EUROPE'S DELIVERY FRONTIER:

Shared Capacity, Strategic Sequencing & the Reality of Simultaneous Delivery to 2030

EUROPEAN CAPACITY REPORT · 2026–2030

Policy Analysis & Strategic Capacity Framework

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Author's Note

This study was prompted by an unsustainable divergence at the core of European governance: the structural gap between high-level legislative target-setting and the physical, administrative, and spatial capacity required to execute those targets across Member States. It emerges at a moment of profound transformation, as an increasingly volatile, multipolar world order fractures supply chains, sharpens geopolitical competition, and challenges Europe's open strategic autonomy and economic resilience.

The benchmark analysis presented in Mario Draghi's report on European competitiveness established the indispensable scale of Europe's investment needs across decarbonization, advanced technologies, and defence. Yet across policy design and institutional discourse, execution has continued to be treated as an automatic downstream consequence of capital allocation. In practice, capital commitments do not compress linear physical lead times, nor do they instantly summon technical labor pools, high-voltage equipment, or municipal planning staff into existence. Under heightened global pressure, Europe cannot afford an internal delivery machinery that falters under its own simultaneous demands.

The empirical consequences of this operational blind spot are already visible. The systemic delivery gridlock in the Netherlands—where over 9 GW of unserved demand, a shortage of 28,000 grid technicians, and saturated networks culminated in a statutory rationing framework—demonstrates that the limits of simultaneous delivery are no longer theoretical. Similar collisions across Spain, Poland, Germany, and Italy confirm that without horizontal capacity management, independent sectoral mandates inevitably cannibalize the very systems they depend upon.

This study was written to move beyond the traditional focus on investment deficits and establish a rigorous framework for Europe's implementation gap. By introducing the mechanics of the Runway Ratio, identifying Implementation Multipliers, and establishing an ex-ante governance architecture, this work seeks to provide the Commission and co-legislators with the analytical and institutional tools necessary to sequence capacity, safeguard the Single Market, and turn 2030 strategic priorities into deliverable realities.

Jaana Ylikoski

September 2026

1. Executive Summary

Europe has set an ambitious portfolio of strategic priorities for 2030, spanning energy transitions, industrial decarbonization, artificial intelligence infrastructure, defence readiness, housing, transport, and climate resilience. The critical policy question is no longer whether these priorities are individually justified. The question is whether Europe can deliver them simultaneously. Strategic objectives are converted into outcomes through shared physical, human, and institutional capacities. Electricity grids, permitting authorities, technical labour pools, construction ecosystems, industrial supply chains, and fiscal envelopes are drawn upon concurrently across multiple portfolios. These enabling capacities are finite, geographically uneven, and slow to expand.

When multiple priority portfolios accelerate concurrently, they place simultaneous demand on identical shared systems. As a result, the delivery system begins to compete with itself:

- Connection queues lengthen and delivery lead times extend across key strategic sectors.
- Expanding one constrained capacity consumes other constrained capacities—a recursive mechanism where capacity is required to create capacity.
- Normal queuing mechanisms break down, forcing national and local authorities into informal rationing or explicit prioritization.

In policy design, the European Commission is rhetorically pursuing a **Capacity-First Europe (Scenario 2)**, yet its administrative baseline remains locked in **Independent Acceleration (Scenario 1)**, where individual portfolios accelerate in vertical silos. Because horizontal execution cannot keep pace with parallel targets, Member States are increasingly forced by default into **Managed Scarcity (Scenario 3)**, rationing access at the local level without European coordination.

To preserve delivery throughput to 2030, Europe must complement target-setting with active **Implementation Capacity Management**. Policy interventions must follow a disciplined five-step response hierarchy:

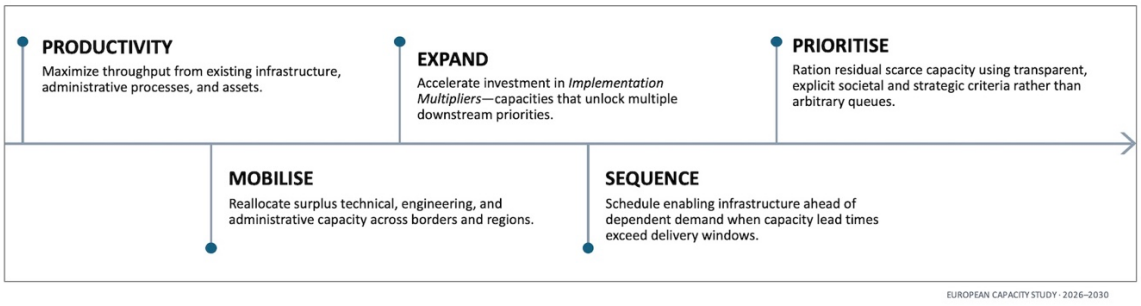


Exhibit 1: The Strategic Capacity Response Hierarchy. *Interventions must exhaust operational productivity, cross-border mobility, and implementation multipliers before relying on sequencing or rationing scarce capacity.*

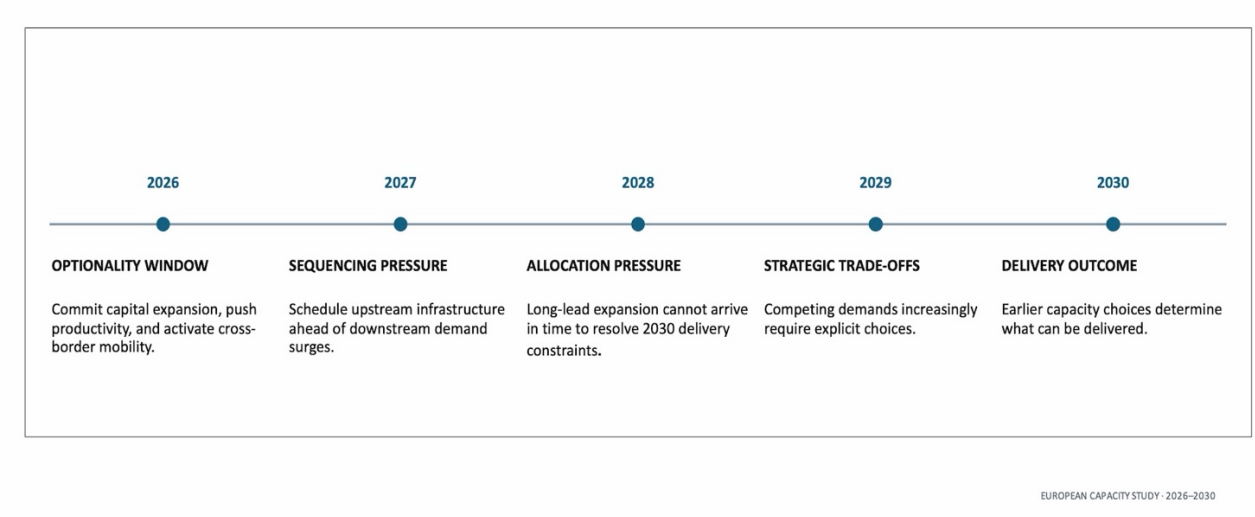


Figure 1: The 2026–2030 Strategic Runway. *Policy optionality narrows rapidly after 2026; because major infrastructure lead times exceed remaining delivery windows, sequencing and allocation pressures become binding by 2028.*

