comparison-area method, technical-loss method (Section 21.3), handling of clustering, who calculates, and who independently verifies

- Consumer representatives consulted and what changed as a result
- How results will be shared with the Board and, for electric cooperatives, with members

Annex D: KPI Reference Definitions

All KPIs are measured for the same population and period in the baseline, pilot, and operations, so that results are comparable.

D.1 Baseline KPIs (Stage A)

KPI	Formula	Source	Required for Gate 1
System loss rate	$(\text{Energy purchased or received} - \text{energy sold}) \div \text{energy purchased or received, 12-month rolling}$	Energy accounts	Must
Estimated-bill rate	Same definition as Section 21.1: bills whose billing determinants were estimated $\div$ bills issued	CIS	Must
Billing accuracy	Same definition as Section 21.1: bills needing no correction within 90 days for metering, data, or billing error $\div$ bills issued	CIS	Must
Billing-read availability	Same definition as Section 21.1: accounts with a validated actual read at billing cut-off $\div$ accounts billed	CIS / reading records	Must
Transformer-level loss (pilot-area sample)	Section 21.3 method, from transformer meters installed at least two months before AMI	Transformer meters	Must if the business case depends on loss reduction
Meter reading cost per account	$\text{Total reading cost (labor, transport, devices)} \div \text{accounts read}$	Finance	Must
Billing and meter complaints per 1,000 accounts	$\text{Billing and meter complaints} \div \text{accounts} \times 1,000$, per month; the same sub-measure is reported for AMI accounts in rollout (Section 21.5)	Complaint log	Must
Average complaint resolution time	Mean working days from receipt to closure	Complaint log	Must
Disconnection and reconnection cost and time	Cost per field order; time from payment to reconnection	Field records	Should
Meter-to-transformer mapping accuracy	$\text{Sampled accounts correctly mapped} \div \text{accounts sampled (field-verified)}$	Field sample	Must (pilot areas)
Collection efficiency	$\text{Collections} \div \text{billings for the period}$	Finance	Should
Reliability indices	SAIFI and SAIDI as defined in the Philippine Distribution Code	Operations	Should

D.2 Pilot and Operating KPIs

The core pilot and operating KPIs, their definitions, and default targets are listed in Section 21. For each, the Pilot Evaluation Plan must additionally state the data source, the measurement frequency, the exclusions (for example, meters not yet commissioned), and who calculates and who verifies the result.

Annex E: Technical Requirements

Requirements apply to the architecture selected in Stage M and are written so that compliance can be tested. The Toolkit sheet “M5 Requirements Compliance” records bidders’ compliance and evidence, and “P5 Acceptance Tests” holds the test cases.

E.1 Smart Meters

- ERC type approval held before any meter is installed (ERC Res. No. 16, s. 2017); a documented path to type approval is acceptable at tender but not at installation
- Tested and sealed as required by ERC rules before installation
- Product safety to IEC 62052-31
- Accuracy class per segment (Section 15.1), certified by an accredited laboratory
- IEC 62056 (DLMS/COSEM) or ANSI C12.18/19/22 data model and protocol
- Interval data at configurable resolution; minimum on-board storage defined
- Event log: power off/on, tamper, cover open, magnetic, reverse energy, voltage events
- Integrated service switch where remote connect/disconnect is in scope; rated for the service
- Bidirectional measurement for net-metering customers, with separate import and export registers and interval channels, and capacity for additional channels for distributed energy resources
- Prepaid functionality where in scope, consistent with ERC prepaid rules
- Signed firmware, secure boot where supported, over-the-air update
- Real-time clock with synchronization; drift no more than 0.5 seconds per day (IEC 62054-21); within ± 5 seconds of reference after synchronization
- Environmental rating suitable for local heat, humidity, and salt exposure; surge withstand specified
- Supports STS (IEC 62055-41) Edition 2 or later, including the post-2024 token identifier range and key change by token, where token-based prepaid is in scope; payment meter requirements to IEC 62055-31
- Interoperability conformance certificates (for example DLMS User Association, Wi-SUN Alliance) where those standards are specified
- Meter identifier compatible with the national meter identifier scheme once issued (Section 25.1); GPS position recorded at installation
- For cellular meters: replaceable communication module, multi-carrier capability or eSIM, and LTE-M/Cat-M or NB-IoT support where available

