DSO ENTITY
DSOs FOR EUROPE

The DSO Network Development Framework: From Strategic Planning to Project Execution

Drafted by Task Force Network Planning

June 2026

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List of abbreviations

DSO – Distribution System Operator

TSO - Transmission System Operator

DNDP - Distribution Network Development Plan

LV – Low Voltage

MV – Medium Voltage

HV – High Voltage

UHV – Ultra-High Voltage

NRA – National Regulatory Authority

1. Executive Summary

Europe's energy transition is reshaping electricity demand and generation at an unprecedented pace, and this transformation is occurring primarily in the distribution grid. Distribution System Operators (DSOs) must adapt networks to rapid growth in electrification, renewable energy, e-mobility, storage, and digitalization, while ensuring reliability and cost-efficiency for society.

DSOs operate in a fundamentally different environment from Transmission System Operators (TSOs), managing hundreds of thousands of small to medium-sized interventions each year, most of them triggered by customer requests at Low Voltage (LV) and Medium Voltage (MV) level. These interventions are individually modest but collectively significant, increasingly driving upstream reinforcement needs.

Because of this mass-scale, decentralized reality, distribution network development relies on scenario-based approaches, aggregated programs, and agile execution rather than long-term asset-by-asset forecasting. The Distribution Network Development Plan (DNDP) provides strategic visibility on future needs while preserving the agility required to manage fast-moving local developments.

The document also underscores the essential role of stakeholder engagement across all phases of network development. DSOs work with customers, TSOs, civil society, municipalities, and regulators to align expectations, improve scenario quality, and enable anticipatory investments. Engagement is tailored to geography, topic, and time horizon, reflecting the inherently local nature of distribution grids.

Overall, the report offers a grounded perspective on the operational, structural, and strategic realities shaping DSO network development. It aims to clarify how DSOs plan, coordinate, and deliver the infrastructure that underpins Europe's electrification, resilience, and long-term climate objectives.

2. Scope of this report

This report aims to offer stakeholders and institutions a clear, reality-based overview of how DSOs develop and reinforce Europe's distribution networks-the infrastructure where the energy transition becomes tangible for citizens, businesses, and territories.

Across Europe, where electrification, RES integration, e-mobility, and digitalization are long-standing and advancing trends, DSOs must plan and execute investments that are both locally responsive and aligned with Europe's long-term climate and industrial objectives.

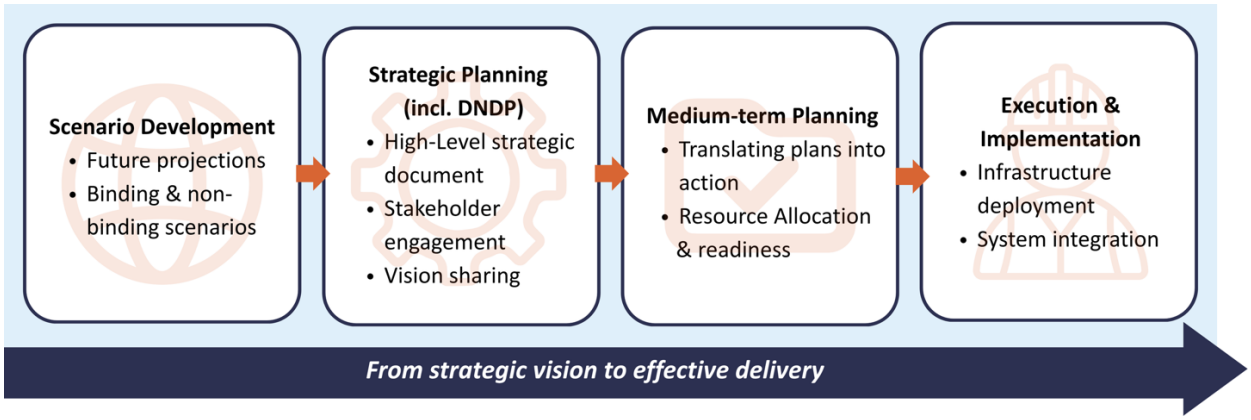

***Figure 1**: DSO Network Development from strategic vision to effective delivery*

This report explains the multi-layer nature of DSO planning, from long-term scenarios to programmatic planning and project execution. This clarifies why DSOs depend on granular local insights that cannot be captured by centralised, top-down modelling alone. DNDPs represent a strategic transparency instrument, offering stakeholders visibility on future network development while preserving the agility required to manage hundreds of thousands of annual MV/LV customer-driven connection requests or changes in injection and consumption patterns.

