Incentive Regulation of Distribution Utilities

A Primer: Theory and Practice

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- Section 1: Economic and regulatory foundations

Basis for Public Utility Regulation

- *Natural monopoly* – high capital costs, high barriers to entry, cannot move or transfer facilities to gain new markets
- *Economic regulation* substitutes for market competition
- Prevents abuse of monopoly power – protects consumers

Double Task of Economic Regulation

- Determine the sum of revenues that a regulated utility is allowed to collect **[remuneration challenge]**
  - Operating costs
  - Investment costs (return of and on investment)
- Determine how the revenues will be collected **[tariff challenge]**
  - Cost allocation
  - Rate design

Remuneration Challenges

- A regulated utility's realized costs depend on:
  - its underlying cost opportunities [i.e. whether is it a high-cost or low-cost utility]
  - the decisions made by its managers to exploit cost saving opportunities

Utility managers know more about their cost opportunities than the regulators

Regulators cannot directly observe managerial effort

Incomplete information introduces *information asymmetries*

Opportunity for *“strategic behavior”*

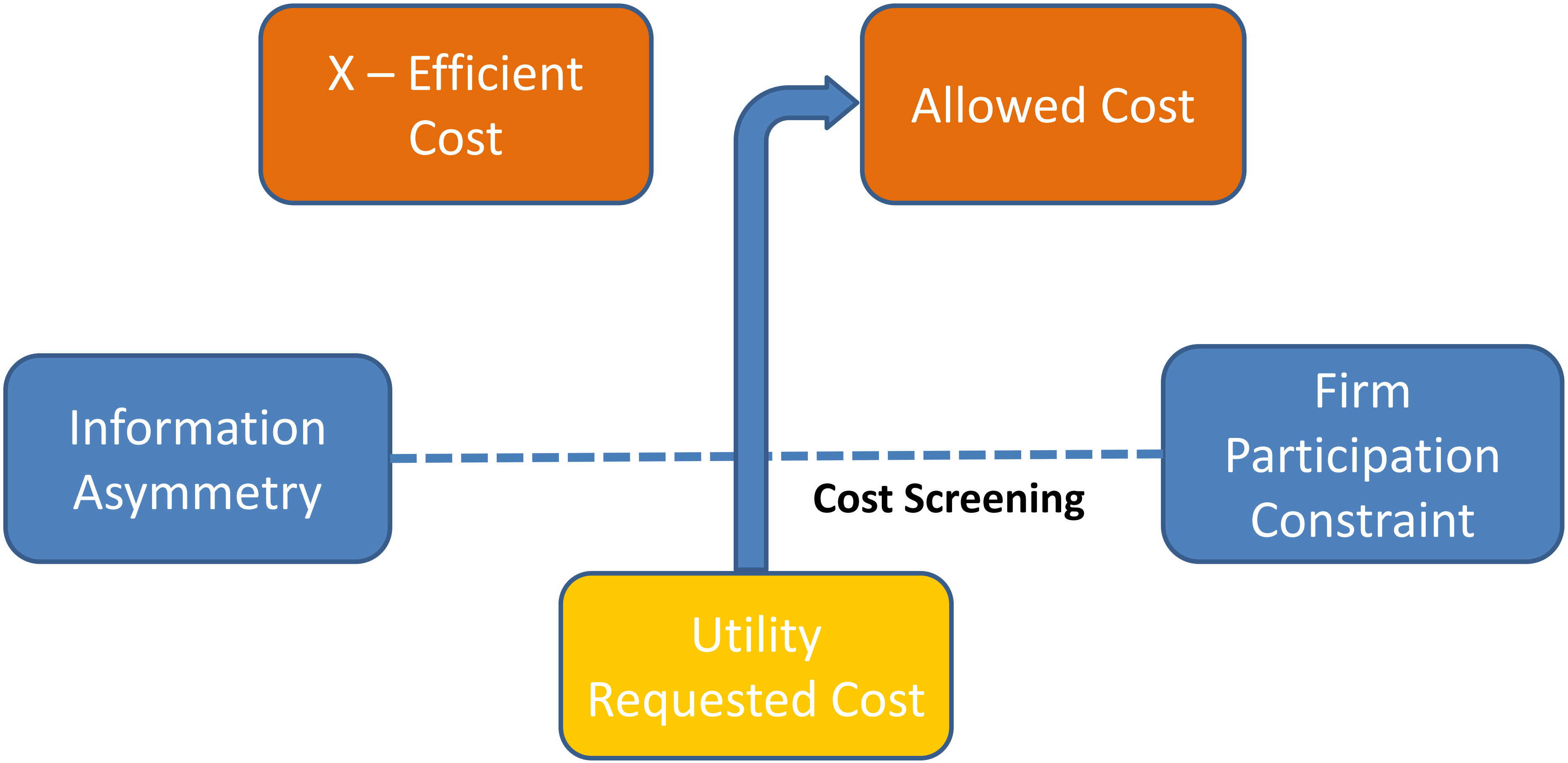
- Utility may attempt to use its information advantage in the regulatory process to increase its allowed revenues and profits (or other objectives)
  - convince the regulator that it is a higher cost firm than it really is
  - take advantage of the regulator’s need to ensure the financial viability of the utility [**firm participation constraint**]

Firm "Participation Constraint"

By participating in the regulatory process, the regulated firm remains financially sound [viable]

- Reverse game theory
  - the goal (outcome) is given:
    - the financial viability of the firm is never harmed.
  - regulatory mechanisms are selected by the regulator to achieve such goal [e.g. an *incentive mechanism*]

Regulators face an ***adverse selection*** problem



Adverse selection occurs when there's a lack of symmetric information prior to a deal between a buyer and a seller [*Investopedia]*

Economic Efficiency: Definitions

- **Productive efficiency:** the degree to which a firm minimizes the inputs used to produce a given level of output
- **X – efficiency**: the degree of productive efficiency under conditions of imperfect competition.
  - x-efficiency theory asserts that under conditions of less-than-perfect competition, inefficiency may persist. [Investopedia]

Cost

- **Allocative efficiency:** occurs when price equals the marginal cost of production (perfectly competitive market). Monopolies can increase the price above the marginal cost of production (allocative inefficiency)
- **Economic rent:** generally, unearned income

Price

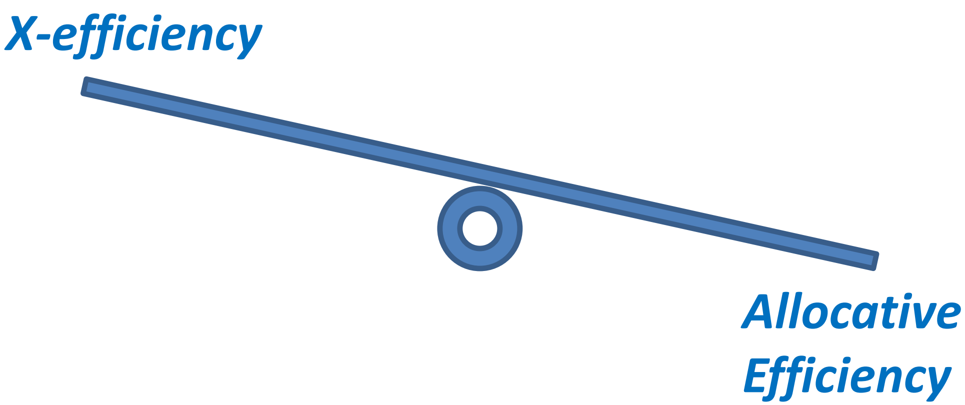
Remuneration Challenges Continued

Cost-of-service vs Incentive Regulation

Regulators attempt to balance the **tradeoff** between:

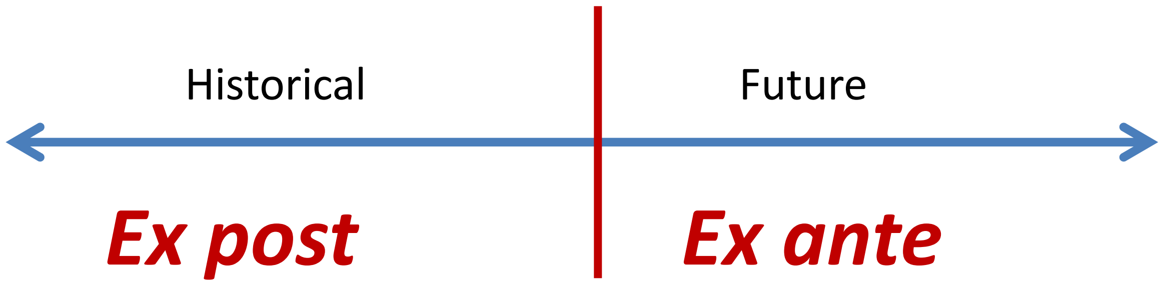
Incenting managerial effort to pursue cost savings [x-efficiency]

Minimizing abuse of market power (economic rents) collected from ratepayers [allocative efficiency]



Regulatory Process Definitions

- ***Ex post*** - Latin "*after the fact*" – review based on historical costs, revenues, earnings
- ***Ex ante*** – Latin "*before the event*"- review based on projections of costs, revenues, earnings or actions planned for the future period



- Section 2: Cost-of-Service regulation and Incentive regulation [contrasted and compared]

Cost-of-Service Regulation Defined

Allowed revenues set equal to realized costs plus a return on investment

In theory

- A regulatory mechanism where the firm is assured that it will be compensated for all of the costs of production that it actually incurs.
  - No "excess profits" left on the table since revenues are equal to "actual" (pro-forma) costs
  - No ***ex post*** renegotiation [retroactive ratemaking prohibited]

In practice

- The firm is given an opportunity to earn its authorized rate of return – but not a guarantee
- The "**used and useful**" standard allows the removal from rate-base of net plant that is no longer providing service, [or the level of service intended]

Cost-of-Service Regulation Pros and Cons

Pros

- **Minimizes the impact of uncertainty**
  - Allowed revenues meaningfully tied to the firm's realized [pro-forma] costs
  - Frequent *ex post* reviews
  - Limited return
  - *Ex post* recovery of CAPEX
- **Readily ensures that utility remains financeable** [meet the *firm participation constraint*]
- **Maximizes allocative efficiency**