E.2 Communications

- Technology selected on Stage M field survey evidence
- Design link margin defined per technology and validated in the field
- Concentrator or collector backup power duration specified and tested at SAT
- Hardening for typhoon and flood exposure at collector and concentrator sites
- NTC equipment authorization and frequency compliance for radio and cellular equipment
- Encryption and device authentication on the field network
- Carrier service levels and network-shutdown notice terms for cellular; private APN or VPN
- Outage event capture target set for each technology (Section 21.1)
- Store-and-forward or satellite backhaul options for off-grid and island areas (Section 15.7)

E.3 Head-End System

- Supports all meter types and communication technologies in the architecture; multi-vendor support demonstrated where specified
- Scheduled and on-demand reads; command queuing with confirmation
- Authorization controls, rate limits, and time-window blocking for disconnect commands, with permitted windows, notice periods, and holiday calendar held as configurable parameters
- On a shared platform, a platform-wide disconnect cap in addition to each tenant's cap
- Firmware and configuration management with staged rollout and rollback
- Key and certificate management under utility control, including wrapped key import and replacement of manufacturing keys after commissioning (Section 16.1)
- Documented APIs to MDMS and other systems (IEC 61968-9 or MultiSpeak preferred)
- Availability and performance service levels
- One-step suspension of disconnections by area for calamities
- Time synchronization from a source traceable to Philippine Standard Time or GNSS-disciplined authenticated NTP; timestamps exchanged in UTC (Section 18.7)

E.4 Meter Data Management and Billing Integration

- Configurable validation rules covering Section 18.2
- Estimation methods and controls per Section 18.3
- Editing with full audit trail and dual approval above thresholds
- Automated reconciliation between HES, MDMS, and CIS
- Billing determinants delivered to CIS before cut-off with exception reporting
- Data export of all data in documented non-proprietary formats
- CMDC and consumer access interfaces per ERC requirements
- Capacity for full deployment volume with defined growth headroom
- Validation for CT/VT multiplier errors, reverse energy on non-net-metered accounts, meter-exchange continuity, and outage-aware zero consumption
- Disaster recovery with documented recovery point and recovery time objectives, tested

E.5 Outage and Network Integration

- Last-gasp and restoration events delivered to OMS or dispatch
- Restoration verification by meter ping
- Transformer and feeder aggregation using the GIS network model
- Voltage event reporting to engineering

E.6 Supply Chain and Vendor Access

- Software bill of materials for meter firmware, HES, and MDMS, updated with each release
- A published vulnerability disclosure process and a commitment to notify the utility of vulnerabilities affecting its systems within a defined period
- Firmware signing keys protected in a hardware security module under the supplier's documented controls, with a revocation process

- Vendor remote access only through a utility-controlled jump host, with multi-factor authentication, session approval, and session logging
- Disclosure of hosting locations, subcontractors, and any access to data from outside the Philippines (Section 16.2)
- Security patches supported for the contract term and a stated end-of-support notice period

Annex F: Glossary and Acronyms

Term	Definition
Adopted edition	A version of AMPERE reissued by an Adopting Body under its own name, which it owns and revises (Sections 30.1, 30.4)
Adopting Body	A government agency, regulator, supervising body, or association that adopts AMPERE as a framework for the utilities it funds, supervises, or represents (Section 23)
AMI	Advanced Metering Infrastructure: smart meters, communication networks, head-end and meter data management systems, and the integrations and processes that use them
AMPERE	Advanced Metering Program for Energy Reliability & Efficiency; also the six stages of this Protocol: Assess, Model, Pilot, Evaluate, Roll Out, Evolve
API	Application Programming Interface
APN	Access Point Name: the cellular network gateway setting; a private APN keeps meter traffic off the public internet
Business-case KPI	A Must-Pass KPI measuring a benefit on which the business case depends (Section 8.6)
CAF / CRS	Cybersecurity Assessment Framework and Cyber Resilience Scorecard under DOE Department Circular No. DC2025-01-0001
CAPEX / OPEX	Capital expenditure / operating expenditure
Census stratum	A stratum in which every meter is measured instead of a sample, used when the stratum is small (Section 8.6)
CERT-PH	The national computer emergency response team under the DICT
CIM	Common Information Model (IEC 61968/61970)
CIS	Customer Information System, including billing
CMDC	Consumer Meter Data Channel: the consumer access channel for near real-time usage data under the ERC Amended AMI Rules
Cohort	A group of installations, usually a month's work in one area, checked together during rollout (Section 10)
Compensating control	A temporary measure, approved by the cybersecurity lead, that reduces the risk of an unremediated security finding (Section 16.1)
Concurrence	An Adopting Body's agreement with a utility's gate decision where it funds, lends to, or supervises the program (Section 24)
Conditional rollout contract	A rollout contract that takes effect only after the required approvals and can be ended without material cost if they are refused (Section 9.7)
Declared calamity area	An area declared under a state of calamity by the competent government authority
Delivery confidence rating	An independent reviewer's assessment of the likelihood of successful delivery: five levels (Green to Red), or three on the lean path at Gate 2 (Section 5.4)