Executive Synthesis: The Seven Strategic Delivery Questions

(Matrix 1)

Core Strategic Question	Empirical Status & Diagnosis	Strategic Recourse & Intervention
1. What is the current capacity ceiling?	Defined regionally by unserved demand: >60% grid requests denied in Spain (~40 GW); ~42 GW rejected in Poland; ~14.3 GW backlogged in the Netherlands; 7.4–8.3 GW German network reserves.	Ceilings must be measured at the node and district level, not masked by national statistical averages.
2. What determines the ceiling?	Long linear lead times (8–12 yrs for transmission), demographic retirement cliffs (7.4m construction exits by 2030), fragmented administration (3–8 authorities/permit), and heavy equipment delays (up to 4 yrs for transformers).	Horizontal systems dictate the delivery ceiling; capital availability alone cannot bypass physical and human lead times.
3. How much can we raise it?	Non-build operational interventions can unlock immediate headroom: Dynamic Line Rating yields +15–30% grid throughput; digital permitting cuts multi-month inter-agency handoffs.	Deploy Steps 1 and 2 (Productivity and Cross-Border Mobilisation) to unlock latent capacity without waiting for new construction.
4. By when can it be raised?	Conventional expansion window for transmission is closed ($RR < 0.5$). Specialized engineering closes by early 2029. Administrative digitisation remains actionable through 2029 ($RR \geq 1.5$).	Interventions must align with the Runway Ratio (RR). Long-lead expansions started after 2026 will not deliver by 2030.
5. Where is the greatest unlocking effect?	In **Implementation Multipliers**: substations, high-voltage equipment factories, vocational electrician schools, and digital planning platforms.	Prioritize capital to projects that create capacity for multiple downstream portfolios over projects that only consume capacity.
6. What must be sequenced?	Grids before electrification clusters; technical skills before social housing surges; administrative capacity before funding calls; component factories before mass rollouts.	Apply the Delivery Alignment Principle: upstream enablers must be scheduled ahead of downstream demand surges.
7. Where, ultimately, must we choose?	At geographically congested transmission nodes and tight local labour markets where $RR < 1.0$. Exemplified by the Netherlands' statutory allocation system.	Replace opaque first-come, first-served queues with transparent criteria: system-unlocking value, essential needs, security, and climate additionality.

PART I — THE STRATEGIC QUESTION

1.1 The Policy Context: Investment Gaps vs. Implementation Gaps

The Draghi report on European competitiveness highlighted that closing Europe's productivity and innovation gap demands unprecedented capital investment across decarbonization, digital infrastructure, and defence. However, capital commitment does not guarantee execution.

$$Deliverable\ Outcome = Strategic\ Objective + Capital + Implementation\ Capacity$$

By treating capital commitments as an automatic guarantee of delivery, European policymaking conflates the authorization of funding with the physical realization of assets. Financing fifty strategic priorities simultaneously does not summon new technical workforces, high-voltage transformers, or municipal planning officers into existence. When immense capital envelopes are funneled into saturated horizontal systems, the surplus financing competes against itself. The result is procurement backlogs, localized wage and component inflation, and prolonged connection queues. Without active horizontal capacity management, increased capital merely purchases delay.

- An **investment gap** measures the financial capital required to achieve a policy target
- An **implementation gap** measures the physical, human, administrative, and supply-chain throughput required to convert capital into operating assets within a specific geography and timeframe.

Financing twenty projects simultaneously does not instantly create twenty engineering teams, twenty high-voltage transformers, or additional municipal planning staff. When capital enters the system faster than enabling capacities can expand, funding competes against itself, driving wage inflation, equipment backlogs, and extended delivery queues.

1.2 The 2026–2030 Time Compression Window

The period between 2026 and 2030 represents an implementation bottleneck. Deadlines under the Recovery and Resilience Facility (RRF), binding Renewable Energy Directive benchmarks (42.5%), the TEN-T core network mandate, urgent housing initiatives, and defence production ramp-ups converge on the exact same five-year delivery window. Because conventional infrastructure expansion requires multi-year lead times, Europe cannot resolve near-term delivery collisions through construction alone. *(See matrix 2 on page 6)*

(Matrix 2)

Capacity	Expansion Mechanism	Typical Lead Time	Short-Term Substitutability	Geographic Mobility
Transmission Grid	Linear infrastructure buildout	8–12 years	Very Low	Immobile
Distribution Grid	Substation and cable reinforcement	4–10 years	Low	Immobile
Grid Equipment	Large transformers, HV cables	2–4 years	Medium (global imports)	Highly Mobile
Specialized Engineers	Tertiary education and accreditation	4–6 years	Low	Moderate
Technical Trades / Electricians	Vocational training / upskilling	1–3 years	Medium	Moderate
Permitting Staff	Agency recruitment, digital tooling	Months to 2 years	Medium	Low (legal jurisdiction)
Civil Construction	Contractor scaling, cross-border deployment	1–3 years	Medium	Moderate
Capital & Fiscal Financing	Budgetary allocation, co-financing	Months	High	Fully Mobile

2. Europe's Strategic Delivery Portfolio (2026–2030)

Europe is pursuing several large-scale physical, industrial, and institutional transformations simultaneously. Their combined challenge lies in the simultaneous demand they place on the shared implementation base across EU27 Member States.

2.1 Strategic Portfolio Requirements

- **Energy, Grids, and Electrification:** Electricity supply must decarbonize while major sectors electrify, driving demand across generation, transmission, distribution, and storage. The European Commission estimates around €584 billion in electricity grid investment is required to 2030, even as much of Europe's distribution network requires modernisation.
- **Industrial Transformation and AI Infrastructure:** Clean technology manufacturing and industrial decarbonization require dedicated energy infrastructure. Concurrently, European Commission projections indicate EU data-centre capacity will more than double by 2030 (rising from ~12 GW in 2025 to ~28 GW). Terna reported over 300 GW of renewable connection applications and nearly 80 GW of data-centre requests in Italy by January 2026, illustrating the scale of convergence on network systems.
- **Housing, Transport, and Climate Resilience:** EU housing targets require over 2 million homes annually (roughly 650,000 units above baseline output), while TEN-T core network needs are estimated at €515 billion to 2030. Climate adaptation demands urgent protection works across 36 major European climate risks identified by the European Environment Agency (EEA). *(See Matrix 3 on page 7)*

(Matrix 3)

