ClimaMind Field M&V Guide for AI HVAC Optimization

Version: 2026-05-09
Audience: site energy engineers, commissioning agents, facilities managers, controls contractors, owner representatives
Scope: measurement and verification for supervisory AI optimization on existing BAS/BMS infrastructure

Executive Use

This guide turns an IPMVP-aware sales conversation into a field procedure. A site engineer should be able to use it to decide whether a building is ready for a ClimaMind savings pilot, collect the right data, define the measurement boundary, run the baseline, document exclusions, and assemble an audit-ready savings packet.

This is not a substitute for a contract-specific M&V plan signed by the owner, ESCO, or licensed engineer of record. It is the working template that gets the site from technical discovery to an approvable M&V plan and repeatable savings reporting.

Field Outcome

At the end of setup, the project team should have:

- A selected IPMVP option and measurement boundary.
- A complete point list with units, sampling interval, history depth, and data-quality status.
- A baseline period, reporting period, and control-period calendar.
- A baseline model with documented independent variables, operating-mode segmentation, and acceptance metrics.
- A comfort and reliability acceptance rule.
- An exclusion log for abnormal periods, overrides, outages, and known non-routine events.
- A savings report package that can be reviewed by facilities, finance, and contract stakeholders.

1. Decide Whether the Site Is Ready

Use this screen before promising measured savings.

Readiness item	Minimum for pilot	Minimum for finance-grade claim	Field action
Metering boundary	Whole-building interval meter or HVAC-system submeters available	Boundary meter or submeters cover the controlled load with known gaps	Confirm meter ID, units, multiplier, timestamp timezone, and ownership
BAS trend history	At least 6 comparable weeks per operating mode	Prefer 12 months; shorter only with explicit seasonal limitation	Export raw trends before changing control logic
Weather data	Hourly outdoor air temperature from BAS or nearby station	Same plus humidity if latent load matters	Lock one weather source for baseline and reporting
Occupancy and schedule	Current schedule and known holiday/special-event calendar	Same plus change log during reporting	Owner must identify schedule changes, not infer them after the fact
Comfort data	Zone temperatures and complaint log available	Zone temperatures, supply conditions, and comfort acceptance rule	Define pass/fail before optimization starts
Control authority	AI can recommend or supervise setpoints within agreed guardrails	Same plus persistent logging of model mode, command, override, and fallback	Confirm BAS integration and operator override behavior
Operations stability	No major equipment project during pilot	No major non-routine change unless separately tracked	Record planned maintenance, retrofits, tenant changes, and sensor replacements

Stop if the project cannot identify the meter boundary, the controlled equipment, or the operator acceptance criteria. Continue only as an operational tuning engagement, not as a measured-savings claim.

2. Select the IPMVP Option

ClimaMind should choose the option from the measurement boundary, not from what sounds best in a proposal.

Option	Use when	Avoid when	ClimaMind default position
Option A: retrofit isolation with key parameter measurement	A narrow control change has one or two dominant measurable parameters and the remaining factors can be stipulated	Savings will be used for shared savings, EPC settlement, or contested finance review	Do not use as the main AI HVAC savings method unless the contract explicitly allows stipulated factors
Option B: retrofit isolation with all relevant parameter measurement	The optimized plant, AHU group, pump system, or controlled equipment can be metered or submetered	Relevant load, runtime, flow, or power parameters are missing	Preferred for system-level AI optimization when submeters and BAS trends are available
Option C: whole-facility	The optimization affects multiple interacting HVAC systems and whole-building interval utility data is reliable	Expected savings are small relative to total building noise or many unrelated operational changes occur	Use for owner-level claims when whole-building savings are large enough to rise above noise
Option D: calibrated simulation	Metered history is insufficient, a major baseline condition cannot be recreated, or scenario analysis is required	The team cannot calibrate to measured energy and operating conditions	Use as an explicit fallback or supplement, not as a casual replacement for metered evidence

Default recommendation for AI HVAC optimization:

1. Use Option B when the controlled HVAC boundary can be isolated with submeters or equipment power data.
2. Use Option C when the owner wants whole-building accountability and the expected savings are material against total facility load.
3. Use Option D when the site lacks adequate pre-period data but still needs an engineering estimate.
4. Avoid Option A for headline savings unless the contract accepts stipulated parameters and the uncertainty is disclosed.

