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Future Fleet

WP3: Smart energy management schemes and business models

June 2026

This report assesses smart energy schemes and business models for eHGV sites, quantifying their impact and identifying most viable and attractive schemes to inform trial design

WP3 Scope / Deliverables	Where Addressed
Catalogue of smart energy schemes and business models	Section 2
Initial assessment of impact on peak and reinforcement deferral	Section 3
Qualitative viability ranking and fleet acceptance considerations	Sections 3 & 4
Quantification of operational flexibility by archetype	Section 3
Identification of schemes suited to managed/flexible connections	Sections 2 & 3
Comparative assessment of cost, benefit, and scalability	Sections 3 & 4
Recommended short-list for quantitative modelling	Sections 3 & 5
Market, regulatory and commercial enablers/barriers	Section 5

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WP3 assesses how smart energy levers can support the electrification of HGV sites

Section	Summary
Context	• Depot electrification will create **concentrated MW-scale demand at logistics, distribution, and industrial locations**, rather than spreading evenly across the network. • A relatively small number of **larger fleets are likely to drive a disproportionate share of future charging demand**, driving connection bottlenecks. • Medium and large depots are expected to face the **greatest connection challenges** because they combine **higher import requirements with a greater likelihood of clustering** around areas of economic activity. • WP3 assesses **four smart energy levers** that respond to this challenge in different ways. (1) **Smart charging**, (2) **on-site energy** assets, e.g. BESS and solar, (3) **Dispersed charging** – shifting demand across various locations, and (4) **Shared sites or Smart Energy Zones** that improve the use of existing or coordinated capacity
Smart energy levers	• Smart charging should be treated as the **baseline capability for depot electrification**. It is scalable, low-capex and consistently improves site economics, but is **unlikely to resolve major connection constraints alone** for larger depots. • **On-site energy assets**, such as BESS and solar, **can play a material role in managing constraints** because they can reduce grid import and the need for a larger site maximum import capacity. If sized properly, **BESS can act as a bridging asset** between site charging demand and lower grid import capacity, so the same demand can still be served. • Dispersed charging can reduce pressure on constrained depots by **shifting demand to satellite depots, customer sites, logistics parks or third-party** charging locations. • Shared hubs and consortium models can **reduce individual capex burdens and improve use of existing capacity**. Smart Energy Zones could create higher system value where multiple users, shared assets, and complementary demand profiles are coordinated.
Techno-Economic Site Modelling	• Smart charging and on-site energy assets were **modelled at site level using representative depot archetypes and duty cycles from WP2**. • The site-level modelling suggests that **smart charging could deliver the largest reduction in levelised cost of energy**, without requiring major additional infrastructure. • **BESS and solar created most value through connection enablement, reducing required MIC by ~25–65%** while still serving the same fleet charging demand. • BESS and solar deliver the most benefit to larger depots or depots with mixed duty cycles where they can avoid a step-up in connection costs, **BESS can act as a bridging asset while remaining at close to cost parity with a larger firm connection**. • **WP3 has not quantified the value of accelerating connections or wider network/system benefits**. These benefits may materially increase the case for BESS and solar and will be tested through the CBA and WP4.
Business model assessment	• **Commercial structure is critical to deployability** because each lever changes who owns assets, funds capex, controls dispatch, takes risk and captures value. • Smart charging is the **most scalable and commercially mature lever**, but requires clear dispatch rights, data access, override rules and benefit sharing. • On-site assets **require investable risk allocation**, with clear ownership of asset performance, degradation, O&M, merchant exposure, and route-to-market responsibilities. • Dispersed charging, shared hubs, and Smart Energy Zones **can improve access and charger utilisation, but increase complexity around governance, capacity allocation, access rights, and long-term utilisation commitments.** • The trial should **test commercial deliverability** as well as technical performance, showing **whether smart energy levers can enable earlier, lower-MIC electrification in a way fleet operators, site hosts and investors can accept**.

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WP3 assesses how smart energy levers can reduce connection requirements and manage network constraints, informing the trial design and cost-benefit assessment

Inputs into WP3

WP2 archetypes
- Fleet and depot archetypes
- Charging demand and duty cycles

WP4 geospatial & network constraints context
- Connection constraints and locational clustering
- Depot size distribution

WP3: Smart Energy Levers & Business Model Assessment

Define smart energy levers
1. Smart charging
2. On-site energy
3. Dispersed charging
4. Shared Sites / Smart Energy Zones

Site-level economic modelling
- Representative depot archetypes
- Techno-economic comparison of scenarios
- Test connection and energy cost impacts

Business model assessment
- Value chains and commercial arrangements
- Enablers, barriers, and risks
- Applicability by archetype and location

WP3 outputs

Trial design requirements
- Priority levers and use cases
- Potential trial sites and models

Cost-benefit assessment
- Wider network, system, and societal impacts
- GB-level extrapolation

Methodology: We worked collaboratively with UKPN and project partners to define the smart energy levers and integrate WP2 and WP4 outputs into the site-level economic modelling and business model assessments

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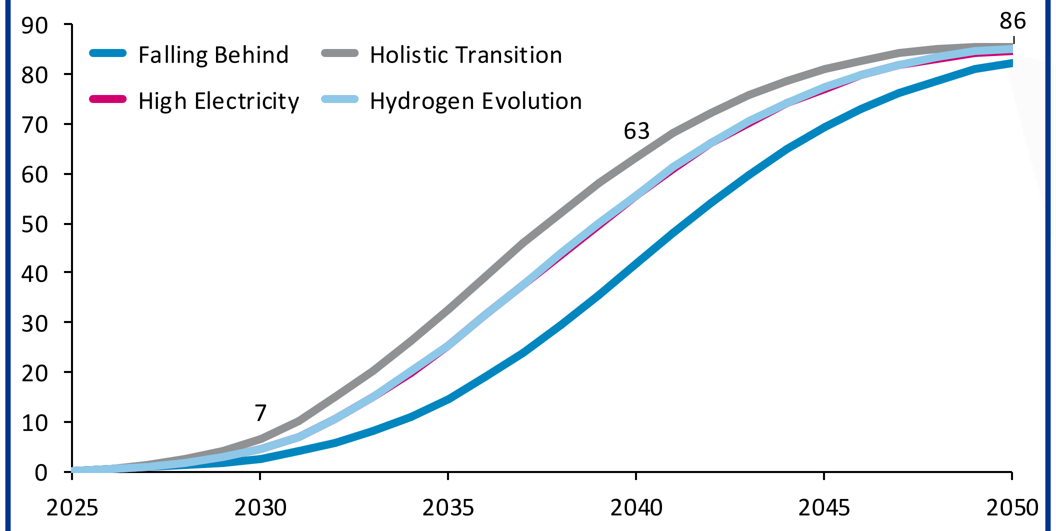
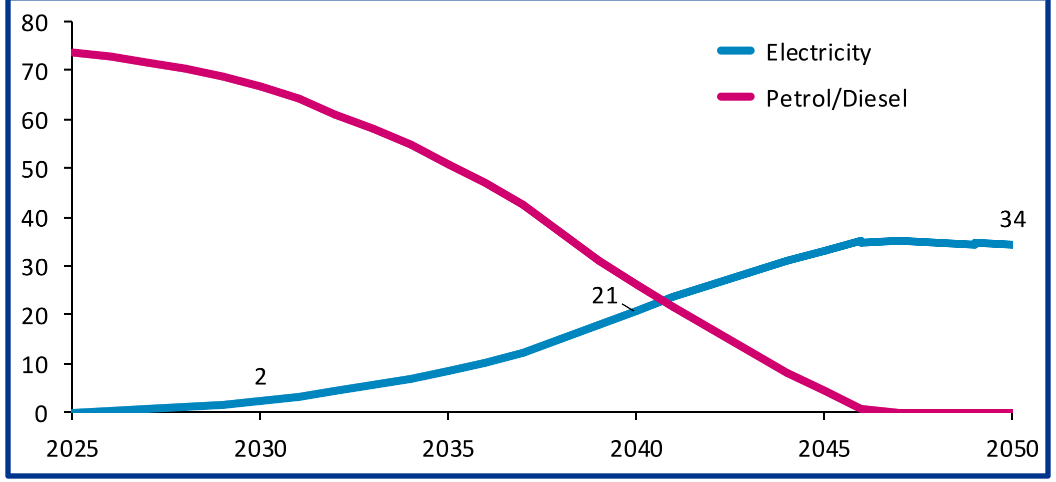
eHGV fleet electrification will drive a step-change in grid demand and connections, requiring fleet operators to engage with smart energy levers to secure grid capacity

DFES 2025: Projected eHGV stock across UKPN licence areas, thousands



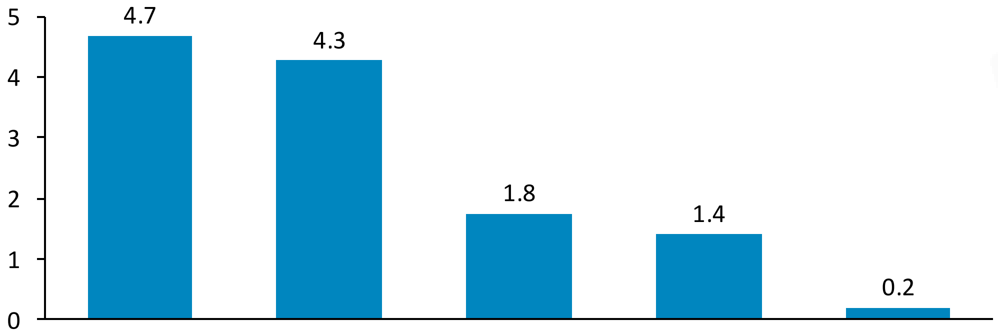
FES 2025: Annual GB HGV energy demand by fuel, Holistic Transition, TWh



- **Rapid fleet growth creates a scale challenge:** DFES 2025 projects over 80k eHGVs across UKPN licence areas by 2050. At the same time, FES shows electricity becoming the dominant HGV fuel source under the Holistic Transition pathway, with electricity demand for HGVs growing from near-zero today to ~34 TWh by 2050, pointing to an increase in depot charging demand over a compressed timeframe.
- **Connections, not just peak demand, will be a constraint:** Depot electrification will create concentrated MW-scale loads around logistics hubs and distribution centres. Costs can rise sharply when sites exceed local network headroom, triggering network upgrades or reinforcement to meet the increased capacity required by fleet operators. As a result, connection availability, cost and timing are as important as the charging infrastructure itself.
- **Smart energy levers can improve connection viability:** Future Fleet is testing how smart energy levers such as smart charging, on-site energy assets, dispersed charging, and shared charging hubs could reduce peak import requirements, avoid or defer reinforcement, and make depot electrification faster and more affordable for fleet operators and DNOs.