The document also highlights the structural differences between HV grid development -characterized by large, long-lead-time investments, and the mass-scale short-cycle MV/LV works that collectively shape the pace and cost of Europe's electrification. These features call for policy and regulatory approaches tailored to DSOs' operational reality: program-based, criteria-driven, and performance-focused, rather than requiring TSO-style asset-by-asset approach of network development.

Finally, the report underscores the importance of effective, context-specific stakeholder engagement across all phases of planning. DSOs work with municipalities, TSOs, national authorities, customers, and civil society to ensure credible scenarios, alignment of expectations, and timely anticipatory investments. Early engagement strengthens the collective ability to deliver the infrastructure that Europe needs for resilience, decarbonization, competitiveness, and social acceptance.

3. Distribution Network Development Business

Distribution System Operators are responsible for the operation, maintenance, and development of secure, reliable, and efficient electricity distribution systems. As such, they play a central role in ensuring security of supply while enabling the ongoing transformation of Europe's energy system.

As Europe accelerates the deployment of renewable energy sources, electrification, e-mobility, data centres, and storage, the role of DSOs becomes increasingly critical.

The energy transition materialises primarily at distribution level, where infrastructure must adapt continuously to evolving consumption and generation patterns. DSOs operate within rapidly changing regulatory frameworks and must respond to shifting stakeholder and customer expectations. Besides working with many customer requests emerging from connection to billing, this requires an integrated and forward-looking approach to network development.

For DSOs, network development is not a single activity but a continuous and interconnected process combining **planning, execution, and maintenance**. These activities take place simultaneously across multiple time horizons and geographical scales, from long-term strategic considerations to very local, customer-driven interventions. A defining characteristic of this process is the need to reconcile short-term dynamics, such as sudden increases in connection requests for renewable generation or electric mobility, with infrastructure that remains in operation for 40 to 60 years, from today to far beyond 2050 when net-zero targets are to be reached in Europe. Decisions taken today must therefore be robust under a wide range of future developments, which makes scenario-based planning and flexible technical solutions essential.

Planning activities translate political objectives, market developments, and long-term trends into scenarios, load-flow analyses, and grid strategies. They also integrate the renewal and modernisation of existing assets, whose long service life requires early and strategic decision-making. These renewal cycles provide opportunities not only to replace ageing infrastructure but also to increase capacity, enhance automation, and integrate digital functionalities. The DNDPs and associated programs do not represent a standalone output of the planning process but rather consolidate and convey its main outcomes and strategic orientations. Both these operate at an aggregated level, particularly for medium- and low-voltage networks where asset-level forecasting is -in contrast to HV and UHV networks- neither feasible nor meaningful.

Execution represents the implementation of these plans through the construction and reinforcement of lines, substations, and transformer stations. This phase is inherently local and often requires close coordination with municipalities, spatial planning authorities, and other infrastructure operators, especially in urban areas where space is constrained and multiple projects must be aligned.

Maintenance, in turn, ensures the long-term reliability and availability of the network through inspection, repair, and replacement activities. It is a fundamental component of security of supply and an integral part of network development rather than a separate function.

A key feature of the DSO business within the three aforementioned activities, is that distribution network development, particularly at medium- and low-voltage levels, is a mass-scale activity. DSOs manage hundreds of thousands of small to medium-sized interventions each year, most of them driven directly by customer connection requests. These interventions follow standardised processes, have relatively short lead times, and are executed efficiently without requiring detailed long-term forecasting at the level of individual assets. In contrast, higher-voltage developments involve fewer projects, higher investment volumes, longer lead times, and closer coordination with transmission system operators.

Investment Characteristics	MV and LV	HV
Project Volume (annually nationwide, orders in magnitude)	Hundreds of thousands of small-scale LV projects Thousands of MV projects	Tens to hundred HV projects
Unit Cost	Low to medium (hundreds to thousands of euros for LV; up to a few million for MV)	High (tens of millions of euros or more)
Lead Time	Short (weeks to months for LV) to medium (months to semesters for MV)	Long (5–10 years or more for EHV)
Customer and stakeholder Interaction	Minimal interaction prior to connection application	Extended engagement during project development
Impact Scope	Local (individual customers, streets, cities)	Broad (regional, national, cross-border)

Figure 2: *Differences in network development characteristics across voltage level (LV, MV, HV)*

The cumulative impact of many small-scale connections can, however, be significant, often triggering the need for upstream reinforcement at higher voltage levels. This interdependence requires careful aggregation, planning, and coordination across voltage levels.

