PROmeter Metrix

TCO & ROI WHITEPAPER

Total cost of ownership compared with a Grafana / BI reference stack, scaled from 5 to 2,500 engineering seats.

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Measuring engineering, the economical way

Whitepaper — PROmeter Metrix compared with BI platforms (Grafana, Power BI, Tableau) on a custom SQL stack

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Executive summary

Engineering organisations need defensible metrics on requirements, traceability, test coverage and release status — usually spread across three to five Application Lifecycle Management (ALM) tools. There are two ways to get them:

1. A **Business Intelligence (BI) platform** (Grafana, Power BI, Tableau) on top of a **custom Structured Query Language (SQL) database** fed by Extract-Transform-Load (ETL) pipelines from each ALM.
2. **PROmeter Metrix** — metrics are defined in a formal Domain-Specific Language (DSL) and executed directly against the ALMs through built-in connectors, with no custom database.

A full list of abbreviations is given in Appendix B.

Scope of this calculation. One project team of **25 members**. Each member receives a Metrix licence. Three to five ALM source systems. Twenty formal metrics. On-premise operation. Three-year horizon.

	BI stack + SQL	PROmeter Metrix
Total Cost of Ownership (TCO) over 3 years (typical)	**≈ €290,000–360,000** (Grafana OSS baseline) — rises to €360,000–540,000 on Power BI / Tableau / Grafana Enterprise	**≈ €125,000–165,000**
Year 1 (ramp-up)	€115,000–150,000 (OSS) · €145,000–230,000 (commercial)	€43,000–55,000
Steady-state cost per annum (p. a., from year 2)	€85,000–105,000 (OSS) · €110,000–160,000 (commercial)	€40,000–55,000
Licences p. a.	**€0 if Grafana OSS**; €3,000 Power BI Pro (25 seats); €21,000–30,000 Tableau Creator (25); €25,000–60,000 Grafana Enterprise / Power BI Premium / Tableau Server for a regulated setup	€15,000 (25-licence Enterprise bundle) + €1,500 CI server
What drives the cost	ETL, dashboards, validation (licence secondary)	Licence and definition upkeep

> **Why the BI licence line is €0 in the headline row.** The comparison uses **Grafana OSS on PostgreSQL** as the BI baseline — the cheapest configuration that still delivers the required features.

> This avoids making the BI side look worse than it has to. In practice many regulated-development teams land on Power BI or Tableau for policy or integration reasons (SSO, RBAC, corporate licence agreement). Where that is the case, the BI TCO grows by **€9,000–180,000 over three years** on the licence line alone, and the Metrix advantage in §4.3–4.7 widens correspondingly. Section 2.1 lists the commercial options and their current list prices.

Headline. The licence question is not where the money lives, even at a 25-person scale. What matters is who builds and maintains the data pipeline. Metrix sidesteps the pipeline entirely: the metric runs directly against the ALM. The gap between the two options at this team size is roughly a **factor of two** on the three-year total — €165,000 saved — and rises if the team later runs follow-on projects on the same process.

Honest framing. At the 25-person, single-project scale the hard annual time savings from automated metrics are modest (≈ €15,000–25,000) in both setups. The business case therefore does *not* rest on time savings alone; it rests on **(a)** avoiding the ETL build-and-maintain burden of a custom BI stack, **(b)** avoiding the cost of a dedicated BI-specialist profile and the engineering ↔ BI translation loop (§2.7, ≈ €35 k in year 1 and €25 k/year thereafter — not in the headline totals), and **(c)** risk avoidance in audits and assessments. Metrix lines up well on all three counts; a BI stack mostly fails (a) and (b) at this scale.

Scaling view (see §4.5–4.7). Metrix remains cheaper than an equivalent BI stack across every realistic team size and project count on the hard-cost line alone; the advantage widens substantially once §2.7 indirect costs are added. The saving is largest at the **small-team end** (5–10 members, ≈ 65–78 % — because a custom BI build has an irreducible floor cost), stable across the mainstream band (25–100 members, 37–75 %), and narrows under flat per-seat pricing above 250 members as the licence line grows. **The tiered schedule above 100 seats and the site-licence cap above 1,000 (§3.1.1) handle the 500+ band**: at 500 members / 1 project Metrix is ≈ 14 % cheaper on hard cost instead of flipping to a BI advantage, and at 1,000+ the cap widens the gap monotonically. The business case is clearest for teams of 5–100 running two or more projects on the same process — the typical shape of a regulated-development unit across automotive, aerospace, medical, industrial, rail and defence, regardless of which specific standard (ISO 26262, DO-178C, IEC 62304, IEC 61508, EN 50128, …) applies.

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1. Assumptions and reference scenario

1.1 Reference team

Parameter	Assumption
Team	**One project team of 25 members** (engineers, reviewers, process owner)
Licences	**One Metrix licence per member** — editors, reviewers, executors as needed
Projects	One active project at a time; same process reused for any follow-on project
Source systems	3–5 ALM integrations (DOORS, Codebeamer, Polarion, Jira, Azure DevOps, …)
Metrics	20 formal metrics — coverage, trace depth and completeness, verification status, criticality distribution (e.g. Automotive Safety Integrity Level (ASIL), Design Assurance Level (DAL), Safety Integrity Level (SIL), medical device class), review cycle time
Regulatory context	Regulated development in general (see table below). The cost model is standard-agnostic; examples throughout use whichever standard is most familiar to the reader
Operation	On-premise, Single Sign-On (SSO), auditable. Full High Availability (HA) is optional at this scale and not assumed in the baseline
Internal day rate (fully loaded)	€500–700
External day rate	€900–1,400
Scope	Germany, 2026

Regulatory standards covered by the cost model

Domain	Standards
Automotive	ISO 26262, Automotive SPICE (ASPICE)
Aerospace	DO-178C, DO-254, ARP 4754A
Medical	ISO 13485, IEC 62304, FDA 21 CFR 820, EU MDR
Industrial	IEC 61508, IEC 62443
Rail	EN 50128, EN 50129
Defence	national programme-specific

> **Scope note.** This whitepaper covers *engineering metrics* (requirements, tests, traces, status). For *observability telemetry* (logs, production metrics) the economics look different — storage and ingest dominate, and Grafana is indispensable. The two worlds mix in practice but lead to very different numbers; this analysis addresses engineering metrics only.

1.2 What is in the calculation

Included: licences, hardware/VMs, people (build and run), metric validation, documentation, training, change management. Excluded: ALM licences themselves (equal in both scenarios), ALM vendor API surcharges (equal in both), general data-centre allocation (equal in both).

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2. Cost structure — BI platform on a custom SQL stack

2.1 Licences (p. a.)

Item	Low	Typical	High
Grafana OSS	€0	€0	€0
Grafana Enterprise (if SSO, Role-Based Access Control (RBAC) or audit required inside Grafana)	€0	€0	€25,000–140,000 (min. commit $25,000)
Power BI Pro (25 users)	€3,000	€3,000	€3,000
Tableau Creator (25 users, team-scale pricing)	≈ €21,000	≈ €25,000	≈ €30,000
PostgreSQL / SQL Server Express	€0	€0	€0
SQL Server Standard (if Microsoft (MS) stack)	€0	€0	€10,000–25,000

To be fair to the BI side, the rest of the comparison uses the cheapest viable configuration: **Grafana Open-Source Software (OSS) + PostgreSQL = €0 licence**.

2.2 Infrastructure (p. a., on-premise)

Scaled to a single team of 25; HA not strictly required at this size but can be added (figures in parentheses).

Component	Cost p. a.
BI server (single node; HA pair +€2,000–3,000)	€2,000–3,500
PostgreSQL (single node; standby +€4,000–6,000)	€3,000–6,000
ETL / scheduler host	€1,500–3,000
Backup storage (≈ 1 TB)	€800–1,500
Total	**€7,300–14,000**

2.3 Build-out effort, year 1

The data pipeline is the dominant item. Even at a 25-person scale, ETL effort per source does *not* shrink — the schemas and APIs are what they are.

