The Reform Trinity: A Tripartite Framework for Utility Reform

Lessons for Papua New Guinea's Electricity Sector

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July 22, 2025

PNG Power – Challenges

- Low performance, ongoing financial distress, limited expansion of access. (Kabuni et al 2021; Jacobs, 2024; Sandhu et al, 2020)
- Challenges are consistent with patterns observed in state-owned utilities across developing countries, where political economy constraints often hinder effective reform (Dornan, 2014; Godinho and Eberhard, 2019; Nepal and Jamasb, 2012; Nepal and Sofe, 2024; Rijal, 2019).
- Challenges include:
  - freeze on tariff adjustments (2013-2025)
  - Political interference in operational decisions (Jacobs,2024; Sandhu et al, 2020)
  - Repeated government bailouts (Kabuni et al., 2021)

Overview and Motivation

- PNG Power (PPL) is stuck in a *low-effort, bailout-dependent equilibrium*
- Piecemeal reform won't work.
- **Reform Trinity** model:
  - Tariff adequacy
  - Incentive-compatible governance
  - Credible fiscal discipline (hard budget constraint)
- The Reform Trinity provides a diagnostic tool and guide for policy
- Dervied from principal-agent model (govt=principle, manager = agent)

Literature Review (1/2): Core Foundations

Soft Budget Constraints:

- Kornai (1980); Kornai, Maskin, and Roland (2003) show how repeated bailouts erode managerial discipline and distort enterprise behavior.

Governance and Incentives:

- OECD (2015), Komives et al. (2005), and Estache and Wren-Lewis (2009) emphasize board independence, managerial accountability, and protection from political interference as keys to utility performance.

Tariff Adequacy:

- Dornan (2014, 2018), World Bank (2017), and Nepal and Sofe (2024) document how politically constrained pricing undermines utility revenue and deters investment.

Literature Review (2/2): Partial Reforms and Contribution

Partial Reform Failures:

- Nepal and Jamasb (2012), Godinho and Eberhard (2019), and Rijal (2019) show that reform success depends on aligning multiple levers—governance, pricing, and fiscal discipline.

Pairs of Conditions Studied:

- Pricing and Governance: Jamasb et al. (2017); Godinho and Eberhard (2019); Sandhu et al. (2020)
- Governance and Fiscal Discipline: Komives et al. (2005); Estache and Wren-Lewis (2009)
- Pricing and Fiscal Discipline: Foster and Rana (2020)

This Paper's Contribution:

- First to formally model the *joint interdependence* of all three pillars—tariff adequacy, incentive-compatible governance, and fiscal discipline—in a unified theoretical framework.

The Reform Trinity Framework

Three Interdependent Conditions

1. **Tariff Adequacy (p):** Utility must be allowed to earn enough revenue to cover costs.
2. **Incentive Strength (θ):** Managers must be rewarded for performance / have autonomy in decision-making
3. **Budget Constraint Hardness (h):** Losses must not be bailed out.

Key insight: *All three conditions must be met* to escape the low-effort trap. Reform fails when even one pillar is weak.

Model Foundations: Revenue, Cost, and Profit

Model a principal-agent relationship between the government (principal) and utility manager (agent). Manager chooses effort, e, which affects both revenue collection and cost reduction.

Utility Operations

$$\begin{aligned} \text{Revenue:} \quad & R(e) = p \cdot e \\ \text{Cost:} \quad & C(e) = c - \mu e \\ \text{Profit:} \quad & \pi(e) = R(e) - C(e) = (p + \mu)e - c \end{aligned}$$

- p: tariff per unit
- c: cost with zero effort
- μ: efficiency gain from effort

Effort raises revenue and reduces cost. The manager's choice of e *shapes outcomes.*

Manager's Objective and Incentives

Utility manager chooses effort to maximize utility, considering profit incentives and effort costs.

Manager's Utility Function

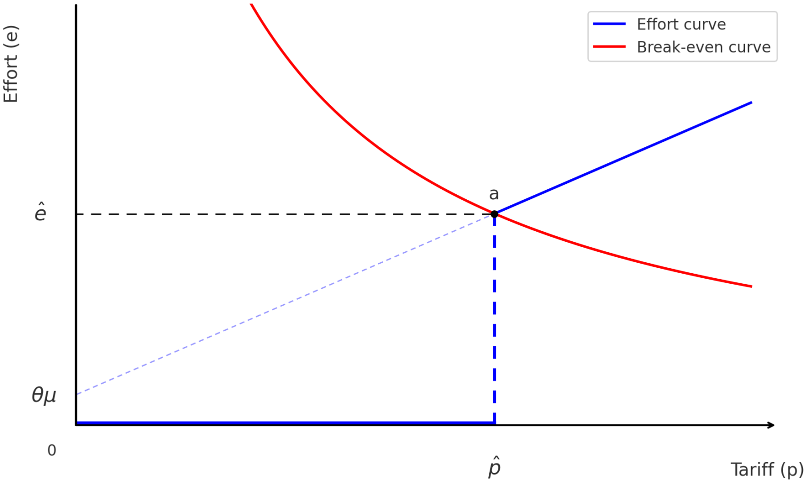
$$U_M(e) = \theta \cdot h \cdot \pi(e) - \frac{1}{2}e^2$$