To manage this complexity, DSOs rely on a set of core principles that guide network development decisions. These include:

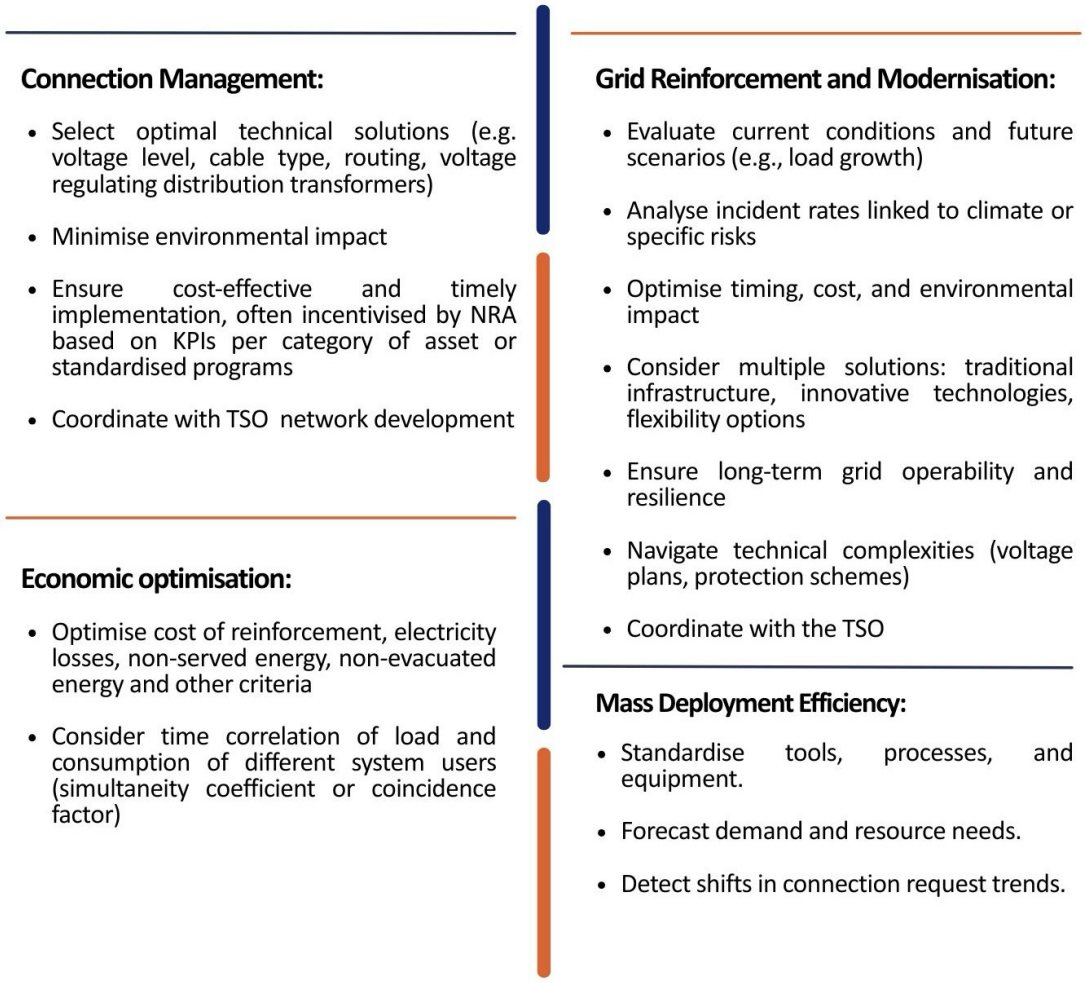

Figure 3: *DSO principles that guide network development*

The DSO network development business therefore is a continuous and integrated process at the core of DSO responsibilities, combining planning, execution, and maintenance to ensure a secure and reliable electricity system. DSOs must manage growing complexity from distributed connections, long asset lifetimes, and evolving system needs, while coordinating across stakeholders and voltage levels. By applying scenario-based planning, efficient investment strategies, and standardized yet flexible solutions, DSOs reconcile short-term demands with long-term system requirements, ensuring a resilient and future-proof distribution network.

4. Distribution Network Development Process

The development of electricity distribution networks relies on a coherent, multilayer planning framework designed to ensure both the efficient management of current operations and the strategic readiness of the system to address future challenges. This framework comprises three complementary layers that respond to distinct objectives and time horizons:

1. Operational Execution (short term)

Day-to-day DSO activities are largely driven by customer connection requests and small-scale reinforcements. These works follow standardized processes and are typically delivered within short time frames. This layer represents a major part of annual DSO interventions.

