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Bankable by Design: Currency Settlement, FX hedging and CHPS Demand Support for a Pilbara-Incheon Green-Hydrogen Pilot Corridor

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Abstract: Early cross-border hydrogen trade must contend with FX pass-through into delivered prices (Qiao et al. 2023). This study develops a compact liquefied-hydrogen (LH_2) pilot corridor from Pilbara (export) to Incheon (import). The foal is to test how settlement design (currency/index choice, explicit FX hedging) and policy scaffolding (Korea's Clean Hydrogen Power Generation Bidding Market, CHPS) shape landed-cost volatility, the weighted average cost of capital (WACC) and renegotiation risk (Đukan & Kitzing 2023). An integrated system-dynamics model links supply, CHPS-backed demand, settlement&finance, and policy instruments. Three settlement regimes are compared for long-term sales and purchase agreement (SPA): USD-dominant, KRW bilateral, and AUD—USD—KRW basket. Pairing indexed, hedged SPAs with CHPS revenue floors stabilizes contracts under supply shocks, improving early-corridor bankability.

Keywords: *Green hydrogen, cross-border settlement, system dynamics, Asia-Pacific trade.*

1. INTRODUCTION

Green-hydrogen corridors face macro-financial risk that can overshadow techno-economic readiness. We focus on a pilot-scale LH_2 corridor because it isolates first-order financial drivers without requiring speculative technology leaps. The core question is how currency/indexation and hedging choices interact with CHPS-backed offtake to stabilize CIF (cost-insurance-freight) prices and de-risk long-tenor SPAs (typically 10-20 year SPAs).

2. METHODOLOGY AND RESULTS

We implement an integrated system-dynamics model with four coupled subsystems: (i) supply (Pilbara renewable H_2 production and LH_2 export); (ii) demand (Incheon H_2-to-power supported by CHPS revenue floors); (iii) settlement & finance (FX pass-through; hedging ratio; feedback to WACC); and (iv) policy (optional carbon-price indexation, corridor-relevant cost caps). We simulate USD-dominant, KRW bilateral, and AUD—USD—KRW basket regimes for 15 years under identical logistics and stress tests. In the USD-dominant SPA, high FX pass-through and limited hedging drive wider price bands and higher risk premia, whereas the KRW-only and multi-currency basket regimes yield medium-to-low FX pass-through and thereby lower financing costs and narrower bands. Local-currency or basket settlements compress volatility by reducing FX pass-through and credit premia, and indexed + hedged SPAs further limit price drift and renegotiation incentives (Đukan & Kitzing 2023). Simulations show that local-currency or basket pricing regimes sharply reduce landed-cost volatility and narrow price bands relative to a USD-dominant regime (annual volatility ~1.3-1.5% and band width ~3.4-5.3%, versus ~2.9% and 6.0% for USD-dominant).

The key assumptions include a fixed FX hedging cost of ~ 2% per annum, a hedge tenor of 15 years, and a basis-risk factor β to capture residual currency-mismatch costs. Behavioral and financial feedback parameters, such as the FX pass-through coefficient (α) and WACC sensitivity to currency volatility, are calibrated from historical data and literature estimates (shown as table 1). For example:

a. FX pass-through: Local price P_{Local} is modelled as P_{USD} $[1 + \alpha (E / E0 - 1)]$, where E is the exchange rate and α is calibrated from historical trade data.

b. WACC feedback: WACC is modelled as $WACC = WACC_0 + k \sigma_{FX}$, where $WACC_0$ is the base cost of capital, σ_{FX} is FX volatility, and k is a sensitivity factor.

c. Hedging dynamics: The hedged fraction H evolves according to $d_H/d_t = \eta (H^* - H)$, where H^* is the target hedge ratio and η is an adjustment rate.

Table 1. Maps key policy levers to model parameters and values used in the baseline case

Policy lever	Model parameter	Value (example)
Currency regime	Pass-through (α)	USD: 1.0; KRW: 0.7; Basket: 0.5
Hedge tenor (years)	Hedge duration (T)	15
Hedging cost	Annual spread (%)	2%
Basis risk	Factor (β)	0.1
Indexation to inflation	Elasticity	0.5 (half of cost moves)

Under these assumptions and a 15-year horizon, local-currency or small-basket pricing significantly dampens volatility and narrows the CIF price band versus USD-only SPAs (e.g. >50% reduction in annual price volatility). Pairing transparent indexation with explicit FX hedging under CHPS support further stabilizes revenues and weakens any short-term price shock pass-through, thereby lowering incentives for short-lived contract renegotiation.

3. CONCLUSIONS

Taken together, our corridor simulations and the recent literature suggest one design rule: settle trade in local currency or a small basket. Then, pair price indexation with FX hedging and add CHPS-style revenue floors where possible. This package narrows delivered-price bands and lowers finance premia relative to USD-dominant SPAs, thereby strengthening debt metrics and addressing rating concerns about domestic prices (Ding et al. 2023). By staying at pilot scale with proven LH_2 shipping and right-sized carriers, the framework isolates first-order financial drivers without speculative technology leaps while remaining consistent with recent carrier/route sensitivity analyses on scale, distance and boil-off management. The resulting settlement-hedging-policy blueprint is readily replicable for Australia-APAC corridors; practical next steps are multi-year auction vintages under CHPS-like schemes, covenant-aware WACC feedback, and cross-vector stress-tests that include ammonia/LOHC alternatives, to map robustness across plausible design spaces.

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