Consulting Proposal: Bidding Strategy for Power Plant Expansion

Client: Diversified Utility Company **Consultants:** Group 20 **Date:** 12 Nov 2025

Problem & Key Challenges: The client plans to expand generation capacity through upcoming power-plant auctions, aiming to minimize capital investment per MW while ensuring reliable supply. Decisions depend on plant costs, fuel prices, and competitor actions under budget limits. Main challenges are 1) Uncertain auction prices and competitor behaviour, 2) Capital allocation trade-offs: few large vs. many small plants, 3) Temporal coupling: today's bids shape long-term flexibility and 4) Non-linear plant and fuel costs. Optimization support is needed to quantify these trade-offs and guide cost-efficient bidding.

Proposed Modelling Roadmap:

Model 1 – Deterministic Baseline: This model provides a transparent baseline to visualize trade-offs (cost, plant type, capacity) assuming perfect, single-period information. It identifies the optimal plant mix that meets demand at minimum capital cost for one time period, using known (deterministic) inputs. The analysis evaluates all technologies by cost and efficiency, comparing the impact of building a few large units versus many smaller ones. This establishes a reference point, showing the most cost-efficient technologies under ideal conditions and identifying binding constraints (like budget or fuel limits).

Model 2 – Dynamic Revenue Maximization: This model builds on the baseline by introducing a multi-round time horizon to assess long-term planning, changing the objective to maximizing total revenue. It adds dynamic elements to simulate market changes, such as a constant growth in demand. This creates a dynamic financial situation where revenue streams must be managed to fund investments, forcing players to plan around an evolving budget rather than a static one.

Model 3 – Scenario & Robustness Analysis: Building on Model 2's dynamic framework, this model introduces "what-if" scenarios to test the strategy's robustness against key uncertainties. It evaluates performance against risks like volatile resource prices and increased bidding competition. The analysis also incorporates major policy and environmental variables by modelling the financial impact of a new, tech-specific carbon tax. Finally, it simulates weather-driven revenue fluctuations for renewables by applying variable capacity factors (good vs. bad years) to the revenue streams.

Model Trade-Offs & Client Value: The primary trade-off across these models is between simplicity and realism. Model 1 offers a clear, easy-to-understand baseline, answering, "What is the cheapest solution under perfect conditions?" Its value is in establishing a simple cost benchmark. Model 2 sacrifices this simplicity to add realism through a time horizon and dynamic finances. It answers, "How can we best plan investments over time to maximize long-term revenue?" This shifts the client's view from static cost to strategic growth. Finally, Model 3 is the most complex, building on Model 2 to test for risk. It answers, "Will our strategy hold up against real-world volatility, policy, and competition?" Its value is in stress-testing the plan to ensure its robustness. Every insight will be supported by visuals and performance data.