Economic Valuation Methods for Public Investment in Hydrail

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Valuation Methods

• Traditional
  – Discounted cash flow, life-cycle, cost-benefit
  – Effectiveness limited by uncertainty

• Incorporating uncertainty
  – Scenarios, sensitivities, simulations
  – Data-intensive, subjectively probabilistic
Valuation Scope

• Device/equipment
  – Hydrail/diesel/electric/hybrid; locomotive: EMUs
  – Metrics: performance, fuel, maint., service life

• Intrasystem (within rail transport system)
  – Expanded to include infrastructure

• Intersystem (whole transportation system)
  – Expanded to include rail, road, water, and air

• Socio-economic (whole of locality)
Hydrail’s Intersystem Value

• Transportation system in general
  – Physical and supporting infrastructure
  – Utility = mobility of labor, commodities, products
  – Intertemporal classification as \( f(\text{technology}) \)

• Transportation system as a good or service
  – “Produced” by a public entity
  – Monopolistic supply with inelastic demand
  – Effect is structural/technological coercion

• Public entity is, in this sense, a monopoly firm
Behavior of the Capitalist Firm

• Purpose: perpetual shareholder return (profit)

Production Cost Curve

Economic profit, or surplus value – Marx’s Valorisation

Perfect competition, Price equals the minimum Average Total Cost
Technology (R&D) Incentive Gap

R&D Investment Return

Required Rate of Return

Social Return

Subsidy

Private Return

Level of R&D Investment

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H₂’s Positive Externalities

- Increased efficiency relative to internal combustion
- Emission-free at point of use
- Virtually unlimited supply of raw material from which H₂ fuel may be derived
- Eliminates dedicated fuel-to-use pathways
Public Entity as Firm

Shareholders = public; return = attainment of positive externalities or the “social return”; eliminate subsidy

Diagram showing R&D Investment Return vs Level of R&D Investment, with lines indicating Required Rate of Return, Social Return, and Private Return.
R&D Investments by Public Entity “Firm”

• Surplus value for the public entity firm is attaining positive externalities/social benefit at minimum average total cost (minATC)
• Given the shift from carbon-intensive to hydrogen-intensive energy at some unknown future point in time
• Min. ATC achieved by minimizing marginal cost, in this case minimizing cost of H₂-fueled transportation system
• Investment in H₂ transportation system -> risk of technological obsolescence
Hydrail: Value Innovation Strategy

• Goal: make R&D investments in H$_2$ transport system in pursuit of minimal average total cost

• Hydrail concept supports minimizing marginal cost with limited risk of technological obsolescence
  – High volume demand of H$_2$, fixed location and limited quantity of refueling infrastructure, regular refueling frequency of fixed fuel quantities

• Result of Hydrail is low marginal cost of H$_2$ fuel, and substantial shift towards fundamentally changed transportation system
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