2. Strategic Programs (1–5 years)

These include modernization, renewal, and resilience programs aimed at strengthening network performance and ensuring security of supply. Prioritization is data driven, based on standardized procedures, and also aligned with national policies and TSO planning when necessary. These programs constitute the backbone of the Distribution Network Development Plan.

3. Long Term Vision through the DNDP (5–10 years)

The DNDP sets out a structured view of future system needs. Using scenario-based planning, it anticipates developments such as electrification, renewable energy integration, and flexibility. It defines priorities for modernization, digitalization, capacity reinforcement, and climate resilience, promoting also transparency towards society, regulators and institutional stakeholders.

The DNDP aligns and integrates these three planning layers with a specific focus on supporting strategic long-term decision-making rather than replacing existing planning processes on the operational and medium-term layers. Its purpose is to support the evolution of the distribution system in a context marked by rapid electrification, accelerated deployment of renewable energy sources, growth in storage, electric mobility and heat pumps. It is a strategic document: it does not list individual MV/LV projects, as these depend also on customer requests that cannot be forecast with accuracy.

Regarding **customer requests**, European DSOs manage hundreds of thousands of customer triggered connections each year, ranging from large-scale requests on high voltage level to the ones on MV/LV levels. These MV/LV interventions are small-scale, predictable in process, and efficiently managed without long-term forecasting. Their localized nature and limited impact mean that DSOs-unlike TSOs cannot and should not publish detailed lists of assets. In this case, forecasting is meaningful only at the level of aggregated programs.

Distribution network development as such combines short-term operations, medium-term programs, and long-term planning through the DNDP to ensure a secure and future-ready grid. Given the large volume of customer-driven, localized connections and the need for aggregated planning, effective coordination and transparency become essential, highlighting the central role of stakeholder engagement in supporting the evolution of the distribution system.

5. Stakeholder Engagement

The energy transition takes place in the distribution grid and incorporates many stakeholders with particular interests. To make the energy transition possible for DSOs, it goes without saying that they engage with a wide range of stakeholders i.e. TSOs, other DSOs, NRAs, national to regional to local authorities, customers as well as their representatives, and civil society.