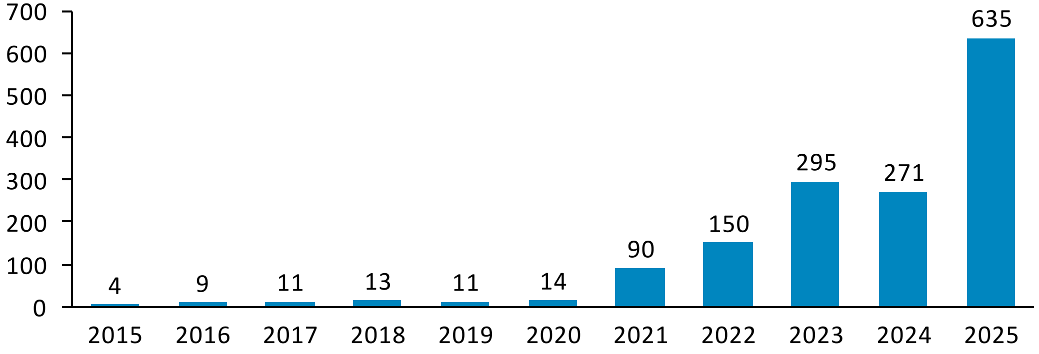
A small number of larger fleets are likely to drive disproportionate future eHGV charging demand, creating a need for larger depot connections

Fleet size distribution in the UKPN area, thousands[1]



	1 vehicle	2-4 vehicles	5-9 vehicles	10-49 vehicles	50+ vehicles
% of fleets	38%	35%	14%	**11%**	**2%**
% of vehicles	6%	14%	14%	**34%**	**32%**

UK annual battery electric HGV first registrations, 2015–2025, vehicles[2]



- **Fleet concentration matters:** Around 70% of fleets in the UKPN area have fewer than 5 vehicles, but larger fleets account for a disproportionate share of total vehicles: 10+ vehicle fleets represent ~13% of fleets but ~66% of vehicles.
- **A growing market: e**HGV registrations were negligible until 2020, but increased from 90 vehicles in 2021 to 635 vehicles in 2025, indicating the market is moving beyond early trials but still relatively nascent.
- **Connection impacts will be concentrated:** This means grid impacts are unlikely to scale evenly across all operators. A smaller number of larger depots, logistics hubs, and distribution centres are likely to drive the highest connection requirements.
- **Clusters present a challenge:** Even modest national eHGV growth can create material local grid impacts where charging demand is concentrated at depots, logistics hubs and distribution centres. The challenge is therefore not just total demand growth, but whether sufficient capacity is available at the right locations and times.
- **Implication for Future Fleet:** WP3 should assess both ends of the distribution: scalable, low-complexity solutions for the many small fleets, and higher-impact smart energy levers for the smaller number of larger depots that are most likely to face connection challenges.

Source: (1) GB Vehicle Operator Licence Database, (2) DfT VEH1153b data, vehicles registered for the first time by body type, keepership and fuel type.

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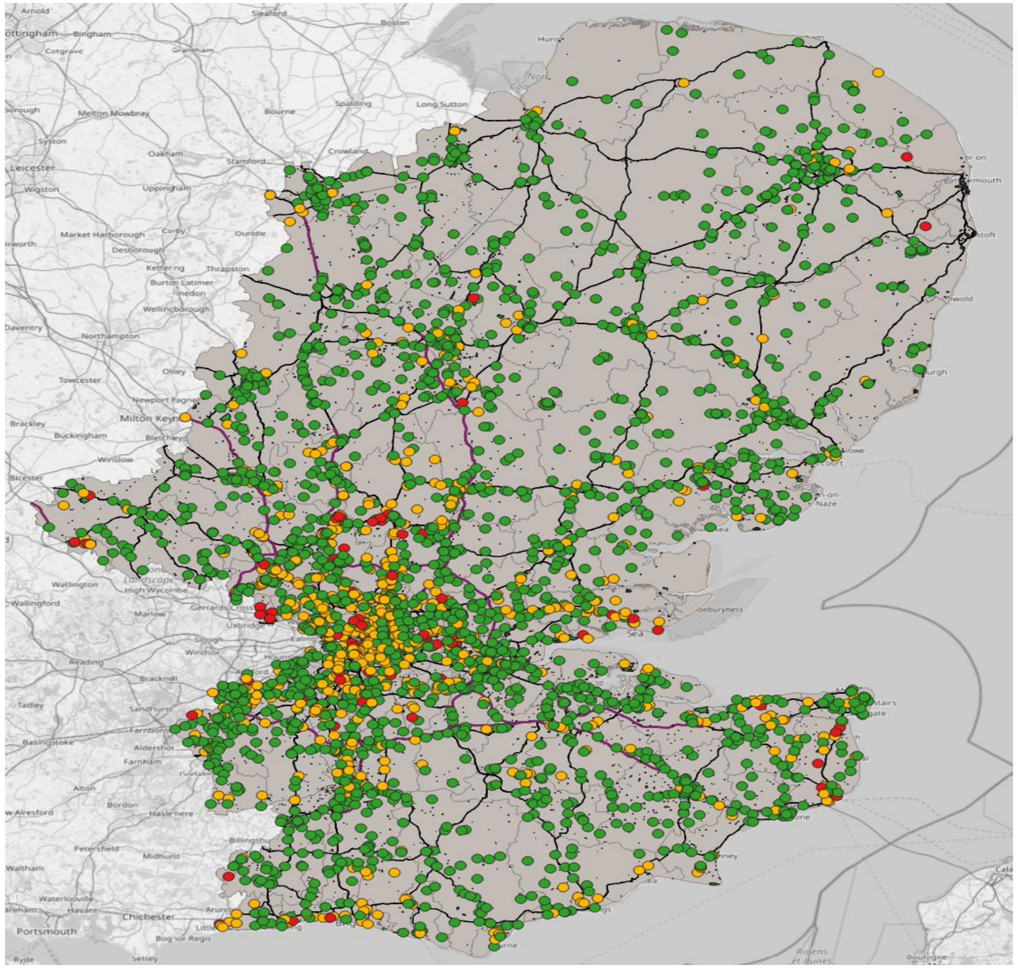
Charging demand will concentrate around logistics and economic activity, but site electrification will depend on local substation capacity and network headroom

Map shows modelled daily HGV charging stops by location, grouped by the number of stops expected at that depot



Red: Large (>100 stops) **Amber:** Medium (16-99 stops) **Green:** Small (1-15 stops)

- **Depot archetypes are not evenly distributed:** Large and medium depots are more concentrated while small depots are more widely spread across the UKPN licence area.
- **Location can be a key challenge:** Connection challenges will depend not only on fleet size, but also where the depot is located relative to local demand and network headroom.
- **Impacts will likely cluster:** A small number of larger depots are more likely to drive concentrated MW-scale and localised connection pressure.
- **WP4 will test this spatially:** We will map depot archetypes to primary substations to test where medium and large depots may create the greatest connection challenges, and where smart energy levers are most relevant.

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Smart energy levers can help integrate concentrated and growing eHGV fleet demand in areas with constrained grid capacity

Grid challenges

1. Peak capacity constraints causing slow and high-cost grid connections
Local networks cannot accommodate high, coincident charging demand

2. System balancing & renewable integration causing rising system costs
Greater need to match demand with variable renewable generation

3. Maintaining high network utilisation while avoiding higher societal costs
Capacity is sized for peak demand, even where that peak capacity may only be used for limited periods, increasing societal costs

4. Concentrated demand causing localised network bottlenecks
Charging demand will cluster around depots and logistics hubs, creating peaks that may exceed available network capacity

Smart energy levers

1. Smart Charging
Optimise charging away from peak network periods and towards periods with lower electricity costs

2. On-site Energy
Use on-site assets to reduce grid import (e.g. battery solutions, solar PV, vehicle-to-grid etc.)

3. Dispersed Charging
Locate charging where it best aligns with capacity, site operations, and cost, whether through dispersed sites or strategic clustering

4. Shared Sites with Spare Capacity / Smart Energy Zones
Co-locate charging at sites that have spare capacity and/or synergistic loads

The challenge is not just connecting load — it is integrating large, geographically concentrated demand into a constrained system with increasing intermittent renewable energy

Our fleet and geospatial modelling suggests most charging demand will occur at depots overnight, with larger depots likely to be the most challenging to connect

	Small depot	Medium depot	Large depot	Destination charging	En-route charging
Description	Average of 5 trucks charging per day, largely overnight	Average of 35 trucks charging per day, largely overnight	Average of 150-200 trucks charging per day, largely overnight	*Not estimated*	*Not estimated*
# of sites in UKPN area	2,300	830	97	*Not estimated*	*Not estimated*
Average import capacity (kVA)	**250-300**	**2,000**	**8,000 to 10,000**	**Highly site-specific**	**Highly site-specific**
Share of total charging demand	**20-25%**	**45-50%**	**22-28%**	**5-10%**	**3-7%**
Potential connection challenges	• Least challenging to connect but delays still possible in constrained areas • Spare headroom may enable flexible charging in response to wholesale / network signals	• Increasingly constrained at upper end, may drive feeder reinforcements • Battery storage may help avoid reinforcement thresholds • Overnight charging may drive peak demand	• Most likely to trigger major reinforcement works • Long lead times and high capex risk • May require phased energisation or flexible connection arrangements • Strongest case for coordinated / shared infrastructure approaches	• Wide variation in site suitability and dwell time • Commercial ownership and operational complexity • Urban sites may face space and connection constraints • Charger mix (fast vs slow) strongly affects peak demand	• Low dwell times reduce charging flexibility • High-power chargers drive large peak demand • Motorway / strategic road locations may already be constrained • Significant reinforcement risk for concentrated charging hubs

WP2 & WP4 outputs

High
Medium
Low

Modelling implications

- Medium and large depots are expected to be the most challenging to connect due to greater import capacity requirements and potential clustering, we intend to map the geographical distribution of depot archetypes to primary substations to test this hypothesis (WP4 synthesis)
- We are modelling these scenarios at a site level to test impact on grid requirements and smart energy lever economics, as well as extrapolating them to UKPN and GB level for the CBA

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Smart charging and on-site energy are the primary site-level levers for reducing peak import, lowering connection requirements, and improving depot economics

Smart Energy Levers	1. Smart Charging	2. On-site Energy
Description	**Change when charging happens at a site to avoid peaks and reduce costs** ***Includes:*** ✓ Shifting charging to off-peak times ✓ Managing charger output ✓ Limiting site peak demand	**Add on-site energy and storage to reduce how much power is taken from the grid** ***Includes*:** ✓ Battery storage (using stored energy to charge vehicles) ✓ Onsite or private-wire renewable generation (solar/wind) ✓ Future: V2G, where operational feasible
What needs to be true	• **Sufficient dwell times:** vehicles are parked long enough to shift charging • **Fleet operational flexibility:** charging does not disrupt operations • **Control capability** (active management of charging)	• Space and infrastructure for battery / solar • Investment in additional infrastructure must make sense (price x load) • Ability to operate and optimise assets (business model ecosystem)
Benefit to Network	• Lower peak demand at sites • Reduced reinforcement requirements	• Lower peak demand • Reduced need for network upgrades
Benefit to Fleet Operator	• Lower energy costs • Quicker time to connect • Avoids costly upgrades • More efficient use of chargers	• Lower charging costs over time • Quicker time to connect • Reduced exposure to peak prices
Benefit to Host Site	• Limited (mainly internal optimisation) / depends who owns the site	• Potential new revenue from energy assets • Better use of on-site energy

Dispersed charging and shared sites are key levers for reducing concentrated depot demand and using existing grid capacity more efficiently

Smart Energy Levers	3. Charging in More Places	4. Shared Sites with Spare Capacity
Description	**Spread charging across multiple locations instead of one large depot** ***Includes:*** ✓ Charging at logistics parks ✓ Charging at customer / third-party sites ✓ Using spare capacity along routes	**Locate charging at sites that already have complementary energy demand to share capacity** ***Includes:*** ✓ Charging at ports, industrial sites, or hubs ✓ Combining with daytime loads ✓ Sharing an existing grid connection
What needs to be true	• Fleets are willing and able to charge at different locations with varying ownership models • Suitable charging sites exist along routes • Operational flexibility in routing / scheduling	• Suitable sites exist with complementary demand (e.g. daytime load) • Charging aligns with when capacity is available • Vehicles can access these sites easily
Benefit to Network	• Reduced concentration of demand at single sites • Lower local network stress	• Higher utilisation of existing connections • Lower incremental peak demand • Reduced reinforcement needs
Benefit to Fleet Operator	• Avoids building large depots • More flexibility in operations • Potentially lower infrastructure costs	• Access to better-located charging • Potentially lower costs if sharing infrastructure • Reduced need for own connection upgrades
Benefit to Host Site	• Revenue from hosting chargers • Increased use of existing assets	• Increased utilisation of existing connection • Potential revenue from hosting charging • Better use of existing demand profile