Role	Person-Days (PD)	Content
Solution architecture	15–20	Data model, metric definitions
ETL development per source	**10–18 each**	Application Programming Interface (API) wrapper, schema, staging
ETL for 4 sources	**40–72 PD**	**largest single item — unchanged by team size**
Dashboard development (20 metrics)	15–25	0.8–1.3 PD per dashboard
Database Administration (DBA)	5–10	Setup, tuning, backup (single-node)
Platform / infrastructure	5–10	Virtual Machines (VMs), Transport Layer Security (TLS)
Security / compliance review	5–10	Approval, penetration test
Metric validation	**8–15**	**not optional for safety-related metrics**
Documentation, training	5–8	
Project management	8–12	
Total	**106–180 PD**	

At a blended rate of €800 per day, that is **€85,000–145,000 of people cost in year 1**, typically ≈ **€112,000**.

2.4 Steady-state effort (from year 2, p. a.)

Operating a BI stack at team scale still demands a part-time specialist — ETL does not maintain itself.

Activity	Full-Time Equivalent (FTE)
Platform operation	0.10–0.15
ETL maintenance (schema drift in sources breaks pipelines)	**0.20–0.35**
Dashboard evolution	0.15–0.25
User support	0.05–0.10
Total	**0.50–0.85 FTE**

At €110,000–140,000 per FTE: **€55,000–119,000 p. a.**, typically ≈ **€80,000**.

2.5 Cost per follow-on project

Each follow-on project on the same process requires ETL and dashboard rework, typically 12–20 PD = **€7,000–14,000 per follow-on project**.

2.6 Variant — AWS-hosted BI (QuickSight / managed Grafana + RDS + Glue)

A frequent counter-proposal to on-premise BI is a cloud-hosted stack on AWS: Amazon QuickSight or Amazon Managed Grafana for presentation, Amazon RDS PostgreSQL for the warehouse, AWS Glue or Lambda for the ETL layer, Amazon Simple Storage Service (S3) for raw and backup data. The build-out and steady-state effort are structurally similar to the on-premise case — the ETL still has to be written and maintained — but the **infrastructure line and the compliance envelope are very different**.

The vanilla cloud setup (public endpoints, default region, no additional controls) is **cheaper than on-premise on paper**. For regulated development it is rarely usable in that form. Three tiers of additional arrangements capture what customers actually buy to make the AWS path acceptable to a regulator or an internal security review.

2.6.1 Baseline — AWS vanilla cloud (no regulated controls)

Component	Cost p. a. (25 users, 1 TB data)
Amazon QuickSight (25 Enterprise users)	€4,000–6,000
Amazon RDS PostgreSQL (db.t3.large, Multi-AZ)	€4,000–6,000
AWS Glue / Lambda ETL jobs	€2,500–5,000
Amazon S3 storage + lifecycle	€500–1,500
Data transfer (ALM ingress/egress, ≈ 1 TB/year)	€1,000–3,000
Total (vanilla)	**€12,000–21,500 p. a.**

Build-out and people cost sit close to §2.3 figures — the ETL itself is not materially cheaper on Glue than on self-hosted Airflow. Steady-state operations are lower by ≈ 0.10 FTE because patching and backup are AWS-managed.

3-yr TCO, 25-member team, vanilla cloud: ≈ €180,000–280,000.

> **This is the headline figure usually cited for "cloud BI is cheaper".** It applies *only* if no additional regulatory controls are required. In regulated development that assumption almost never holds.

2.6.2 Tier 1 — Minimum defensible setup for a European regulated team

Private subnets in an EU region, Key Management Service (KMS) customer-managed keys, AWS CloudTrail + AWS Config, Amazon GuardDuty baseline, site-to-site Virtual Private Network (VPN) to on-premise ALMs, Data Protection Impact Assessment (DPIA), works-council review. Sufficient for an internal audit at a small regulated project; **not** sufficient for ISO 27001-certified or TISAX-certified environments.

Item	One-off	Recurring p. a.
VPC design, private subnets, KMS CMKs	5–10 PD	—
CloudTrail, Config, GuardDuty baseline	3–5 PD	€1,500–4,000
Site-to-site VPN to on-premise ALMs	2–3 PD	€1,000–2,000
Data Protection Impact Assessment, works-council review	5–10 PD	—
Added	**15–28 PD ≈ €12,000–22,000 one-off**	**€2,500–6,000**

3-yr TCO, Tier 1: ≈ €200,000–310,000.

2.6.3 Tier 2 — Realistic for most regulated programmes

Everything in Tier 1, plus a Control Tower landing zone across multiple accounts, AWS Direct Connect for dedicated connectivity, PrivateLink endpoints, AWS Security Hub with ISO 27001 / Bundesamt für Sicherheit in der Informationstechnik Cloud Computing Compliance Criteria Catalogue (BSI C5) control mapping, AWS Business Support, and the customer-side compliance work that attaches to those controls.

Item	One-off	Recurring p. a.
AWS Control Tower, multi-account landing zone, Service Control Policies	15–25 PD	—
AWS Direct Connect (1 Gbps, EU region)	5 PD	€5,000–10,000 (port) + traffic
AWS PrivateLink endpoints (S3, RDS, QuickSight)	2–3 PD	€2,500–4,500
Security Hub + Config rules mapped to ISO 27001 / BSI C5	10–15 PD	€3,000–6,000
AWS Business Support (de facto mandatory for regulated workloads)	—	**10 % of monthly cloud spend, min ≈ €1,100** → typically **€6,000–12,000**
Formal compliance documentation + customer-side ISO 27001 maintenance	15–25 PD	€15,000–25,000 (0.15–0.25 FTE)
Added	**47–73 PD ≈ €38,000–58,000 one-off**	**€31,500–57,500**

3-yr TCO, Tier 2: ≈ €305,000–490,000.

This is the band most regulated customers end up in once their security team and data-protection officer have signed off. **Cloud BI at this tier costs roughly the same as Tableau + PostgreSQL on-premise, and considerably more than Grafana OSS on-premise.**

2.6.4 Tier 3 — High-assurance / air-gap-equivalent

Required in defence, high-risk medical device programmes (FDA pre-market review, EU Medical Device Regulation Class III), TISAX Level 3, and many aerospace programmes where original equipment manufacturers forbid public cloud for programme data.

Item	One-off	Recurring p. a.
AWS Outposts (on-premise rack, AWS-managed) or Dedicated Tenancy	20–30 PD	**€100,000–180,000**
AWS Enterprise Support (prerequisite for Outposts and for most regulator asks)	—	**€180,000 floor** (10 % of spend, min $15,000/month)
Redundant Direct Connect (10 Gbps)	10 PD	€15,000–30,000
Full BSI C5 / TISAX Level 3 / ISO 27001 certification cycle	30–50 PD + external auditor	€20,000–40,000 audit fees + 0.25–0.4 FTE internal
Added	**60–90 PD ≈ €48,000–72,000 one-off**	**€315,000–500,000+**

3-yr TCO, Tier 3: ≈ €1,100,000–1,800,000.

At this tier the cloud option is no longer cheaper than on-premise BI and is typically several times more expensive than running Metrix on an existing build server.

2.6.5 Summary across BI reference cases

Configuration	3-yr TCO (25 members, 1 project)	Regulated fit
Grafana OSS + PostgreSQL, on-premise	€290,000–360,000	✅ Good — air-gapped, auditable
Tableau + PostgreSQL / SQL Server, on-premise	€380,000–470,000	✅ Good with policy work
AWS vanilla (no regulated controls)	€180,000–280,000	❌ Usually not acceptable
AWS Tier 1 (minimum defensible)	€200,000–310,000	⚠️ Internal audit only; not certified environments
AWS Tier 2 (realistic regulated)	€305,000–490,000	✅ ISO 27001 / BSI C5 attainable
AWS Tier 3 (high-assurance / air-gap equivalent)	€1,100,000–1,800,000	✅ Defence / Class III medical / high-assurance aero
PROmeter Metrix on-premise	**€125,000–165,000**	✅ Good — air-gapped, auditable, DSL is the specification

The remainder of §3–§7 compares Metrix against the **Grafana OSS on-premise baseline** to avoid stacking the comparison against BI. Readers whose real alternative is Tableau, AWS Tier 2 or AWS Tier 3 should read the Metrix delta as correspondingly larger than the figures quoted — by roughly **€80,000–1,650,000 over three years**, depending on the BI reference case.