Reference basis: DOE FEMP describes the four generic M&V options and their relationship to retrofit-isolation, whole-facility, and calibrated-simulation methods. EVO IPMVP Core Concepts defines measurement boundary, adjustment methods, savings accounting, operational verification, and plan/report requirements.

3. Define the Measurement Boundary

Write the boundary in one paragraph that a controls technician can validate in the field.

Required boundary fields:

- Facility name, address, timezone, and utility account or meter ID.
- Controlled systems: chillers, boilers, pumps, cooling towers, AHUs, VAV static pressure, economizer logic, supply air temperature reset, chilled water reset, condenser water reset, or other supervised points.
- Included energy streams: electricity, gas, chilled water, steam, hot water, or district energy.
- Excluded systems: tenant plug load, process load, lighting, data center load, kitchen load, elevators, or non-HVAC loads.
- Boundary meter list and BAS point list.
- Known interactions: simultaneous heating/cooling, reheat, economizer, humidity control, ventilation minimums, demand limiting, or thermal storage.

Example:

> The measurement boundary is the chilled-water plant serving Building A, including chillers CH-1 to CH-3, primary and secondary chilled-water pumps, condenser-water pumps, and cooling towers CT-1 to CT-4. Energy

> is measured by plant electric submeters M-CHP-01 and M-CHP-02 at 15-minute intervals. AHU fan energy and downstream VAV reheat are outside the boundary, but supply air temperature demand, chilled-water supply temperature, outside air temperature, humidity, occupancy schedule, and operator overrides are tracked as explanatory variables and acceptance evidence.

4. Collect the Field Data

4.1 Required Point List

Ask for raw trend exports, not screenshots.

Category	Required points	Preferred cadence	Notes
Energy	Whole-building electric meter, HVAC submeter, chiller kW, pump kW, fan kW, gas meter, district energy meter	15 minutes or better; hourly acceptable for whole-building	Include multiplier, rollover behavior, and demand vs consumption definition
Weather	Outdoor air dry bulb, relative humidity or wet bulb, enthalpy if available	15 minutes to hourly	Use one source consistently
Load proxy	Chilled-water tons, flow, delta-T, supply/return temperatures, heating hot-water load, AHU mixed-air or discharge-air load proxies	15 minutes	Needed to separate real savings from load changes
Equipment status	Chiller enable, pump status, tower fan status, AHU occupancy, economizer status, valve/damper positions	5 to 15 minutes	Needed for operating-mode segmentation
Control commands	Setpoint commanded by AI, BAS accepted setpoint, actual measured value, guardrail limit, model mode	Every command plus trend	Required to prove what the AI did
Overrides	Operator override flag, manual mode, lockout, alarm inhibit, local hand switch if available	Event-based plus trend	Overrides are not failures if they are visible and justified
Comfort	Zone temperature, humidity where relevant, supply air temperature, complaint/ticket log	15 minutes to hourly	Savings cannot be accepted if comfort criteria fail
Reliability	Alarms, trips, maintenance events, sensor faults, equipment unavailable	Event-based	Keep separate from ordinary optimization data
Schedule	Occupied/unoccupied schedule, holidays, special events, tenant changes	Daily plus changes	Schedule drift is a common false-savings source

4.2 Data Export Rules

Every export must include:

- Point name as shown in BAS.
- Human-readable description.
- Units.
- Timestamp with timezone.
- Sampling interval.
- Raw value.
- Quality flag if available.
- Source system and export date.

Do not resample, smooth, interpolate, or remove outliers before archiving the raw export. Cleaning happens in a reproducible analysis layer after the raw data is preserved.