Smart Energy Zones on greenfield sites could be another flavour of this - new sites being co-developed and led by a SEZ operator

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Smart energy levers address multiple grid challenges with different levels of impact

Mapped to challenges highlighted on page 10

Smart Energy Levers	1. Connection capacity constraints	2. System balancing & renewable integration	3. Network utilisation	4. Demand concentration / bottlenecks	What it does (system view)
1. Smart Charging	High	High	Medium	Low	Shifts demand in time to reduce peaks and align with system conditions
2. On-site Energy (Battery / Solar)	High	Medium	Medium	Low	Reduces grid import and aligns demand with renewable generation
3. Dispersed charging	Medium	Low	Medium	High	Distributes demand across the network to reduce local bottlenecks
4. Shared Sites with Spare Capacity	Medium	Low	High	Medium	Improves use of existing network capacity by co-locating demand

High
Medium
Low

Each lever reduces the need for new network capacity in a different way, while also reducing overall system costs

Note: These levers are not mutually exclusive and will be combined in practice — e.g. smart charging can be applied alongside dispersed charging, shared sites, and on-site energy solutions

A techno-economic model was developed to quantify the long-term impact of smart energy interventions on depot electrification costs and connection requirements

Objective

To assess how different smart energy levers influence the economics and deliverability of eHGV depot electrification across a range of fleet and network archetypes, and to identify the most promising interventions to support scalable, cost-efficient network connections; acting as a key input into detailed business model assessment and future trial deployment.

Modelling Approach

The analysis evaluates the long-term costs and benefits of Smart Energy Levers 1–2 across representative depot archetypes based on WP2 outputs, comparing conventional charging approaches against more sophisticated energy management solutions.

The model combines:

- Fleet charging demand profiles derived from WP2 operational archetypes
- Depot size archetypes (small, medium and large)
- Network connection requirements and UKPN connection cost assumptions
- Smart charging optimisation strategies (Lever 1)
- On-site solar and battery deployment scenarios (Lever 2)
- Wholesale electricity, flexibility and ancillary service revenues
- Asset capital expenditure, replacement, and O&M costs

Scenarios Evaluated

The modelling compares a range of representative site archetypes:

- **Baseline charging** (unmanaged charging)
- **Lever 1: Smart charging optimisation**
- **Lever 2: Smart charging + battery storage**
- **Lever 2: Smart charging + battery storage + solar PV**

For each archetype, scenarios are assessed under different connection capacities and network cost assumptions to assess how levers interact with grid constraints.

Outputs

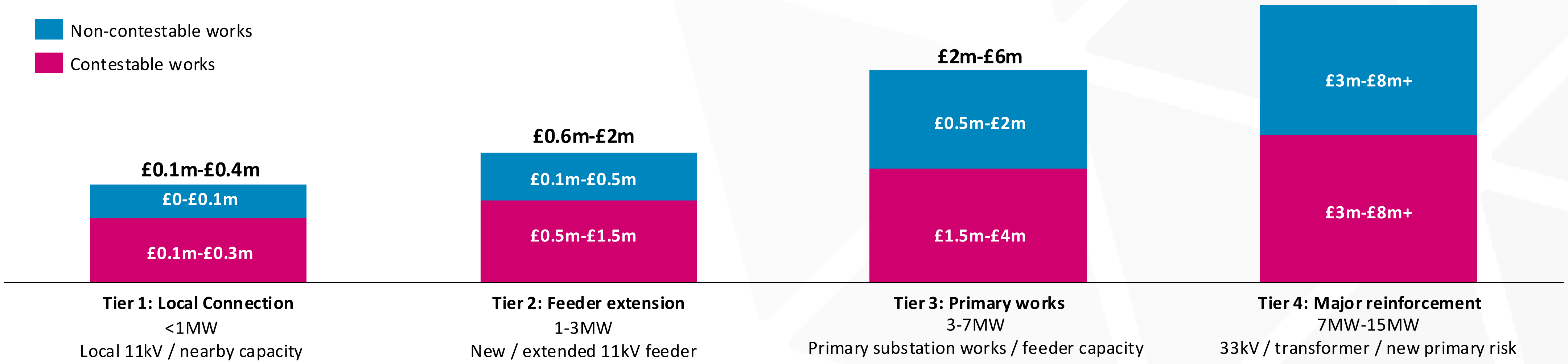
The modelling provides:

- 20-year undiscounted energy and infrastructure site costs
- Discounted net site cashflow (£NPV)
- Levelised charging costs (£/kWh)
- Connection cost sensitivities
- Flexibility and energy value breakdowns
- Comparative economics across depot archetypes
- A benchmark of eHGV charging cost against diesel operating costs
- Insights to support trial site identification, business model design, and inputs for WP4 cost-benefit assessment

Connection costs are a key modelling input because smart energy levers are only economical at the site-level relative to a connection cost

Connection costs do not scale linearly on a £/MW basis. They are driven by threshold jumps, sole-use extension assets and whether the customer needs to reach a further point of connection. This means reducing peak import requirements can materially change a site's connection cost.

Total illustrative connection cost[1], £m



Modelling implications

- Connection capex is treated as a threshold-driven (L/M/H) scenario input, not a linear £/MW assumption
- BESS and solar are tested against the cost of securing a larger firm maximum import capacity (MIC)
- The value case is driven by whether smart energy levers can meet site charging demand whilst reducing connection capex

Case study example: Nissan Sunderland Plant & GRIDSERVE

- On-site civils and enabling works can be a material cost driver for eHGV charging sites, particularly where sites require significant groundworks.
- The Nissan Sunderland & GRIDSERVE project delivered a £1.4m shared eHGV charging depot, with 10 high-power charging bays to support an initial 25 electric HGV fleet.
- The project was enabled through the Innovate UK and DfT-funded ZEHID[2] programme, showing that high upfront infrastructure and civils costs may require public funding support to make early deployments viable.

Notes: (1) Illustrative connection costs that were developed in discussion with the UK Power Networks Connections Team. (2) Zero Emission HGV and Infrastructure Demonstrator (ZEHID)

Modelling scenarios test WP2 depot duty cycles and compare smart energy levers against connection-cost sensitivities based on defined depot archetypes

Depot type	Fleet & charger mix	Duty / charging cycle	Scenarios modelled
Small overnight	5 vehicles 5 x 50 kW overnight charges	Overnight charging 17:00–05:00	• Baseline: 300 kW firm: unmanaged charging • 300 kW firm: smart charging • 100 kW + smart charging + 200 kW / 400 kWh BESS • 100 kW + smart charging + BESS + 100 kW solar
Medium overnight	80 vehicles 80 x 50 kW overnight chargers	Overnight charging 17:00–05:00	• Baseline: 5 MW firm: unmanaged charging • 5 MW firm: smart charging • 3.5 MW + smart charging + 1 MW / 3 MWh BESS • 3.5 MW + BESS + 500 kW solar
Medium overnight + handover	80 vehicles 65 × 50 kW overnight 15 × 200 kW handover	Overnight: 17:00–05:00 Handover: 02:00–03:00 and 17:00–18:00	• Baseline: 7 MW firm: smart charging • 4 MW + smart charging + 3 MW / 6 MWh BESS
Large overnight	200 vehicles 200 × 50 kW overnight chargers	Overnight charging 17:00–05:00	• Baseline: 12 MW firm: unmanaged charging • 12 MW firm: smart charging • 9 MW + smart charging + 1 MW / 4 MWh BESS • 9 MW + smart charging + BESS + 1 MW solar

Depot archetypes are informed from WP2 and WP3 modelling outputs. Economic inputs (asset capex & opex, energy prices etc.) are based on Baringa internal assumptions and projections. See Annex [X] for detailed modelling assumptions.

Central modelling assumptions

- **Depot archetypes test WP2 duty-cycles:** scenarios model overnight-only depot charging and a medium-depot handover[1] sensitivity to test how different operating patterns affect peak demand, MIC requirements, and site economics.
- **Connection costs**: treated as threshold-driven inputs, not linear £/MW assumptions. Lower MIC cases assume reduced reinforcement scope / lower connection capex.
- **Lever 1: Smart charging** tested first as the primary operational lever to reduce cost and smooth charging demand.
- **Lever 2: BESS** sized as a bridging asset to support charging under a lower MIC scenario, while also accessing flexibility and export revenues.
- **Lever 2: Solar** tested as an incremental on-site energy lever, reducing grid imports and adding export value where available.
- **Revenues**: Capacity Market, Ancillary Services, Balancing Mechanism and export revenues are modelled but are sensitive to asset size, market participation, and available flexibility.
- **Utilisation**: high charger utilisation is assumed, with vehicles charging immediately on return to depot, lower utilisation would increase LCOE across all scenarios.

Key sensitivities & caveats

- **Connection costs are a key value driver**: results are highly sensitive to the assumed cost of securing firm capacity. Lower MIC only creates site-level value where it avoids or reduces material connection capex. Site-level modelling and NPV results include contestable and non-contestable connection costs.
- **BESS value depends on stacked revenues:** stronger Ancillary Services, Balancing Mechanism, Capacity Market, and export revenues improve the on-site energy case; weaker market revenues reduce the benefit of adding storage. This is also sensitive to energy prices; i.e. higher import prices increase the value of load shifting and on-site generation
- **Solar and BESS require sufficient on-site space**, which may limit applicability for some depots, in practice.

Notes: (1) Based on WP2 outputs, a "handover" duty cycle reflects vehicles returning briefly between shifts, creating a short charging window that can overlap with overnight charging.

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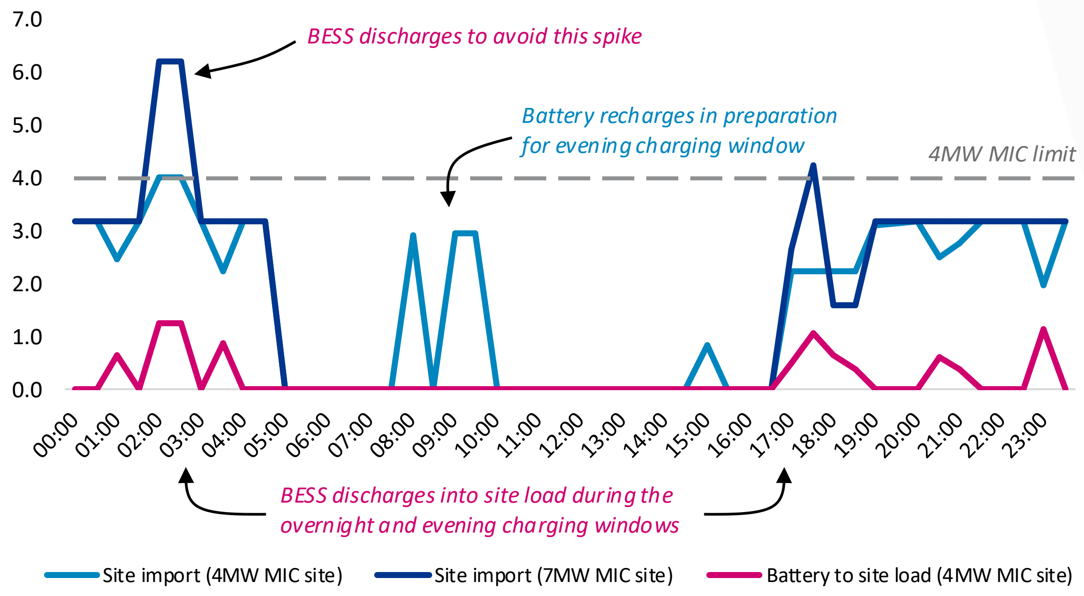
On-site BESS can reduce depot MIC requirements by meeting the gap between charging demand and lower grid import capacity

Depot import profile showing how BESS supports charging demand under a lower MIC
Example from the medium depot handover sensitivity, comparing a 7MW smart charging case with a 4MW smart charging + BESS case



- **This profile shows how BESS can act as a bridging asset between site charging demand and a lower MIC, allowing the same fleet demand to be served.**
- **This sensitivity assumes overlapping overnight and handover[1] charging, creating a coincident peak that would require a 7MW firm connection.**
- In the 4 MW case, the BESS charges when there is headroom and discharges into site load during the charging windows.
- This reduces the grid import needed to serve the same charging demand, enabling a lower MIC.
- The sensitivity assumes overnight chargers are available 17:00–05:00, while handover chargers create short additional charging spikes at 02:00 and 17:00. The peak periods are driven by this overlap.