2.7 Indirect cost — specialist dependency and cross-team communication

The figures in §2.3 and §2.4 already price the BI build and run work, but they implicitly assume (a) that competent Business Intelligence specialists are available to do it, and (b) that the engineering team's time spent *talking* to those specialists is free. In practice neither assumption holds. These costs rarely show up in a budget sheet; they show up in the delivery plan.

2.7.1 Dedicated BI expertise

A regulated-development BI stack needs people who understand Structured Query Language (SQL) at depth, the specific BI platform's query language (DAX for Power BI, PromQL for Grafana, VizQL / calculations for Tableau), ETL tooling, and dimensional modelling. This profile is scarce and carries a premium over a generic developer rate.

Item	Cost impact
Day-rate premium for BI specialist over blended developer rate	€200–500 / PD × 60–100 PD of specialist work in year 1 → **+€12,000–50,000 year 1**
Dedicated 0.3–0.5 Full-Time Equivalent (FTE) for ongoing BI work (optional, often required)	€36,000–70,000 p. a. premium over absorbing it in the generic engineering budget
Bus-factor risk — if the specialist leaves, replacement needs 20–30 PD ramp-up + external search	one-off €20,000–45,000 per departure
Dashboard governance (ownership rules, duplicate prevention)	5–10 PD p. a. = €3,000–6,000 — only needed because non-specialists can't re-derive what the specialist built

A customer that *does* already have BI specialists in-house avoids the day-rate premium but still carries the bus-factor and the ongoing-FTE commitment. A customer that does not pays a premium to hire or contract.

2.7.2 Cross-team communication and translation overhead

Every BI metric is shaped by two incompatible knowledge bases: the engineering domain (standards, process semantics, what the metric is supposed to prove) and the BI platform (how to express it in SQL / DAX / VizQL). The two sit in different teams. Each metric therefore goes through a translation loop: engineer explains → specialist implements → engineer validates → specialist adjusts.

Item	Cost impact (year 1)
Engineering time lost to translation and validation — 20 metrics × 2–3 iteration rounds × 1.5–2 hours per round	60–120 engineer-hours = 7.5–15 PD **of engineering capacity not delivering engineering → €4,500–9,000**
Specification writing in a form the BI team can consume (not reusable later)	5–10 PD = €3,000–6,000
Rework from misunderstood requirements (typically 2–4 metrics / project)	4–8 PD = €2,400–4,800
Total year-1 communication overhead	**≈ €10,000–20,000**

Steady-state communication cost is lower but not zero:

Item	Cost impact (p. a.)
Metric changes and new metrics (≈ 30 % of the catalogue per year) × translation round-trip	15–25 engineer-hours = €1,100–1,900
New-joiner onboarding (both sides re-explaining the catalogue)	2–5 PD = €1,200–3,000
Total steady-state communication overhead	**≈ €2,500–5,000 p. a.**

2.7.3 Net indirect cost added to the BI case

Horizon	Range	Typical
Year 1 (specialist premium + translation)	€22,000–70,000	**≈ €35,000**
Steady state p. a. (specialist retention + ongoing translation)	€15,000–40,000	**≈ €25,000**
3-year indirect cost added to §4.3 BI totals	**€52,000–150,000**	**≈ €85,000**

These numbers are **not** included in the §4 side-by-side totals, because every organisation absorbs them differently. They should be added to the BI side whenever a buyer wants a realistic comparison — especially when no BI specialist is already on staff. Adding the typical figure widens the Metrix advantage over Grafana OSS by about **€85,000 over three years** (from –€171,000 to **–€256,000** for the 25-member baseline).

2.8 Does AI coding assistance change the BI picture?

AI coding assistants (GitHub Copilot, Claude Code, Cursor, Codeium, and similar) have become part of day-to-day engineering workflows in 2025–2026. A fair ROI analysis has to ask whether they close the gap between a custom-ETL BI stack and PROmeter Metrix. The honest answer is **they narrow it, but do not close it**, and the structural reasons for Metrix's advantage remain.

2.8.1 Where AI tools help the BI build

Activity	Expected speed-up with AI assist
ETL code generation (SQL, Python for AWS Glue / Apache Airflow)	25–35 % faster for straightforward pipelines
Dashboard query authoring (DAX, PromQL, Tableau calculations)	20–30 % faster
Boilerplate (schema definitions, data-contract code, unit test scaffolds)	40–60 % faster
Documentation generation from code	substantial, hard to quantify
Routine debugging and error-message interpretation	modest

Applying these to §2.3, year-1 build-out effort compresses from **141–252 PD to roughly 115–215 PD**, a ≈ 15–20 % reduction. People cost drops correspondingly from €115,000–200,000 to **≈ €92,000–172,000** for the 25-member baseline (typical ≈ €92,000, down from €112,000).

2.8.2 Where AI tools do not help

Activity	Why AI does not materially shorten it
Domain translation from engineering semantics to BI implementation	AI does not know the organisation's ISO 26262 / IEC 62304 / IEC 61508 conventions, process semantics, or which `ASIL` decomposition is in force on this project. The translation loop between engineering and the BI team (§2.7.2) stays the dominant cost at this scale, not the SQL writing.
Metric validation in a regulated context	AI-generated code has a well-documented tendency to produce plausible-looking but subtly wrong SQL — off-by-one joins, incorrect NULL handling, missed cross-ALM edge cases. In regulated development the standard reflex is to validate *more*, not less, when a generator is involved. Expect validation effort to stay flat or **rise by 10–20 %** on AI-assisted output.
ALM-API quirks and undocumented behaviour	AI assistants train on public APIs. Proprietary DOORS, Polarion, Codebeamer and MKS/Windchill RV&S behaviours — especially for cross-tool traceability — remain in human territory.
Specialist dependency (§2.7.1)	AI narrows but does not remove the need for someone who understands DAX / PromQL / VizQL deeply enough to debug when the AI output does not work. The bus-factor and premium day-rate persist.
Governance (dashboard sprawl, duplicate prevention)	Social and procedural problem, not a code-generation problem.
Compliance evidence generation	Still requires humans to write the trace argument and defend it in an audit.

2.8.3 Cost of the AI tooling itself (BI case)

Item	Cost p. a.
GitHub Copilot Business (3–5 BI specialists)	€720–1,200
Alternative: enterprise AI assistant (Claude for Enterprise, Gemini Enterprise)	€4,000–8,000 for a small team
Code-review tooling adapted for AI output	€500–2,000
Training on effective AI use + organisational policy	2–5 PD one-off (€1,600–4,000)
Added to §2.4 run cost	**≈ €5,000–11,000 p. a.**

Small in absolute terms. The real caveat is organisational: in several regulated sectors, AI-generated code must be flagged as such, reviewed on a separate track, and documented as a tool-chain input. For ISO 26262 and DO-178C contexts, this is tool qualification territory and is non-trivial.

2.8.4 Does Metrix also benefit from AI tools?

Yes, and to a similar proportion:

Activity	AI benefit on Metrix side
Drafting `.mxb` metric definitions in the DSL	20–30 % faster (small training corpus means the uplift is modest today, rising as the sample library grows)
Writing report / dashboard HTML templates	30–40 % faster
Generating documentation and audit narratives from `.mxb` files	substantial
Explaining a metric's semantics to a joining team member	useful

Applying this to §3.4 compresses Metrix year-1 effort from 32–61 PD to **27–53 PD**, a similar 15–20 % reduction. People cost drops from €26,000–49,000 to ≈ €22,000–42,000 (typical ≈ €23,000, down from €28,000).

Metrix benefits from AI proportionally more than BI in one specific way: because the `.mxb` DSL is small, declarative and domain-shaped, an AI assistant can usually get a correct first draft of a metric from a plain English description. On the BI side the AI still has to pick the right join across the right ETL staging tables — a step that does not exist in the Metrix model.

A further step-change in Metrix-side productivity arrives with the v1.2 Model Context Protocol (MCP) server — see §3.8.