Strategic Portfolio	Selected Delivery Signal	Main Shared Implementation Inputs
Energy & Renewables	Binding 42.5% renewable energy share by 2030; widespread electrification	Power grids, permits, engineers, specialized equipment, capital
Electricity Networks	~€584bn grid investment need to 2030; ageing distribution assets	Technicians, electrical engineers, civil construction, cables/transformers, permits
Transport (TEN-T)	~€515bn estimated investment for TEN-T core network completion to 2030	Civil engineering, heavy construction, public procurement, permits, capital
Housing Construction	>2m homes/year required (~650,000 units/year above current output)	Construction workforce, land access, local administration, grid access, financing
Digital & AI Infrastructure	EU data-centre load expanding from ~12 GW (2025) / 15.1 GW (2026) to ~28 GW (2030)	Power access, transmission grids, land, cooling water, construction, digital skills
Industrial Transformation	Electrification and clean-tech manufacturing scale-up	Power capacity, process engineers, specialized equipment, permitting, capital
Defence Readiness & Security	Rapid spending surge, 200,000 reskilled, 500 dual-use mobility hotspots	Manufacturing facilities, engineers, logistics infrastructure, specialized materials
Climate Adaptation & Resilience	36 major European climate risks identified by the EEA requiring protective works	Civil engineering, construction contractors, water systems, local delivery teams

3. Europe's Shared Implementation Layer and Dependencies

European governance evaluates policy portfolios in vertical silos, but execution depends on horizontal shared systems.

(Matrix 4)

Strategic Portfolio	Permitting & Legal	Grid Power Access	Specialized Engineering	Construction Trades	Industrial Supply Chain	Local Delivery & Admin	Institutional Coordination
Energy & Renewables	High	High	High	High	High	Medium	High
Electricity Networks	High	High	High	High	High	High	High
Industrial Transformation	High	High	High	High	High	Medium	High
Digital & AI Infrastructure	High	High	High	High	Medium	Medium	High
Defence Readiness	Medium	Medium	High	High	High	Medium	High
Housing Construction	High	Medium	High	High	Medium	High	High
Transport Infrastructure	High	Medium	High	High	High	High	High
Climate Adaptation	High	Medium	High	High	Medium	High	High

Figure 2: The Horizontal Implementation Layer. *Separate vertical policy portfolios (energy, AI, defence, housing) converge on the exact same enabling physical and administrative capacities.*

3.2 Systemic Bottlenecks Across Enabling Layers

Permitting as an Administrative Production Line

Permitting processes function as an administrative production line with finite throughput capacity, rather than just a legal formality. Data from a DG GROW study across 14 Member States covering strategic sectors (clean tech, semiconductors, critical raw materials, pharmaceuticals) demonstrates structural friction:

- Strategic projects must navigate between **3 and 8 separate regulatory authorities**.
- **76% of project developers** report that multi-authority handoffs extend project timelines by several months to years.
- **80% of permitting authorities** rely primarily on unstructured email for cross-agency coordination.
- **50% of authorities** use integrated digital platforms for inter-agency coordination, and zero surveyed Member States operate a single integrated end-to-end permitting platform covering all permits.
- Administrative overhead averages **€119,000–€460,000 per project** in developer staff time and **€215,000–€250,000** in public authority administrative costs.
- Typical strategic permitting procedures take **12 to 24 months**.

Specialized Labour and the Construction Replacement Challenge

Workforce constraints directly impact delivery timelines across clean energy, housing, and industrial renewal:

- EURES records shortages of electrical engineers in **16 Member States** and civil engineers in **15 Member States**.
- The European construction ecosystem faces approximately **7.4 million retirements or departures between 2024 and 2030**, requiring a total intake and upskilling of roughly **11 million workers** to satisfy replacement and strategic expansion needs.
- In the Netherlands alone, network operators project a deficit of **~28,000 technicians through 2029** to execute planned grid reinforcements—competing directly with home building, charging networks, and industrial electrification.

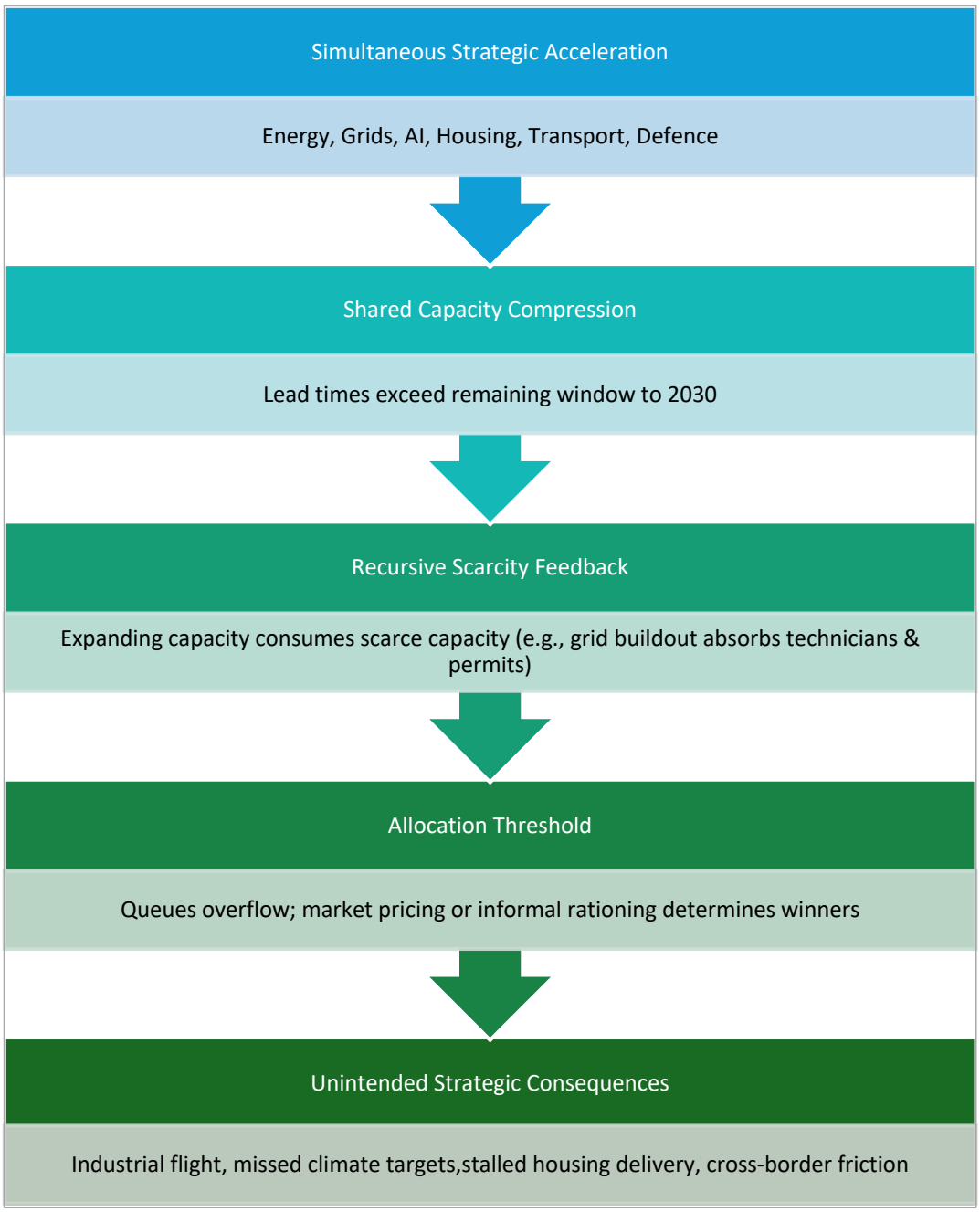
Fiscal Allocation and Administrative Absorption