Cons

- **Significant x-inefficiency**
  - Blunted management incentive to pursue cost savings [especially long-term savings]
  - Managerial ***moral hazard*** issue (cost borne by ratepayers)

Moral hazard occurs when one person takes more risks because someone else bears the cost of those risks [*Wikipedia*]

Incentive Regulation Defined

- Regulatory mechanisms designed to provide powerful <u>economic incentives</u> for regulated firms to:
  - reduce costs
  - make efficient infrastructure investments
  - improve service quality (in a cost effective way)
  - provide efficient pricing of regulated services.
  - introduce new services

- Diverse range of mechanisms
- Weakens the link between utility costs and rates

- Two key attributes:
  - automatic adjustment mechanisms
  - uses external data to set allowed revenues

Incentive Regulation
Pros and Cons

Regulator caps allowed revenues or prices *ex ante* for a set period

Pros

- Powerful incentive to optimize x-efficiencies
  - Empowers managerial efforts to reduce costs below price or revenue cap
  - Earnings depend on "beating the cap"

Cons

- Reduces allocative efficiency
  - Potential for significant economic rents
- Significant exposure to uncertainty/risk
  - Allowed revenues based on exogenous (non-utility) metrics
  - Incurs the full cost of "adverse selection"
    - Regulator must set high prices to ensure firm participation constraint met

Actual Implementation - Less Distinction Between Approaches

Cost of Service

- **Use of fully projected (*ex ante*) test-year**
  - Disconnects allowed revenues from realized [pro-forma] costs
  - Softens benefits of regulatory lag [associated with use of an historical test-year and with case processing delays]
  - Project pre-approval weakens X-efficiency incentives
  - Increases adverse selection issue
- ***"Used and useful"* standard rarely exercised**

Incentive Regulation

- Periodic ratchets of revenue or price cap
  - Realign revenues with actual (x-efficient) cost trends
  - Transfers economic savings from utility to ratepayers [increases allocative efficiency]
- Revenue sharing
  - creates nexus between allowed revenues and actual costs

Evolution Will Impose New Demands and Increased Competition on Utilities

Evolutionary drivers:

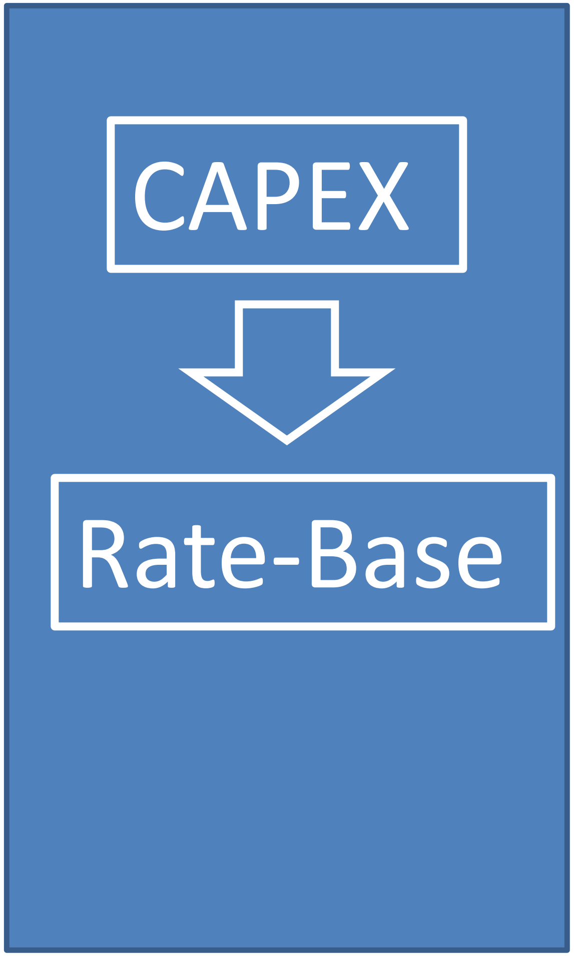
- Will require utilities to focus on delivering improved **outputs** at a competitive cost [high performance]
- May create substantial future investment opportunities to provide enhanced grid services
  - to connect new DG users, manage bidirectional flows/supply volatility,

However…

- COS regulation focuses on the prudence of **inputs**
  - Challenging to respond to evolving demands for outcomes or improved performance
- COS regulation requires utilities to meet no more than **minimum** performance levels
  - Provides little incentive (reward) for delivering a higher quality of service or new services

Additional Challenges Related to Pure Cost-Plus Regulation

- Key utility-management hurdle is getting CAPEX included in rate-base
  - Backward looking nature of COS regulation can impede utility efforts to innovate
  - Apparent high risk related to investment in emerging technologies [*ex post* regulatory review]
  - In actuality, difficult for regulators to identify (and disallow) all but the most obvious imprudent or wasteful investments



Trade-offs Between CAPEX and OPEX Under Cost-of Service Regulation

- **After** CAPEX included in rate-base, marginal reward to take full advantage of cost savings opportunities (x-efficiency)
    I. Utilities only profit from realized savings until the next rate case [when historical cost savings are folded into pro-forma cost calculation]
    II. Utilities focus on short-term cost savings [OPEX], sacrificing long-term opportunities
    III. Marginal penalties for failure to take full advantage of capabilities of approved CAPEX. Regulators are reluctant to remove or reduce plant in service for infraction of "used and useful" standard.

COS and a Regulated Utility's Strategic Business Model

- When faced with the choice between a capital investment [CAPEX] or an expense [OPEX] a regulated IOU will tend to choose the CAPEX route despite x-efficiency benefits of the latter.

- Examples:
  - Build out of a private data (mesh) network for smart meters vs. contracting with a public telecommunications carrier for point-to-point cellular service
  - Depreciation unit defines replacement size; may affect repair/replacement decisions

Preferable Regulatory Mechanism

- Balance between a pure cost-of-service and pure incentive regulation

Role of Economic Incentives for Investor Owned Utilities

- **Economic incentives** are the key to signaling that a certain investment or decision is valued or encouraged and another is relatively discouraged
- Holds true irrespective of which regulatory model is used by regulators

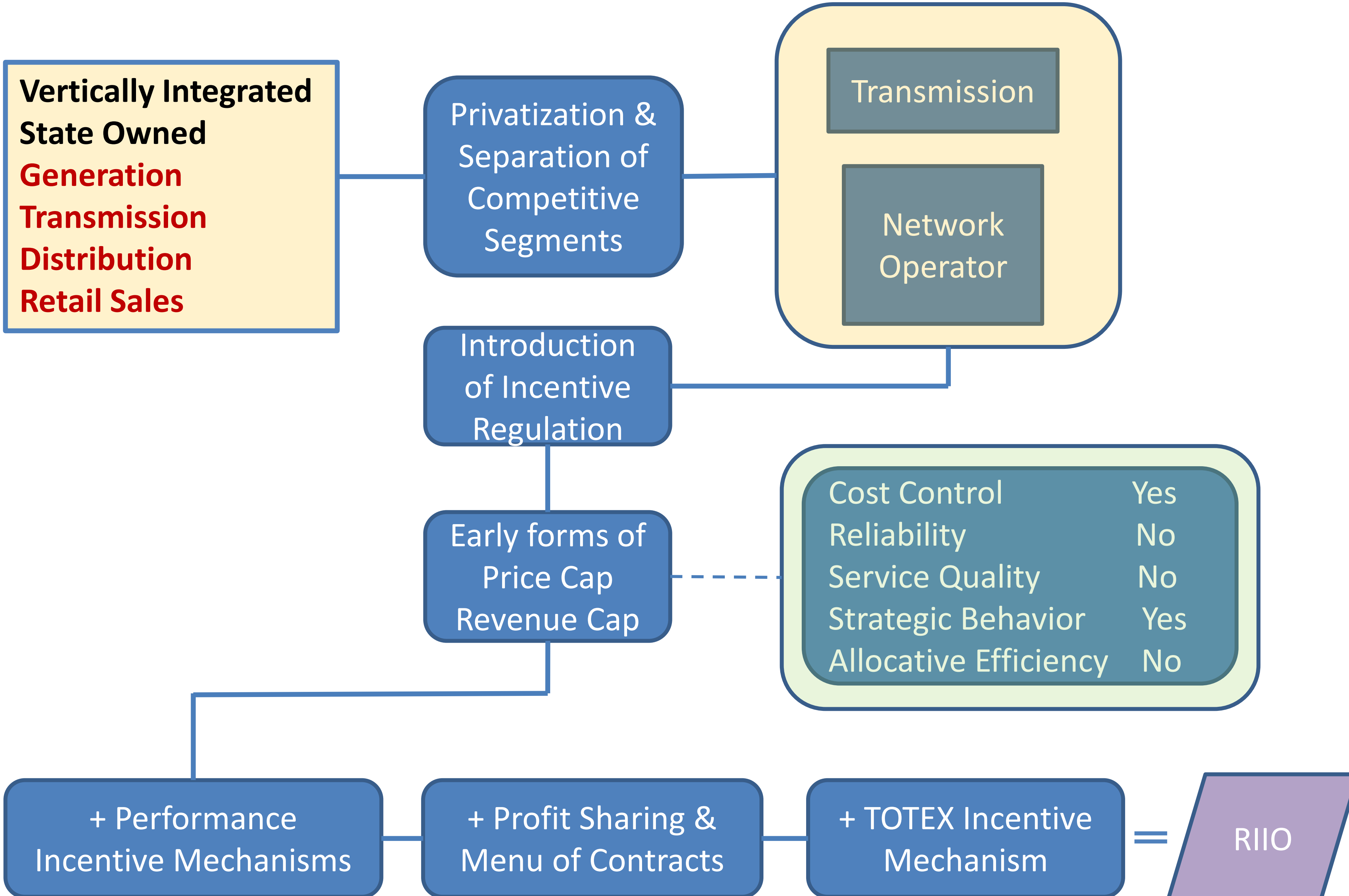
Incentive Regulation Strategic Goal

Incentive-based regulatory mechanisms make it profitable for regulated utilities to make *x-efficiency* improvements and yield consumer benefits (in the long run)