2.8.5 Revised totals with AI assistance on both sides

Item	BI stack + SQL (AI-assisted)	PROmeter Metrix (AI-assisted)	Delta
Year 1 total	**≈ €102,500** (was €122,500)	**≈ €40,500** (was €45,500)	**–€62,000**
Steady state p. a.	**≈ €78,000** (was €90,500)	**≈ €40,000** (was €43,500)	**–€38,000**
3-yr TCO	**≈ €258,500** (was €303,500)	**≈ €120,500** (was €132,500)	**–€138,000 (≈ 53 %)**
Add §2.7 indirect cost on BI (unchanged by AI, see §2.8.2)	+€85,000	—	**–€223,000 (≈ 65 % of combined base)**

Reading. AI assistance shaves ≈ 15 % off the BI side and ≈ 9 % off the Metrix side. The absolute Metrix saving drops from €171,000 to ≈ €138,000 over three years at the 25-member baseline — still a comfortable **53 % advantage** — and widens to ≈ €223,000 (**≈ 65 %** of the combined BI base of €343,500) once the indirect cost from §2.7 is included. The structural case holds.

2.8.6 What AI cannot buy the BI side

The three largest structural costs on the BI side (§2.7 translation loop, §7 point 5 knowledge concentration, §8 recursive multi-stage metrics requiring ETL pre-computation) are **not reduced by AI coding assistants**. They are organisational, domain-knowledge and architectural problems, not code-writing problems. A buyer who expects AI tooling to close the ROI gap should price this in explicitly: AI is a ≈ 15 % cost reducer on the mechanical work and **does not touch the ≈ 85 % that drives the gap**.

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3. Cost structure — PROmeter Metrix

3.1 Licences (p. a.)

Package	Cost	Content
Team Bundle	€3,000/year	8 licences (1 Editor, 2 Reviewer, 5 Viewer) — small-team pilot
Enterprise (25-licence bundle)	**€15,000/year**	**25 licences, one per team member**, full Editor + Executor configuration
Server Execution (optional)	€1,500/server/year	Continuous Integration / Continuous Delivery (CI/CD) integration, unlimited pipeline runs
Multi-year discount	–5 % (2 y), –10 % (3 y)	

For this scenario: **€15,000/year for all 25 team members + €1,500/year for one CI/CD executor = €16,500/year licence cost**. Additional report readers outside the team (programme office, management, auditors) consume generated HTML, JSON and Excel reports and pay no licence.

3.1.1 Volume pricing above 100 seats

For organisations deploying Metrix to larger populations — multiple teams, divisions, or enterprise-wide roll-out — the per-seat licence drops in tiers so that the cost per seat falls as the deployment grows. The mainstream 25–100-seat pricing (where most engineering teams sit) is **left unchanged**. The discount curve is set in line with observed enterprise-SaaS practice for comparable regulated-industry platforms (Atlassian Data Center, Siemens Polarion, PTC Codebeamer, GitLab Ultimate): roughly 15–18 % at 250 seats, 25–30 % at 500, 40 % at 1,000, site-licence cap beyond.

Deployment size	Effective per-seat rate	Discount vs €600 base	Annual licence (indicative)
1–8 seats	Team Bundle €3,000/year flat	—	€3,000
9–25	Enterprise bundle €15,000/year flat	—	€15,000
26–100	€600 / seat / year	0 % (baseline)	up to €60,000
101–250	€500 / seat / year	≈ 17 %	up to €125,000
251–500	€425 / seat / year	≈ 29 %	up to €212,500
501–1,000	€350 / seat / year	≈ 42 %	up to €350,000
1,000+	**Site-licence cap at €350,000 / year**	—	€350,000 flat

Tiers are **flat-replace within band**, i.e. at 500 seats all 500 pay €425/seat (the rate for the 251–500 band). This matches how Atlassian, Microsoft and most mid-market enterprise SaaS platforms express volume discounts and makes contracts easier to administer than marginal-tier schemes. Multi-year framework agreements (–5 % at two years, –10 % at three years) apply on top of either the tiered or the capped number.

Worked examples:

Seats	Band rate	Charged p. a.	Effective per-seat rate
100	€600	**€60,000**	€600
250	€500	**€125,000**	€500
500	€425	**€212,500**	€425
1,000	€350	**€350,000**	€350
2,500	site cap	**€350,000**	€140

The site-licence cap turns the 1,000+ zone from a per-seat cost into an enterprise-agreement cost, which is how large customers already buy enterprise software in regulated industries. It also sets an honest price floor for the cost of running the Collaborative Support Service at large-deployment scale; purely marginal tiers would eventually cross zero.

Why these specific step sizes.

- **17 % at 250 seats** matches the typical "first serious discount" tier and signals good faith to procurement without eroding the 25–100 band.
- **29 % at 500 seats** is the minimum credible discount in regulated-industry SaaS at that volume. Below ~25 % procurement teams reopen the conversation; above ~35 % T4Test's margin tightens prematurely on deployments that are still growing.
- **42 % at 1,000 seats + site cap** is what enterprise customers already expect from comparable platforms. The cap closes the arithmetic question decisively against any BI alternative.

Effect on the scaling table. Each row below rebuilds the Metrix TCO as *(seats × band-rate × 3 years) + non-licence cost (infrastructure, people, support) carried over from the flat-€600 §4.5 baseline*. The non-licence component is the same in both columns.

Team size	Non-licence (infra + people), 3-yr	Metrix 3-yr TCO (flat €600)	Metrix 3-yr TCO (tiered + site cap)	BI 3-yr TCO	Delta with tiered pricing
100	€150,000	€330,000	€330,000 (unchanged)	€520,000	**–€190,000 (≈ 37 %)**
250	€240,000	€690,000	**€615,000**	€820,000	**–€205,000 (≈ 25 %)**
500	€390,000	€1,290,000	**€1,027,500**	€1,200,000	**–€172,500 (≈ 14 %)**
1,000	€690,000	€2,490,000	**€1,740,000**	€2,100,000 (est.)	**–€360,000 (≈ 17 %)**
2,500	€1,290,000	€5,790,000	**€2,340,000**	€4,800,000 (est.)	**–€2,460,000 (≈ 51 %)**

Reading. At 500 seats the tiered rate drops the 3-year Metrix TCO from €1.29 M to about €1.03 M — the 500 × 1 cell in §4.7 that previously showed "BI ≈ 7 % cheaper on paper" flips to "**Metrix ≈ 14 % cheaper on hard cost alone**", before §2.7 indirect cost is added (which widens the gap by ≈ €85 k per 25-member slice, i.e. substantially more at 500 seats). Beyond 500 seats, the tiered rate and then the site-licence cap hold the Metrix licence growth below the BI operations-cost growth, so the Metrix advantage widens from 14 % at 500 seats to 17 % at 1,000 and roughly 51 % at 2,500.

> **Compared with a more conservative step schedule** (e.g. 600 / 550 / 500 at the same bands), the moderate curve above wins ≈ 8–10 percentage points more at 500 seats. Procurement in regulated industries expects the 25–35 % per-seat discount band at 500 seats as a market norm; staying below that band typically reopens the negotiation rather than closing it. The total-cost delta looks smaller than the headline per-seat discount because non-licence cost (ops, support) scales with team size and does not shrink under the discount — a point worth making explicitly to procurement.

3.2 What is included in the 25-licence Enterprise bundle

Beyond the seats themselves, the bundle ships with a set of enablement elements that would otherwise be purchased separately. Each line below is costed at its equivalent professional-services rate so the

comparison with a BI setup stays apples-to-apples.

Included element	Equivalent purchase	Equivalent value
Onboarding and architecture coaching	3–5 consulting days	€2,700–7,000
Hands-on training for editors and reviewers	2-day class for up to 10 attendees	€3,000–5,000
Process coaching during the first two metric iterations	3–5 coaching sessions	€2,000–3,500
Sample library for self-learning — ready-to-run `.mxb` definitions across the common regulated-development standards: Automotive SPICE (ASPICE), ISO 26262, DO-178C, DO-254, IEC 62304, EU MDR, IEC 61508, IEC 62443, EN 50128	reference material purchase	€2,000–5,000
Connector access — all shipped connectors (DOORS, Codebeamer, Polarion, Jira, Azure DevOps, MKS/Windchill RV&S, …) at no extra cost	would otherwise be add-on	€0 charged
Collaborative Support Service for connectors — bug fixes, API changes and connector improvements are delivered at no cost, because improvements benefit the product itself	ongoing integration maintenance	€0 charged
Total enablement value included		**≈ €10,000–20,000 in year 1**

Two consequences for the ROI calculation:

- The 15,000 € Enterprise fee is not *only* a seat licence; it absorbs the equivalent of 10–20 k € of professional-services spend that the BI route would have to buy separately.
- There is **no connector licensing, no per-connector maintenance fee, and no cost for connector changes forced by ALM vendor updates**. If a connector needs an update, it is produced by the vendor under the Collaborative Support Service and shipped to every customer.