While large EU programmes exist, public financing is bound by the fiscal parameters of national deficit rules and the upcoming 2028–2034 Multiannual Financial Framework (MFF). The need to agree on the MFF creates a decision window, concentrating fiscal allocation pressure ahead of 2028. Furthermore, capital absorption is limited by the administrative capacity of local planning and procurement bodies to process tenders before funding expiration deadlines.

4. The Capacity Collision Mechanism and Systemic Compression

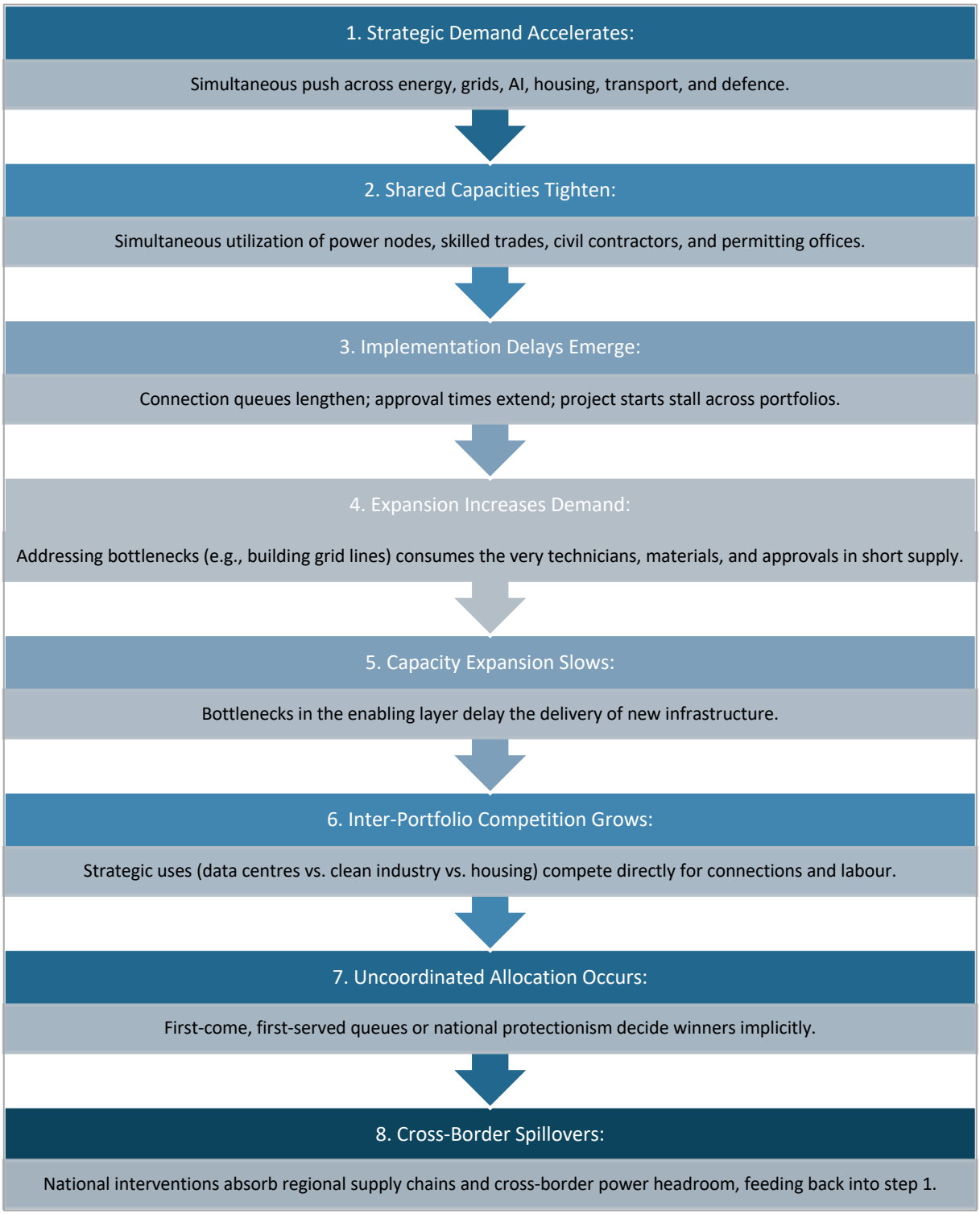
4.1 Anatomical Progression of a Collision

A bottleneck slows an individual project or sector. A **capacity collision** occurs when multiple independent policy portfolios converge on the same constrained resource in the same space and time, producing recursive delays across the entire delivery system.



4.2 The Systemic Compression Feedback Loop

When capacity expansion is attempted under conditions of simultaneous demand, scarcity becomes recursive.



4.3 The Allocation Threshold and Queuing Failures

When capacity demand significantly exceeds throughput, systems default to **First-Come, First-Served (FCFS)** queues. FCFS appears neutral, but operates as an arbitrary allocation rule: Earlier applications receive scarce access ahead of subsequent projects regardless of societal or strategic value. Under binding grid constraints, speculative connection applications can block hospitals, public transport electrification, social housing, clean manufacturing, or defence infrastructure for years. When waiting times become prohibitive, authorities cross the **Allocation Threshold**, moving from project acceleration to explicit administrative rationing. First-Come, First-Served (FCFS) queuing operates under the illusion of market neutrality, but in a resource-constrained environment, it represents an administrative refusal to govern. When access to finite infrastructure nodes is allocated solely by application timestamps, speculative applications and low-value assets are permitted to block high-impact decarbonization, critical defense logistics, and essential civic housing for years. Crossing the Allocation Threshold demands that public authorities abandon passive queuing and establish transparent, legally robust prioritization regimes anchored in measurable societal and strategic criteria.