4.3 Data QA Acceptance Rules

Use these rules before fitting a baseline or publishing a savings result. Contract requirements override these defaults.

QA item	Pass condition	Fail / hold condition	Field response
Timestamp timezone	Timezone is explicit and consistent across meter, BAS, weather, and control logs	Unknown timezone, mixed timezone, or daylight-saving shift not handled	Normalize to site local time and preserve original timestamp column
Sampling interval	At least 90% of expected intervals are present for each required point in each modeling segment	Required point has large gaps, repeated timestamps, or irregular sampling that changes model meaning	Mark point as blocking, substitutable, or excluded before modeling
Meter reconciliation	Interval totals are within owner-approved tolerance of utility bill or BAS monthly total	Multiplier, rollover, or unit mismatch cannot be explained	Resolve meter scaling before using savings result
Units	Units are known and physically plausible	Units missing, mixed, or inconsistent with point description	Do not infer units from point name alone; confirm with BAS vendor or owner
Negative or impossible values	Values are physically plausible for the point type	Negative kWh, impossible temperatures, stuck values, or flatlines during active operation	Flag as sensor/meter fault; correct only with documented method
Missing data treatment	Short gaps are filled only by pre-approved method and flagged	Gap filling materially changes savings or comfort result	Exclude affected interval or report sensitivity
Outlier treatment	Outlier rule is defined before result review	Outliers are removed manually after seeing savings	Stop and document a reproducible rule
Point mapping	Point alias map links old and new BAS names	Point rename or BAS upgrade breaks continuity	Treat as a new point unless continuity is proven
Weather source	Same source and station logic used for baseline and reporting	Weather source changes without documented mapping	Rebuild or adjust baseline with approved source rule
Control log join	AI command log can be joined to BAS data by timestamp and point	Commands cannot be tied to measured operation	Report as site-level observed savings, not AI-attributed savings

For finance-facing reports, include a data-quality summary with required points, missingness, excluded intervals, corrections, and unresolved limitations.

4.4 Minimum History

Use the strongest available history:

- Finance-grade annual claim: 12 months of pre-period utility or submeter data, plus BAS trends covering the main operating modes.
- Seasonal pilot: at least 6 comparable weeks for each included operating mode, with the report explicitly limited to that season and operating mode.
- Short A/B control pilot: paired or alternating windows only when load, weather, schedule, and operating mode are comparable and the owner accepts the limited inference.
- No adequate history: do not claim measured savings. Use Option D or an engineering estimate labeled as such.

5. Segment Operating Modes Before Modeling

Do not fit one baseline across incompatible plant behavior.

Create separate segments when any of these materially changes energy response:

- Cooling season vs heating season vs shoulder season.
- Occupied vs unoccupied.
- Economizer available vs locked out.
- Chiller staging pattern.
- Thermal storage charge/discharge.
- Humidity control active.
- Demand response or demand limiting active.

- Equipment unavailable or degraded.
- Different tenant schedule or process load.

Minimum segment record:

Field	Example
Segment name	Occupied cooling, normal chiller plant
Inclusion rule	Occupied schedule true, OAT above 60 F, at least one chiller enabled, no active plant alarm
Exclusion rule	Manual override, maintenance event, known sensor failure, BAS communication outage
Baseline model	kWh = f(OAT, CHW tons, hour-of-week)
Reporting rule	Report savings only when same segment rule is true

6. Build the Baseline

6.1 Baseline Period Selection

Select a baseline period that represents normal operation before ClimaMind changes control behavior.

Baseline period must document:

- Start and end dates.
- System configuration.
- Occupancy and schedule.
- Equipment availability.
- Known faults and maintenance events.
- Weather source.
- Meter and trend point versions.
- Excluded dates with reason codes.

Do not include early tuning, commissioning, or unapproved AI recommendation periods in the baseline.

6.2 Independent Variables

Use variables that explain energy use without leaking the optimized outcome.