Where:

- $\theta \in [0, 1]$: incentive strength (performance-based governance)
- $h \in [0, 1]$: budget constraint hardness ($1 =$ no bailout, $0 =$ full bailout)
- $\pi(e) = (p + \mu)e - c$: operating profit
- $\frac{1}{2}e^2$: convex disutility of effort

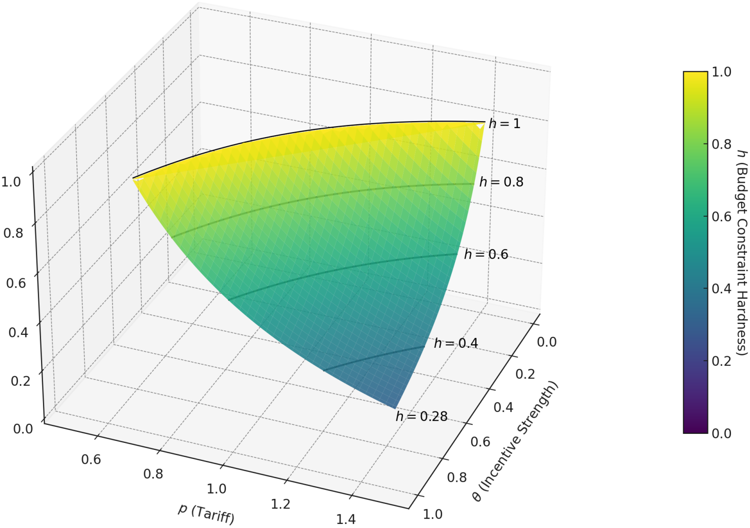
Interpretation: Managers only exert effort when profits matter. A soft budget ($h = 0$) eliminates incentive to perform.

Effort-Tariff Tradeoff Diagram



Managers only exert effort when the combination of incentives and tariff allows break-even operation. Below this threshold, effort collapses.

The Reform Surface



Threshold

Reform Trinity Threshold Condition

High-effort, financially sustainable equilibrium:

$$\theta h(p+\mu)^2 \geq c$$

- θ — Incentive strength: performance contracts, autonomy.
- h — Budget constraint hardness: credibility of no-bailout commitment.
- p — Tariff: must be cost-reflective.
- μ — Cost savings from effort.
- c — Baseline costs (e.g., fuel, maintenance).

Condition defines the threshold for escaping the low-effort trap. All three levers must be sufficiently strong.

PNG Case: All Three Levers Misaligned

Incentive Strength (θ)

- Weak performance incentives
- Political interference in operational decisions
- Low managerial autonomy
- $\Rightarrow \theta$ is low

Tariff Adequacy (p)

- Tariffs below cost-recovery levels: frozen 2013–2025
- Political sensitive to increase
- $\Rightarrow p$ is low

Budget Constraint (h)

- Repeated government bailouts
- Implicit state guarantees
- $\Rightarrow h$ is low

Weak Governance and Incentives (Low θ) – Part I

- Around ten CEOs over past decade, many removed after political changes rather than performance (Jacobs, 2024; Kabuni et al., 2021).
- Leadership instability undermines long-term planning
- Political interference pervasive: discouraging performance-based management (Sandhu et al., 2020).
- Managers limited incentive to undertake needed reforms with long-term payoffs.

Weak Governance and Incentives (Low θ)

- Authorities intervened in tariff decisions, hiring, and investments (Jacobs, 2024; Nepal and Sofe, 2025).
- Oversight by ICCC / NEA has been limited.
- **Conclusion:** Governance environment provides little incentive for improved efficiency / effort, reinforces low-effort equilibrium.

Tariff Inadequacy (Low p)

- PPL's average tariff (p) below cost-recovery level.
- No tariff increases 2013 to 2025
- Increases overruled citing affordability (Jacobs, 2024).
- General prices and input costs continued to rise:
  - Decline in real tariffs,
  - Erosion in per-unit revenue (Nepal et al., 2023).
- High costs (c) stem from diesel reliance and aging, inefficient infrastructure (Nepal et al., 2023).

The Low-Tariff Trap

- In model terms: with constrained p, high c, and limited efficiency gains μ, we have:

$$(p + \mu)e < c \quad \text{for any feasible } e.$$

- Result: even high effort cannot restore financial viability $\Rightarrow$ low-effort equilibrium.
- Consequences:
  - Deferred maintenance and capital investment (Sandhu et al., 2020).
  - System reliability deteriorates.
  - 30% of energy lost to theft and non-payment (Post Courier, 2023).
- PPL remains structurally unable to recover costs $\Rightarrow$ entrenched bailout dependence.