Notes: (1) Based on WP2 outputs, a "handover" duty cycle reflects vehicles returning briefly between shifts, creating a short charging window that can overlap with overnight charging.

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The primary value of smart energy levers is not reducing energy costs, but enabling electrification through lower connection requirements and alternative infrastructure investment

Conclusions	Evidence from modelling	Implications for Future Fleet
Smart charging should be considered the baseline capability for depot electrification	Across every archetype, moving from unmanaged to smart charging delivered the largest reduction in long-run energy costs and LCOE without requiring additional infrastructure investment.	**Smart charging should be assumed as the default charging strategy** for future eHGV depots, rather than an optional enhancement. Any future trial should incorporate smart charging as a baseline capability.
On-site assets can substitute for a portion of grid connection requirements	BESS and solar enabled equivalent charging demand to be met on materially lower MICs, reducing required import capacity by ~25-65% across modelled scenarios.	**Smart energy levers can reduce connection requirements and avoid or reduce network reinforcement**, potentially enabling faster and lower-cost electrification in constrained locations.
Smart energy levers shift investment behind the meter rather than eliminating infrastructure costs	BESS and solar investments were largely offset by connection cost savings. Total lifetime economics often remained comparable despite materially different infrastructure configurations.	**The key question is not whether infrastructure investment is required, but where it sits.** Smart energy solutions shift expenditure from network reinforcement towards customer-side assets and controls.
The value of BESS is driven more by grid constraints than energy market revenues	BESS rarely outperformed smart charging on energy cost savings alone, but became increasingly attractive where connection costs, capacity constraints or peak charging requirements were significant.	**The strongest case for BESS is enabling access to capacity and reducing connection requirements**, rather than relying solely on arbitrage or flexibility revenues.
As depots scale, the challenge shifts from energy optimisation to connection deliverability	Larger depots achieved lower LCOEs through higher utilisation but required significantly larger MICs and faced materially higher connection costs. Operationally intensive duty cycles further increased connection requirements.	**Future network planning should focus on where charging demand becomes concentrated.** The highest-value interventions are likely to be those that help larger depots and logistics hubs secure capacity more quickly and efficiently.

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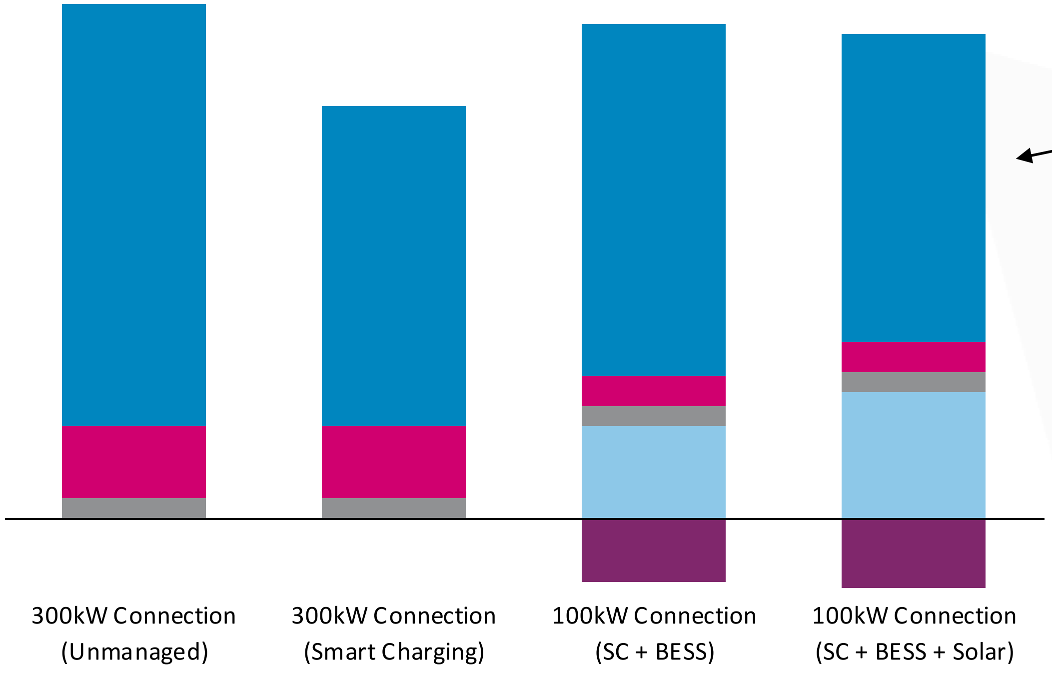
Chart Explainer: Analysis results show whole-life economics through NPV and LCOE, with stacked bars used to explain the cost and revenue drivers behind each scenario

20-year undiscounted cost stack for small depot charging scenario[1], £m (real 2026)



	300kW Connection (Unmanaged)	300kW Connection (Smart Charging)	100kW Connection (SC + BESS)	100kW Connection (SC + BESS + Solar)
Discounted net site cost NPV (£m)	1.2	1.0	1.0	1.0
LCOE (p/kWh)	16.8	13.7	14.7	14.6

Energy costs | Connection costs | Charging infrastructure | On-site assets | BESS revenues

20-year **undiscounted** cost and revenues for each scenario. Positive values are site costs, negative values are revenues

Discounted net site cashflow over 20 years, applying a 6% discount rate, a lower NPV means a lower-cost output for the site

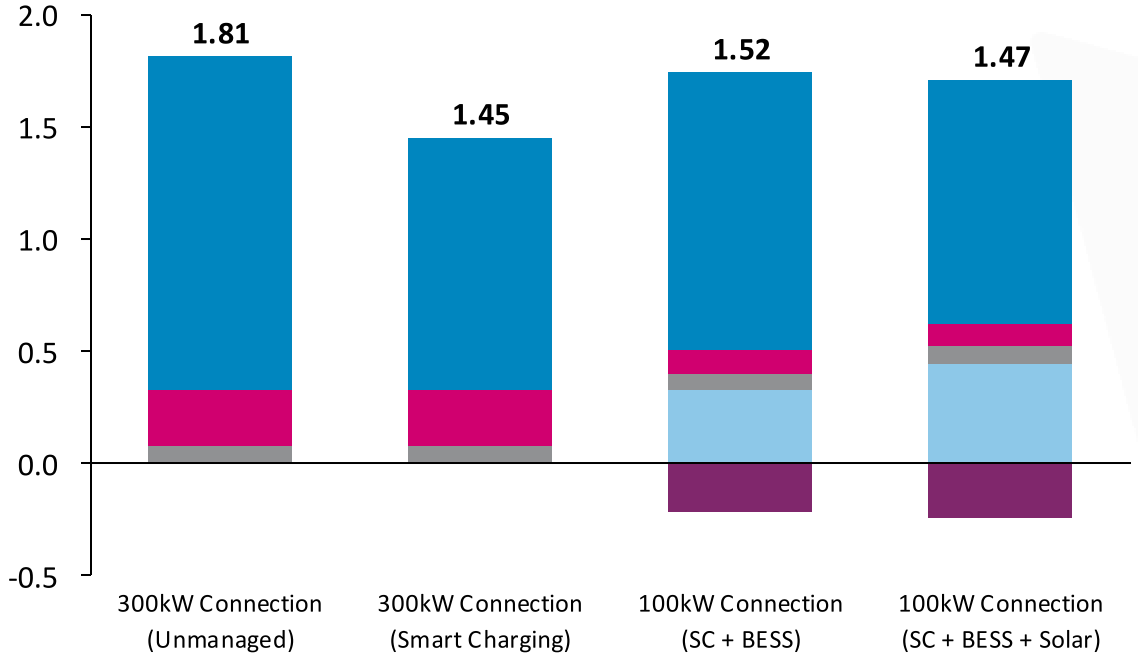
Converts the discounted net site cost into a p/kWh charging cost by dividing the NPV by total modelled charging demand over the project lifetime

Assumptions for each modelled scenario

Notes: (1) Based on WP2 outputs, assumes 5 × 50 kW overnight chargers with a 17:00–05:00 charging window. Energy costs use Baringa's Wholesale and Retail Price projections. Bars show 20-year real costs in 2026 prices; NPV is discounted at 6%. Detailed modelling assumptions are included in the appendix.

Small depots derive most value from smart charging, with BESS primarily reducing connection requirements rather than site costs

20-year undiscounted cost stack for small depot charging scenario[1], £m (real 2026)



	300kW Connection (Unmanaged)	300kW Connection (Smart Charging)	100kW Connection (SC + BESS)	100kW Connection (SC + BESS + Solar)
Discounted net site cost NPV (£m)	1.2	1.0	1.0	1.0
LCOE (p/kWh)	16.8	13.7	14.7	14.6

Notes: (1) Based on WP2 outputs, assumes 5 × 50 kW overnight chargers with a 17:00–05:00 charging window. Energy costs use Baringa's Wholesale and Retail Price projections. Bars show 20-year real costs in 2026 prices; NPV is discounted at 6%. Detailed modelling assumptions are included in the appendix.