- Regulated firms may earn significantly higher returns than their cost of capital when these "excess" returns are achieved from cost savings beyond the benchmark
- In theory, if the firm over performs against the target, consumers eventually benefit at the *next* price review "ratchet"

- Section 3: Price Cap regulation is the historical foundation of Performance Based Regulation

The Road to RIIO



Pure Price-Cap Incurs the Full Costs of Adverse Selection

- A pure price cap mechanism does not respond to:
  - Changes in managerial efforts (cost savings)
  - Ex post cost realization (no reconciliation)

Pros

- Highest powered incentives to exploit cost opportunities
- Utility can claim in full any variance between the target and actual operating costs

Cons

- Regulator will have to set prices high enough to cover the firms realized costs
  - Regulator must adhere to ***firm participation constraint*** despite uncertainty about cost opportunities
  - [must assume that the firm may be inherently high cost]
  - Leaves ***economic rents*** to the firm
- Focus on costs may lead to poor quality of service

Price-Cap Index (CPI)

Competitive Market Standard

- The long-run trend in an industry's (output) prices is equal to the long-run trend in its unit costs

$$\boldsymbol{\delta\ Output\ Prices = \delta\ Unit\ Cost}$$

(δ) is equal to the long-run growth trend (%/yr.)

$$Where\ \delta = \frac{\int_{x_i}^{x_f} \frac{dx}{x}}{\int_{t_i}^{t_f} dt} \quad \text{i.e. } \delta\ Unit\ Costs = \frac{\ln(\frac{C_f}{C_i})}{\Delta T}$$

$$\boldsymbol{\delta\ Unit\ Cost} = \frac{\ln(\frac{C_f}{C_i})}{\Delta T} \cong \left[\frac{(Unit\ cost\ index)_{End\ of\ Period}}{(Unit\ cost\ index)_{Beginning\ of\ Period}}\right]^{1/n} - 1$$

Competitive Market Standard

In Terms of Macro-economic Measures

- The trend in the unit cost is equal to the difference between trends in that industry's input price index and total factor productivity (TFP) index. Same for economy as a whole.

$$\boldsymbol{\delta\, Unit\, Cost_{Industry} = \delta\, Input\, Prices_{Industry} - \delta\, TFP_{Industry}} \quad \text{Eq. a}$$

$$\boldsymbol{\delta\, Unit\, Cost_{Economy} = \delta\, Input\, Prices_{Economy} - \delta\, TFP_{Economy}} \quad \text{Eq. b}$$

- Subtract Equation (b) from Equation (a)

General Price-Cap Index (PCI) Formula

Derivation of Productivity Offset

- $\boldsymbol{\delta\, Unit\; Cost_{Industry} - \delta\, Unit\; Cost_{Economy} = [\delta\, Input\; Prices_{Industry} -}$

$Where\ \pi = macroeconomic\ inflation\ measure$

What is the Productivity Offset

- ***X*** reflects {in theory} the sum of:
  - the difference between the target Total Factor Productivity (TFP) growth rate for the utility and the TFP growth rate for the economy as a whole, and;
  - the difference between input prices faced by firms in the general economy and (expected) input prices of the regulated firm

X= $\left[\left(\delta TFP_{Target} - \delta TFP_{General\ Economy}\right) +\right.$

Regulated prices should rise at a rate that reflects the general rate of inflation [$\delta Unit\ Cost_{Economy}$] less an offset [X] for: (1) higher (or lower) productivity growth, and: (2) for higher (or lower) input price inflation

Basic Formula for a Pure Price-Cap Regulation

- For the first year, a full cost-of-service calculation of projected revenue requirements [allowed revenue], a COSS, and rate design is performed
- Thus, $P_0 = f([RR]_0)$
- For the following years:
- $P_1 = P_0 \times [1 + \delta\pi_{Economy} - X]_1$
- $P_2 = P_1 \times [1 + \delta\pi_{Economy} - X]_2$
- $P_3 = P_2 \times [1 + \delta\pi_{Economy} - X]_3$

$\boldsymbol{[proxy\ RR]_i = f(P_i)}$

Automatic Adj.
Mechanism

- Section 4: The U.K.'s RPI-X and RIIO PBR Models

RPI-X Price-Control Method

Regulatory Building Blocks

Many similarities to practical COS regulation
[with a fully projected test-year]

- Characterized as a combination of:
  - Cost-of-service regulation [capital and operating cost recovery]
    - Capital investment plan reviewed and approved ***ex ante*** *(projected)*
      - reasonableness reviewed ***ex post***
    - Determine an allowed rate-of-return and compatible valuations of the rate-base and depreciation rates
    - Set projected operating costs via indexes or comparative benchmarking
  - Price ratchets setting new starting values for prices (cost-contingent)
  - Performance standards for quality of service (with financial incentives for meeting or exceeding performance standards, or penalties for failure)

RPI-X Price Cap Mechanism

- P_0 = initial price, set by allowed revenues over multi-year period
- P_1 = year 2 adjusted price
- n = number of periods (5)
- RPI = [Retail Prices Inflation] = {change in general inflation}
- $$RPI = \left[\frac{(Inflation\ index)_{End\ of\ Period}}{(Inflation\ index)_{Beginning\ of\ Period}}\right]^{1/n} - 1$$
- *X* = productivity offset

$$P_1 = P_0 * [1 + (RPI - X)]$$

Under Pure Price Cap

How the Price Cap is Set

P_0 is chosen so that the present value of revenues are equal to the present value of the total operating and capital costs (depreciation plus return) that have been allowed during the five–year review period:

$$\left[\boldsymbol{PVrevenues} \ = \boldsymbol{PVcosts}\right]$$

$$\boldsymbol{PV\ revenue} = \sum_{i=0}^{4} \boldsymbol{P_0}\left[[1 + (RPI - x)]^i (kWh)_i (1 + d)^{-i}\right]$$

$$\boldsymbol{PVcosts} = \sum_{i=0}^{4} \left[\left(\$_{Total\ Allowed\ Expenditures}\right)_i (1 + d)^{-i}\right]$$

Where d is the discount rate; (kWh) is the forecasted demand

Solving for P_0:

$$\boldsymbol{P_0} = \frac{\sum_{i=0}^{4} \left[\left(\$_{Total\ Allowed\ Expenditures}\right)_i (1 + d)^{-i}\right]}{\sum_{i=0}^{4}[1 + (RPI - x)]^i (kWh)_i (1 + d)^{-i}]}$$

- Note that P_0 would be a vector of prices for multiple services or rate schedules; and that this simplified calculation assumes a uniform annual commodity) charge.

RPI-X Insights

- Contrary to popular misconception, the price-cap formula [P = f(RPI, X)] does not actually determine the level of approved revenues (over the 5-year control period) *Note: a pure price-cap mechanism does*
- The PPI –X mechanisms is actually an **ex ante revenue-control** mechanism. The mechanism requires a full projected cost-of service (COS) calculation of revenue requirements, a depreciation study, a COSS and rate design.
- The regulated firms ability to determine the structure of prices under an overall revenue cap is *limited*

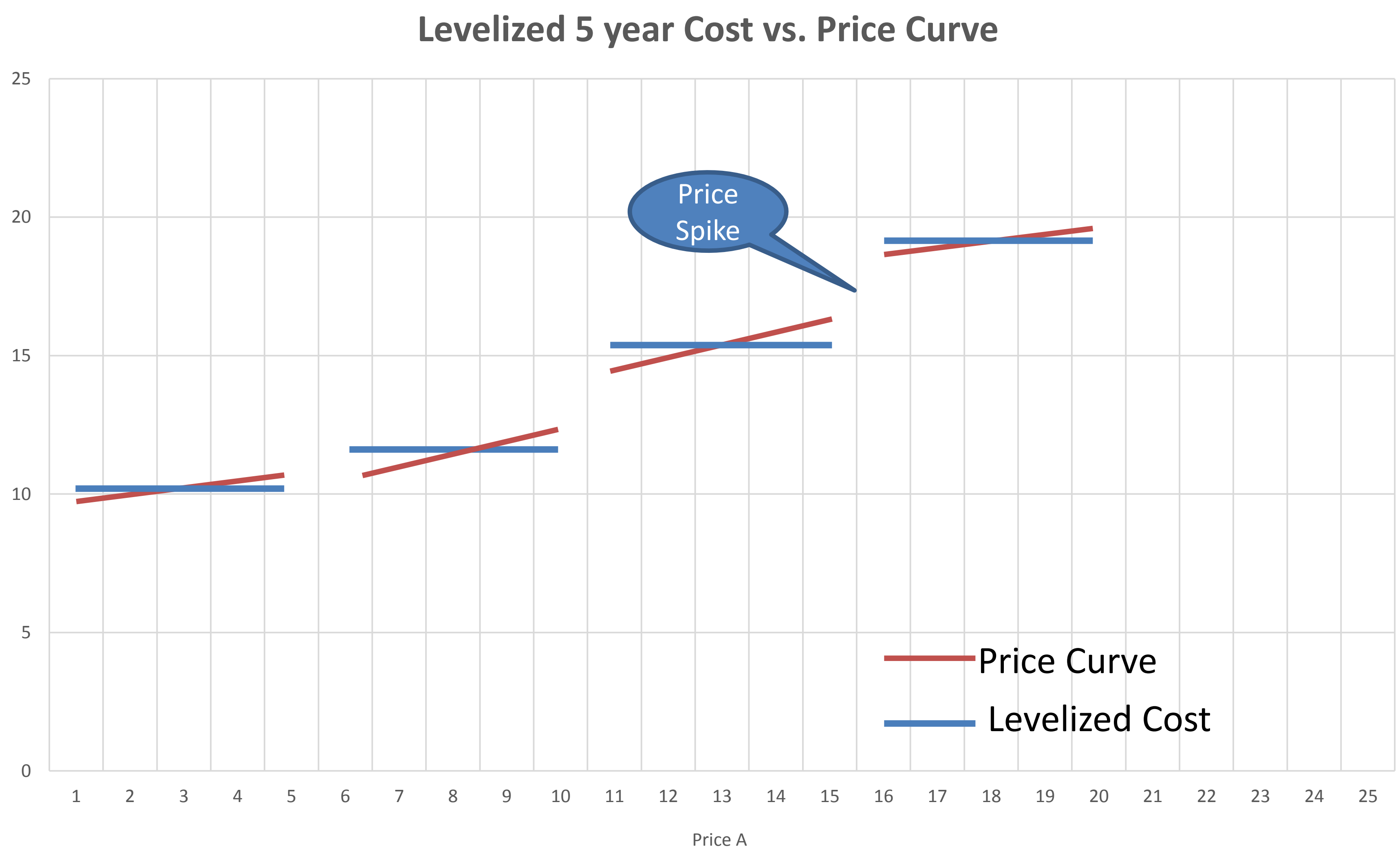
UK(United Kingdom) Price-Cap Implementation Issues

- Large increases in investment approved for the next multi-year price control period would result in a price spike between the end of the prior "price control" period and the beginning of the next.