Term	Definition
DER	Distributed Energy Resources, such as rooftop solar, batteries, and EVs
Design effect	A multiplier applied to a sample size to allow for results that cluster by area or equipment (Section 8.6)
DICT	Department of Information and Communications Technology
DLMS/COSEM	Device Language Message Specification / Companion Specification for Energy Metering (IEC 62056)
DOE	Department of Energy
DPO	Data Protection Officer
DU / EC	Distribution Utility / Electric Cooperative
E1 / E2	Stage E1, Evaluate, and Stage E2, Evolve
ERC	Energy Regulatory Commission
eSIM	Embedded SIM that can be switched between carriers remotely
FAT / SAT	Factory Acceptance Test / Site Acceptance Test
Finite-population correction	An adjustment that reduces the required sample when the sample is a large share of a small stratum (Section 8.6)
Five Case Model	A business case structure with Strategic, Economic, Commercial, Financial, and Management cases (Section 19.1)
Gate	A defined decision point at the end of an AMPERE stage, with criteria, evidence, and a decision owner
GIS	Geographic Information System
GNSS	Global Navigation Satellite System, such as GPS, used as a time and position source
HES	Head-End System: software that communicates with meters and executes commands
HSM	Hardware Security Module
Independent specification review	Review of a procurement package for vendor bias by a party that did not prepare it (Section 13.3)
KMC	Key Management Centre operated for the STS Association, which issues STS vending keys
Knockout item	A readiness condition that blocks Gate 1 regardless of scores (Annex A.2)
Last gasp	A message sent by a meter as it loses power, used for outage detection
Lean path / lean core	The proportionate way of applying AMPERE for smaller utilities (Section 2.4) and the minimum Toolkit sheets it uses (Section 2.5)
Low-volume segment	A customer segment too small to sample, judged by functional testing and full reconciliation (Section 8.6)
MDMS	Meter Data Management System

Term	Definition
Monitor KPI	A KPI that is tracked and managed but does not by itself decide a gate
Must-Pass KPI	A KPI that must pass under the rule in Section 8.6, in every stratum to which the gate decision applies
NEA	National Electrification Administration
NIST CSF	National Institute of Standards and Technology Cybersecurity Framework (version 2.0, 2024)
Non-inferiority margin	The amount, fixed before the pilot, by which the lower confidence bound of a KPI may fall below its threshold while the KPI still passes (Section 8.6)
NPC	National Privacy Commission
NTC	National Telecommunications Commission
NTL	Non-technical losses: energy delivered but not billed, for example through theft, tampering, or metering and billing errors
OMS / DMS	Outage Management System / Distribution Management System
PAB	Philippine Accreditation Bureau
Pause trigger	A condition that stops new installations until the Steering Committee decides how to proceed (Section 10.6)
PIA	Privacy Impact Assessment
PLC	Power Line Carrier communication
Pooled sector evidence	Verified pilot results from another utility's comparable stratum used to supplement a sample (Section 8.6)
Post-calamity recovery	The resilience KPI: share of affected meters back to daily reads within 3 days of power restoration (Section 21.2)
RCOA	Retail Competition and Open Access
Register-read reconciliation	Comparison of the register value delivered through the AMI data chain with a physical meter display reading
Remediation deadline	The time allowed to fix a security finding of a given severity (Section 16.1)
RF mesh	Radio frequency network in which devices relay data for one another
SAIFI / SAIDI	System Average Interruption Frequency Index / System Average Interruption Duration Index
SBOM	Software bill of materials: a list of the software components in a product
SCADA	Supervisory Control and Data Acquisition
Sector baseline	The minimum requirements every AMI program under a sector framework must meet (Section 25)
Sector companion specification	A common technical specification of data models, events, messages, and interfaces issued for a sector (Section 25.1)

Term	Definition
Stratum	A group of pilot meters sharing a customer segment, technology, and area type, evaluated separately
STS	Standard Transfer Specification (IEC 62055-41) for prepaid token systems
Supply group code	The STS code identifying a group of prepaid meters that share a vending key
TOU	Time-of-Use tariff
TWG	Technical Working Group
Unresolved security findings	The security KPI defined for each gate in Section 21.1
VEE	Validation, Estimation, and Editing of meter data
Wave	A planned deployment area; each wave is installed as a series of cohorts (Section 10)
Workforce Transition Plan	The plan for employees whose roles AMI changes, approved before Gate 4 (Section 12.1)

Annex G: Alignment with Recognized Frameworks

How to read this annex

This annex shows where AMPERE applies established practice from widely used frameworks, so that Boards, lenders, and reviewers can relate AMPERE to methods they already know. It is an alignment map. It does not claim that AMPERE is endorsed by, certified against, or fully compliant with any of these frameworks or their owners.