1 Smart charging could deliver the largest reduction in levelised cost of energy under these assumptions

- Reduces site cost NPV from £1.2m to £1.0m
- Lowers LCOE from 16.8p/kWh to 13.7p/kWh

2 BESS enables a 67% smaller connection

- Reduces max import capacity from 300kW to 100kW
- Can lower connection capex from £250k to £100k

3 Small depots cannot fully utilise BESS economics

- Additional capex outweighs additional flexibility value
- Smart charging remains the lowest-cost option

Key Takeaway

For small depots, smart charging should be prioritised first, with BESS deployment focused on sites where connection costs or network constraints are significant

Scenario	Connection capex (£k)	BESS capex (£k)	Total upfront CAPEX (£k)
300kW Smart charging	250	-	250
100kW Smart charging + BESS	100	240	340

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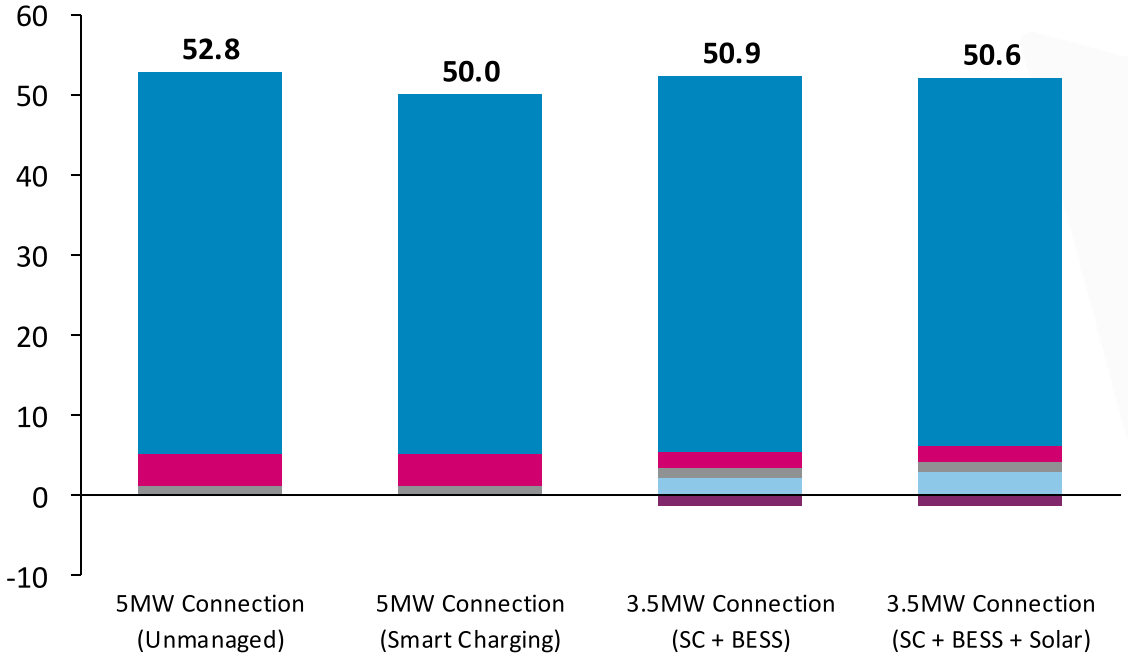
Baringa

For medium depots with overnight duty cycles, BESS and solar can enable a 30% lower MIC while remaining close to cost parity with smart charging alone

20-year undiscounted cost stack for medium depot charging scenario[1], £m (real 2026)



	5MW Connection (Unmanaged)	5MW Connection (Smart Charging)	3.5MW Connection (SC + BESS)	3.5MW Connection (SC + BESS + Solar)
Discounted net site cost NPV (£m)	33.2	31.5	32.0	32.0
LCOE (p/kWh)	10.6	10.0	10.2	10.2

Energy costs · Connection costs · Charging infrastructure · On-site assets · BESS revenues

Notes: (1) Based on WP2 outputs, assumes 80 × 50 kW overnight chargers with a 17:00–05:00 charging window. Energy costs use Baringa's Wholesale and Retail Price projections. Bars show 20-year real costs in 2026 prices; NPV is discounted at 6%. Detailed modelling assumptions are included in the appendix.

1 Smart charging could deliver the largest reduction in levelised cost of energy under these assumptions

- Reduces site cost NPV from £33.2m to £31.5m
- Lowers LCOE from 10.6p/kWh to 10.0p/kWh

2 BESS enables a 30% smaller connection

- Reduces max import capacity from 5MW to 3.5MW
- Can lower connection capex by 50%, from £4m to £2m

3 For overnight medium depots, value is primarily connection enablement

- BESS + solar remains close to the 5MW smart charging case on total cost
- Value is increasingly driven by connection enablement, not just energy cost savings

Key Takeaway

For medium overnight depots, smart charging remains the lowest-cost option, but BESS and solar become attractive where grid constraints, connection delays or costs make a lower MIC valuable

Scenario	Connection capex (£m)	BESS capex (£m)	Total upfront CAPEX (£m)
5MW Smart charging	4	-	4
3.5MW Smart charging + BESS	2	1.8	3.8

Baringa

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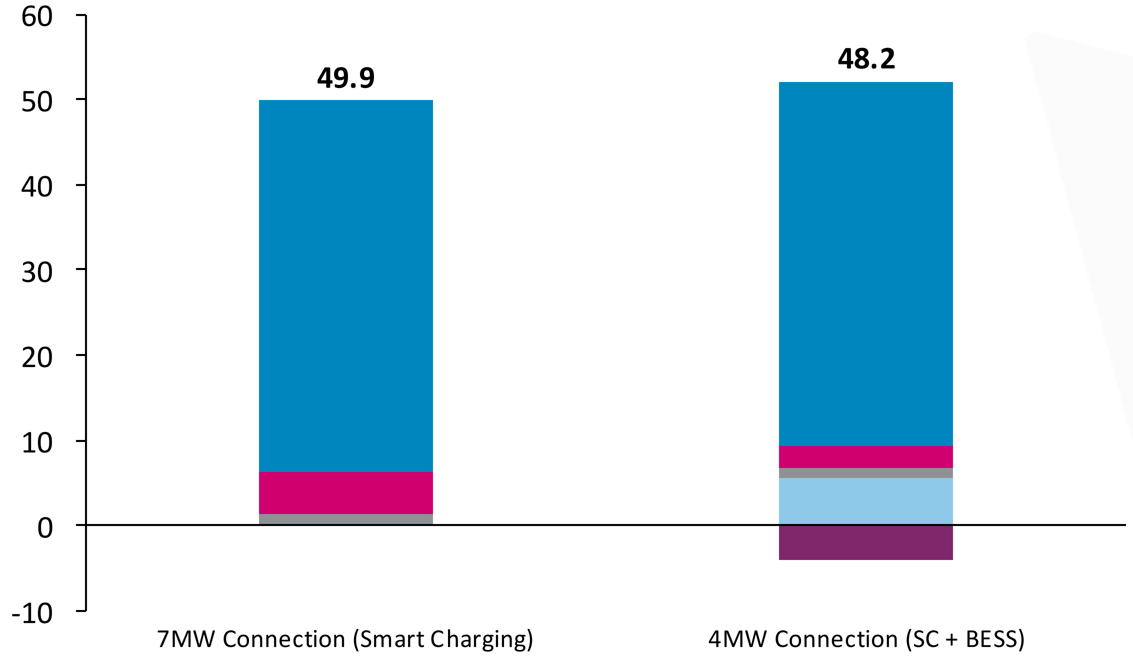
For medium depots with coincident evening peaks driven by handover duty cycles, BESS can reduce required MIC by ~40% while serving fleet demand at a lower overall cost

20-year undiscounted cost stack for medium handover depot charging scenario[1], £m (real 2026)



	7MW Connection (Smart Charging)	4MW Connection (SC + BESS)
Discounted net site cost NPV (£m)	31.8	31.3
LCOE (p/kWh)	10.7	10.6

Energy costs | Connection costs | Charging infrastructure | On-site assets | BESS revenues

Notes: (1) Based on WP2 outputs, assumes 65 × 50 kW overnight chargers with a 17:00–05:00 charging window and 15 × 200 kW handover chargers with 02:00–03:00 and 17:00–18:00 charging windows. Energy costs use Baringa's Wholesale and Retail Price projections. Bars show 20-year real costs in 2026 prices; NPV is discounted at 6%. Detailed modelling assumptions are included in the appendix. A "handover" duty cycle reflects vehicles returning briefly between shifts, creating a short charging window that can overlap with overnight charging.

Modelling sensitivity

This sensitivity tests a medium depot where overnight and handover duty cycle charging overlap during the evening peak. This short coincident peak drives the need for a 7MW firm connection.

1. **BESS becomes the lowest-cost option where evening peaks exist**
   - Reduces site cost NPV from £31.8m to £31.3m
   - Marginally lowers LCOE from 10.7p/kWh to 10.6p/kWh
2. **BESS enables a 40% smaller connection**
   - Reduces max import capacity from 7MW to 4MW
   - Can lower connection capex by 50%, from £5m to £2.5m
3. **Value is driven by avoiding larger connection costs, not energy savings alone**
   - BESS bridges the short evening peak created by overlapping duty cycles
   - Additional value comes from avoided connection capex and flex revenues

Key Takeaway

For medium depots with coincident peaks driven by overlapping charging patterns, BESS becomes valuable because it can avoid a larger grid connection threshold and enables a lower LCOE

Scenario	Connection capex (£m)	BESS capex (£m)	Total upfront CAPEX (£m)
7MW Smart charging	5	-	5
4MW Smart charging + BESS	2.5	3.6	6.1

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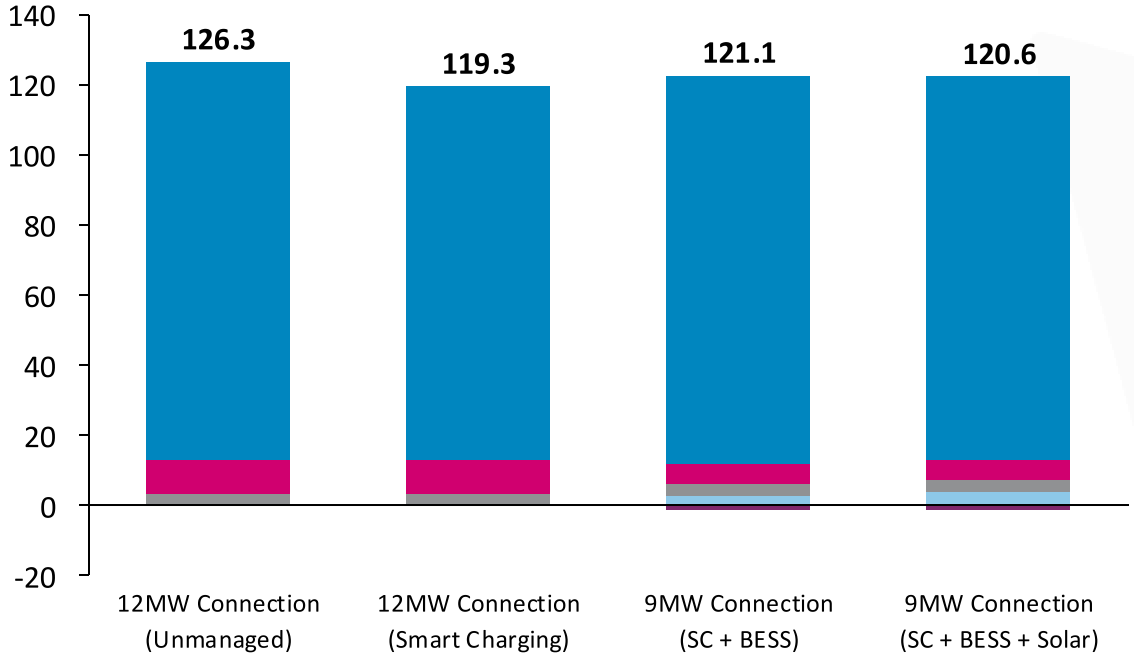
Baringa

For large depots, smart charging remains lowest cost, while BESS and solar can reduce MIC by ~25% while remaining near cost parity on a levelised cost basis

20-year undiscounted cost stack for large depot charging scenario[1], £m (real 2026)



	12MW Connection (Unmanaged)	12MW Connection (Smart Charging)	9MW Connection (SC + BESS)	9MW Connection (SC + BESS + Solar)
Discounted net site cost NPV (£m)	79.8	75.6	76.0	76.0
LCOE (p/kWh)	10.2	9.6	9.7	9.7

Energy costs · Connection costs · Charging infrastructure · On-site assets · BESS revenues

Notes: (1) Based on WP2 outputs, assumes 200 × 50 kW overnight chargers with a 17:00–05:00 charging window. Energy costs use Baringa's Wholesale and Retail Price projections. Bars show 20-year real costs in 2026 prices; NPV is discounted at 6%. Detailed modelling assumptions are included in the appendix.