  [price shock]
- **UK Regulators "smoothed" the price increase** by building in a steeper escalation of the retail price [resulted in a lower initial price P_0 and back-loading of the revenues toward the end of the period]
  - ***Productivity offset X* set to zero**, thus retail price escalation during price control period only reflected general inflation: $P_1=P_0*(1 + RPI)$; $P_2= P_0*(1+RPI)^2$ etc.
  - Improvements in operating cost efficiency (*X*) rolled into the cost-plus-return calculation [benchmarking] of "targeted" revenue requirements
  - Typically initial price P_0 set in a range from [- 10% to + 10%] from the last price control period, with a mean of ~+1%

- **Lesson learned: Practical implementation may require deviation from theory - nothing is set in stone!**

Original Impact of RPI –X Price Curve



Levelized Cost V.S. RPI-0 Price Curve

Comparative Benchmarking of Operating Expenses (OPEX)

- Assessment of efficiency of distribution company operating costs
- OPEX subjected to comparative regression-based benchmarking
- Benchmarking allows regulators to project the *efficient* level of operating expenses
- [RPI – X] e.g. *x-efficiency* implicitly reflected in forecasted OPEX

Practical Capital-Cost Recovery Issues

- Significant efforts required to develop the **target** capital expenditure schedule during the next [five-year] price control period
  - Utility presents its proposed investment budget, and regulators evaluate using its staff (or outside engineering consultants) and third parties' evidence **[expert appraisal]**
  - **Traditionally highly contested**
    - Increasing importance of future distribution investments due to: (1) aging of the grid; (2) related reliability and service quality issues; and (3) infrastructure enhancement projects

Performance Based Regulation Foundations for Further Evolution

Under pure COS regulation

$$Rev_{Allowed} = f(C_{Realized/Historical}) > C_{Xefficient})$$

Poor Managerial Efficiency

full impact of *managerial moral hazard*

Good Allocative Efficiency

Under pure Price Cap regulation

$$Rev_{Allowed} = f(C^{*} > C_{Realized} \sim C_{X\,efficient})$$

Poor Allocative Efficiency

full impact of *adverse selection*

Good Managerial Efficiency

C^{*}=[regulator’s assessment of efficient costs of the highest cost type]

Performance-Based Regulation Essential Foundations

Greater economic efficiency derived from a regulatory mechanism in which allowed revenues are: (1) partially fixed *ex ante,* and (2) partially responsive to changes in realized costs

$$R_{allowed} = f(costs_{ex\ ante} + costs_{realized})$$

Profit sharing Mechanism

$$R_{allowed} = R_{ex\ ante} - [R_{ex\ ante} - C_{realized}](1 - \theta)$$

θ = sharing factor

Example: Price Cap + Profit Sharing

Trade off *X-Efficiency* for *Allocative Efficiency*

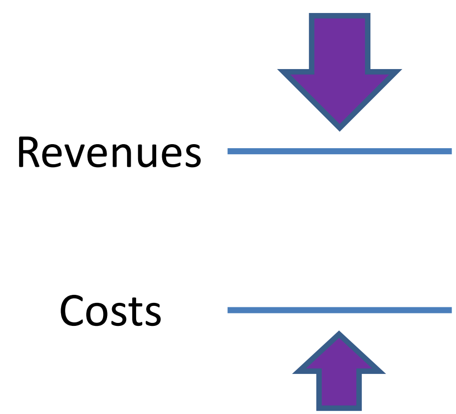
- $R_{allowed} = R_{ex\ ante} - [R_{ex\ ante} - C_{realized}](1 - \theta)$

Let C^*= [regulators assessment of efficient costs of the highest cost type]; θ =profit sharing level,[0< θ <1]

- $R_{allowed} = C^* - \{[C^* - C_{realized}](1 - \theta)\}$
- Thus:
- $R_{allowed} < C^*$ where $C_{realized} \geq C_{X\ efficient}$

Reduced Impact of Adverse Selection

Increased Allocative Efficiency



Performance-Based Regulation Essential Foundations

- **Even better** economic efficiencies may be obtained with a *sliding-scale* menu of *profit-sharing* “contracts”
- Prices are partially fixed *ex ante*, and partially responsive to realized costs
- The utility “picks” a contract from the menu by filing their ex ante forecast. The ratio of their request to the regulator’s base estimate determines the allowed revenue, and the level of sharing
- The menu of contracts satisfies the *incentive compatibility constraint*
  - Utilities with low cost opportunities choose a high profit-sharing contract, and those with high cost opportunities choose a low profit-sharing contract
  - For any realized cost, the utility earns the most income when its filed forecast equals the realized cost

Sliding-Scale Menu of Profit Sharing Contracts

Performance Based Regulation

- Allowance for future CAPEX required to meet reliability targets subject to increased scrutiny and contention
  - Large amount of infrastructure has reached (or nearing) end of its useful life (retirement, replacement, and early retirement issues)
  - Increased importance of reliability
  - Emergence of new technologies

Utility given **choice of incentives** depending on their ability to control costs

Most Control **Least Control**

Sliding Scale Mechanism For CAPEX

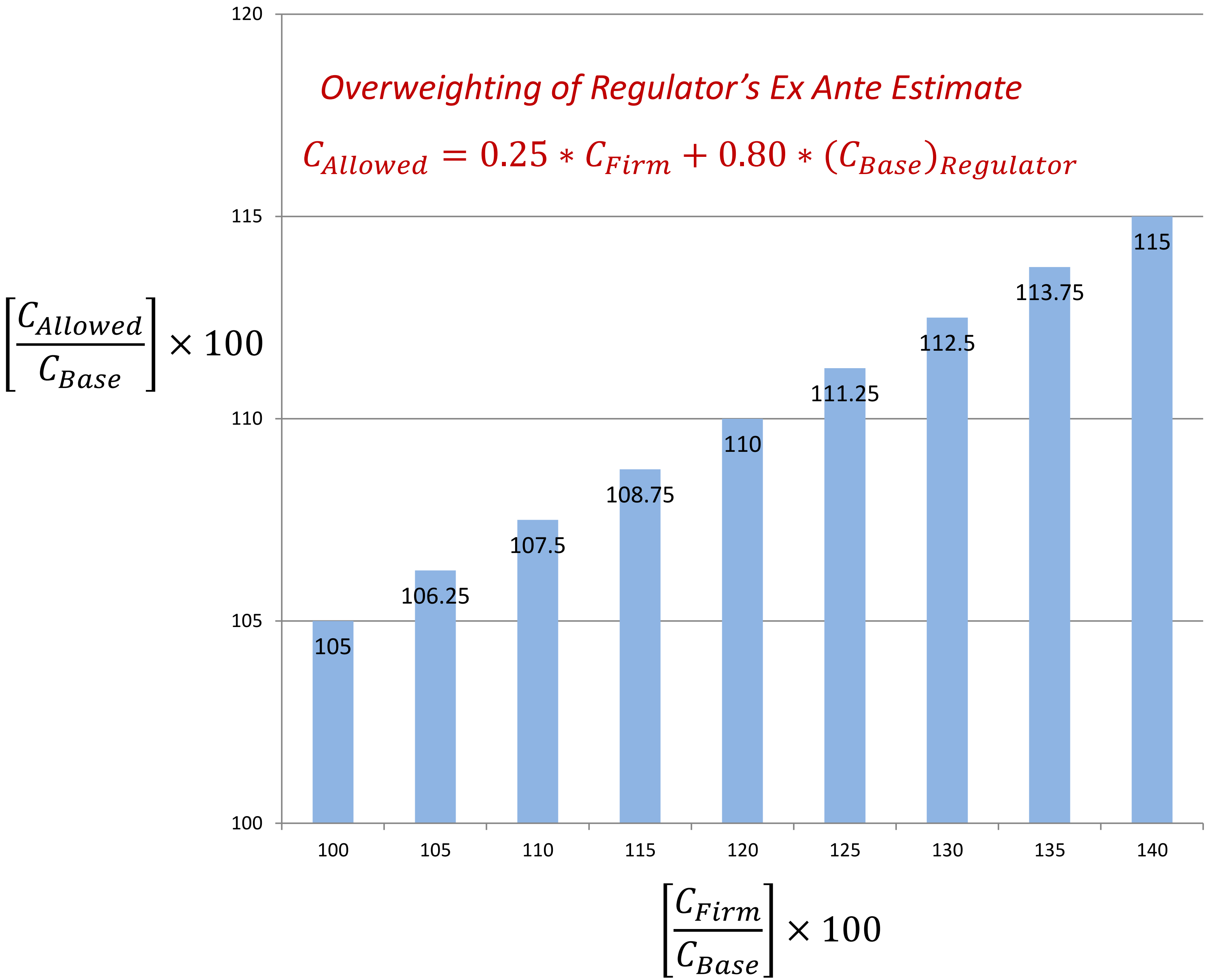
Sliding scale menu at discretion of utility management

- Menu forces the utility to reveal its <u>type</u> ex post
  - [type means high-cost or low-cost]
- Resolves the *asymmetric* information problem facing regulators
- Choice between 100% and 100+ y% of base capital expenditure allowance

Regulated firm can choose from a menu of contracts:

- A **lower** capital expenditure allowance
  - High sharing factor
  - Higher expected return
- A **higher** capital expenditure allowance
  - Low sharing factor
  - Lower expected return
- The sliding scale mechanism applies to capital cost variations but not operating cost variations

