



## Article

# Improving Mechanisms to Ensure Financial Sustainability of Energy Companies in the Context of Digital Transformation

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**Abstract:** Financial sustainability in energy companies increasingly depends on the ability to keep tariffs affordable while maintaining reliability, funding asset renewal, and responding to energy-transition pressures. Digital transformation has moved from “nice-to-have IT” to a core financial lever because it can reshape operating cost structures, reduce technical and commercial losses, strengthen cash collection, and improve capital allocation discipline through data-driven planning. International analytical work also stresses that digitalisation brings material risks—especially cyber and data governance—which must be managed as part of the business model, not treated as a side issue. In parallel, investors and lenders are demanding decision-useful disclosure of sustainability-related risks and opportunities that can affect cash flows, access to finance, and the cost of capital, which increases the value of trustworthy digital measurement, control systems, and reporting pipelines.

**Keywords:** Financial Sustainability, Energy Companies, Digital Transformation, Advanced Analytics, Smart Metering, Revenue Assurance

## 1. Introduction

Energy companies operate in a difficult financial triangle: they must provide continuous and safe service, keep prices politically and socially acceptable, and still generate enough cash to maintain aging infrastructure and invest in modernization. The strain is amplified by volatile fuel and power markets, tightening reliability expectations, and rising capital needs for decarbonisation, grid reinforcement, flexibility, and cybersecurity. In most systems, the weak link to sustainability is less a failure of engineering capability than of financial plumbing — losses between generation and billing; billing and collection gaps; underpriced risk; deferred maintenance that becomes emergency spending; and poorly prioritize capital programs. In such contexts, financial sustainability is not a buzz-word; it is the real capacity to sustain liquidity and balance sheet strength while perpetually funding operations and investment even through shocks [1].

Digital transformation matters here because it changes how value is produced and protected. It is not limited to installing new software; it is the redesign of processes, decisions, and accountability using data, automation, and analytics across the full value chain—from customer connections and metering, to dispatch and grid operations, to asset replacement planning, to financial reporting and risk management. International evidence has long argued that digitalisation can improve efficiency and sustainability of energy

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systems while also raising new security and disruption risks [2]. The question for financial sustainability is therefore not “Should we digitalise?” but “Which digital mechanisms measurably improve cash flow, reduce risk, and improve capital productivity—and how do we implement them without creating new fragilities?”

This article develops an applied framework: (1) identify the primary financial failure modes in energy companies (cost leakage, revenue leakage, and capital inefficiency); (2) map them to digital mechanisms that address root causes; and (3) embed the mechanisms in governance, disclosure, and financing logic so that benefits are sustained, auditable, and investable [3]. A key assumption is that digital transformation must be treated as a financial program with explicit value pools, not as a technology project with vague promises.

## 2. Methodology

A useful way to structure financial sustainability is to view it as the outcome of five interlocking capabilities: operational efficiency (the cost base), commercial efficiency (revenue integrity and working capital), capital efficiency (investment productivity), risk resilience (the volatility of outcomes), and financial credibility (access to finance and cost of capital). Digital transformation can strengthen each capability, but only if it is designed around concrete mechanisms and measurable targets.

Mechanisms that compress the operating cost base through data-driven operations [4]. Energy companies often carry structural operating costs driven by preventive maintenance routines that are not risk-based, fragmented work management, and limited visibility into asset condition. Digital operations address this by shifting from calendar-based maintenance to condition-based and risk-based maintenance, supported by IoT sensors, advanced analytics, and integrated work execution. When analytics are embedded in asset management, the company can forecast failures, prioritize interventions, and avoid expensive emergency repairs and outage penalties [5]. A detailed case perspective presented in a utility context shows that advanced analytics in asset management can unlock major savings that translate into profit-and-loss improvements or reinvestment capacity—reported ranges include reductions in operating expenses and large reductions in capital expenditures when replacement decisions become risk-based rather than rule-based [6]. Financially, the mechanism works because it converts uncertain “break-fix” costs into planned interventions and improves the marginal productivity of every maintenance dollar. Strategically, this is not about buying an analytics tool; it is about rebuilding the decision logic of maintenance and renewal with transparent risk metrics, so finance teams can forecast O&M with less variance and regulators can see the rationale behind cost recovery.

Yet another cost model shows how digitalisation needs to be done together with redesigning workforce and process [7]. While automating dispatching, scheduling, and reporting will reduce manual overhead, the operating model must change, in terms of a clear product owner of the digital systems, standardized data definitions and disciplined coordination between relevant stakeholders to decommission legacy tools, which are redundant. Otherwise, companies digitise on top of chaos and double the spend—once on legacy processes and once on the new platforms [8]. This implies sustainable cost compression hinges on one operational backbone — an Integrated Asset Registry, Unified Work Management and a Data Platform enabled to support analytics and automation at scale. The financial logic should be transparent—for every digital initiative, there needs to be a line-of-sight to lower unit-cost (per km of network, per customer, per MWh delivered), lower compensation for outages, or lower contractor spend—and those savings must be reflected in budgets (not absorbed in “more projects”).