1. **Smart charging could deliver the largest reduction in levelised cost of energy under these assumptions**
   - Reduces site cost NPV from £79.8m to £75.6m
   - Lowers LCOE from 10.2p/kWh to 9.6p/kWh
2. **BESS enables a 25% smaller connection**
   - Reduces max import capacity from 12MW to 9MW
   - Can lower connection capex by 40%, from £10m to £6m
3. **For large depots, value is primarily connection enablement**
   - BESS + solar remains within ~1% of the 12MW smart charging case on NPV
   - At this scale, avoiding 3MW of firm capacity could materially improve deliverability where large connections are costly, delayed, or constrained

Key Takeaway

BESS and solar remain near cost parity with the smart charging case, this could enable fleets to avoid greater connection costs and access capacity faster where grid constraints exist

Scenario	Connection capex (£m)	BESS capex (£m)	Total upfront CAPEX (£m)
12MW Smart charging	10	-	10
9MW Smart charging + BESS	6	2.4	8.4

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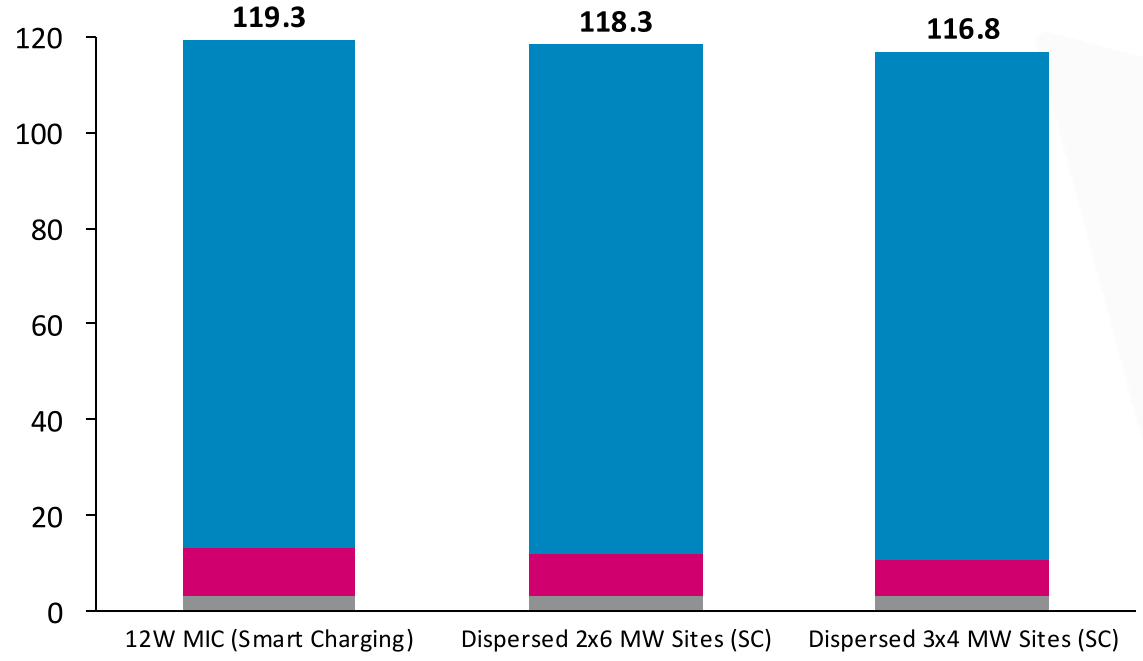
Baringa

Dispersed charging delivers modest savings, but could unlock greater value where smaller connections enable faster electrification

20-year undiscounted cost stack for large dispersed depot charging scenario[1], £m (real 2026)



	12W MIC (Smart Charging)	Dispersed 2x6 MW Sites (SC)	Dispersed 3x4 MW Sites (SC)
Discounted net site cost NPV (£m)	75.6	74.6	73.2
LCOE (p/kWh)	9.6	9.5	9.3

Energy costs | Connection costs | Charging infrastructure

Notes: (1) Based on the large overnight depot archetype, assuming 200 vehicles, 200 × 50kW overnight chargers and a 17:00–05:00 charging window. Total fleet demand and charger capex are held constant across cases. The dispersed sensitivity splits the same total fleet demand across multiple charging sites to test the impact of lower site-level connection requirements. Bars show 20-year real costs in 2026 prices; NPV is discounted at 6%. Detailed modelling assumptions are included in the appendix.

Modelling sensitivity

This sensitivity tests the economic impact of splitting a large 200-vehicle depot across smaller charging sites to assess how lower connection requirements affect NPV and LCOE.

1 Dispersed charging delivers modest financial savings on a levelised cost basis

- Site cost NPV improves by ~1-3%, from £75.6m to £74.6m and £73.2m
- Marginally lowers LCOE from 9.6p/kWh to 9.5p/kWh and 9.3 p/kWh

2 Smaller sites may reduce aggregate connection costs

- Dispersing load reduces connection capex by 10–25%
- Value is from avoiding connection cost tiers rather than energy savings

3 Faster electrification is the key unquantified upside

- If smaller connections are faster to secure, dispersed charging could unlock value beyond the modelled cost savings
- The operational impact of dispersed charging has not been quantified

Key Takeaway: **Dispersed charging can reduce connection capex, but the modelled economic benefit is modest, the main upside is where smaller connections enable faster electrification**

Scenario	Connection capex (£m)	Connection capex saving vs 12MW
12MW Smart charging	10	-
2x6MW Smart charging	9	10%
3x4MW Smart charging	7.5	25%

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Baringa

Parked eHGVs create a material overnight flexibility opportunity, but Ancillary Services revenues should be treated as upside given value cannibalisation and technical delivery risks

Illustrative Ancillary Services revenue

Revenue = available kW x 4hrs/day x clearing price x success rate x 365 days

Available charger capacity[1]	Clearing price (£/kW/hr)	Success rate	Illustrative revenue (£ per charger per year)
1 × 50kW charger	£5	100%	**£365k**
1 × 50kW charger	£1	50%	**£36.5k**
1 × 50kW charger	£0.5	50%	**£18.3k**

For 20 chargers participating in ancillary services, a conservative service fee of £0.5–1/kW/hr sensitivity could represent ~£0.37–£0.73m per year

- **Ancillary Services (AS)** are electricity system balancing services used to maintain grid frequency and stability. For eHGV depots, the primary opportunity is flexing charging demand in response to system signals.
- **Illustrative services include:**
  - Dynamic Containment (DC)
  - Dynamic Moderation (DM)
  - Dynamic Regulation (DR)

WP3 treats ancillary services as an illustrative flexibility revenue stream rather than modelling any specific ESO product, and we note the current technical complexity regarding provision of these services using aggregated behind-the-meter assets.

Notes: (1) Chargers require bi-directional charging capability

Key considerations

1 Overnight eHGV dwell creates a material flexibility opportunity

- Based on our modelled depot archetypes, eHGVs are assumed to return to depot for overnight charging, typically with a 12-hour dwell window. This creates a potential flexibility window where vehicles could, in principle, provide Ancillary Services if bidirectional charging is available and SOC requirements can be met.
- DFES projects ~80k eHGVs across UKPN licence areas by 2050. If each vehicle required access to a 50kW depot charger, this would imply up to ~4GW of connected charger capacity.

2 Revenues remain meaningful under conservative assumptions

- Current ancillary service clearing prices are assumed at c.£1–5/kW/hr, but prices have already fallen in recent years as grid-scale BESS has entered the market, highlighting the risk of further value cannibalisation.
- Continuous 4-hour daily clearing may be ambitious; however, even at £0.5–1/kW/hr and 50% clearing success, revenues can remain meaningful

3 Technical delivery risk remains a key constraint

- Behind-the-meter provision of Dynamic Containment-type services is technically challenging, requiring robust telemetry, metering, settlement, controls and capacity aggregation
- Evidence of behind-the-meter participation remains limited, and vehicles must still meet depot charging, morning SOC and route requirements

Key Takeaway

Ancillary services revenues may offer material upside, but significant uncertainty remains due to the market value and technical delivery risks. Ancillary services provision would not materially reduce a site's MIC, so, this does not impact the main conclusions from WP3

Baringa

Bi-directional charging may unlock additional flexibility value, but operational and commercial viability remains uncertain for depot-based eHGVs

Key hypothesis: eHGV batteries represent a potentially significant flexible energy resource while vehicles are parked overnight. In principle, bi-directional charging could allow fleets to provide flexibility services, reduce site import peaks, or support wider site energy management — though value depends on charger costs, battery degradation, market revenues, and fleet utilisation.

Potential opportunities

Vehicle-to-Grid (V2G)

- Export energy from parked eHGVs back to the electricity network
- Participate in ancillary services and flexibility markets
- Reduce depot MIC requirements during peak demand
- Provide additional value streams beyond charging optimisation

Vehicle-to-Building (V2B)

- Vehicles support depot or building loads during peak periods
- Reduce import peaks and demand charges
- Most relevant where significant non-charging site loads exist (warehousing, refrigeration, manufacturing, ports)

Vehicle-to-Vehicle (V2V)

- Energy transferred between vehicles within a depot
- Allows charging resources to be shared more flexibly across the fleet
- Could support operational resilience in specific circumstances

Key challenges

Limited net benefit from V2V

- V2V does not create additional energy; transfers must be replenished from the grid
- Risks "robbing Peter to pay Paul" without wider site optimisation
- Unclear whether V2V outperforms smart charging or stationary BESS

Operational constraints

- Vehicles must meet route, dwell time and state-of-charge requirements
- Fleet readiness likely prioritised over flexibility revenues
- Availability varies significantly by depot and duty cycle

Commercial uncertainty

- Ancillary service values may fall as more flexible assets enter the market
- Revenue stacking remains uncertain
- Additional capex for bidirectional chargers and control systems

Technical complexity

- Requires advanced controls, telemetry and aggregation
- Integration with EMS, charging management and fleet operations
- Battery degradation impacts require further assessment

WP3 conclusion: Smart charging and stationary BESS are likely to provide the majority of near-term value. Bi-directional charging should be viewed as a future flexibility opportunity and potential upside rather than a core assumption within the Future Fleet business case.

Future trial consideration: monitor V2G-capable heavy vehicles; assess V2B at sites with significant building loads; treat V2G/V2B as an optional enhancement to future smart energy trials where vehicle availability and duty cycles allow.

