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Reported innovation intensity in electricity and gas DSOs around the world

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The Electricity and gas distribution system operators (DSOs) manage the networks that deliver energy from transmission grids to homes and businesses. As countries move toward net zero greenhouse gas emissions, these companies are expected to play a growing role. Electricity grids must integrate more renewable energy, electric vehicles, heat pumps and batteries. Gas grids must adapt to declining fossil gas demand while exploring the use of hydrogen and biomethane. Meeting these challenges requires innovation for incorporating new technologies, business models, operational practices and regulatory approaches.

Despite its importance, measuring innovation in DSOs is difficult. Traditional indicators such as research and development (R&D) spending or patents are often unavailable or not comparable across countries. DSOs differ widely in ownership, structure and reporting practices, and many are part of larger integrated utilities. This makes it hard to compare innovation performance on a global scale.

This paper introduces a novel way to measure innovation using text analysis of corporate reporting. We examine annual and sustainability reports from 102 electricity DSOs and 41 gas DSOs around the world. By counting the frequency of words associated with innovation such as "innovation," "pilot," "trial," "prototype," and "research and development" we construct a measure called Textual Innovation Intensity (TII). This is calculated both in absolute terms and relative to the total length of each report.

The results reveal significant variation in how DSOs report innovation. For electricity networks, reported innovation intensity is highest on average in South America, Europe and Asia. DSOs in OECD countries tend to report more innovation activity than those in non-OECD countries. Unbundled "wires-only" electricity DSOs report more innovation than bundled utilities, and mixed or privately owned DSOs report more than fully public ones. Higher reported innovation intensity is also associated with better operational performance, particularly lower network losses (though the associations are not statistically significant).

For gas networks, patterns are somewhat different. Innovation intensity is more evenly distributed across continents, and there is little difference between OECD and non-OECD countries. In gas, bundled and privately owned operators report slightly higher levels of

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innovation. Larger gas DSOs measured by customers, network length or sales tend to report more innovation, although correlations are generally modest.

Case studies of leading DSOs illustrate what reported innovation looks like in practice. Across continents, electricity DSOs focus on digitalisation, smart grids, renewable integration, battery storage and customer-centric services. Gas DSOs emphasize digital monitoring, methane reduction, hydrogen readiness and integration of low-carbon gases. Local contexts also matter for innovation themes: island systems prioritise storage and resilience, emerging economies focus on affordability and access, and high-income countries often highlight digital transformation for net zero.

The paper also highlights important limitations. Reporting practices differ widely between countries, and some innovation may be under- or over-reported. Automated translation and text processing may lose nuance. Furthermore, innovation reported at the parent-company level may not reflect activity specific to distribution networks. Nonetheless, text-based analysis provides a practical method for global comparison when other innovation data are unavailable.

The study confirms that innovation in distribution networks varies greatly and is shaped by income levels, regulatory frameworks and ownership structures. As DSOs become increasingly central to the energy transition, understanding how and where innovation occurs is crucial for regulators and policymakers. Although textual innovation intensity does not measure innovation directly, it offers a new window into how network companies report their strategic priorities particularly in the context of net zero.

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