### 3. Results and Discussion

Mechanisms that improve revenue integrity and working capital through smart commercial control [9]. For many energy companies, the largest hidden value pool is not reducing costs but stopping leakage of revenue between delivery and cash collection. Digital transformation attacks revenue leakage through advanced metering infrastructure (AMI), improved billing accuracy, fraud/tamper detection, and faster cycle times from meter read to invoice to payment. World Bank experience notes that improving system performance and AMI is among the fastest and most cost-effective response directly addressing the utility cash constraint through revenue collection. The financial sustainability mechanism is simple: better measurement and control lead to fewer commercial losses, higher billed energy as a share of delivered energy and faster collections which both reduces dependence on short-term borrowing and delays the piling up of arrears [10].

However, AMI is only an equipment upgrade until it is coupled with revenue protection and customer management. This World Bank knowledge note further underscores that the deployments which address revenue constraints can have a good prospect and brings out improved revenue collection, as a key benefit [11]. This aligns with a disciplined commercial transformation: segment customers by risk and payment behavior, use data to trigger targeted interventions (warnings, remote disconnect/reconnect where permitted, prepaid solutions, or payment plans), and create dashboards that link technical events (outages, voltage issues, meter tampering) to financial outcomes (write-offs, disputed bills, delayed payments). When billing disputes are resolved faster with granular interval data, companies reduce bad debt expense and improve customer trust—both of which have a measurable financial effect.

**Table 1.** Fact-based impacts of digital mechanisms on the financial sustainability of energy companies.

Digital mechanism	Reported / quantified result (fact)	How it improves financial sustainability
Advanced Metering Infrastructure (AMI) + Revenue Protection Program (RPP)	At an average tariff of \$0.05/kWh, commercial losses of ~353 TWh ≈ \$17.6B (over 6 years, 12 countries)	Higher billed energy and fewer leakages → stronger cash inflows → improved liquidity and working capital
Early revenue-assurance results (utility examples)	Some utilities reported reducing losses from ~40% to the low teens	Loss reduction closes the “revenue gap” → lower arrears and short-term borrowing pressure
Targeting large customers (revenue concentration)	In many utilities, 1–2% of customers can account for ~50–60% of revenue	Better control over the biggest cash contributors → more stable revenue and collections forecasting
Kenya Power (KPLC) large-customer focus (AMI/RPP context)	~2% of customers account for ~72% of revenue; commercial losses reported as reduced by about half after intervention	Reduced revenue risk from top accounts → stronger cash discipline → improved credit profile and financing conditions
Advanced analytics in utility asset management (case example)	OPEX savings: 20–25% and CAPEX savings: 40–60% (UtilityCo case, 2021)	Lower cost base + better capital prioritization → higher margins, better interest coverage, more investment headroom

Table 1 consolidates fact-based evidence showing how specific digital transformation mechanisms translate into measurable improvements in the financial sustainability of energy companies. The table makes a central point clear: digitalisation creates value not only through “better technology,” but through financially traceable

mechanisms—revenue protection, working-capital strengthening, operating-cost compression, and capital productivity gains—each of which affects liquidity, solvency, and long-term investability.

Working capital mechanisms also include digital payment channels and automated reconciliation. In many environments, cash collection is slowed by physical payment points and manual reconciliation, which creates delays, leakages, and opportunities for fraud. A digital-first collection ecosystem—mobile payments, e-invoicing, instant receipts, and automated matching—reduces the average days sales outstanding and stabilizes cash flow. The key is governance: revenue assurance must be a cross-functional accountability between operations, customer service, and finance, with shared KPIs such as loss rates, collection rates, dispute cycle time, and write-offs. Otherwise, AMI data sits in a database while the utility continues to bleed cash through old processes.