U. K Sliding Scale Incentive Mechanism
Calculation of Allowed Ex Ante CAPEX

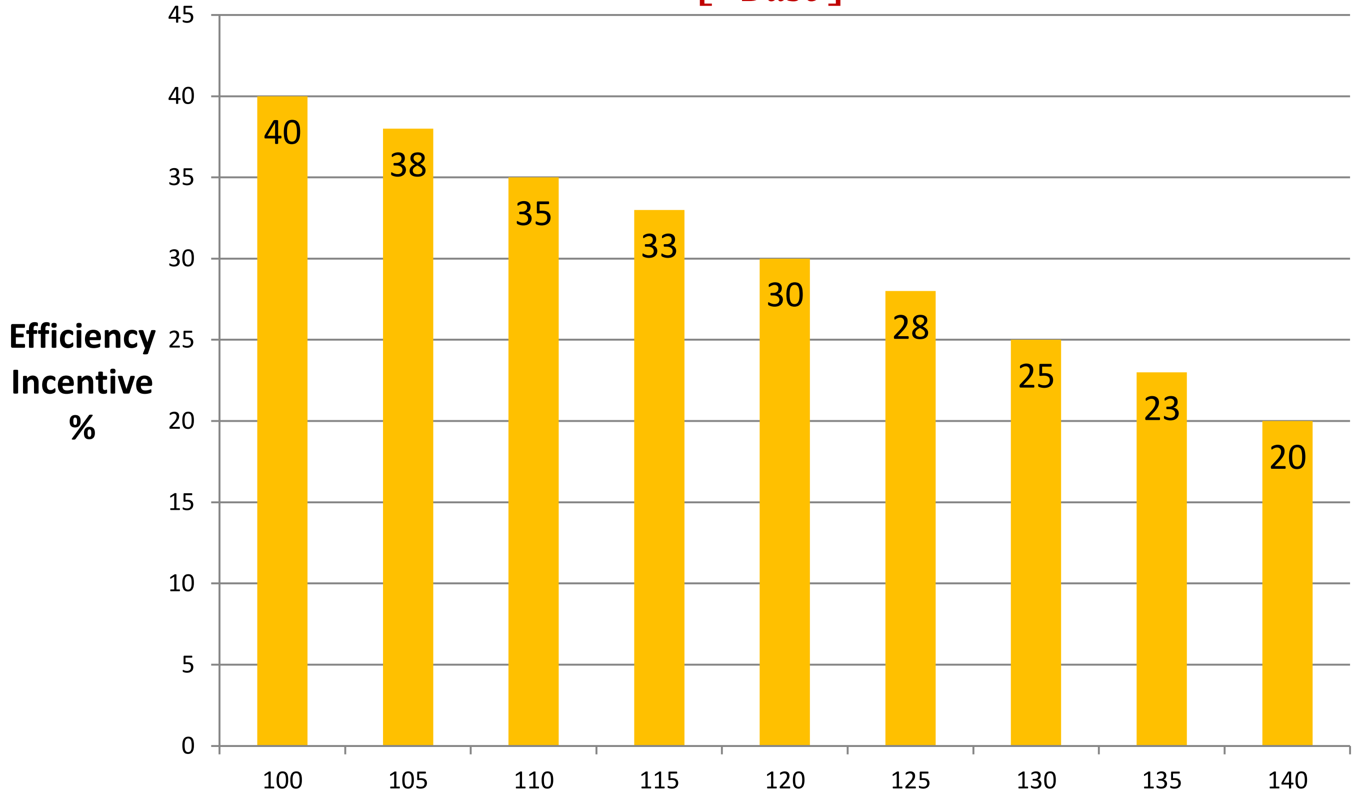


U. K Sliding Scale Incentive Mechanism for CAPEX

Profit Sharing Factor as a % of CAPEX Savings:

$$Savings = SF * [C_{Allowed} - C_{Realized}]$$

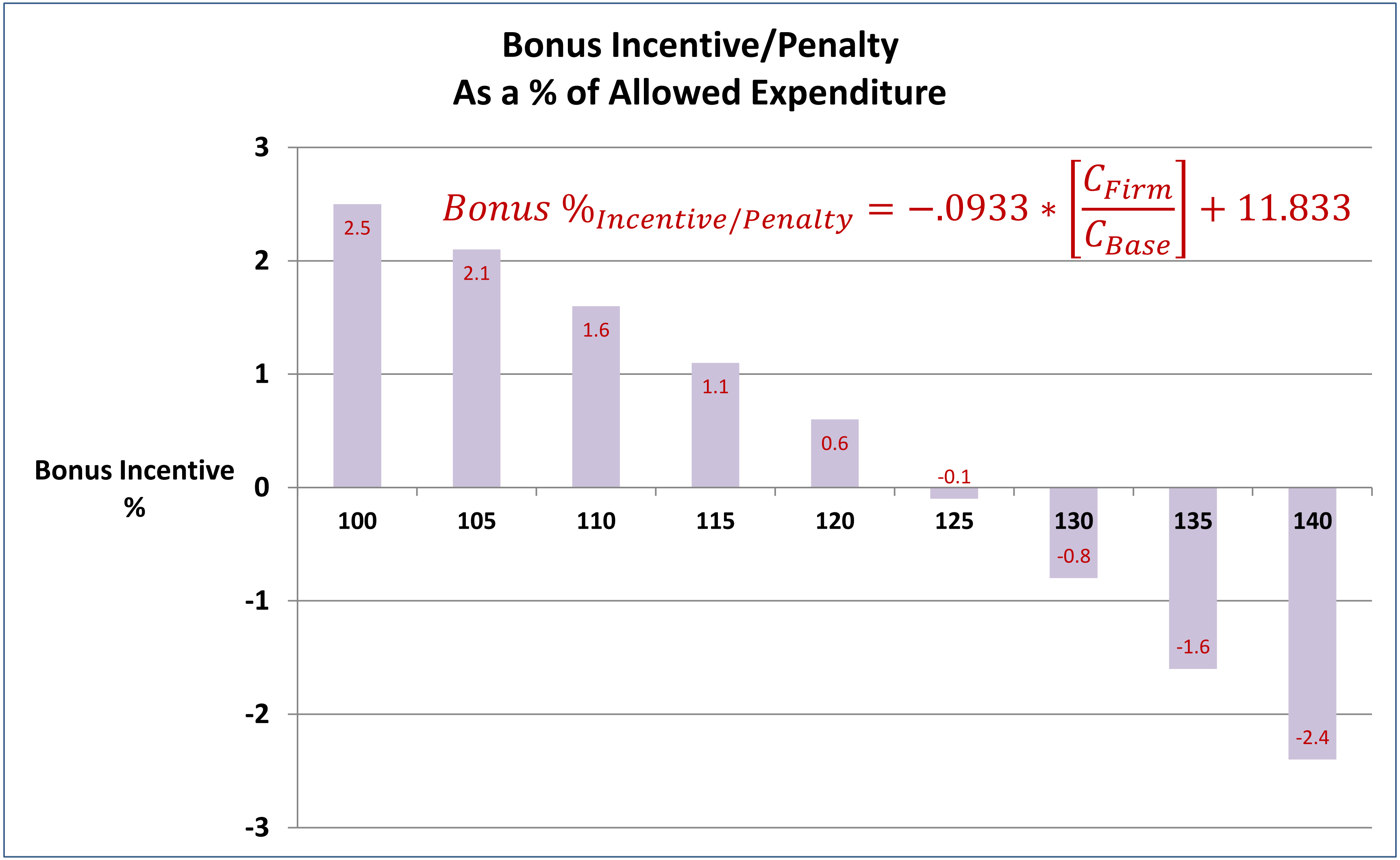
$$SF = -0.50 * \left[\frac{C_{Firm}}{C_{Base}}\right] + 0.90$$



$$\left[\frac{C_{Firm}}{C_{Base}}\right] \times 100$$

$$SF_{Reference} = 0.40$$

U. K Sliding Scale Incentive Mechanism for CAPEX



$$\left[\frac{C_{Firm}}{C_{Base}}\right] \times 100$$

UK Sliding-Scale Incentive Calculation For CAPEX

- $I_{CAPEX} = [(Allowed\ CAPEX - Actual\ CAPEX) \times \boldsymbol{Sharing\ Factor} +$

Relationship Between CAPEX/OPEX and Service Quality

- Problem:
  - Cost-control incentive mechanisms inherently create unintended consequences – economic incentives to reduce service quality or compromise reliability
  - Deferred maintenance (e.g. tree trimming) and deferred capital expenditures may lead to **deterioration of reliability and service quality**
- Solution:
  - Regulators reserve the right to capture-back cost savings if they were not the result of efficiencies but rather efforts to cut services
  - Introduce **service-quality performance incentives** [to maintain or enhance reliability and service quality]

Service Quality Incentives

1) Service interruption –number of outages
2) Interruption duration – minutes per outage
3) Quality of phone responses
    1) Ordinary
    2) Storm (outage or restoration of service request)
4) Discretionary award based on surveys of customer satisfaction
5) Customer payment obligations targeted at utility response time during severe weather events
6) Other incentives set by regulator

Structure incentives to: (1)maintain, and; (2) enhance performance

Theoretical Calculation of Penalty or Reward formula for Customer Outages

- Customer surveys indicate that customers value reducing the (minutes per outage) more than the (number of outages)
- Difficult to separately value number of outages (n) and outage minutes (hrs)
- Calculate value of lost load (VLL)
- $VLL = \sum_n [\frac{\$}{kWh}]_{Value} \times [\frac{kWh}{hour}]_{Residential} \times (Duration)_{Hrs}$

Service Quality Incentive Examples (UK)