Soft Budget Constraint and Moral Hazard (Low *h*)

- Widespread expectation of government bailouts undermines financial discipline.
- PPL operates with large arrears but continues receiving fuel and power from suppliers: debts treated as government-backed (Jacobs, 2024; Nepal & Sofe, 2025).
- PGK 800 million owed to IPPs in 2024 (Jacobs, 2024).
- Government entities—70% of demand—often do not pay bills on time (Kabuni et al., 2021).
- Liquidity shortfalls are met with ad hoc bailouts or debt clearances (IMF, 2020).
- **Consequence:** Financial accountability is weak, reinforcing low effort.

Bailout Culture and Its Consequences – Part II

- Repeated government support
- PPL has not defaulted—protected by an implicit state guarantee.
- No insolvency procedures or precedent for letting a utility fail (Jacobs, 2024).
- **Outcome:** Moral hazard:
  - Less incentive to reform, rely on rescue.
  - Persistent underinvestment in efficiency, cost control, and collections.
- Survival despite losses signals a persistent soft-budget regime (IMF, 2020).

Reform to increase Incentive Strength

- Incentives require stability:
  - Fixed-term executive contracts (3–5 years).
  - Legal protection from politically motivated dismissal (Sandhu et al., 2020).
- Governance reform: strengthen board independence.
  - Shift oversight toward commercial goals (Dornan, 2014).
  - Shield operations from political interference (Kabuni et al., 2021).

Tariff Reform

- Cost-recovering tariffs essential for PPL's viability (Sandhu et al., 2020; Nepal and Sofe, 2024).
- World Bank and IFC: cost-reflective pricing is key to attracting investment (World Bank, 2019a; IFC, 2021).
- Reform sequence:
  - Independent cost-of-service study
  - Multi-year phased tariff adjustment plan (e.g. 5 years) (Dornan, 2014)
- Depoliticize tariff setting (easier said than done)
  - Strengthen regulator (NEA) independence (Dornan, 2018)
  - Adopt rule-based systems: fuel pass-through, inflation indexation (Godinho and Eberhard, 2019)

Tariff Reform

- Address equity through:
  - Lifeline tariffs (e.g., first 30 kWh/month)
  - Targeted subsidies for low-income households
- Reduce costs and improve efficiency:
  - Infrastructure upgrades
  - Better metering, billing, and enforcement to tackle theft (World Bank, 2024)
- In model terms: increase μ and reduce c so that $\theta(p+\mu)^2 \geq c$

Enforcing a Hard Budget Constraint

- Hard budget constraint is essential (but difficult to enforce).
- Without it, tariff and governance reforms lose effectiveness (Rijal, 2019).
- Key actions:
  - Public commitment: PPL to operate within own revenues post-reform.
  - Legal reform to prevent ad hoc bailouts (IMF, 2020). (credible)
- Greater autonomy:
  - Allow PPL to retain earnings and borrow independently (World Bank, 2014; OECD, 2015).
  - Commercial lenders provide external pressure to maintain solvency. (partial privatization)

Nepal: From Losses to Reform – Part I

- **Pre-2016**: Nepal EA faced chronic losses, decade-long tariff freeze.
- Political interference and regular bailouts normalized poor performance (Nepal and Jamasb, 2012; Rijal, 2019).
- **2016 Reform**: New CEO with political backing increased θ (incentives).
- Aggressive actions:
  - Increased maintenance, better demand management
  - Power imports from India
  - Elimination of blackouts by 2017 (consumers onboard)

Nepal: Full Trinity Alignment

- **Tariffs**: 20% hike in 2012, further increases $\rightarrow$ raised p.
- **Budget**: 2011 debt write-off + 2016 restructuring $\rightarrow$ enforced h.
- **Outcome**: NepalEA returned to profit, paid dividends, ended bailouts.
- *Key lesson:* Success required **simultaneous alignment** of incentives, pricing, and budget rules.

Kenya: Reform and Early Success

- **1990s Reform:**
  - Unbundled vertically integrated KPLC $\rightarrow$ KenGen for generation.
  - Independent regulator established; tariffs moved toward cost recovery.
- **2000s Reform:**
  - KenGen partial IPO (30%), minority private stake in KPLC.
  - Introduced performance contracts and corporatized governance.
  - Expanded access via donor-backed connection subsidies (IEA, 2025).
- **Results:**
  - Cost recovery improved, losses reduced, access expanded.
  - Private investment and operational efficiency increased.

Kenya: Reform Reversal and Key Lessons

- **2017–2020: Reform backsliding**
  - Populist tariff freeze undermined p.
  - Government review launched in 2021 amid bailout concerns.
- **Lessons:**
  - *All three reform levers must remain aligned* to sustain success.
  - Gains can unravel if political pressures return.

Privatization in the Trinity Model

- Privatization increases θ and h:
  - Private managers face stronger incentives.
  - Governments less likely to bail out.
- But p (tariff) often remains politically controlled.
- **Result:** Privatization must be *complemented* by tariff and regulatory reform.

Conclusion

- Piecemeal reform fails. **The reform trinity must be activated.**
- PNG Power offers a textbook case of failure across all three dimensions.
- Nepal and Kenya show reform is possible if all pillars are addressed.
- This framework offers both a diagnostic and a roadmap for reform.

Thank You!

Questions welcome.