Figure 1. Fact-based digital-to-financial value mechanisms for energy companies

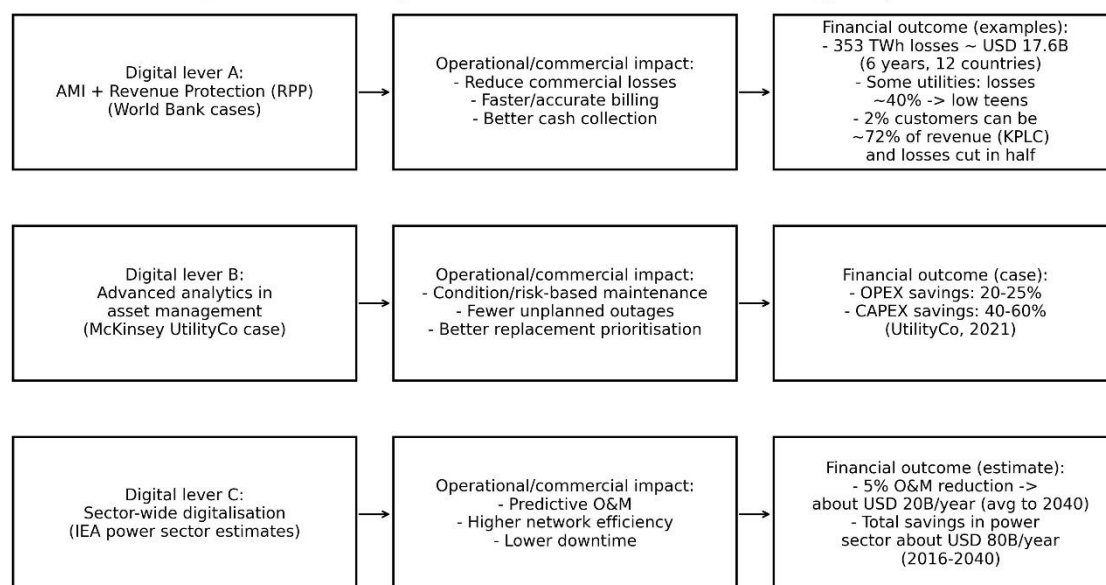


Figure 1 visualizes, in a compact cause–effect chain, how digital transformation initiatives in energy companies translate into financial sustainability outcomes through operational and commercial mechanisms. The diagram is structured in three horizontal pathways. Each pathway begins with a digital lever (left column), moves through an operational/commercial impact (middle column), and ends with a financial outcome supported by reported facts (right column). This structure is deliberate: it indicates that digitalisation impacts financial performance in measured business processes (metering and revenue protection, asset maintenance and renewal decisions, and system-level efficiency) instead of acting as isolated IT upgrades.

Methods of boosting the productivity of capital via digitization of planning and portfolio governance While operating costs may take a larger share of the pie, it is capital programs that are too big, too slow, or simply misprioritized that often break financial sustainability. Digital channels enhance the productivity of capital by improving forecasting accuracy and prioritization quality. The ability of advanced analytics to estimate probability of failure and consequence of failure, enhances the visibility of risk and allows utilities to target their investments where they provide the most risk and customer impact reduction. The capital implication is “heading room by design”: the firm delivers lower reliability with less capex, or the firm delivers higher reliability with the same capex—both actions enhance credit and stakeholder confidence [12].

Besides asset substitution, these digital twins and linked grid models have the potential to consolidate engineering, demand forecasts, distributed energy resources (DERs), and climate impacts into a single planning context. This lowers the risk of

stranded investments and enables scenario-based planning: what if-load patterns under electrification, grid reinforcements needed for renewables integration, how heatwaves or floods change failure probabilities, how storage and demand response can defer capex [13]. Scenarium planning, importantly, become tool of financing: lenders / investors provide willing long term capital only in the presence of credible, data-backed transition plans and risk management, packed in a report, and only if the ambition is specific and tailored rather than generic. This is how digital planning is actually connected to cost of capital.

Capital governance must also change. Embed stage-gates and prove benefits within the continuum of the investment lifecycle — every digital project has a baseline, a forecast benefit, and a post-implementation benefit verification process utilizing actual operational and financial data. If there are no benefits, the company either changes the process or withdraws financial investment in the initiative. This is the needed “capex disciplinary force,” because otherwise digital programs can just become endless pilots. Financial sustainability requires that digital transformation earns the right to scale by creating proven value

Mechanisms that reduce volatility through integrated risk resilience—cyber, operational, market, and climate. A financially sustainable company is not only profitable on average; it is resilient under stress. Digitalisation can reduce operational volatility by improving reliability and reducing outages through predictive insights, but it can also increase exposure to cyber risks and systemic failures if IT/OT integration is poorly governed. International analysis has warned that digitalisation in energy brings promise alongside security and privacy concerns and economic disruption. Therefore, cyber resilience is a financial mechanism: preventing major disruptions protects revenue, avoids emergency spending, and protects reputation, which influences regulatory treatment and financing access [14].

Similarly, climate risk has legitimately joined that group: impacting assets, demand, prices and policy constraints. Climate risk is material when it has the potential to impact cash flows, access to finance or the cost of capital, and is therefore a financial risk event. IFRS S1 clearly mandates the disclosures to neighbouring material sustainability-related risks and opportunities that are reasonably likely to impact cash flows, access to finance, or cost of capital [15]. That requirement increases the value of digital measurement and traceability, because disclosures must be based on reliable internal systems rather than ad hoc spreadsheets. Companies that cannot evidence their risk assessments and transition plans face credibility discounts, while those with strong data pipelines may secure better financing terms or broader investor access.

#### 4. Conclusion

In the context of the energy transition and heightened stakeholder expectations, financial sustainability is increasingly determined by the company’s ability to protect cash flow, allocate capital efficiently, and credibly manage risks. Digital transformation provides powerful levers, but only when it is framed as a financial architecture rather than a technology upgrade. Cost-side mechanisms such as advanced analytics in asset management can convert maintenance and renewal into risk-based decisions that unlock operating and capital efficiencies. Revenue-side mechanisms, especially AMI+revenue assurance, can decrease commercial losses and significantly bolster collections, enhancing liquidity, and decreasing reliance on borrowing. Risk mechanisms, in turn, must treat cyber and climate exposure as financial variables, in line with an increasing need to report on sustainability-related issues that impact cash flows and cost of capital. Last but not least, financing mechanisms increasingly incentivize companies that are legible in the digital world and credible in the operational world, as controllability and transparency are prized features in uncertain environments.

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