Common variables:

- Outdoor air temperature.
- Outdoor air humidity or enthalpy.
- Cooling or heating degree hours.
- Chilled-water tons or load proxy.
- Occupied schedule.
- Hour-of-week.
- Holiday flag.
- Equipment availability.
- Production or tenant load if relevant.

Avoid variables that are direct AI decisions unless the model is specifically estimating system efficiency under measured load. For example, do not use the optimized chilled-water supply temperature setpoint as a whole-building baseline variable if that would explain away the savings.

6.3 Model Acceptance

Use the acceptance thresholds in the contract if they exist. If not, use these screening thresholds as defaults and disclose them:

Data interval	NMBE target	CVRMSE target	Use
Monthly	absolute NMBE <= 5%	CVRMSE <= 15%	Utility-bill style Option C
Hourly or sub-hourly aggregated to hourly	absolute NMBE <= 10%	CVRMSE <= 30%	Interval-meter Option B or C

These thresholds are commonly associated with ASHRAE Guideline 14 style calibration screens. They are not a guarantee that the model is contractually acceptable. The team must still review residuals, operating-mode coverage, sensor validity, and whether savings are large enough relative to model uncertainty.

6.4 Model Review Checklist

Before approving the baseline, answer yes to all:

- The model uses only variables available in both baseline and reporting periods.
- The baseline and reporting periods have overlapping weather and load ranges, or extrapolation is flagged.
- Residuals are not obviously biased by hour, weekday, temperature band, load band, or operating mode.
- Excluded periods are listed with reason codes.
- Sensor replacements, meter changes, and point renames are documented.
- The model can be rerun from raw data and configuration.
- The owner understands what conditions are outside the model's valid range.

6.5 Uncertainty and Savings Acceptance

Do not treat model fit as the same thing as savings confidence. A model can pass CVRMSE/NMBE screens and still be too uncertain for a small savings claim.

Each finance-facing report should include:

- Baseline model error metrics.
- Number of accepted baseline and reporting intervals.
- Weather and load overlap between baseline and reporting periods.
- Excluded interval share.
- Estimated uncertainty or confidence interval for adjusted baseline energy, when the analysis method supports it.
- A plain-English statement of whether accepted savings are large enough relative to model uncertainty.

Default acceptance logic:

Result condition	Report label	Field action
Savings are positive, comfort/reliability pass, and savings are materially larger than model uncertainty	Accepted measured savings	Publish savings with uncertainty statement
Savings are positive but close to model uncertainty	Directional savings	Report as preliminary or directional; do not use for settlement without owner approval
Savings are positive but comfort/reliability fail	Operational result, not accepted savings	Exclude failed windows or report separately
Savings are positive but control audit trail is missing	Site-level observed savings	Do not attribute savings to AI control
Savings are negative or statistically inconclusive	No accepted savings for the period	Investigate operations, data quality, and model validity

Minimum uncertainty review:

1. Check whether reporting-period weather and load are inside the baseline model's observed range.

2. Compare savings to residual error by operating mode, not only to total monthly error.
3. Report excluded interval share and the top exclusion reasons.
4. Confirm that non-routine events do not explain the apparent savings.
5. If the contract requires a formal confidence level, have the M&V lead define it in the site-specific plan before the reporting period.

7. Define Comfort and Reliability Acceptance

Energy savings are accepted only when the building is served acceptably.

7.1 Default Comfort Rule

Use the owner's standard, lease requirement, or applicable comfort basis if one exists. If not, define a project-specific rule before the reporting period and have the owner approve it. A practical temporary default for approval is:

- Occupied zone temperatures must remain within the agreed heating and cooling bands for at least 95% of occupied zone-hours.
- No more than 2 consecutive occupied hours may be outside the allowed band for any critical zone unless a documented non-HVAC cause exists.
- Humidity-controlled spaces must use a separate humidity rule.
- Critical spaces such as labs, healthcare, data centers, and museums require site-specific acceptance criteria.