3.3 Infrastructure (p. a.)

Metrix needs **no dedicated database** for standard operation. Metrics run directly against the ALM Application Programming Interfaces (APIs); results are stored as signed artefacts in Git or the artefact store.

Component	Cost p. a.
Desktop / editor installations	€0 (existing workstations)
CI/CD executor (existing build server)	€0
Optional: central metric library server	€1,000–2,000
Total	**€0–2,000**

3.4 Build-out effort, year 1

Role	Person-days	Content
Solution architecture (covered partly by included coaching)	2–5	metric catalogue, scope
Connector configuration per source	**1–2 each**	parameterisation only; connectors ship with the product
Connectors for 4 sources	**4–8 PD**	
Metric definition in DSL (20 metrics)	5–10	0.25–0.5 PD per metric
Dashboard / report templates	5–10	HTML / JSON / Excel
Metric validation	5–10	shorter than the BI case because the DSL *is* the specification
Training absorbed by the included class	0–2	attendance only
Project management	5–8	
Total	**26–53 PD**	

At a blended rate of €800 per day: **€21,000–42,000 of people cost in year 1**.

3.5 Steady-state effort (from year 2, p. a.)

Activity	FTE
Metric upkeep (definition changes)	0.05–0.10
Connector updates — delivered by vendor, user applies the update	**≈ 0.00–0.02**
Report / dashboard evolution	0.05–0.10
User support	0.05–0.10
Total	**0.15–0.32 FTE**

At €110,000–140,000 per FTE: **€17,000–45,000 p. a.**, typically ≈ **€26,000**.

3.6 Cost per follow-on project

For a follow-on project on the same process: copy the portable `.mxb` definitions, adjust connector parameters. **0.5–1 PD = €300–700 per follow-on project.** No ETL rework. No extra connector purchase. No licence change — the 25 seats stay with the team.

3.7 Why Metrix does not carry the §2.7 indirect cost

The communication and specialist-dependency overhead that §2.7 attaches to the BI case largely disappears in the Metrix model. Three structural reasons:

1. **Metrics are written by domain engineers, not translated for them.** The Metrix DSL is deliberately designed so that engineers who understand the domain — safety, verification, process — can author, review and evolve metrics themselves. A two-day class (included in the Enterprise bundle) is enough to reach productive use. There is no second team between the domain expert and the running metric.
2. **No dedicated BI specialist is required.** The scarce profile that the BI case needs (SQL + DAX / VizQL + ETL + dimensional modelling) is not on the hiring plan. Any safety / quality / verification engineer who defines the metric semantically can also run it. The bus-factor risk collapses from "the one person who knows the ETL left" to "the `.mxb` file is in Git, anyone on the team can read it".
3. **No translation loop.** The `.mxb` definition is itself the specification, the executable and the reviewable artefact. The engineer who proposes a metric and the engineer who approves it look at the same file. There is no "engineer explains, specialist implements, engineer validates" cycle because there is no second role in it.

Net effect on the comparison. The indirect cost that §2.7 quantifies at **≈ €85,000 over three years** for the 25-member team is simply not spent on the Metrix side. If a customer is building a business case against the true cost of a BI stack (specialist premium + translation overhead + bus-factor), the Metrix advantage from §4.3 should be read as **≈ €85,000 larger** than the headline numbers suggest. Section 4.3 keeps these costs out of the main totals so that both sides are compared on their directly budgetable lines — but §2.7 and §3.7 together are the real-world version of the people-cost story.

3.8 MCP server in Metrix v1.2 (target: early 2027)

The Metrix roadmap publishes a Model Context Protocol (MCP) server in version 1.2, which exposes metric definitions, metric evaluations, scopes, profiles and dry-run evaluations as read-only tools to any MCP-capable AI agent (Claude, Copilot, Cursor, enterprise agents). The practical effect is that an AI assistant can be given access to the live Metrix state and used to:

- draft new `.mxb` definitions against the real project graph instead of against a specification sketch (further 20–40 % speed-up on metric authoring, on top of the §2.8.4 baseline);
- score a proposed batch of artefacts against the current snapshot *without persisting anything* (dry-run evaluation), cutting review iteration time;
- generate audit narratives and management reports from the exact Metrix state, with a reproducibility fingerprint that ties the narrative back to the data it came from;
- answer ad-hoc questions ("which requirements changed between baseline A and B and lost a test link?") in a conversational way, over the same authoritative data that the metrics use.

Projected effect on the §2.8.5 totals, once v1.2 is in production (2027+):

Item	Metrix today (AI-assisted)	Metrix v1.2 with MCP	Further saving
Year 1 build	≈ €40,500	**≈ €34,000**	–€6,500
Steady state p. a.	≈ €40,000	**≈ €34,000**	–€6,000 p. a.
3-yr TCO (first full year under v1.2)	≈ €120,500	**≈ €102,000**	**–€18,500 (≈ 15 %)**

On the BI side there is no equivalent. An AI agent could in principle be pointed at a BI stack's SQL warehouse, but doing so safely in a regulated environment requires wrapping each query in access control, audit logging and schema contracts that the BI team has to build and maintain — i.e. yet another ETL/governance layer on top of the one that already exists. In Metrix the MCP layer is part of the product, maintained by T4Test under the Collaborative Support Service, and ships with the regulatory-relevant features (read-only exposure, reproducibility fingerprints, scope filtering) built in.

The MCP capability therefore **widens the Metrix advantage from 2027 onwards**, both for the engineering-metrics use case covered by this whitepaper and for the cross-domain extension discussed in §9.

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4. Side-by-side totals

4.1 Year 1 (ramp-up), typical

Item	BI stack + SQL	PROmeter Metrix
Licences	€0	€16,500
Infrastructure	€10,500	€1,000
People (build)	€112,000	€28,000
Included enablement (training, coaching, samples) you would otherwise buy	— (add €10,000–20,000 if comparable)	**included**
Total	**€122,500**	**€45,500**

4.2 Steady state from year 2 (p. a., typical)

Item	BI stack + SQL	PROmeter Metrix
Licences	€0	€16,500
Infrastructure	€10,500	€1,000
People (run)	€80,000	€26,000
Connector maintenance	≈ €0 (self)	**€0 — covered by Collaborative Support Service**
Total	**€90,500**	**€43,500**

4.3 3-year TCO, typical

	BI stack + SQL	PROmeter Metrix	Delta
Year 1	€122,500	€45,500	**–€77,000**
Year 2	€90,500	€43,500	–€47,000
Year 3	€90,500	€43,500	–€47,000
Total	**€303,500**	**€132,500**	**–€171,000**
per team member × year (25)	≈ €4,050	≈ €1,770	

Metrix saves roughly €171,000 over three years in this scenario — approximately 56 % of the comparable BI total. The saving comes from the ETL pipeline that does not have to be built and maintained, and from the enablement bundle absorbed in the Metrix licence.

> **Which totals are "live".** The §4 tables deliberately use the pre-AI, no-indirect-cost baseline so both sides are compared on their directly budgetable lines. The AI-adjusted comparison (§2.8.5) keeps the Metrix advantage at ≈ 53 % on hard cost and ≈ 65 % once §2.7 indirect cost is added. The 2027+ comparison with MCP active (§3.8) widens it further. Readers choosing which number to quote should pick the horizon that matches their investment window.

4.4 Scaling with follow-on projects

If the team runs follow-on projects on the same process (sequentially or overlapping), each adds **€7,000–14,000 of one-off rework** on the BI side and **€300–700 on the Metrix side**.

Follow-on projects over the 3-year horizon	Extra cost (BI)	Extra cost (Metrix)
0 (baseline, one project)	baseline	baseline
1	+€7,000–14,000	+€300–700
2	+€14,000–28,000	+€600–1,400
4	+€28,000–56,000	+€1,200–2,800

4.5 Scaling with team size (single project)

The two models scale very differently as the team grows. BI costs rise mostly on the operations side: more users, more dashboards, more support, and at a certain point HA and Enterprise licence features become mandatory rather than optional. Metrix costs scale predictably on the licence line (€600 per seat per year) and barely elsewhere — the metric definitions and connector configurations do not know how many people read the result.

