

Efficiency Versus Permission: Transaction Cost Economics and Regulatory Feasibility of Battery Energy Storage for System Services in the Dutch Electricity System

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Extended Abstract

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Abstract Summary

The retirement of conventional power plants removes six system services that the Dutch electricity system can no longer take for granted. Battery energy storage systems are technically capable of replacing those services, but technical capability alone does not resolve the governance question. A BESS must be deliberately configured, contracted, and controlled for each service. The Energy Act 2026 (Energiewet), which entered into force on 1 January 2026, simultaneously restricted and conditionally permitted TenneT's ownership of storage assets. No analytical framework existed to determine which governance arrangement was appropriate for each service under these conditions.

This thesis applies Williamson's transaction cost economics to derive governance predictions for six system services and tests those predictions against the Energiewet and EU unbundling rules. The analysis finds that the law fully permits the efficient governance form for balancing and voltage support, partially for congestion management, and not by default for synthetic inertia, system strength, and black start. The gaps are structural. The central finding is that standardisation determines what transaction cost economics predicts: regulatory decisions about product definitions are simultaneously governance design decisions.

The System Services Governance Framework operationalises both analyses into a sequential decision tool. Applied to three cases at the Utrecht Lage Weide 150 kV node, all three route to hybrid bilateral governance through different analytical paths. Governing battery energy storage for system services demands not only a theory of what is efficient, but an exact understanding of what is permitted.

Presenting Author Biography

Annegien Koopal is a master's student in Complex Systems Engineering and Management at Delft University of Technology. Her research focuses on the governance of battery energy storage systems for system services in the Dutch electricity system, applying transaction cost economics to analyse the interaction between technical infrastructure and regulatory design. She conducted this research in collaboration with TenneT, the Dutch transmission system operator.