G.1 UK Gateway Review Process

Owner: the UK National Infrastructure and Service Transformation Authority (NISTA). Short, independent reviews at key decision points of major projects.

Gateway element	AMPERE equivalent	Notes
Gate 0: Strategic Assessment	Stage A; Gate 1	AMPERE adds a measured operational baseline
Gate 1: Business Justification	Gate 2 (outline business case)	AMPERE combines business justification with pilot approval
Gate 2: Delivery Strategy	Gate 2 (procurement package, pilot plan)	
Gate 3: Investment Decision	Gate 4	AMPERE requires pilot evidence before this decision
Gate 4: Readiness for Service	Gate 3 (pilot acceptance); Gate 5 (cohort checks)	AMPERE checks readiness cohort by cohort
Gate 5: Operations Review and Benefits Realisation	Stage E2 (Evolve); annual Board review; benefits tracker	
Independent review team; delivery confidence assessment	Independent gate review with delivery confidence rating (Section 5.4)	Required at Gates 2 and 4

G.2 HM Treasury Five Case Model

Owner: HM Treasury (the Green Book). Adopted in other public-sector systems, such as New Zealand's Better Business Cases.

Five Case element	AMPERE equivalent
Strategic, Economic, Commercial, Financial, and Management cases	Section 19.1; Annex B gate decision paper
Strategic Outline Case	Objectives statement and baseline (Stage A)
Outline Business Case	Preliminary business case (Stage M, Gate 2)
Full Business Case	Final business case (Stage E1, Gate 4)

Five Case element	AMPERE equivalent
Benefits realization and post-implementation review	Benefits tracker; annual review (Stages R and E2)

G.3 EU Joint Research Centre Guidelines for Smart-Metering Cost-Benefit Analysis (2012)

JRC step	AMPERE equivalent
1. Review and describe technologies, elements, and goals	AMI objectives (A-4); solution architecture (M-3)
2. Map assets into functionalities	Toolkit M4 Benefit Mapping
3. Map functionalities into benefits	Section 19.3; Toolkit M4
4. Establish the baseline	Stage A; Operational Baseline (A-2); transformer-level loss baseline (Section 21.3); Toolkit A2
5. Monetize benefits and identify beneficiaries	Section 19.3; Toolkit M2 and M4
6. Quantify costs	Section 19.2; Toolkit M2 including component lives
7. Compare costs and benefits	Section 19.5; Toolkit M2 (NPV, IRR, payback)
Sensitivity analysis	Section 19.5; Toolkit M2 scenarios
Non-monetary and social impacts	Section 19.4

G.4 NIST Cybersecurity Framework 2.0

CSF 2.0 element	AMPERE equivalent
Functions: Govern, Identify, Protect, Detect, Respond, Recover	Section 16.4 mapping; Toolkit W2
Organizational Profiles (current and target)	Current and target state recorded per control in Toolkit W2
Tiers (Partial, Risk Informed, Repeatable, Adaptive)	One current and one target tier for the AMI program (Section 16.4)
Cybersecurity supply chain risk management	Section 15.6 and Section 16.1 (third parties); Toolkit T4 contract clauses
Informative references	Section 15.2 standards (IEC 62443, IEC 62351, ISO/IEC 27001, NISTIR 7628)

G.5 SPIRIT 2025 Guideline for Trial Protocols

SPIRIT sets the minimum content of clinical trial protocols. AMPERE applies its logic to AMI pilots, which are field experiments rather than clinical trials.