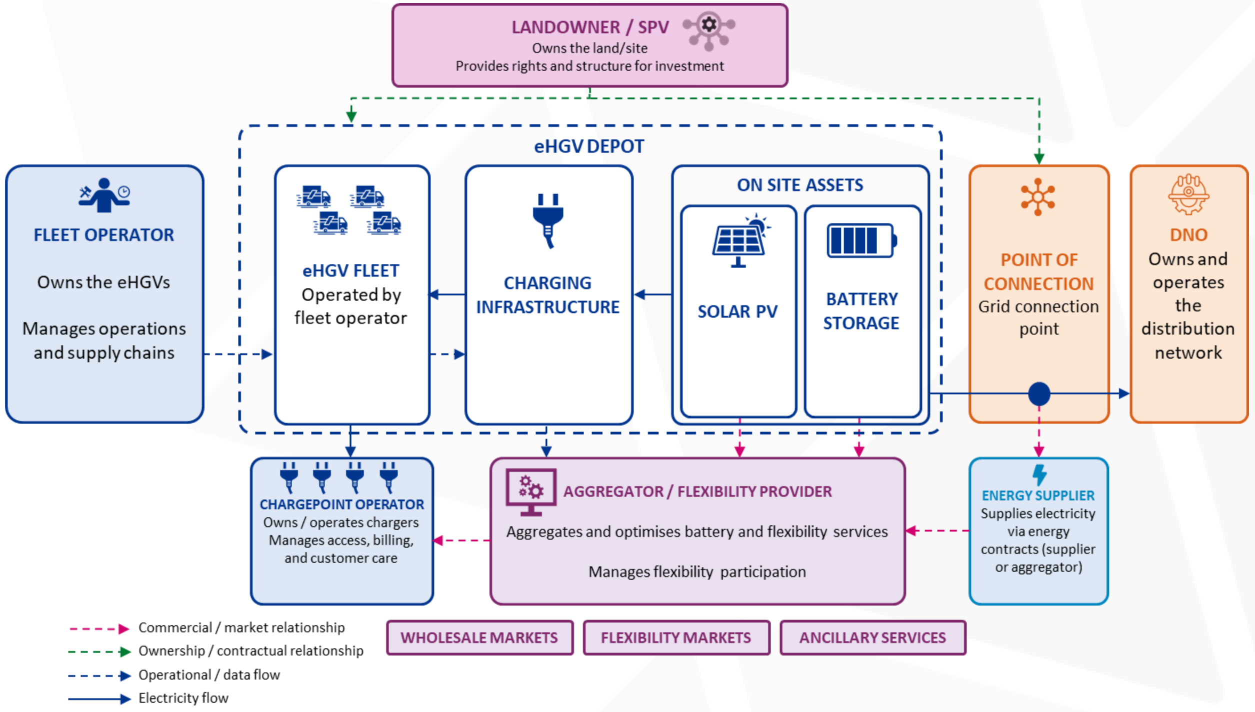
Baringa

Commercial structures and risk allocation materially affect deployability and financing feasibility

Business models determine how risks, roles, and value are allocated across parties. There are many variations for business models between eHGV sites. The table summarises the main business model dimensions assessed, with a schematic illustrating the various types of ecosystem actors and operators who could be involved in financing, operating, and developing a depot.

Category	Key Questions Assessed
Asset ownership	Who owns the charger, grid assets, solar, battery and shared infrastructure?
Capital investment	Who funds upfront capex and takes financing risk?
Revenue exposure	Who is exposed to risk, wholesale volatility and flexibility revenues?
Operational responsibility	Who operates, dispatches and maintains assets?
Technical performance risk	Who carries availability, degradation and performance risk?
Market participation	Which parties access flexibility, wholesale or balancing markets?
Contractual structure	Which long-term agreements underpin investment certainty?
Counterparty ecosystem	Which market participants are required to enable delivery?

Illustrative on-site energy business model structure



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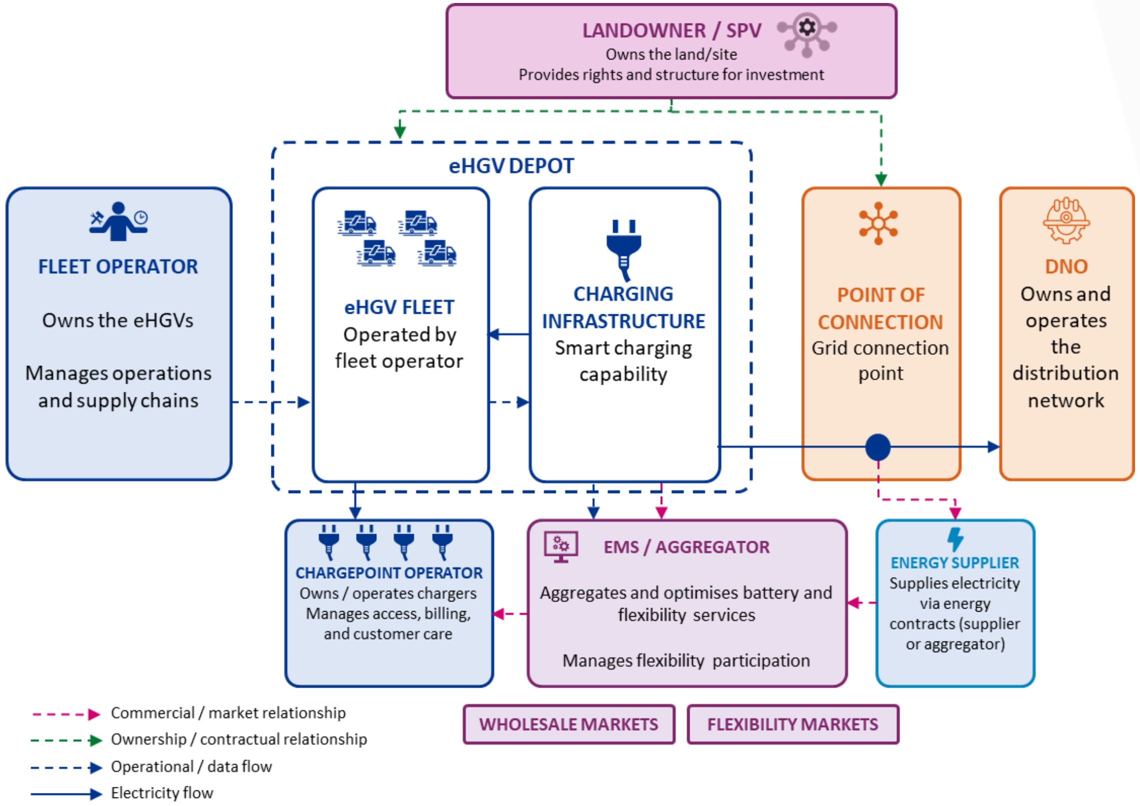
Baringa

Smart charging is simpler to deploy than asset-led models, but requires clear control rights, data visibility, and benefit sharing to be investable

Illustrative smart charging business model structure



Category	Key Enabling Factors
Commercial	• Low-capex intervention compared with on-site assets or grid reinforcement • Clear savings-share or service-fee model can align fleet, CPO and optimiser incentives
Operational	• Predictable duty cycles and dwell windows allow charging to be shifted without disrupting vehicle readiness • Fleet operators retain override rights while allowing optimisation within agreed constraints
Market & Revenue	• Value can be captured through tariff optimisation and reduced peak import • Flexibility participation may provide upside where technically and contractually feasible
Technical & Infrastructure	• Charger controls, EMS integration and site metering enable reliable load management • Flexible or profiled connections become more viable where charging can be actively managed
Investment & Delivery	• Simpler deployment than on-site assets, using existing chargers and operational processes • Clear contracts define who controls dispatch, owns data and captures optimisation benefits

Category	Key Risks / Barriers
Commercial	• Savings may be limited where price spreads, peak charges or network constraints are modest • Value leakage if the party funding optimisation does not capture the resulting benefit
Operational	• Dispatch optimisation must not interfere with fleet operations • Variable schedules, short dwell times, or uncertain state-of-charge could impact optimisation
Market & Revenue	• Flexibility revenues may be uncertain and should not be the primary business case • Benefits can be difficult to realise where reduced connection costs accrue to a different party
Technical & Integration	• Requires reliable charger control, telemetry, metering and integration with fleet systems • Poor data quality or limited visibility of depot demand can weaken optimisation performance
Contractual & Delivery	• Dispatch rights, override rules and liability for missed charges need to be clearly allocated • Multi-party models can create misaligned incentives between involved parties

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Smart charging is a scalable baseline capability, but its value depends on who controls dispatch, manages capacity and captures optimisation benefits

	Fleet Operations		Charging Operations		Energy Infrastructure & Dispatch Rules			Energy Optimisation	Energy Supply	Asset Operations	Commercial & Contracting
Key Activities	**Truck ownership & leasing**	**Fleet operations management**	**Smart charging optimisation**	**Chargepoint ownership & management**	**Grid connection & capacity management**	**Smart charging optimisation and dispatch**	**Connection & capacity management**	**Tariff optimisation**	**Retail electricity supply**	**Operations & maintenance (O&M)**	**Revenue settlement & contracting**
	Ownership / financing of eHGV fleet. Vehicle readiness requirements	Routing, scheduling, depot operations, dwell times and dispatch priorities	Charging schedules aligned to operational and energy constraints	Charger ownership, uptime, access management	Connection agreement, import capacity, Profiled connection participation	Charging schedules, power allocation, load balancing, and override rules	Import capacity, flexible connection compliance, peak management	Dispatch against tariff windows, DUoS signals, DNO flexibility, and wholesale pass-through	Supply contract for residual power demand	Charger maintenance, software uptime, communications, telemetry and fault response	Savings share, service fees, performance incentives, value allocation
Typical Owners	Fleet operator / leasing provider	Fleet operator	CPO / EMS provider / fleet operator	Fleet operator, CPO or infrastructure investor	Fleet operator / landowner / site host	EMS provider / optimiser / CPO operator	*Fleet / site host / EMS*	Aggregator / optimiser	Supplier	CPO / OEM/ specialist operator	Fleet / CPO / Supplier /Optimiser / Aggregator

Important Nuances

Chargepoint ownership
Depending on the commercial structure, they could be:
- Fleet-owned
- CPO-owned
- Or financed by an infrastructure fund

Baseline capability
- Smart charging should be treated as the baseline capability for depot-led eHGV electrification
- Core value comes from peak management and tariff optimisation

EMS/optimisation boundary
- Could sit with the fleet, CPO, software provider or integrated energy manager
- Fleet must retain override and vehicle readiness assurance, but the optimiser needs enough control to generate value

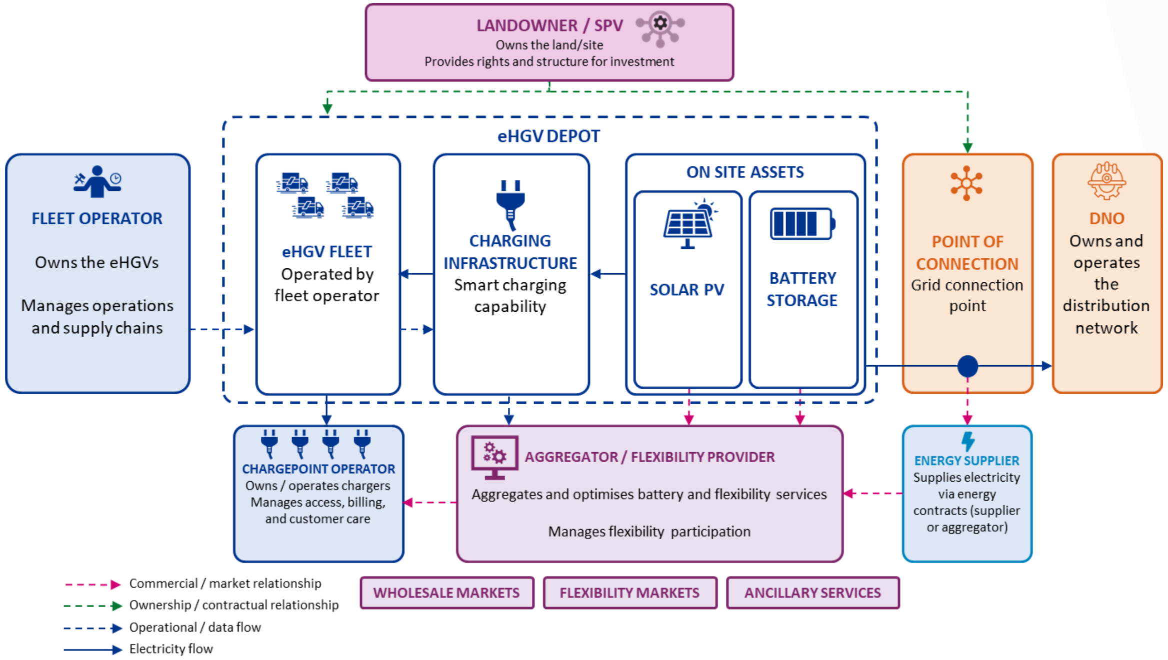
Value capture
Main value streams include:
- Avoided peak import
- Lower wholesale costs
- Non-energy cost optimisation
- Flexibility revenues