5. Empirical Evidence: Observed Systemic Collisions

Observed capacity constraints across Member States illustrate the transition from localized bottlenecks to cross-portfolio collisions:
(Matrix 4)

Member State / Region	Constrained Enabling Capacity	Empirical Evidence & Quantified Gap	Competing Strategic Portfolios	Operational Status & Evidence State
Netherlands	Transmission & distribution grid access; technical labour	**~9.3 GW** (15,014 firms) withdrawal queue; **~5.0 GW** feed-in queue; **28,000-technician deficit** through 2029	Housing, industrial decarbonization, data centres, public transport, schools	**Allocation Threshold Crossed:** Statutory priority framework enacted July 2026
Spain	Distribution and transmission node capacity	**>60%** of demand and storage requests denied in 2024 (**~40 GW unserved demand**)	Grid-scale batteries, industrial electrification, clean tech, AI data hubs	**Quantified Insufficiency:** Direct access refusals documented by CNMC
Poland	Transmission grid absorption capacity	**~42 GW** of renewable connection requests rejected in 2025 relative to a 72 GW total system	Renewable generation, coal phaseout, industrial power supply	**Direct Insufficiency:** Transformation compression under system restructuring
Germany	Operational transmission reserve capacity	**7.407 GW** network reserve required (2026/27), rising to **8.274 GW** (2028/29)	Renewable integration, industrial electrification, cross-border flows	**Binding System Constraint:** Operational measures required to maintain grid security
Italy	Grid connection and authorization throughput	**>300 GW** of renewable requests and **~80 GW** of data centre requests backlogged	Renewable power, AI infrastructure, regional industrial electrification	**Extreme Oversubscription:** Network planning and authorization pipeline pressure
EU-14 Overview	Strategic industrial permitting throughput	**3–8 authorities** per project; **76%** report multi-authority delays; **80%** coordinate via email	Clean tech, semiconductors, critical raw materials, pharmaceuticals	**Observed Delay:** Administrative production constraints documented by DG GROW

6. The 2026–2030 Strategic Runway and Runway Ratio

Europe's remaining operational runway varies by enabling capacity. Conventional linear infrastructure cannot be expanded on demand to meet 2030 goals. A Runway Ratio below unity ($RR < 1.0$) serves as a mathematical boundary condition: it proves that conventional engineering construction initiated today cannot arrive in time to satisfy near-term policy deadlines. For systems characterized by multi-year gestation periods—such as high-voltage transmission networks or specialized workforce pipelines—initiating conventional expansion after 2026 delivers operational assets exclusively to the post-2030 landscape. For the 2026–2030 window, policy effectiveness is strictly confined to non-build operational optimization, cross-border resource mobilization, and explicit demand sequencing.

The **Runway Ratio (RR)** measures whether an enabling capacity can expand in time to support a strategic delivery milestone:

$$\text{Runway Ratio } (RR) = \frac{\Delta t_{\text{available}}}{L_{\text{expansion}}} = \frac{T_{\text{target}} - T_{\text{current}}}{L_{\text{expansion}}}$$

Where:

- $\Delta t_{\text{available}} = T_{\text{target}} - T_{\text{current}}$ is the time remaining until the delivery deadline.
- $L_{\text{expansion}}$ is the verified lead time required to plan, permit, and construct the enabling capacity.

- **Operational Implication:** Because $RR < 1.0$, conventional grid expansion cannot be commissioned in time to meet the 2028 delivery date. The project must rely on Step 1 (Productivity / Dynamic Line Rating), Step 2 (Flexible connection contracts), or Step 4 (Demand sequencing).

Decision Criteria: $RR \geq 1.0$*:* Expansion window remains open; conventional capacity addition can resolve the constraint before the deadline. $RR < 1.0$**:** Structural **runway deficit**. Physical expansion will arrive after demand peaks, making productivity, sequencing, and strategic allocation mandatory.

Empirical Calculation (Late 2026 Grid Constraint):

- Time to requirement $\Delta t_{"available} \approx 2.0\ years$ (for an industrial or renewable facility targeting operation by late 2028). Conventional grid expansion lead time $L_{"expansion} = 4\ to\ 10\ years$. The resulting ratio:

  $$RR = \left[\frac{2}{10}, \frac{2}{4}\right] = 0.20 \text{ to } 0.50$$

- **Implication:** Because $RR < 1.0$, conventional grid construction starting today cannot solve a 2028 access shortage.

6.2 Strategic Runway Dynamics Across Capacities

(Matrix 5)

Enabling Capacity	Lead Time to Add Capacity	Effective Expansion Window Closes	Runway Status to 2030	Primary Strategic Policy Recourse
Grid & Electricity Transmission	6–12 years	**Closed** (Late 2026 / Early 2027)	**Severe Deficit** ($RR \approx 0.4 - 0.7$)	Dynamic Line Rating, non-firm contracts, storage flex, demand sequencing
Skills & Specialized Engineering	3–7 years	2028 – Early 2029	**Deficit** ($RR \approx 0.6 - 1.5$)	Intra-EU mobility, cross-sector reallocation, retention schemes
Permitting & Administrative Throughput	1–3 years	2029	**High Optionality** ($RR \geq 1.5$)	Digital coordination platforms, deemed approvals, staffing single points of contact
Industrial Supply & Components	3–7 years	Late 2028 – 2029	**Tight** ($RR \approx 0.6 - 1.5$)	Joint EU procurement, strategic reserves, manufacturing expansion
Capital & Fiscal Programming	Annual budget cycles / MFF	2026 (for 2028 MFF start)	**High Mobility / Fixed Horizon**	Early political agreement, targeting Implementation Multipliers
Digital & Data Infrastructure	2–5 years	2029 – Early 2030	**Moderate** ($RR \approx 0.9 - 2.2$)	Spatial planning, co-locating data loads near surplus clean power
Regional & Local Delivery	2–5 years	2029 – 2030	**Tightening** ($RR \approx 0.9 - 2.2$)	Technical assistance facilities, standardized project playbooks

7. Strategic Capacity Response Hierarchy

When simultaneous demand exceeds shared throughput, policymakers must move through a five-step hierarchy before resorting to project cancellations:

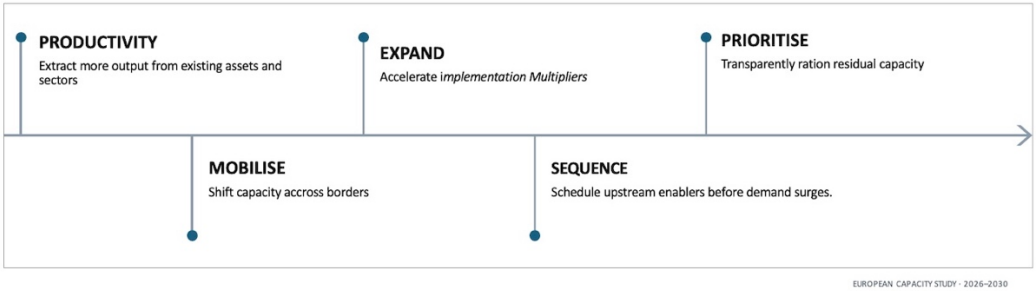


Figure 3: Five-Step Intervention Sequence. *To maximize realized delivery throughput, public authorities must treat project prioritization as a last resort rather than a starting principle.*

Step 1: Productivity — Extract More From Existing Capacity

Maximize output without waiting for long-lead construction:

- **Power Networks:** Mandate Dynamic Line Rating (DLR), integrate utility battery peak shaving, roll out non-firm flexible connection agreements, and improve dispatch software. The

deployment of non-build grid productivity measures is held back less by technical feasibility than by inherited regulatory design. Traditional utility remuneration models incentivize Capital Expenditure (CAPEX) through guaranteed rates of return on physical assets while penalizing the Operational Expenditure (OPEX) needed for sensor deployment, dynamic software dispatch, and automated flexibility contracts. Unlocking immediate throughput requires national regulatory authorities to transition from CAPEX-biased models to Total Expenditure (TOTEX) frameworks that reward system operators for maximizing capacity per kilometer over deploying steel in the ground.