7.2 Reliability Rule

Savings windows fail acceptance when any of these occur and materially affect the measured boundary:

- Equipment trip or lockout.
- Safety alarm requiring operator intervention.
- BAS communication loss that prevents normal supervisory control.
- Sensor failure for a required control or measurement point.
- Manual override outside the approved operating plan.
- Maintenance work that changes equipment availability or efficiency.

Failures are not hidden. They are recorded, excluded when appropriate, and summarized separately from accepted optimization windows.

8. Establish the Control and Reporting Periods

8.1 Timeline

Phase	Typical duration	Gate to exit
Discovery	1 to 2 weeks	Boundary, point list, site readiness, and owner objectives confirmed
Data QA	1 to 3 weeks	Raw data complete enough for baseline attempt
Baseline	1 to 2 weeks	Model acceptance and baseline memo approved
Shadow mode	1 to 2 weeks	AI recommendations visible, no autonomous control unless approved
Limited control	1 to 4 weeks	Guardrails, override behavior, and comfort monitoring verified
Reporting	Monthly or agreed interval	Savings packet issued with exclusions and acceptance status

8.2 Control-Period Logging

Every control action should leave an audit trail:

- Timestamp.
- Model mode: off, shadow, recommend, supervise, fallback.
- Input snapshot or input data version.
- Recommended setpoint or action.
- Guardrail limits.
- Final command sent to BAS.
- BAS accepted value.
- Operator override status.
- Reason for fallback, if any.

If this log is missing, savings may still exist operationally, but the project does not have a strong audit trail for AI-attributed savings.

9. Non-Routine Events and Exclusions

Define reason codes before analysis starts.

Code	Event	Default treatment
NRE-01	Major occupancy or tenant schedule change	Exclude or adjust with owner-approved method
NRE-02	Equipment failure or unavailable equipment	Exclude affected window
NRE-03	Planned maintenance	Exclude affected window
NRE-04	Manual override outside approved plan	Exclude unless override is part of accepted operating strategy
NRE-05	BAS communication outage	Exclude if control or measurement is compromised
NRE-06	Meter fault, reset, rollover, or multiplier change	Correct if auditable; otherwise exclude
NRE-07	Sensor failure or recalibration	Correct with documented method or exclude
NRE-08	Weather or load outside baseline range	Flag as extrapolation; exclude if contract requires
NRE-09	Demand response or curtailment event	Report separately
NRE-10	Fire, flood, emergency, or abnormal facility event	Exclude

Every exclusion entry must include start time, end time, reason code, evidence source, decision owner, and whether the period is excluded, adjusted, or reported separately.

10. Calculate Savings

10.1 Core Formula

For each accepted interval:

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Adjusted baseline energy = baseline model prediction under reporting-period conditions
Measured reporting energy = metered energy during the same interval
Energy savings = adjusted baseline energy - measured reporting energy
Percent savings = energy savings / adjusted baseline energy
Cost savings = energy savings * applicable energy rate, plus demand savings if included
```

Savings must be reported with:

- Included intervals.
- Excluded intervals.

- Comfort pass/fail status.
- Reliability pass/fail status.
- Baseline model version.
- Weather and load ranges.
- Uncertainty or confidence statement when available.

10.2 Demand Savings

Do not mix demand savings into energy savings without a separate method.

For demand savings, define:

- Utility tariff demand window.
- Baseline demand model or matched baseline period.
- Coincident peak treatment.
- Demand response events.
- Whether AI control was allowed to shift load or only reduce energy.

10.3 Attribution

AI-attributed savings require evidence that:

- ClimaMind was in an approved operating mode.
- Commands or recommendations were generated within guardrails.
- BAS accepted the relevant commands, or operators followed the recommendations.
- Comfort and reliability acceptance passed.
- No non-routine event explains the reduction.

If attribution evidence is incomplete, report the savings as site-level observed savings, not AI-attributed savings.

11. Savings Report Package

Each reporting period should produce a packet with these files or sections:

1. Cover memo: site, period, option, boundary, headline accepted savings, and pass/fail status.
2. M&V method: selected IPMVP option, baseline model, variables, thresholds, and limitations.
3. Data inventory: meters, BAS points, units, cadence, gaps, and QA status.
4. Baseline diagnostics: model metrics, residual review, operating-mode coverage, and extrapolation flags.
5. Savings table: interval totals, excluded intervals, accepted savings, cost conversion, and demand treatment.
6. Comfort and reliability evidence: zone-hours, complaints, alarms, overrides, and failed windows.
7. Control audit trail: AI mode, commands, BAS acceptance, guardrails, fallback, and operator actions.
8. Non-routine event log: event codes, evidence, owner decision, and treatment.
9. Appendices: raw data manifest, scripts or model configuration hash, weather source, tariff assumptions, and sign-off page.

11.1 Required Site-Specific M&V Plan Fields

Before using this guide for contract or finance review, convert it into a site-specific M&V plan with the following fields completed and approved.

Plan field	Required decision
Project objective	Operational tuning, internal reporting, utility incentive, shared savings, EPC settlement, or other
Reporting authority	Who can approve the M&V plan, baseline, exclusions, and final report
IPMVP option	Option A, B, C, or D, with reason and limitations
Measurement boundary	Included systems, excluded systems, energy streams, and meter IDs
Baseline period	Dates, operating conditions, included intervals, excluded intervals, and known limitations
Reporting period	Start date, reporting cadence, expected duration, and accepted operating modes
Independent variables	Weather, load, schedule, occupancy, production, or other variables used for adjustment
Baseline model method	Model family, segmentation rule, acceptance metrics, uncertainty method, and versioning
Data sources	Meter, BAS, weather, control logs, utility bills, tariff source, and owner-provided records
Data QA rules	Missingness threshold, interpolation rule, outlier rule, meter reconciliation, and point alias rules
Non-routine event process	Reason codes, evidence requirements, decision owner, and adjustment or exclusion method
Comfort criteria	Owner-approved temperature, humidity, zone-hour, complaint, or critical-space criteria
Reliability criteria	Alarms, trips, overrides, fallback, equipment availability, and sensor-fault treatment
Control attribution	Evidence needed to attribute savings to ClimaMind rather than general site operations
Demand savings	Whether demand savings are included, tariff window, coincident peak rule, and calculation method
Cost conversion	Energy rates, demand charges, escalation, taxes/fees inclusion, and currency
Data retention	Raw export location, processed data location, report archive, and retention period
Change control	Who approves model changes, point mapping changes, baseline changes, and report corrections
Sign-off	Owner representative, facility engineer, M&V lead, ClimaMind technical lead, and date