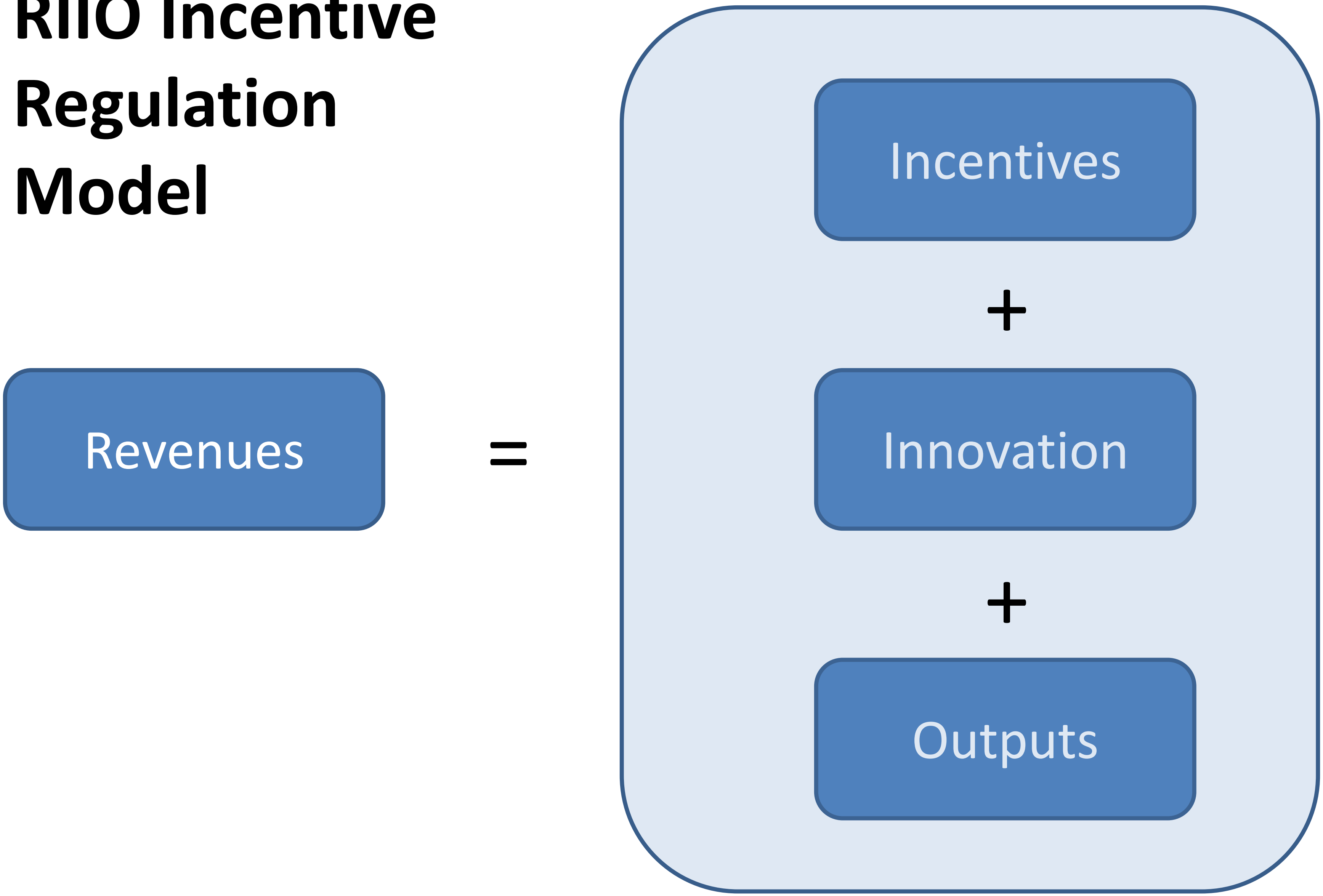
SERVICE QUALITY MEASURES	INCENTIVE AS A % OF REVENUE
Interruption (frequency & duration)	+/- 3.0% (Combined)
Quality of Phone Response	+ 0.05% to -0.25%
Quality of Phone Response (during storms)	+/- 0.25%
Discretionary Awards	up to 1 million £
Storm Compensation (customer payments)	-2%
Other Standards of Performance	Uncapped
Overall Cap	-4% on downside No cap on upside

UK Quality of Service Incentive

- Each distribution company is disaggregated by distribution-circuit voltage
- Performance targets are developed for each voltage level
  - Based on historical data and benchmarking of performance
  - Performance targets are set by re-aggregating targets for each type of circuit

An estimate of the aggregate cost of improving service quality is built into the allowed revenue calculation

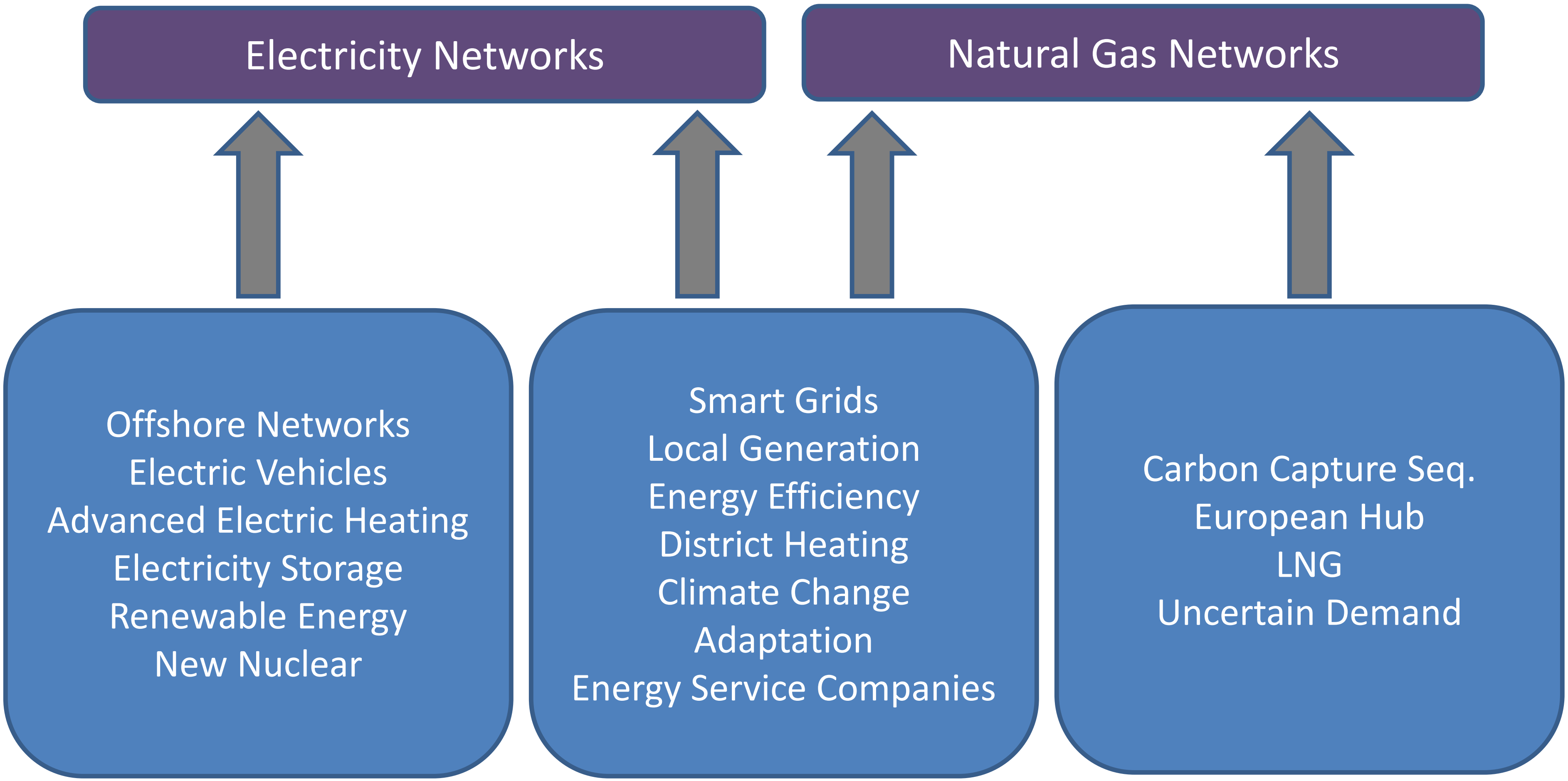
RIIO Incentive Regulation Model



RIIO Price-Cap Regulation Output-Based Framework

- **RIIO: R**evenue set to deliver strong **I**ncentives, **I**nnovation and **O**utputs; or [Revenue = incentives + innovation+ outputs]
- Change needed to foster greater innovation and investment
  - in light of new climate policy demands and aging infrastructure.
  - Realization that security of supply and de-carbonization are no longer just add-ons
- Regulatory goal: reward companies that innovate and run their networks to better meet the needs of consumers and network users.
- Change from former RPI-X price control framework:
  - Move from a five (5) year, to an eight (8) year price-control period
  - Expand the RPI-X methodology

Challenges Facing the UK Energy Sector



Aging Assets – Security of Supply – Affordability

RIIO Changes Relationship with Regulators

- Not a price control system set unilaterally by the regulator [as was RPI-X]
- RIIO price controls are the product of negotiated **settlements**
- Result in regulatory contracts between Ofgem and regulated utilities