- **Permitting Authorities:** Replace unstandardized email file tracking with secure, inter-agency digital workflows; introduce deemed-approval mechanisms for repowering existing assets and low-impact grid upgrades; adopt standardized application dossiers across Member States.
- **Construction & Housing:** Expand modular off-site prefabrication to decrease on-site labour hours per square meter built.

Step 2: Mobilise – Deploy Underutilized Resources Across Borders

Leverage structural asymmetries across the Single Market:

- European Labour Authority data indicates that of 430 recognized shortage occupations, **422 have an identified labour surplus in at least one other Member State**.
- Establish a deployable **European Technical Assistance Pool** composed of permitting officers, electrical engineers, and public procurement specialists to support overburdened regional authorities.

Step 3: Expand – Invest in Implementation Multipliers

Focus capital expansion on assets that unlock multiple downstream priorities:

- An **Implementation Multiplier** is an enabling investment that materially increases the capacity ceiling for several subsequent portfolios.
- Examples include high-voltage transmission lines, substation expansions, transformer and cable manufacturing facilities, technical vocational academies, and digital permitting platforms.
- Downstream investments (clean steel mills, data centres, heat pumps, housing developments) consume scarce capacity, whereas Implementation Multipliers expand future system throughput.

Step 4: Sequence – Align Demand With Physical Lead Times

Where enabling infrastructure cannot be expanded before demand arrives, align project milestones with physical delivery timelines:

- Build transmission lines and substations prior to commissioning large-scale offshore wind farms or industrial hydrogen clusters.

- Scale vocational electrical trades before subsidizing mass residential heat-pump retrofits.
- Modernize local administrative planning teams ahead of launching new regional infrastructure funding calls.

Step 5: Prioritise – Explicit, Transparent Strategic Allocation

When residual capacity remains constrained after exhausting steps 1 through 4, authorities must allocate access explicitly and transparently. Arbitrary queues must be replaced with objective socio-economic criteria:

1. **System-Unlocking Value:** Projects that create operational capacity for other users (e.g., utility battery storage, interconnectors).
2. **Essential Societal Needs:** Basic public welfare infrastructure, including acute hospitals, drinking water networks, and social housing.
3. **Strategic Security & Resilience:** Defence facilities, cybersecurity infrastructure, and critical climate flood barriers.
4. **Economic & Decarbonization Value:** Strategic industrial decarbonization projects that deliver the highest verified emissions reduction per megawatt allocated.
5. **Maturity & Additionality:** Projects with committed financing and immediate construction readiness, penalizing speculative connection requests.

7.1 Regulatory Alignment for Asset Optimization The TOTEX Transition

Maximising throughput through **Step 1 — Productivity** also requires regulatory incentives that do not systematically favour physical asset expansion over solutions that unlock additional capacity through operational efficiency. In some regulated network environments, **capital expenditure can receive more favourable treatment than operating expenditure**, potentially creating an incentive to solve capacity constraints through additional physical investment even where operational or flexibility-based solutions could unlock capacity faster.

- **The CAPEX–OPEX challenge:** Under RAB-based regulatory models, capital investment is incorporated into the regulated asset base and can generate an allowed return over time. By contrast, expenditure on operational measures, digital tools or flexibility arrangements may be treated differently within the regulatory framework. The resulting incentives can make some non-build solutions less attractive from an operator's perspective.
- **The TOTEX alternative:** A **Total Expenditure (TOTEX)** approach can reduce this distortion by evaluating CAPEX and OPEX together when determining allowed expenditure and regulatory incentives. This can make investments such as Dynamic Line Rating, digital optimisation and other operational measures more economically comparable with conventional network reinforcement.
- **Flexibility remuneration:** Regulatory frameworks should also ensure that system operators can appropriately value and recover the costs of non-firm connections, flexibility services, storage and other measures that increase usable network capacity without requiring immediate physical expansion.

The strategic objective is not to replace network expansion. It is to ensure that regulation rewards the fastest and most efficient route to additional usable capacity — whether that capacity comes from new infrastructure, digital optimisation, flexibility or a combination of these.

8. Forward-Looking Delivery Scenarios to 2030 and EU Baseline Assessment

The choices facing European policymakers can be structured into three distinct operating scenarios to 2030:

(Matrix 6)

Dimension	SCENARIO 1: Independent Acceleration (Current EU Operational Baseline)	SCENARIO 2: Capacity-First Europe (Required Policy Target)	SCENARIO 3: Managed Scarcity (Default National Reality)
Strategic Logic	Accelerate portfolios independently without cross-sector coordination	Expand shared enabling platforms before downstream deployment	Accept physical lead-time constraints and manage residual scarcity explicitly
Primary Action	Parallel sectoral legislative packages and subsidy distribution	Target capital toward Implementation Multipliers (grids, skills, admin)	Maximize productivity, steer demand, and apply statutory priority rules
Treatment of Shared Capacity	Implicitly assumed to be abundant and universally accessible	Treated as Europe's central strategic asset to be expanded first	Explicitly measured, budgeted, and allocated where binding
Dominant Delivery Risk	Uncoordinated queue congestion, cost inflation, project failure	Upstream construction delays postpone downstream rollout	Political frictions over national and sectoral allocation criteria
2030 Delivery Outcome	**Throughput Deterioration:** Projects funded but stalled across sectors	**Highest System Throughput:** Maximizes total deliverable operating capacity	**Controlled Strategic Realization:** Protects critical societal and security priorities
Governance Requirement	Status quo; vertical portfolio coordination with weak horizontal oversight	Common European capacity-intelligence layer and stress-testing	Statutory allocation frameworks and transparent priority criteria

Assessing Current European Commission Policy Against the Scenarios

1. The Institutional Default: Scenario 1 – Independent Acceleration

Institutionally and administratively, the European Commission continues to operate predominantly within **Scenario 1**:

- **Vertical Silos:** Policy is driven through separate legislative tracks: the Clean Industrial Deal and Industrial Decarbonisation Accelerator Act, the Cloud and AI Development Act, the Housing Simplification Package, the Renewable Energy Directive (42.5% target), and defence procurement packages.