SPiRiT 2025 principle	AMPERE equivalent
Objectives and pre-specified outcomes	Hypotheses and Must-Pass thresholds fixed at Gate 2 (Section 8.6; Annex C.1; Toolkit P1)
Sample size justification	Sample-size rule (Section 8.6); Toolkit P2 calculator
Comparator	Comparison with baseline and with a comparison area
Statistical analysis plan	Analysis plan (Annex C.2; Toolkit P7)
Monitoring during the trial	Monthly pilot performance reports (P-4); Steering Committee oversight
Harms	Complaints, safety incidents, and security findings tracked throughout the pilot
Protocol amendments with dates and descriptions	Amendment log (Toolkit P7)
Patient and public involvement	Consumer-owner involvement in pilot design (Section 8.6)
Open science and transparency	Summary of pilot results shared with the Board and, for electric cooperatives, with members

G.6 Other Sources Drawn On

- Cooper, R. G., “Stage-Gate Systems: A New Tool for Managing New Products,” Business Horizons, 1990: Go / Kill / Hold / Recycle decisions and must-meet versus should-meet criteria (Section 5.1)
- Software Engineering Institute, Carnegie Mellon University, Smart Grid Maturity Model: domain-based maturity assessment (optional survey in Toolkit A1)
- U.S. Department of Energy, “Advanced Metering Infrastructure and Customer Systems: Results from the Smart Grid Investment Grant Program,” September 2016: systems integration, metrics, and consumer engagement lessons (Sections 1, 8, and 21)
- IEC and ISO/IEC standards listed in Section 15.2, for technical and security requirements
- Published reviews of national smart-metering programs in other countries, for consumer-protection and procurement lessons (Sections 17 and 19.6)

Annex H: Sector Reporting Dataset

Submitted by each utility under a sector framework (Section 26), using the Toolkit sheet “K2 Sector Submission.” Definitions follow Section 21. No personal data is included.

Group	Data item	Frequency
Profile	Utility name; connections served; peer group (size band, grid-connected or off-grid, dominant communication technology); reporting period; AMPERE version followed	Each submission
Program status	Current stage; last gate, outcome, and date; next gate and planned date; open conditions	Each submission
Readiness	Lowest readiness category score and the category concerned (full scores are held by the utility; Annex A)	At each gate
Baseline	System loss rate; estimated-bill rate; billing accuracy; billing-read availability; billing and meter complaints per 1,000 accounts	First submission after Gate 2; updated at Gate 4
Deployment	AMI meters installed and commissioned; cumulative against approved plan; cohorts in pause or on watch	Quarterly
Technical	Daily read success rate; HES and MDMS availability; remote command success; outage event capture; post-calamity recovery where a calamity occurred	Quarterly
Billing	Billing accuracy (bills at least 90 days old); estimated-bill rate	Quarterly
Consumer	Complaints per 1,000 AMI accounts; average resolution time; meter-test turnaround; disconnection-safeguard breaches (Section 21.5); prepaid self-disconnection rate	Quarterly
Security and privacy	Unresolved security findings; security incidents; personal data breaches notified (definitions in Section 21.5)	Quarterly
Financial	Capital and operating costs against approved budgets; benefits realized against approved business case	Quarterly during rollout; annually after
Conformance	Approved tailoring decisions; deviations; independent review ratings at Gates 2 and 4	At each gate

Annex I: Minimum Data Exchange Profile

Minimum content every AMI system under a sector framework should be able to record and exchange, until an Adopting Body issues a sector companion specification (Section 25.1). The profile states what must be available, not how a vendor implements it.

Data area	Minimum content
Identifiers	Meter identifier (national scheme once issued) and serial number; utility; premise and account; transformer and feeder ID; phase connection; GPS position; meter type; metrology and communication firmware versions
Registers	Active energy import and export; reactive energy and maximum demand, with the demand integration period, for demand-billed and CT-connected customers; for CT/VT-connected meters, a flag stating whether values are primary or secondary and the multiplier applied
Units and scaling	Unit and scaler for every value, so that values can be interpreted without vendor documentation
Interval data	Active energy import and export at the interval length set in the sector specification (recommended default: 15 minutes); voltage per interval, or minimum and maximum voltage per interval, where the meter supports it; a sequence number or equivalent to detect gaps and duplicates
Events	Power failure and restoration; cover and terminal-cover opening; magnetic interference; reverse energy; neutral disturbance; clock adjustment; firmware change; switch operation and switch (relay) failure; security events such as failed authentication and key changes; low and zero prepaid credit
Time	Timestamps exchanged in UTC, with Philippine Standard Time (UTC+8) for display and billing; synchronization status (Section 18.7)
Data quality	Flag on every value: actual, estimated, or edited, with the rule or user responsible
Exchange	Documented, non-proprietary formats; standards-based meter data model (for example, IEC 62056 DLMS/COSEM) and enterprise messages (for example, IEC 61968-9 or MultiSpeak) where specified
Consumer access	Data required for the Consumer Meter Data Channel
Export	Complete export of all of the above on request, at no additional charge