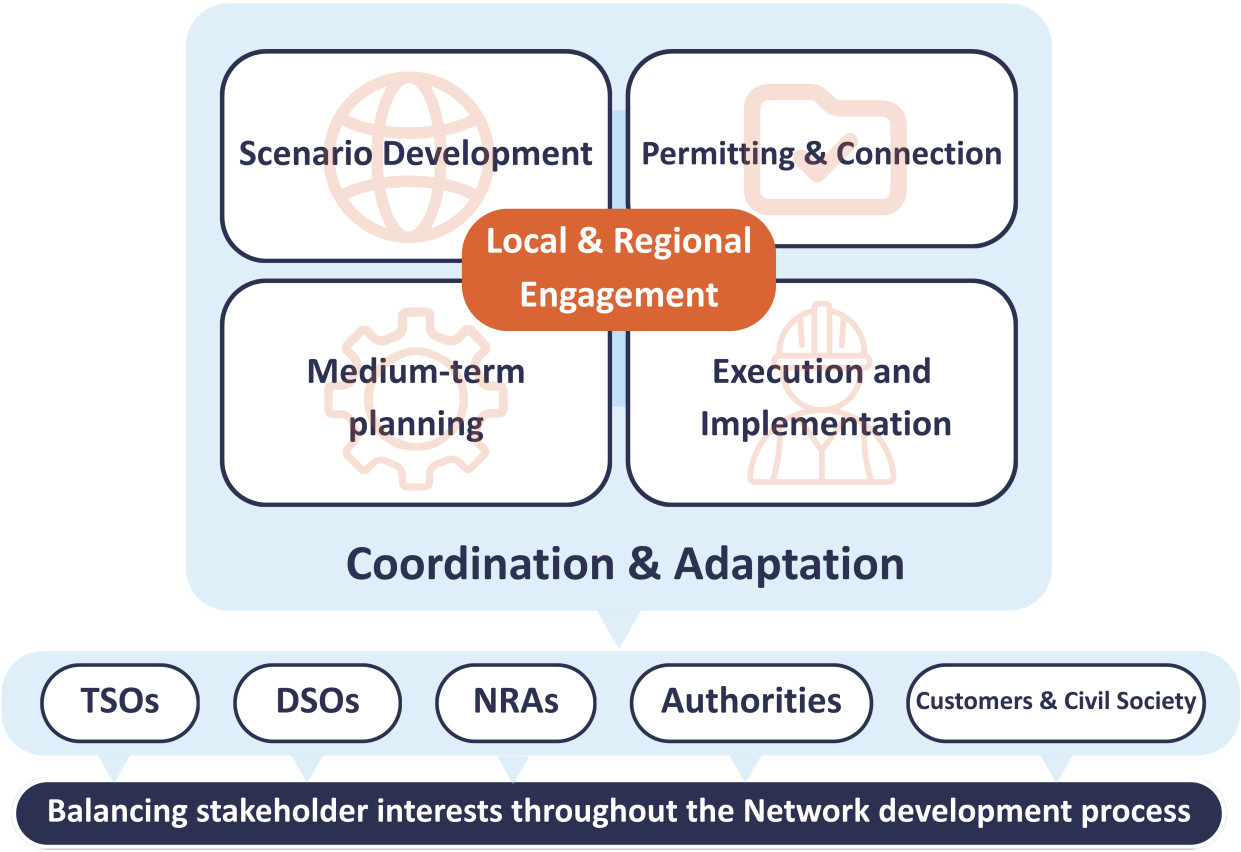

Figure 4: *Stakeholder Engagement in DSO Network Development*

DSOs consider stakeholder engagement as an essential for network development:

- While national and European activities provide essential framing, local and regional engagement is critical to capture granularity, timing, and spatial signals relevant for distribution network development plans and subsequently investment planning.

- DSOs adapt Stakeholder engagement to the context, topic, geography, and time horizon. DSOs expect stakeholders to engage within the tailored context, the topic to be addressed and their relevance/knowledge of the topic. This includes the collection of inputs from aggregated bodies and organisations, representing citizens, producers, and other system users when it concerns aggregated data and strategy such as for DNDP. This engagement takes place over the full network

development process from scenario development until operational execution (permitting and connecting). In case of the DNDP, stakeholder engagement is defined within country specific national regulation.

- An early and transparent engagement improves scenario quality, strengthens commitment to a shared net zero vision, Network Development and increases quality of anticipatory investment. However, local scenarios come with high uncertainty as future developments may depend on single stakeholders from single sectors. At the same time stakeholder engagement needs to focus on the strategy instead of an asset-by-name level.

- The earlier and the firmer stakeholder commits, the more visibility and planning reliability materializes for all. The scenario development does not imply a local grid connection right but ensures to be on the "right path" in the longer term.

- It is the core business of DSOs to consider and weigh individual stakeholder needs in a non-discriminatory way in the network development process.

- Permitting remains a local process involving direct stakeholder engagement. Permitting for LV and MV generally limits the number of stakeholders involved. However, permitting for HV generally involves a broad range of stakeholders.

- Where not formally mandated, DSOs often proactively facilitate coordination and often step in as part of their system and society's responsibility. The junction of concepts of local energy calls for DSOs involvement, as a leader of stakeholder involvement or as an involved stakeholder.

In conclusion, stakeholder engagement is an essential and embedded part of DSO network development, reflecting the inherently local, complex, and multi-actor nature of the energy transition. DSOs already engage with a wide range of stakeholders - from system operators and regulators to authorities, customers, and civil society - adapting the level, timing, and scope of engagement to the context and needs of each process. While stakeholder involvement is particularly critical for scenario development and planning, it is applied in a targeted and efficient manner, balancing transparency with practicality and focusing on strategic rather than asset-level detail. Even where not formally mandated, DSOs step in to facilitate coordination and ensure alignment across actors, underlining their role as both a system operator and a key enabler of the broader energy transition.

6. Conclusion

The development of distribution networks sits at the core of the energy transition, where electrification, renewable integration, e-mobility, and digitalization are continuously reshaping system needs across Europe. DSOs must deliver investments that are both locally grounded and aligned with long-term climate and energy objectives, managing a system that evolves through the combined effect of short-term operational actions, medium-term programs, and long-term strategic planning.

This multi-layer approach reflects the inherent nature of the DSO role: combining standardized, high-volume MV/LV interventions driven by customer needs with fewer, long-lead-time HV developments, all the while ensuring coordination across voltage levels and stakeholders. Given the long lifespan of assets and the uncertainty of future developments, planning must rely on scenario-based approaches and aggregated programs rather than detailed, asset-by-asset forecasting.

DSOs consider stakeholder engagement as a structural component of effective network development. It is already embedded in DSO practices and applied in a targeted, context-specific, and efficient manner across all phases of the process, ensuring transparency, alignment, and high-quality outcomes.