Figures below are 3-year TCO, single active project. For 5- and 10-member teams, scope is also scaled down to 2–3 ALM sources and 10–15 metrics, which is realistic for a small safety team; the 25-member

baseline and larger teams use 4 sources and 20 metrics as before. The Metrix licence model picks up the team-size shift: Team Bundle up to 8 seats (€3,000/year), individual licences in the 8–24 range, Enterprise from 25 upwards (€600 / seat / year).

Team size	BI stack + SQL (3-yr TCO)	PROmeter Metrix (3-yr TCO)	Delta in favour of Metrix	Assumption shift
5	€143,000	€46,500	**–€96,500 (≈ 67 %)**	2 sources, 10 metrics; Metrix on Team Bundle (€3,000/y)
10	€206,000	€72,000	**–€134,000 (≈ 65 %)**	2–3 sources, 12–15 metrics; Metrix on Team Bundle + 2 add-on seats (≈ €5,000/y)
25 (reference)	€303,500	€132,500	**–€171,000 (≈ 56 %)**	single-node BI, no HA; Metrix Enterprise 25-licence bundle (€15,000/y + CI server)
50	€380,000	€195,000	**–€185,000 (≈ 49 %)**	HA becomes mandatory; +0.15 FTE user support
100	€520,000	€330,000	**–€190,000 (≈ 37 %)**	Grafana Enterprise or Tableau Server becomes realistic; dashboard sprawl appears
250	€820,000	€690,000	**–€130,000 (≈ 16 %)**	Enterprise licensing dominates on the BI side; Metrix licence scales linearly
500 (flat €600/seat)	€1,200,000	€1,290,000	**+€90,000 (BI ≈ 7 % cheaper on paper)**	per-seat Metrix licence overtakes BI *if* no volume contract is in place
500 (tiered pricing, §3.1.1)	€1,200,000	**€1,027,500**	**–€172,500 (≈ 14 %)**	with the 101-250 / 251-500 / 501-1,000 schedule, hard-cost gap reopens; adding §2.7 indirect cost widens it substantially further

Downscaling note — 5- and 10-member teams. Even at the smallest viable scale, the Metrix advantage is proportionally the largest. Two reasons:

1. **A BI stack has a floor cost.** Building an ETL pipeline for a single ALM still takes 10–18 PD, regardless of whether 5 or 50 people will look at the result. The custom pipeline doesn't scale down the way a Team Bundle does.
2. **Metrix drops to a €3,000-per-year floor** for teams ≤ 8, with full access to connectors, the sample library and the Collaborative Support Service. The marginal cost of adding one small team to an existing Metrix deployment inside the same organisation is essentially the licence line alone.

Both of these make Metrix the obvious choice for pilot teams and for small independent safety-critical projects — the segment where a BI+ETL build is typically too expensive to justify at all.

What the table shows.

1. **Between 25 and 100 members Metrix is clearly cheaper**, by roughly €170,000–190,000 over three years. The absolute saving is remarkably stable, because BI operations cost grows at about the same rate as Metrix licence cost.
2. **Around 250 members the two curves start to converge.** Per-seat Metrix licence becomes the dominant line; BI still carries the ETL operations burden but amortises licences over many users.
3. **At 500+ members the hard-cost comparison tips towards the BI side,** but this is the point at which a volume-based Metrix contract (not covered here) becomes the right negotiation lever, and where the cross-ALM and `.mxb` portability benefits typically carry the decision anyway.

> **Rule of thumb** (post-§3.1.1 pricing). **Up to 100 members:** Metrix is 37 % cheaper on list price; no negotiation needed. **100–500 members:** the tiered schedule (€500 / €425 / €350) applies automatically; hard-cost saving sits in the 14–25 % band, and the §2.7 indirect saving on the BI side widens it further. **500–1,000 members:** the €350/seat band and site-licence cap carry the argument; procurement teams at this volume expect — and get — the market- standard 29–42 % per-seat discount. **1,000+ members:** the €350,000/year site cap turns the discussion into an enterprise-agreement conversation rather than a per-seat negotiation.

4.6 Scaling with the number of active projects

Projects multiply BI cost through rework (ETL, dashboards, validation) and through parallel operations (separate dashboards, separate access rules). Metrix multiplies almost nothing — one metric library serves many projects through the portable `.mxb` definitions.

Figures below are **additional** 3-year cost on top of the single-project baseline for a 25-member team. "Serial" assumes one project at a time with the per-follow-on rework from §4.4 (€7–14 k on the BI side, €0.3–0.7 k on Metrix). "Parallel" adds operational overhead (extra dashboards, duplicate access rules, duplicate validation) that serial runs avoid, which is why the per-project numbers are higher.

Active projects over 3 years	Extra cost (BI)	Extra cost (Metrix)	Delta
1 (baseline)	—	—	—
3 total, serial (2 follow-ons × §4.4 rate)	+€14,000–28,000	+€600–1,400	**–€13,400 to –€26,600**
3 total, parallel (2 follow-ons + overlap overhead)	+€45,000–75,000	+€1,500–3,500	**–€43,500 to –€71,500**
6 total, mixed	+€90,000–150,000	+€3,000–7,000	**–€87,000 to –€143,000**
10 total, programme-level parallel	+€180,000–280,000	+€5,000–12,000	**–€175,000 to –€268,000**

Observation. The project-count axis is the single strongest Metrix lever. A 25-member team running three parallel safety-related projects already sees a 3-year Metrix TCO of roughly **€135,000** against a BI TCO of **€360,000 — a factor of 2.7**.

4.7 Combined view — where Metrix is decisively better, where it is marginal

	1 project	3 projects	6 projects	10 projects
5 members	Metrix 67 % cheaper	Metrix ≈ 72 % cheaper	Metrix ≈ 78 % cheaper	*(unusual at this size)*
10 members	Metrix 65 % cheaper	Metrix ≈ 70 % cheaper	Metrix ≈ 76 % cheaper	Metrix ≈ 80 % cheaper
25 members	Metrix 56 % cheaper	Metrix ≈ 63 % cheaper	Metrix ≈ 70 % cheaper	Metrix ≈ 75 % cheaper
50 members	Metrix 49 % cheaper	Metrix ≈ 58 % cheaper	Metrix ≈ 66 % cheaper	Metrix ≈ 72 % cheaper
100 members	Metrix 37 % cheaper	Metrix ≈ 50 % cheaper	Metrix ≈ 60 % cheaper	Metrix ≈ 67 % cheaper
250 members	Metrix 16 % cheaper	Metrix ≈ 35 % cheaper	Metrix ≈ 50 % cheaper	Metrix ≈ 60 % cheaper
500 members (flat €600/seat)	BI ≈ 7 % cheaper (hard cost only)	Metrix ≈ 15 % cheaper	Metrix ≈ 35 % cheaper	Metrix ≈ 50 % cheaper
500 members (tiered §3.1.1)	**Metrix ≈ 14 % cheaper**	**Metrix ≈ 27 % cheaper**	**Metrix ≈ 41 % cheaper**	**Metrix ≈ 54 % cheaper**

Reading the matrix.

- The **top rows (5–25 members)** are where Metrix is the obvious choice from first principles. A BI+ETL build has a floor cost that small teams simply cannot absorb; Metrix's Team Bundle starts at €3,000/year and includes connectors, samples and support. **Metrix is essentially the only defensible option for small safety-critical teams.**
- The **middle rows (50–100 members)** show the mainstream enterprise case — consistent 37–72 % savings across the project-count axis, carried by avoided ETL rather than by licence arbitrage.
- The **bottom rows (250–500 members)** are where Metrix remains cheaper on the multi-project side but tightens on single-project deployments. In this band, a volume-tier Metrix contract (not covered here) becomes the right negotiation lever, and the cross-ALM / portable `.mxb` benefits typically carry the decision anyway.
- The **500 × 1 cell** is the only zone where a BI stack looks cheaper on paper **under flat per-seat Metrix pricing**. With the tiered schedule from §3.1.1 (17 % / 29 % / 42 % per-seat discount at 250 / 500 / 1,000 seats, site-licence cap at 1,000+) the hard-cost advantage returns to Metrix (≈ 14 % at 500 × 1), widening to ≈ 51 % at 2,500 seats. Adding the §2.7 indirect cost widens all cells in the 500+ band substantially further.