- **Implicit Capacity Assumptions:** While each portfolio accelerates delivery schedules, funding envelopes, and simplified permitting, they continue to assume that electrical connections, skilled trades, raw materials, and municipal planning bodies can scale concurrently to meet their independent targets.
- **Systemic Friction:** This operational mismatch between parallel demands and finite horizontal capacity is already producing the symptoms of Scenario 1: over 60% of demand/storage grid access applications denied in Spain, ~42 GW of renewable connection rejections in Poland, and widespread multi-authority permitting backlogs.

2. Rhetorical and Sectoral Shifts: Towards Scenario 2 – Capacity-First Europe

Recognizing that physical infrastructure is choking downstream delivery, the Commission has begun adopting specific **Implementation Multiplier** policies characteristic of Scenario 2:

- **Anticipatory Grid Investment:** Under the reformed Electricity Market Design and European Grids Package, national regulatory authorities are directed to approve grid investments *ahead* of confirmed connection demand rather than waiting for project-by-project requests.
- **Statutory Overriding Public Interest:** The Net-Zero Industry Act applies overriding public interest status and mandatory time limits to grid lines, storage, and clean-tech manufacturing.
- **Targeted Skills Initiatives:** Initiatives such as Net-Zero Industry Academies and ELA mobility tools focus on specialized technical trades to address deficits such as the ~28,000-worker grid shortfall in the Netherlands.

The Critical Gap: While these measures reflect Scenario 2 logic, they are applied **sector by sector**. The EU still lacks a horizontal, multi-sector mechanism to evaluate whether industrial electrification, AI data centers, and housing can physically co-exist on the same local grid infrastructure.

3. The Unintended Consequence: Defaulting into Scenario 3 – Managed Scarcity

Because the EU level remains caught between the ambition of Scenario 2 and the reality of Scenario 1, **Member States are being pushed into Scenario 3 by necessity**:

- **National Rationing:** When queues become unmanageable and capacity expansion lead times exceed remaining delivery windows, national authorities are forced into explicit rationing.
- **The Dutch Precedent:** The statutory framework introduced in the Netherlands in July 2026—explicitly prioritizing congestion-relieving infrastructure, national security, and essential public needs over ordinary commercial connections—is the direct empirical manifestation of Scenario 3 emerging locally because horizontal European coordination is absent.

Scenario 3 is not an intentional policy destination, but an uncoordinated default driven by administrative necessity. When the European Commission accelerates vertical mandates without

governing horizontal throughput, the burden of managing physical scarcity falls on local network operators and municipal offices. This produces fragmented national rationing, distorts cross-border industrial competition, and threatens the integrity of the Single Market. The Dutch statutory priority framework is an early indicator of this dynamic: in the absence of a coordinated European capacity architecture, local access rationing replaces community-wide strategic delivery.

9. A European Capacity Architecture

To prevent fragmented national rationing from disrupting the Single Market, the European Union requires a coordinated capacity layer.

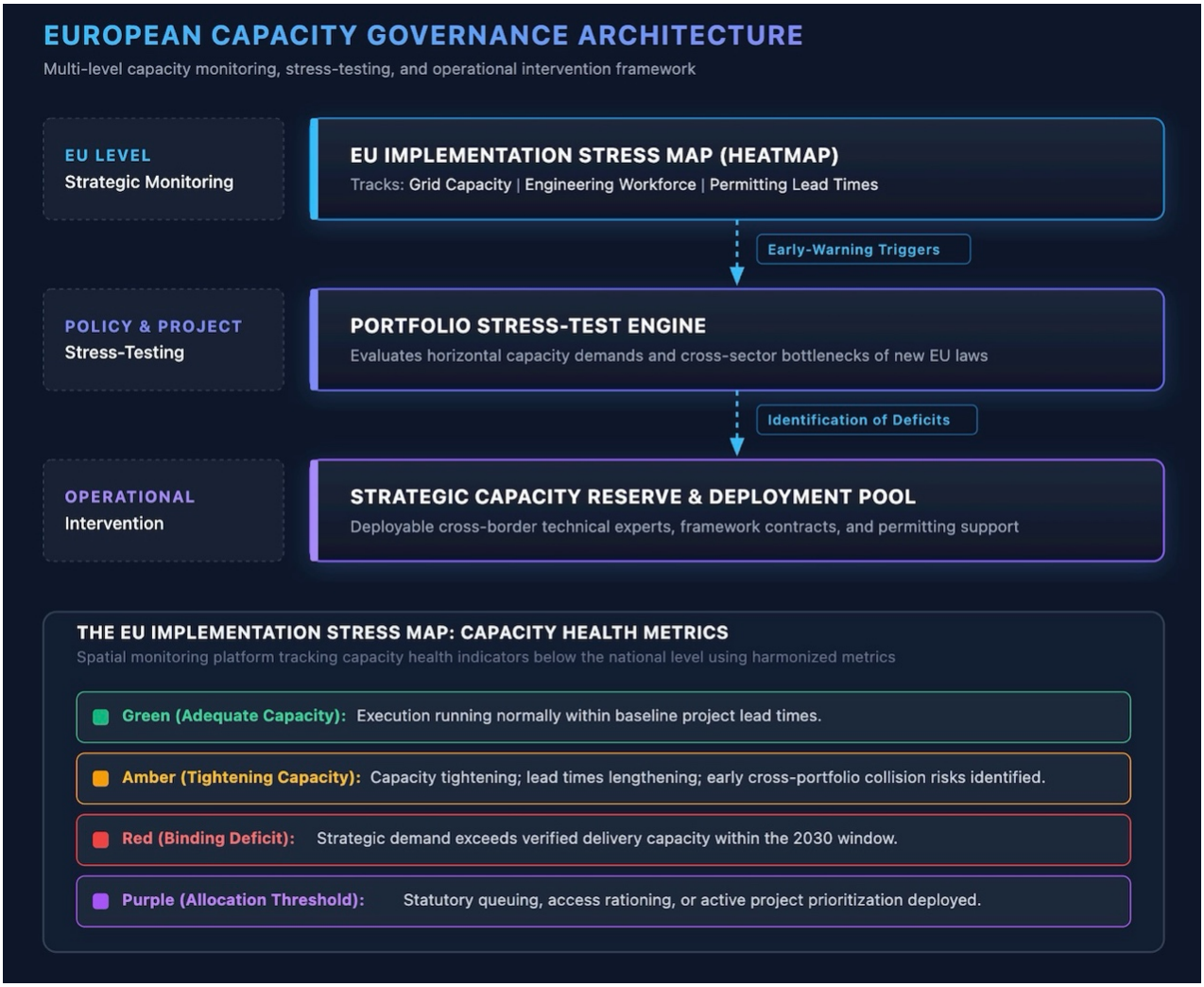


Figure 4: European Implementation Capacity Governance Architecture. *A coordinated operational framework linking sub-national stress monitoring and ex-ante legislative stress-testing to deployable technical reserves.*

9.1 Institutional Precedents vs. The Horizontal Capacity Gap

The proposed architecture does not duplicate existing EU oversight or coordination bodies, nor does it require the creation of a centralised approvals agency. The European Union already operates sophisticated monitoring, planning and coordination systems. However, these systems are largely

structured by sector or institutional function. The proposed architecture addresses the resulting horizontal capacity gap**:** the ability to assess how simultaneous strategic demand interacts with shared capacity across portfolios, geography and time.