Key changes from RPI-X

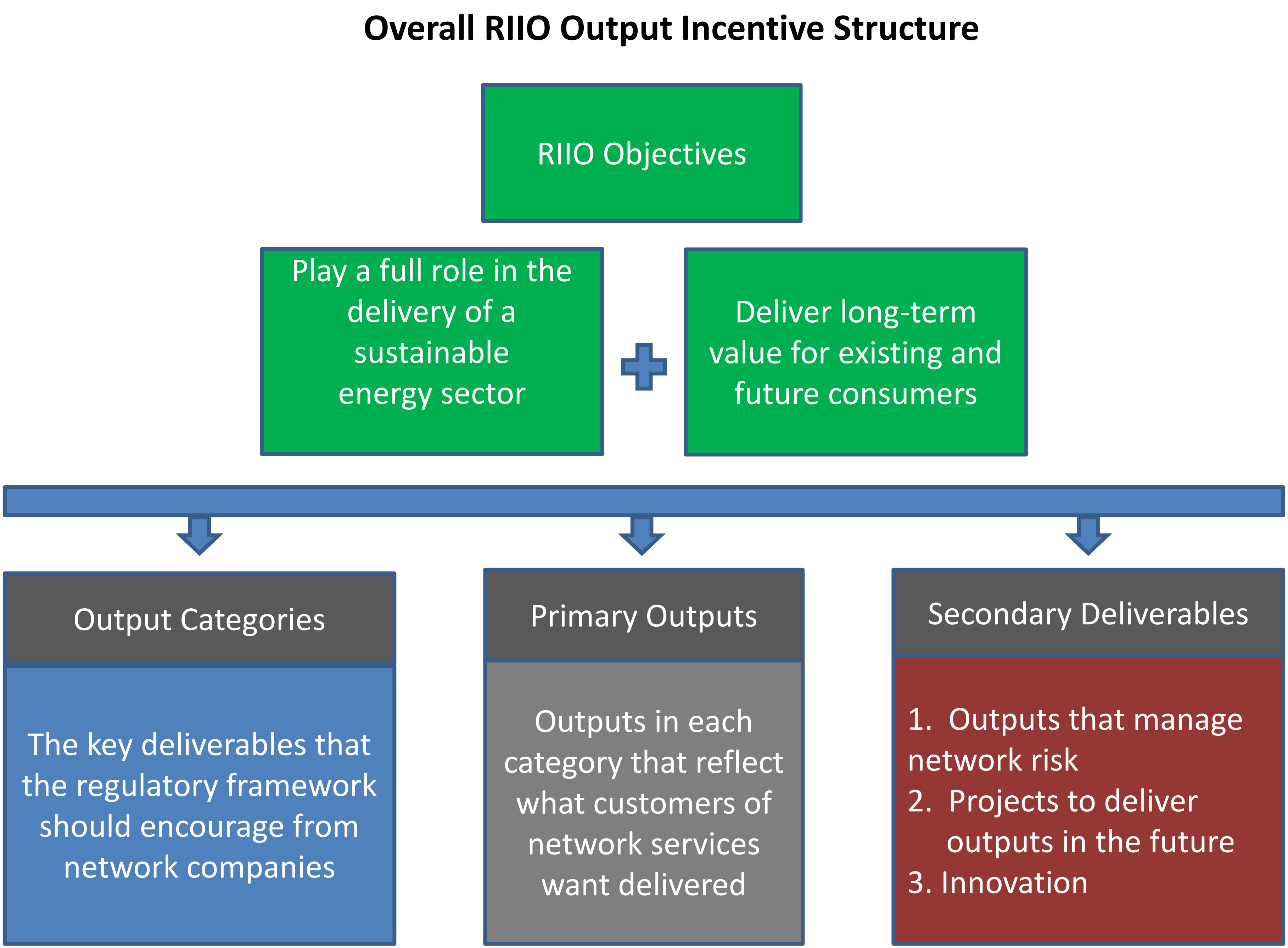
- Base revenue requirements calculated using forecasts of efficient total expenditures (***TOTEX***) rather than distinguishing between capital (CAPEX) and operating (OPEX) costs
  - TOTEX benchmarking uses statistic (regression) models
  - Includes both replacement investment and incremental investment
  - CAPEX no longer based on engineering analysis
- (TOTEX) presumably balances the goals of reducing costs and increasing investment, (which are often at odds)

Performance Incentives

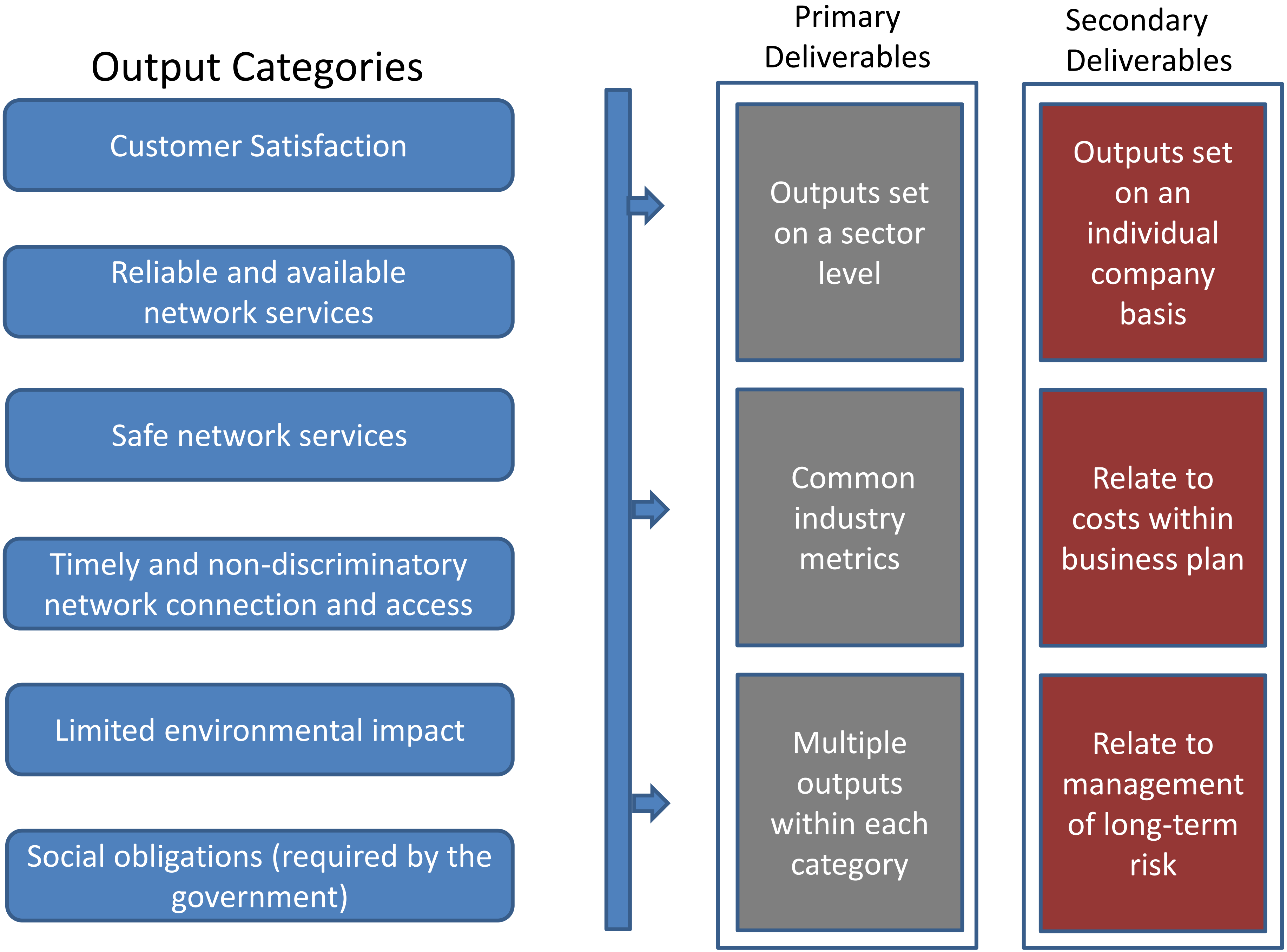
- Under RPI-X performance incentives were disconnected from the price review
- Under RIIO, performance incentives are integrated into the review process
  – Six outputs are integrated into performance incentives
  – Mid-period review
  – End of period review

RIIO Output Goals

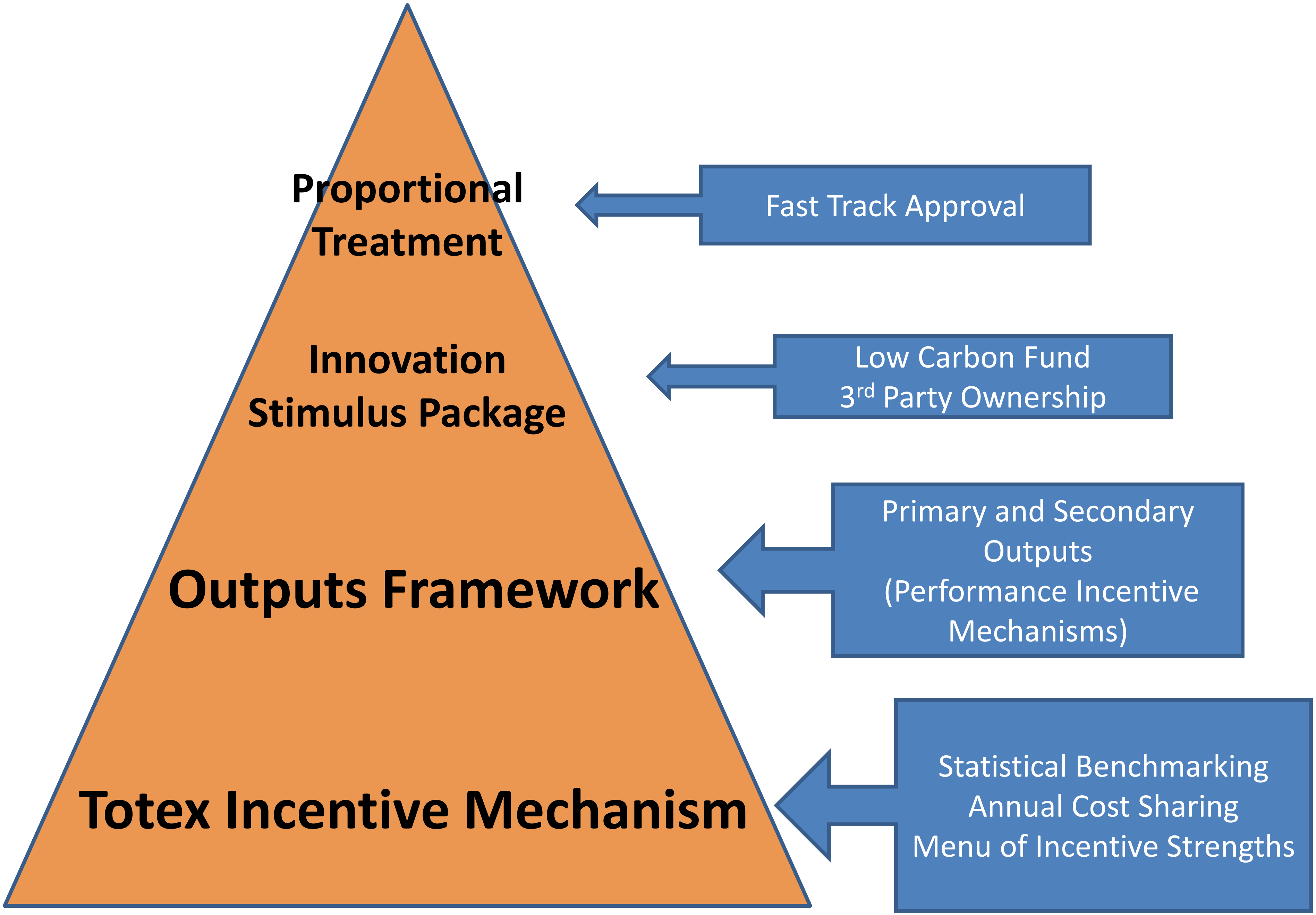
1. *Customer satisfaction*
2. *Reliable and available network services*
3. *Safe network services*
4. *Timely and non-discriminatory network connection and access terms*
5. *Limited environmental impact*
6. *Social obligations* (that the network companies are required by the government to deliver)