5. Where the value comes from

5.1 Hard savings per year (same in both scenarios, team of 25)

Item	Amount
Replace manual status reports (1 team × 12 mo × 1.5 PD × €600 × 70 % realised)	€7,500
Audit / assessment preparation (1 × 7 PD × €600)	€4,000
Data collection for management reviews (12 × 0.5 PD × €600)	€3,500
Reduced duplicate fact-finding across the 25 members (12 × 1 PD × €600)	€7,000
Realistic annual saving	**€18,000–25,000**

5.2 Break-even

Setup	Run cost p. a.	Break-even against hard savings
BI stack + SQL	€90,500	**not achievable** on time savings alone at team scale — relies on risk avoidance
PROmeter Metrix	**€43,500**	≈ **2× the team** or ≈ **2 follow-on projects** close the gap; risk avoidance covers the rest

At a 25-person, single-project scale, neither route pays back on time savings alone. The Metrix run cost is close enough to the hard savings that **one prevented engineering gap of medium cost** (see §5.3 — a missing test case surfaced in audit, an inconsistent-baseline rework, a one-week certification delay) tips the balance. The BI run cost is further from the line and typically needs several such prevented events per year to close. This is the real shape of the business case at this scale.

5.3 Cost of engineering gaps that metrics expose (and avoid)

The second — and in regulated development usually the larger — half of the business case is the cost of defects that metrics catch early. These apply in both setups, but only if the metrics exist and are run continuously. A dashboard built once and left to drift does not prevent anything.

The categories below are domain-independent. They occur in automotive, aero, medical, industrial, rail and defence programmes, differing mostly in the regulator and in the eventual size of the cost.

Gap category	How it typically manifests	Order of magnitude when found late
Missing requirements traces (requirement → architecture / design)	Requirement exists but has no downstream link; re-discovered during assessment or integration	€5,000–25,000 per gap in rework; multiplier for assessment delay
Missing requirements → test traces	Requirement is implemented but has no verification evidence	€8,000–30,000 per gap (write test, re-verify, re-baseline, re-document)
Missing test cases (requirements not covered by any test)	Discovered during audit sampling or in the field	€10,000–40,000 per gap; higher if a safety claim depends on the missing test
Missing implementation (requirement has traces but no code / artefact actually realises it)	Caught in integration, pre-release review or — worst case — in acceptance	€15,000–80,000 per gap (design change, re-implementation, re-verification)
Orphaned artefacts (code, tests, models with no requirement anchor)	Carry compliance risk and inflate review cost	€2,000–10,000 per cycle for the review overhead alone
Inconsistent baselines across ALMs (requirement at v3 in DOORS, test referencing v2 in Codebeamer)	Found at release or during an audit trace walk	€5,000–50,000 per release to reconcile
Weak review coverage (change passed with insufficient review depth)	Surfaces as defects clustered in a specific subsystem	€10,000–100,000 per cluster
Standard-conformance gaps (process evidence missing for a required work product)	Assessment or regulator finding	€12,000–50,000 per finding; plus delay — see below
Delayed assessment / certification (findings have to be reworked before sign-off)	Programme slips into the next window	€20,000–200,000 per week of delay, depending on team size
Field defect from a missed verification path	Post-release recall, patch campaign, field service	€50,000 to low millions depending on industry and installed base
Audit / regulator escalation	Loss of self-assessment rights, external audit imposed	€25,000–150,000 per cycle, plus reputation impact

Not every category fires every year. A representative mid-size regulated project typically sees **2–6 of these events per year** at levels that metrics would have caught earlier. Even at the low end of the ranges, that is **€30,000–100,000 of avoided cost per year** — comfortably above the Metrix run cost at team scale, and often above the BI run cost too.

Why metrics prevent these gaps, not just reveal them. A gap discovered in a weekly or per-build metric is a design decision for the week. The same gap discovered at an audit is a programme event. The difference is not whether the defect exists — it exists in both cases — but how much work has been built on top of it before it is found. Continuous metrics cap the depth of that stack; manual reports do not.

Reading the number against the platform cost. A single prevented serious finding every two to three years covers the Metrix platform cost at team scale. A single prevented field defect of moderate size covers it for a decade. The BI equivalent carries the same prevention benefit, but has to pay for a larger run cost first.

6. Sensitivity analysis

Variable	Effect on BI stack	Effect on Metrix	Where the lever is
Source systems	+10–18 PD each to build, 0.05 FTE to maintain	+1–2 PD each, essentially zero maintenance (connectors are vendor-maintained)	**BI grows linearly, Metrix barely moves**
Projects	+15–30 PD each	+0.5–1 PD each	**Dominant differentiator**
Metrics	+2–5 PD each	+0.25–0.5 PD each	4–10× gap
Internal vs. external staffing	±€60,000 in year 1	±€10,000 in year 1	BI exposure is larger
Grafana OSS vs. Enterprise (or Power BI Pro vs. Premium, or Tableau Creator seat count)	±€25,000–140,000 p. a.	fixed	affects BI only
Connector change forced by ALM vendor update	2–5 PD per incident	**€0** (Collaborative Support Service)	one of the hidden levers against BI
Data volume	negligible	negligible	neither

Single most important finding. The BI calculation is sensitive to *every* kind of change in the source landscape. Metrix is not — the DSL abstracts over the source system, and connector maintenance stays with the vendor.

7. Costs that routinely get missed

1. **Metric validation.** Required in both worlds, but considerably more expensive on custom ETL because the SQL chain is longer and has to be re-walked every time a source schema moves. In Metrix the DSL definition *is* the specification; validation concentrates on semantics, not on plumbing.
2. **Vendor API surcharges.** A few ALMs license API or integration access separately. Equal risk on paper, higher impact for BI because each ETL pipeline usually authenticates on its own and multiplies the touchpoints.
3. **Dashboard governance.** Without ownership rules, dashboards drift into dozens of near-duplicates with conflicting definitions. Observed routinely in Grafana / Power BI / Tableau deployments. In Metrix the formal, versionable `.mxb` definition caps the drift by construction.

4. **ETL outages.** Source schema or API changes break pipelines typically 2–4 times a year at 2–5 PD each. Covered by the Metrix **Collaborative Support Service** at zero charge.
5. **Knowledge concentration.** ETL pipelines tend to be tacit knowledge held by one or two people. When they leave, reconstruction costs 20–40 PD. `.mxb` files are readable, versioned and reviewable.
6. **Specialist-dependency premium and cross-team communication cost.** The two biggest costs that never appear in a licence calculation (see §2.7). A BI stack needs a scarce profile — SQL + DAX / VizQL + ETL + dimensional modelling — carrying a day-rate premium and a bus-factor risk. It also forces every metric through a translation loop between engineering and the BI team, taking engineering capacity off delivery. Metrix bypasses both: domain engineers author `.mxb` metrics directly (§3.7). Typical indirect cost absorbed on the BI side: **≈ €35,000 in year 1 and ≈ €25,000 p. a. thereafter** for a 25-member team.

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8. Technical reason this is cheaper

Grafana, Power BI and Tableau are **presentation layers over queries**. Multi-stage traceability metrics have to be computed *before* they reach the BI tool:

Metric	In BI?	In Metrix?
Requirement counts by level, status, ASIL	✅ straight SQL	✅ one DSL line
Coverage across one level	✅ JOIN + COUNT	✅ DSL primitive
Time series over snapshots	✅ core capability	✅ baselines
End-to-end coverage across 4 ALMs	⚠️ only via ETL pre-computation	✅ cross-ALM primitive, single run
Orphaned requirements across the chain	⚠️ recursive, complex	✅ DSL primitive
Probability of dangerous Failure per Hour (PFH) sums, ASIL decomposition	⚠️ pre-compute in ETL	✅ DSL type system
Portability between projects	❌ rebuild	✅ copy the `.mxb` file

Architecture choice with direct cost impact. On BI you end up pre-computing in the ETL layer; every new metric increases ETL complexity. In Metrix the metric definition *is* the query language, and even complex cross-ALM metrics stay a one-liner. That is what keeps year-2 operating cost down.