- **Regulatory Tracking vs. Physical Capacity:** Tools such as the *Single Market and Competitiveness Scoreboard* monitor legal transposition, regulatory compliance, and market integration. They do not evaluate physical node throughput, local engineering availability, or real-time infrastructure lead times.
- **Siloed Sectoral Planning:** Frameworks such as ENTSO-E's *Ten-Year Network Development Plan (TYNDP)* model transmission grids in detail, but they operate within the energy sector. They do not model the cross-portfolio collision between simultaneous housing targets, AI data-centre surges, and defence industrial ramp-ups.
- **Compliance Checks vs. Implementation Footprint:** Standard Commission *Impact Assessments* and *Competitiveness Checks* evaluate regulatory costs and administrative burdens on businesses. They do not stress-test the incremental demand that new directives place on already constrained shared inputs like electrical engineers, high-voltage transformers, or municipal planning desks.
- **Ad-Hoc Technical Assistance vs. Operational Reserves:** DG REFORM's *Technical Support Instrument (TSI)* provides valuable capacity-building, but operates on an ad-hoc, application-driven basis for general institutional reforms. It is not structured as an early-warning deployment pool triggered by operational delivery collisions.

The table below highlights the structural distinctions between current EU governance instruments and the proposed horizontal capacity architecture:

DIMENSION	CURRENT EU GOVERNANCE ARCHITECTURE	PROPOSED EUROPEAN CAPACITY ARCHITECTURE
Governance Orientation	**Vertical / Siloed:** Separate Directorate-Generals establish independent policy targets and timelines.	**Horizontal / Shared:** Assesses the convergence of multiple independent portfolios on shared enabling systems.
Analytical Unit	**Policy & Budget Envelopes:** Evaluates funding adequacy and regulatory compliance.	**Capacity** $\times$ **Geography** $\times$ **Time** $\times$ **Portfolios:** Evaluates physical, human, and administrative throughput.
Intervention Trigger	**Ex-Post / Compliance:** Missed legislative transposition deadlines, spending absorption delays, or infringement cases.	**Ex-Ante / Lead-Time Signals:** Early-warning triggers when the Runway Ratio (RR) indicates lead times exceed remaining delivery windows.
Operational Focus	**Acceleration:** Pushing for faster independent progress across all initiatives simultaneously.	**Sequencing & Allocation:** Scheduling enablers ahead of demand and establishing transparent priority criteria when capacity is binding.

The European Union has constructed a comprehensive apparatus for monitoring legal transposition and budget absorption, yet it remains blind to spatial, logistical, and thermodynamic constraints. Directives continue to be drafted on the assumption that underlying physical networks and administrative bodies have limitless elasticity. Ensuring European delivery requires institutionalizing

an ex-ante "Implementation Capacity Footprint" across all major legislative initiatives. Upstream policy ambition must be reconciled with physical lead times before binding benchmarks are codified into law.

9.2 Subsidiarity, Spatial Sovereignty, and Article 194(2) TFEU

The proposed European Capacity Architecture is designed to operate **within existing EU and Member State competences**. It does not require a centralised European approvals agency, transfer responsibility for local permitting, or determine Member States' choices concerning their energy mix. Article 194(2) TFEU expressly preserves Member States' rights concerning the conditions for exploiting their energy resources, their choice between different energy sources, and the general structure of their energy supply.

- **Preserving Member State Prerogatives:** The European Capacity Architecture does not seize local permitting authority or override national or regional spatial-planning decisions. Competent national, regional and local authorities retain responsibility for project approvals and spatial designations.
- **Harmonised Capacity Intelligence:** The European layer functions as a **coordinating, stress-testing and technical-support function**. Its role is to standardise capacity metrics, identify cross-border infrastructure interdependencies, and provide predictive analysis through the proposed **EU Implementation Stress Map** and **Portfolio Stress-Test Engine**.
- **A Common Framework for Scarcity Allocation:** Where local capacity constraints require Member States to introduce administrative prioritisation, the European framework can provide **common analytical and transparency criteria** to reduce avoidable Single Market distortions. Such criteria would support non-discriminatory, transparent and evidence-based prioritisation while leaving the underlying allocation decisions within the relevant national and competent-authority frameworks.

10. Five Strategic Actions for European Leadership

To safeguard delivery through 2030, European policymakers should implement five core changes:

1. **Measure Combined Implementation Demand:** Stop evaluating strategic targets in isolation. Quantify the combined horizontal demands of energy, digital, defence, and housing on power grids, labour, and administration.
2. **Finance Implementation Multipliers First:** Direct EU budget facilities and cohesion envelopes into enabling infrastructure—substations, transformer factories, technical trades, and administrative digitization—ahead of dependent downstream projects.
3. **Stress-Test Every Major Initiative:** Require all major Commission legislative proposals and funding mechanisms to publish an "Implementation Capacity Footprint".
4. **Sequence Demand When Lead Times Clash:** Adjust delivery milestones so upstream enablers are built before dependent industrial and digital projects come online.
5. **Replace Opaque Queues With Explicit Criteria:** Replace passive, first-come-first-served queues with transparent, harmonized strategic allocation frameworks across all constrained systems.

11. Methodological Note and Evidence Hierarchy

The study evaluates implementation capacity using an evidence hierarchy to maintain analytical discipline across heterogeneous systems:

Evidence State	Methodological Definition	Observed Empirical Example
Quantified Insufficiency	Observed unmet access demand expressed in comparable quantitative units	Spain: ~40 GW of denied distribution grid access requests in 2024
Binding Constraint	Operational scarcity directly documented by regulatory or system authorities	Germany: 7.407 GW (2026/27) and 8.274 GW (2028/29) network reserve mandates
Extreme Oversubscription	Pipeline volume vastly exceeds connection or processing capacity	Italy: >300 GW renewable requests and ~80 GW data-Centre connection requests
Capacity Collision	Multiple independent strategic portfolios compete for the same binding input	Netherlands: Industry, housing, data hubs, and transit competing for grid MW
Allocation Threshold	Scarcity forces administrative transition from queues to explicit prioritization	Netherlands: Statutory grid priority framework enacted July 2026
Evidence Gap	Absence of standardized reporting despite strong qualitative signals of stress	EU-wide local government municipal planning staff and permitting throughput data

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