If any required field is blank, label the document "Draft M&V Plan" and do not use it as a settlement instrument.

11.2 One-Page Owner Summary

Use this layout for finance and executive review:

Field	Value
Site	
Reporting period	
IPMVP option	
Measurement boundary	
Accepted baseline energy	
Measured reporting energy	
Accepted energy savings	
Accepted percent savings	
Estimated cost savings	
Comfort status	Pass / Fail / Partial
Reliability status	Pass / Fail / Partial
Excluded period share	
Main exclusion reasons	
Residual risk	
Prepared by	
Reviewed by	

12. Field Forms

12.1 Site Intake

Item	Field entry
Facility name	
Address	
Timezone	
Owner representative	
Facility engineer	
BAS vendor/contact	
Utility account or meter IDs	
Primary HVAC systems	
Optimization scope	
Critical comfort zones	
Known upcoming projects	
Required reporting audience	Facilities / Finance / ESCO / Utility / Other
Target IPMVP option	

12.2 BAS Trend Request

Point name	Description	Unit	Cadence	History needed	Source	Status

12.3 Meter Inventory

Meter ID	Boundary served	Unit	Interval	Multiplier	Data owner	Known issues

12.4 Exclusion Log

Start	End	Code	Evidence	Treatment	Decision owner	Notes
				Exclude / Adjust / Report separately		
				Exclude / Adjust / Report separately		

12.5 Control Acceptance Log

Date	Mode	Guardrails active	Operator acceptance	Comfort pass	Reliability pass	Notes
	Shadow / Recommend / Supervise	Yes / No	Yes / No	Yes / No	Yes / No	
	Shadow / Recommend / Supervise	Yes / No	Yes / No	Yes / No	Yes / No	

13. Field Runbook

Day 0: Before Site Data Pull

- Confirm owner objective: operational improvement, measured savings, shared savings, EPC support, or internal capital approval.
- Confirm whether the project requires IPMVP adherence or only IPMVP alignment.
- Identify the proposed measurement boundary and likely IPMVP option.
- Freeze a point-list request and meter inventory request.
- Ask the site to disclose known upcoming non-routine events.

Day 1 to 5: Data Collection

- Export raw meter and BAS trend history.
- Verify timezone, units, intervals, and point names.
- Compare meter totals against utility bills or BAS dashboards for obvious scaling errors.
- Identify missing points and decide whether they are blocking, substitutable, or optional.
- Create the first exclusion log from known outages, maintenance, holidays, and overrides.

Day 6 to 10: Baseline Attempt

- Segment operating modes.
- Fit the baseline model only on approved baseline intervals.
- Review residuals and acceptance metrics.
- Test whether the reporting-period variables will be available continuously.
- Draft a baseline memo with limitations.

Day 11 to 20: Shadow and Limited Control

- Run ClimaMind in shadow mode and compare recommendations against operator expectations.
- Confirm guardrails and fallback behavior.
- Start command/audit logging.
- Move to limited control only after the owner approves the guardrails and override procedure.
- Review comfort and reliability daily during the first control week.

Monthly Reporting

- Lock the reporting period.
- Recompute adjusted baseline for accepted intervals.
- Apply exclusion and adjustment decisions.
- Generate savings, comfort, reliability, and control audit sections.
- Review with facility engineer before sending finance-facing claims.

14. Worked Example: Chilled-Water Plant Option B

This example shows the minimum shape of a field-ready M&V packet. Replace all values with site data before use.

14.1 Site and Boundary

Field	Example entry
Site	Building A, 250,000 sq ft office
Objective	Measure chilled-water plant savings from supervisory AI setpoint optimization
IPMVP option	Option B: retrofit isolation with all relevant parameter measurement
Boundary	Chillers, primary/secondary chilled-water pumps, condenser-water pumps, and cooling towers
Excluded	AHU fans, VAV boxes, reheat, lighting, plug load, tenant process load
Meter	Plant electric submeter M-CHP-01, 15-minute kWh
Weather	Site BAS outdoor air temperature and humidity, 15-minute
Load proxy	Chilled-water tons from flow and delta-T
Comfort evidence	Occupied zone temperature, supply air temperature, complaint log
Control evidence	AI mode, recommended CHWST, BAS accepted CHWST, guardrails, override flag

14.2 Baseline Segment

Field	Example entry
Segment	Occupied cooling, normal chiller plant
Inclusion rule	Occupied schedule true, OAT >= 60 F, at least one chiller enabled, no plant alarm
Exclusion rule	Maintenance, meter fault, manual lockout, BAS communication outage, load outside baseline range
Baseline period	2025-06-01 to 2025-09-30
Reporting period	2026-06-01 to 2026-06-30
Baseline model	Plant kWh per hour = f(chilled-water tons, OAT, humidity, hour-of-week)