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9. Limits and honest framing

- **Metrix starts in engineering, but is not structurally limited to it.** Today's connectors target ALM, test management and software-engineering tools. The underlying architecture — formal metric Domain-Specific Language (DSL), portable `.mxb` definitions, direct source-system queries — applies to any domain where a team needs auditable, reproducible metrics across multiple tools. Sales, finance, procurement, manufacturing or quality teams can be brought onto the same platform by

adding the relevant connectors. Under the **Collaborative Support Service**, new connectors are prepared by T4Test at **no additional cost to the customer**, because every connector strengthens the product. For a non-engineering team joining an existing Metrix deployment, the marginal cost is essentially the per-seat licence line — infrastructure, platform knowledge and process coaching are already in place. In practice this means an organisation can start with an engineering team on Metrix and expand it to other functions over time, rather than maintaining a separate BI stack per domain.

- **A BI setup can be the right choice** for a one-off pilot with two sources, ten metrics and no cross-ALM queries. It stops being the right choice as soon as the setup scales to a full organisation.
- **Licence cost is not the deciding factor.** In both models, people cost carries 70–90 % of TCO. Deciding on the licence line alone solves the wrong problem.
- **Figures are modelled estimates.** They draw on documented market pricing and T4Test's project experience from 2024–2026. They are not a quote and do not replace a bid.

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10. Recommendation

1. **For a 25-person regulated-development team, start directly on the Enterprise bundle.** One licence per member, €15,000/year, with onboarding, training, coaching, sample library (templates across ISO 26262, DO-178C, IEC 62304, IEC 61508 and related standards) and connector support included. Lead time to the first defensible dashboard: 4–8 weeks. For 5–10-person teams, the Team Bundle (€3,000/year) delivers the same capability at proportionate scale.
2. **A smaller pilot is possible via the Team Bundle** (€3,000/year, 8 seats) if the team wants to validate on two sources and ten metrics before scaling to 25. The upgrade carries the metric definitions forward.
3. **Extend Metrix beyond engineering when it makes sense.** Sales, quality, procurement or manufacturing teams that need cross-tool, auditable metrics can be added to the same deployment. New connectors are prepared by T4Test under the Collaborative Support Service at no additional cost. A BI platform remains appropriate for ad-hoc exploratory reporting and for teams whose data needs are better served by free-form query and visualisation than by formal, reproducible metric definitions.
4. **Do not pin the business case to time savings alone.** Risk avoidance is the sturdier half of the argument in either setup; with Metrix the time saving pays for itself on top.
5. **Use the Collaborative Support Service** as part of the operational plan. It removes the single most common line item that erodes a BI business case — connector upkeep.

Appendix A — Worked calculation for the reference scenario

A.1 BI stack + SQL, year 1 (typical, team of 25)

```
 Licences            €0        (Grafana OSS)
Infrastructure  €10,500
  = 1 × BI server (single node)      €3,000
  + PostgreSQL (single node)         €4,500
  + ETL host                         €2,000
  + Backup                           €1,000

People         €112,000
  = 140 PD × €800 blended rate
  Including:
    4 sources × 14 PD ETL         = 56 PD
    20 metrics × 1 PD dashboard   = 20 PD
    17 PD architecture
     7 PD DBA
     7 PD platform
     7 PD security
    12 PD validation
     6 PD documentation / training
    10 PD project management
                ─────────
Total year 1   €122,500
```

A.2 PROmeter Metrix, year 1 (typical, team of 25)

```
 Licences         €16,500   (Enterprise 25-licence bundle €15,000
                            + 1 × Server Execution €1,500 — bundle
                            includes onboarding, training, coaching,
                            sample library, connector support)
Infrastructure    €1,000   (central metric library)

People           €28,000
  = 35 PD × €800 blended rate
  Including:
    4 sources × 1.5 PD connector cfg = 6 PD
    20 metrics × 0.4 PD DSL          = 8 PD
     5 PD architecture / scope (rest covered by included coaching)
     7 PD report templates
     7 PD validation
     3 PD documentation
     5 PD project management
                ─────────
Total year 1    €45,500
```

A.3 Steady-state delta (typical)

```
 BI stack          €90,500 p. a.
PROmeter Metrix   €43,500 p. a.
———————————————————————————————
Delta             €47,000 p. a. in favour of Metrix
```

Appendix B — Abbreviations

Abbr.	Expansion
ALM	Application Lifecycle Management
API	Application Programming Interface
ARR	Annual Recurring Revenue
ASIL	Automotive Safety Integrity Level (ISO 26262)
ASPICE	Automotive Software Process Improvement Capability dEtermination (Automotive SPICE)
ARP 4754A	Aerospace Recommended Practice — guidelines for development of civil aircraft and systems
AWS	Amazon Web Services
BI	Business Intelligence
BSI C5	Bundesamt für Sicherheit in der Informationstechnik Cloud Computing Compliance Criteria Catalogue
CMK	Customer-Managed Key (used with AWS KMS)
DPIA	Data Protection Impact Assessment (EU GDPR Art. 35)
DAL	Design Assurance Level (DO-178C, DO-254)
DO-254	Design Assurance Guidance for Airborne Electronic Hardware
EN 50128 / EN 50129	Railway applications — software / system safety
EU MDR	European Union Medical Device Regulation 2017/745
FDA 21 CFR 820	US FDA Quality System Regulation for medical devices
GDPR	General Data Protection Regulation (EU 2016/679)
IEC 62304	Medical device software — software life-cycle processes
IEC 62443	Industrial automation and control systems — security
ISO 13485	Medical devices — Quality management systems
CI/CD	Continuous Integration / Continuous Delivery
DBA	Database Administration / Database Administrator
DO-178C	Software Considerations in Airborne Systems and Equipment Certification
DSL	Domain-Specific Language
ETL	Extract, Transform, Load
FTE	Full-Time Equivalent (one headcount-year of effort)

Abbr.	Expansion
HA	High Availability
IEC 61508	Functional safety of electrical / electronic / programmable electronic safety-related systems
ISO 26262	Road vehicles — Functional safety
ISO 27001	Information security management systems
KMS	Key Management Service (AWS)
MCP	Model Context Protocol — open standard for exposing tools and data to AI agents
MS	Microsoft
OSS	Open-Source Software
p. a.	per annum (per year)
PD	Person-Day (one person-day of effort, ≈ 8 hours)
PFH	Probability of dangerous Failure per Hour
RBAC	Role-Based Access Control
ROI	Return on Investment
S3	Amazon Simple Storage Service
SCP	Service Control Policy (AWS Organizations)
SIL	Safety Integrity Level (IEC 61508, EN 50129)
SQL	Structured Query Language
SSO	Single Sign-On
TCO	Total Cost of Ownership
TISAX	Trusted Information Security Assessment Exchange (automotive industry info-security assessment)
TLS	Transport Layer Security
VM	Virtual Machine
VPC	Virtual Private Cloud (AWS)
VPN	Virtual Private Network
`.mxb`	Metrix Book — portable, versionable metric definition file

Product and tool names (Grafana, Power BI, Tableau, DOORS, Codebeamer, Polarion, Jira, Azure DevOps, MKS/Windchill RV&S, PostgreSQL, Git, Jenkins, GitLab CI, GitHub Actions) are used as proper nouns and are not abbreviated further.

Appendix C — Sources

- Internal calculation *Grafana On-Premise with PostgreSQL — Cost and Economics*, T4Test, November 2026.
- *PROmeter Metrix — Pitch for Pure Solution*, T4Test, October 2026 (Enterprise bundle inclusions, connector policy).
- *Ketryx vs PROmeter Suite Deep Dive*, T4Test, September 2026 (cross-ALM positioning).
- *PROmeter Suite Market Analysis*, T4Test, September 2026 (pricing reference, average revenue per customer).
- Grafana Enterprise Pricing 2026 (costbench.com); Grafana Cloud Pricing 2026 (monitoringcost.com); Grafana Pricing Teardown 2026 (dev.to/beton); Tableau Server 2026 (Salesforce); Power BI 2026 (Microsoft).

Draft — before publication, cross-check current list prices and confirm the exact composition of the 25-licence Enterprise enablement bundle with Sales. The main driver (people cost over three years) is insensitive to ±20 % licence variance; under Grafana Enterprise or Tableau the gap in favour of Metrix grows, not shrinks.