Overall RIIO Output Incentive Structure
RIIO Objectives
Play a full role in the delivery of a sustainable energy sector
Deliver long-term value for existing and future consumers
Output Categories
The key deliverables that the regulatory framework should encourage from network companies
Primary Outputs
Outputs in each category that reflect what customers of network services want delivered
Secondary Deliverables
1. Outputs that manage network risk
2. Projects to deliver outputs in the future
3. Innovation

RIIO Output Incentive Details



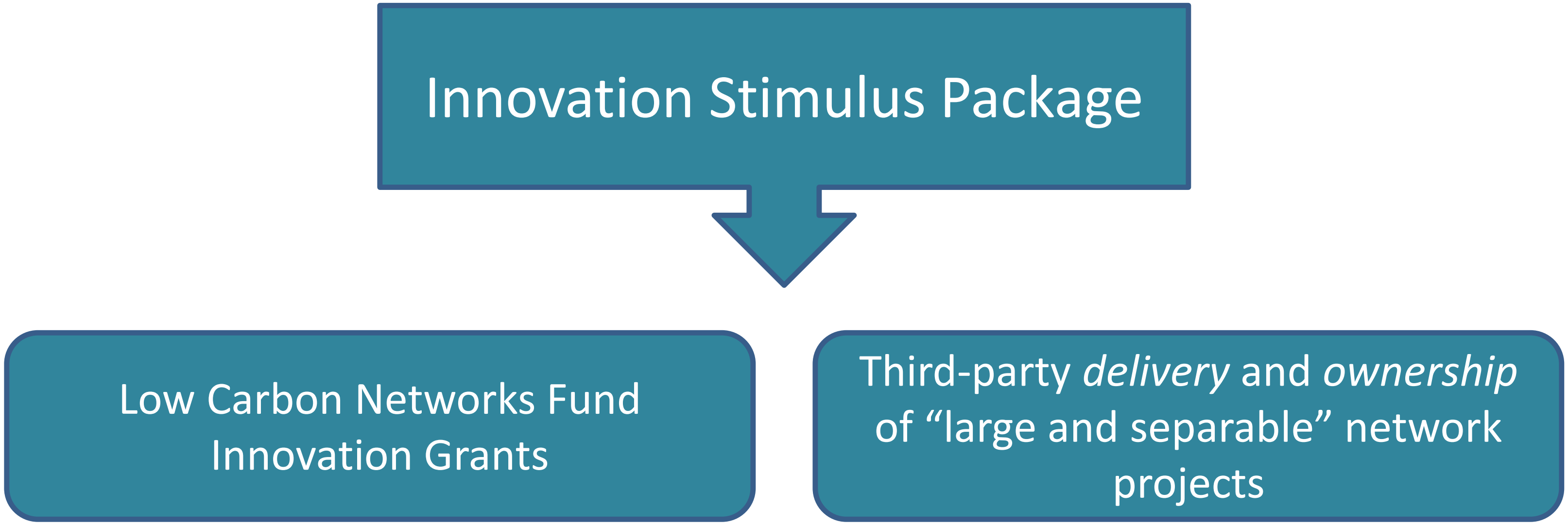
RIIO Incentive Structure



RIIO Innovation Provision

- Productivity efficiency gains [δTFP_{target}]emanating from investments in innovative new technologies will be shared between the utility and the ratepayers

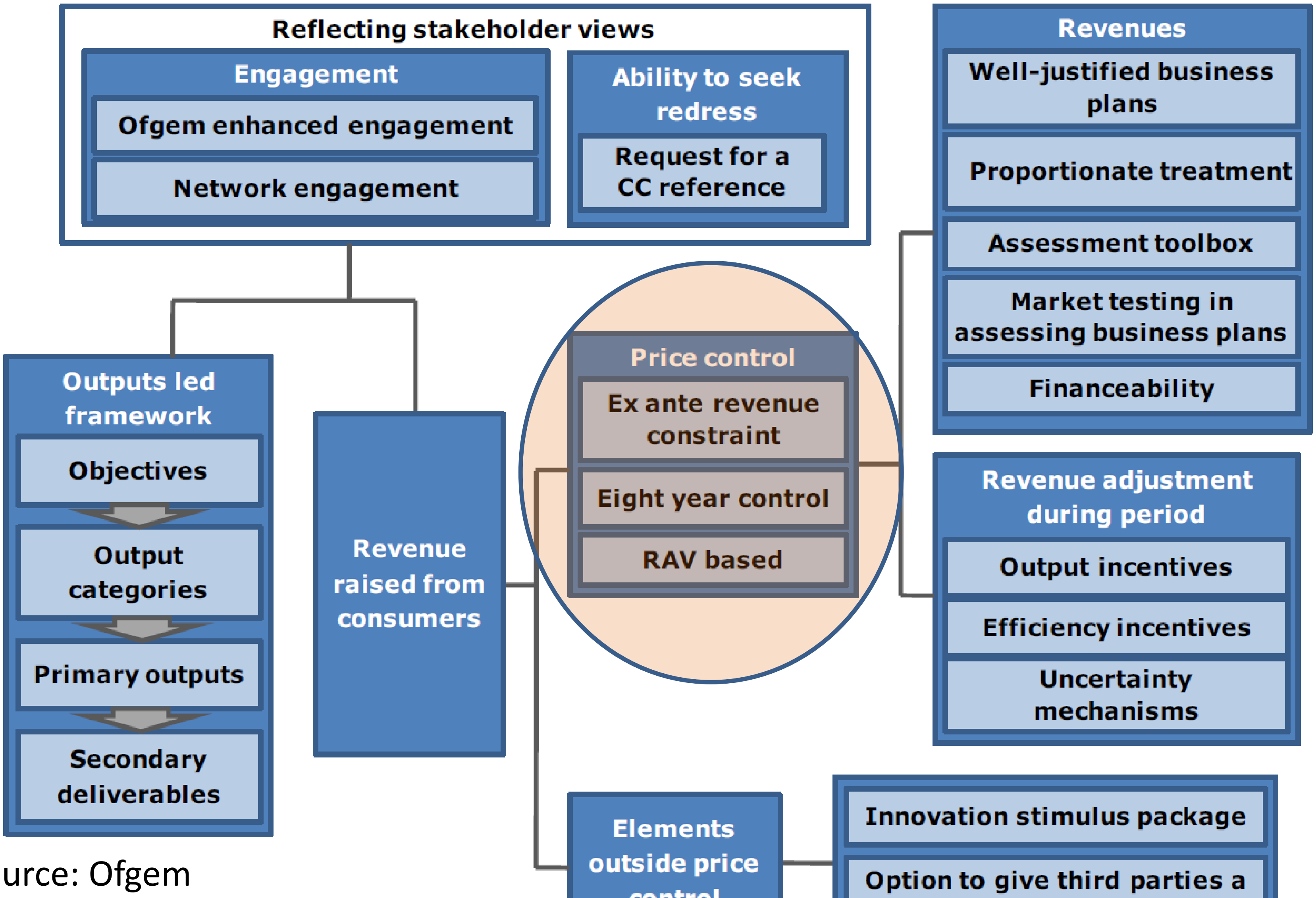
RIIO Enhances Long Term Value of Innovation



Utility Business Plan

- The utility files a business plan (cost-benefit analysis) covering the six performance outputs
- **Funding included in the price control calculation [if business plans are well justified]**

Figure 1: Elements of the RIIO model



Source: Ofgem

TOTEX Benchmarking

Regression Modeling

- TOTEX models only control for differences in utility scale and regional labor variation
- Assumes a common & synchronous investment cycle among utilities
- Differences not controlled:
  - Regional topography
  - Population density
  - Network design
- Issue: system enhancement “lumpy”
  - Solution: BOTEX = Base TOTEX: limit to operating and capital maintenance - system enhancement excluded

MPSC Staff Observations

- **Michigan has a long history of cost-plus ratemaking** and the current rate-setting process is well developed
- **The UK's RIIO model of PBR is innovative and highly aggressive** in attempting to extract optimal x-efficiencies and output-based objectives
- **The RIIO PBR model is applied to a utility industry that has been restructured** to exclude competitive segments, and Michigan is likely to continue with a vertically-integrated regulated utility structure [significantly complicates RIIO type PBR}
- **Full implementation of a RIIO type PBR** in Michigan would entail significant cost and human resources
- **Current direction of the electric utility industry** in Michigan will continue toward further grid automation, expanding renewable energy, distributed generation, and ultimately a high level of de-carbonization
- **Output based PBR mechanism such as Performance Incentive Mechanisms (PIM's)** may be considered as a means of achieving policy objectives at most reasonable cost to ratepayers

Building Blocks To PBR For Consideration

Existing Programs

- Energy Waste Recovery Program
- Renewable Portfolio Standard
- Integrated Resource Planning
- Distribution Planning Initiative
- Demand Response & Load Control

New Programs

- Benchmarking & Best Practices Process
- New Performance Incentive Mechanisms
  - System Efficiency PIM's
  - System Reliability PIM's
  - Service Quality PIM's
  - Technology Innovation PIM's
  - Environmental & Social Impact PIM's
- Expanded Stakeholder Engagement

References

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- **INCENTIVE REGULATION IN THEORY AND PRACTICE: ELECTRICITY DISTRIBUTION AND TRANSMISSION NETWORKS** Paul L Joskow1; MIT, January 21, 2006
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