Acceptance metrics	Hourly NMBE and CVRMSE within approved thresholds; residuals reviewed by load and OAT band

14.3 Example Monthly Savings Table

Item	Example value
Reporting-period intervals	720 hourly intervals
Excluded intervals	42 hours: 18 maintenance, 12 BAS outage, 12 manual override
Accepted intervals	678 hours
Adjusted baseline energy	182,400 kWh
Measured reporting energy	158,900 kWh
Accepted energy savings	23,500 kWh
Accepted percent savings	12.9%
Comfort status	Pass: 97.4% occupied zone-hours within approved band
Reliability status	Pass for accepted intervals
Attribution status	AI-attributed for accepted intervals with command and BAS acceptance logs
Uncertainty statement	Savings exceed model uncertainty screen for the accepted monthly segment; formal confidence interval stored in appendix

14.4 Example Exclusion Entries

Start	End	Code	Evidence	Treatment	Decision owner
2026-06-07 02:00	2026-06-07 14:00	NRE-03	Planned condenser-water pump maintenance ticket	Exclude	Facility engineer
2026-06-13 09:00	2026-06-13 21:00	NRE-05	BAS communication outage log	Exclude	M&V lead
2026-06-24 13:00	2026-06-25 01:00	NRE-04	Operator manual CHWST lockout	Exclude	Owner representative

14.5 Example Owner Summary

> For June 2026, the chilled-water plant Option B measurement boundary produced 23,500 kWh of accepted energy savings, equal to 12.9% of adjusted baseline energy for accepted intervals. Comfort and reliability passed for accepted intervals. Forty-two hours were excluded for documented maintenance, BAS communication outage, and manual override. Savings are attributed to ClimaMind only for intervals with AI command logs, BAS accepted setpoints, active guardrails, and no non-routine event explaining the reduction.

15. Troubleshooting

Problem	Likely cause	Field response
Savings look too high	Schedule changed, load dropped, meter scaling error, or comfort failed	Check schedule, load proxy, meter multiplier, and comfort pass before publishing
Model passes CVRMSE but residuals are biased	Missing operating mode or bad independent variable	Segment more tightly or add a valid explanatory variable
Whole-building noise hides HVAC savings	Savings too small relative to total meter variation	Move to Option B with system boundary or use Option C only as supporting evidence
BAS point names changed	BAS upgrade, vendor rename, or point mapping drift	Preserve point-alias map and verify units before stitching history
AI commands not visible in BAS trends	Integration logs not joined to BAS history	Treat as operational savings until command audit trail is complete
Comfort complaints increased	Aggressive setpoint, bad zone sensor, simultaneous heating/cooling, or local issue	Pause affected strategy, investigate, and exclude failed windows
Chiller efficiency appears worse after optimization	Load shifted to different equipment, condenser conditions changed, or staging changed	Review equipment status, load, condenser water temperature, and tower control
Owner wants a guaranteed savings number early	M&V plan not yet approved	Provide a preliminary estimate with uncertainty, not an accepted savings claim

16. Minimum Acceptance Checklist

Do not publish a measured-savings claim until all are true:

- Measurement boundary approved.
- IPMVP option selected and documented.
- Required meters and BAS points available with units and timezone.
- Baseline period and reporting period approved.
- Baseline model passes agreed review or limitations are explicitly accepted.
- Comfort rule approved.
- Reliability rule approved.
- Exclusion reason codes approved.
- Control audit trail available for AI-attributed savings.
- Facility engineer reviewed the draft packet.
- Finance or contract stakeholder understands uncertainty and exclusions.

References

- DOE Federal Energy Management Program, "Measurement and Verification Options for Federal Energy- and Water-Saving Projects": https://www.energy.gov/femp/measurement-and-verification-options-federal-energy-and-water-saving-projects
- DOE Federal Energy Management Program, "M&V Guidelines: Measurement and Verification for Performance-Based Contracts Version 5.0": https://www.energy.gov/femp/articles/mv-guidelines-measurement-and-verification-performance-based-contracts-version-50
- Efficiency Valuation Organization, IPMVP Core Concepts 2022 document library: https://evo-world.org/br/library/download-protocol-documents-mainmenu-en
- ASHRAE Guideline 14 is a licensed standard commonly used for energy measurement and demand savings calibration concepts. Use the owner's licensed copy or M&V professional guidance for contract-specific requirements.