Smart charging has lower merchant risk than battery-led models
- Savings-share and performance incentives still matter but who captures value depends on dispatch right and contract structure

Baringa

Solar and battery deployment can materially improve electrification economics, but requires investable risk allocation and credible long-term value capture

Illustrative on-site energy business model structure



Category	Key Enabling Factors
Commercial	• Avoided/deferred reinforcement can materially improve economics • Predictable charging demand supports long-term investment cases
Operational	• Flexible charging operations enable optimisation of battery dispatch • O&M responsibilities can be outsourced to specialist providers
Market & Revenue	• Multiple value streams (tariff optimisation, flexibility, wholesale arbitrage) improve returns • Growing flexibility market participation pathways may provide additional upside
Technical & Infrastructure	• Flexible/phased connections reduce upfront grid requirements • Co-location with large eHGV demand improves utilisation and value capture
Investment & Delivery	• Third-party investors may finance assets where stable revenues exist • Shared/SPV structures can support deployment and risk allocation

Category	Key Risks / Barriers
Commercial	• Merchant revenues may be volatile and uncertain • Fleet operators may not wish to own merchant-exposed assets
Operational	• Dispatch optimisation must not interfere with fleet operations • Multi-party coordination increases operational complexity
Market & Revenue	• Long-term flexibility and ancillary market values remain uncertain • Financing may require credible long-term revenue assumptions
Technical & Integration	• Integration between EMS, chargers and battery controls adds complexity • Battery degradation and performance risk impact long-term returns
Contractual & Delivery	• Multi-party contractual structures may be required • Economics may weaken in unconstrained locations with lower avoided network costs

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Baringa

On-site solar and battery solutions introduce additional optimisation, investment and operational counterparties beyond traditional fleet charging models

	Fleet Operations		Charging Operations		Energy Infrastructure & Dispatch Rules				Energy Optimisation	Energy Supply	Asset Operations	Commercial & Contracting
Key Activities	**Truck ownership & leasing**	**Fleet operations management**	**Smart charging optimisation**	**Chargepoint ownership & management**	**Grid connection & capacity management**	**Solar & BESS asset investment**	**Asset installation & EPC**	**Energy management system (EMS)**	**BESS optimisation & dispatch control**	**Retail electricity supply**	**Operations & maintenance (O&M)**	**Revenue settlement & contracting**
	Ownership / financing of eHGV fleet	Routing, scheduling, depot operations	Charging schedules aligned to operational and energy constraints	Charger ownership, uptime, access management	Connection agreement, Peak demand management	Funding and ownership of assets	Design, procurement and construction of on-site assets	Controls integration across chargers, battery and site demand	Dispatch into charging, optimisation, participation in flexibility markets	Supply contract for residual power demand	Maintenance of chargers, battery and solar assets	Revenue sharing, toll/floor agreements, settlement and contractual risk allocation
Typical Owners	Fleet operator / leasing provider	Fleet operator	CPO / EMS provider / fleet operator	Fleet operator, CPO or infrastructure investor	Fleet operator / landowner / site host	Infrastructure investor / SPV / fleet operator	EPC contractor / specialist infrastructure provider	EMS provider / optimiser / CPO	Aggregator / optimiser	Supplier	OEM / specialist operator	Supplier, SPV, Aggregator, Energy services provider

Important Nuances

Chargepoint & asset ownership
Depending on the commercial structure, they could be:

- Fleet-owned
- CPO-owned
- Or financed by an infrastructure fund

Grid connection ownership is important strategically:

- often owned by site host/landowner
- not necessarily by the charging operator

EMS/optimisation boundary

- Could sit with the fleet, CPO, software provider or integrated energy manager
- Fleet must retain override and vehicle readiness assurance, but the optimiser needs enough control to generate value

Flexibility participation is a key value lever for BESS, depending on route-to-market, ownership may sit with:

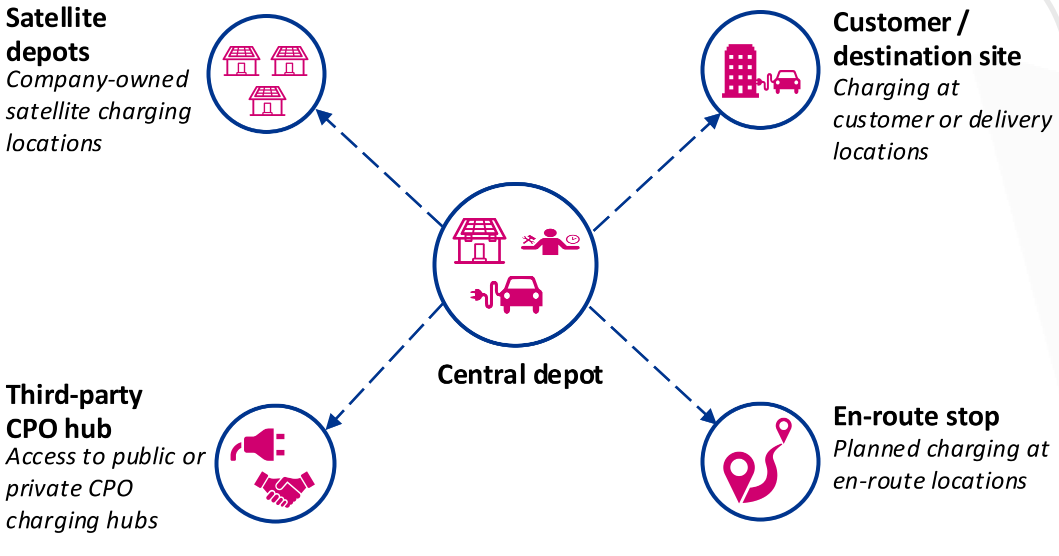
- the supplier
- optimiser
- aggregator

Merchant risk allocation

- Battery revenues may be exposed to wholesale spreads, flexibility market uncertainty
- Risk appetite influences investability and ownership structure

Baringa

Dispersed charging can relieve constrained depots, but shifts the business model from owning one site to coordinating access, routing, and reliability across multiple locations



A portion of charging demand is shifted from one constrained depot to locations that align with route patterns, dwell time, and available network capacity

Business model implications

1	**Fleet proposition**	Reduces reliance on a single depot connection and creates a portfolio of charging access rights across multiple sites
2	**Commercial model**	Can include fleet-owned satellite chargers, host-site charging, reserved CPO access, or bilateral agreements for third-party charging
3	**Revenue & value**	Significant value can come from avoided connection or reinforcement costs, lower concentrated peak demand, and improved utilisation. Hosts and CPOs can monetise access fees and charging margins
4	**Operating model**	Requires route-planning integration, booking or reservation rules, charger availability SLAs, and reliable data across sites. In practice, it could be complicated to establish and manage efficiently

Applicability to operators

- Larger fleets where one depot connection or MIC upgrade would be too costly or delayed
- Operators with regular routes, repeated destinations, and predictable dwell windows
- Constrained urban and/or logistics areas where spreading demand helps manage constraints
- Duty cycles where destination or en-route dwell is long enough for sufficient top-up charging

Key enablers

Operational compatibility

- Alternative charging locations must fit existing routes, dwell windows, and driver patterns
- It should not materially add mileage, delay, or add driver-hours cost

Reliable access rights

- Fleets need confidence that bays and power are available when required
- Hosts and CPOs need committed utilisation or reservation fees to invest

Key barriers

Operational leakage

- Detours, queues, or missed charging windows can lead to value erosion of the dispersed charging business case
- Reliability risks become distributed across several sites rather than one

Commercial confidence and utilisation risk

- Fleets need price certainty and access whilst hosts need sufficient utilisation to recover margins
- Contracts must allocate availability risk, upgrade cost recovery, and priority rights where utilisation is uncertain

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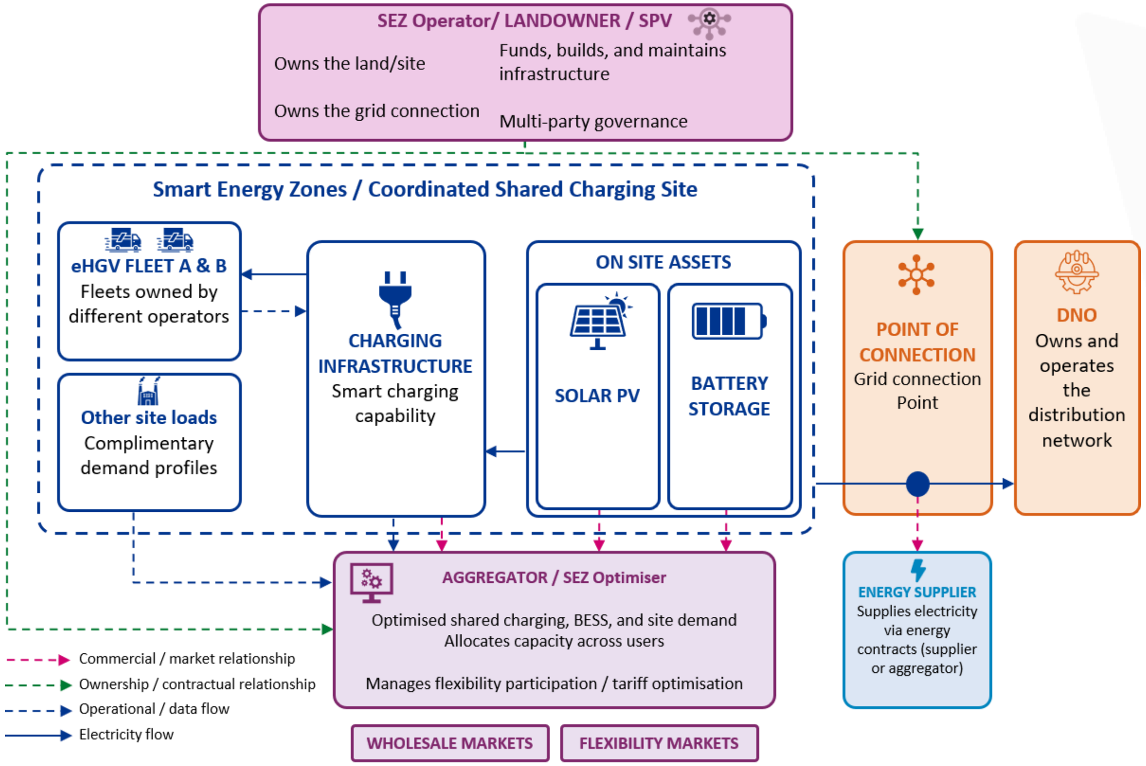
While a Consortium or Shared Hub model may lessen grid connection cost burden, there are various commercial and operational hurdles to consider

Illustrative shared site / smart energy zone business model structure



Category	Key Enabling Factors
Commercial	• Shared investment structure reduces individual fleet capex burden • Enables access to grid connections that may otherwise be uneconomic for a single operator
Operational	• Aggregated demand can justify larger and more efficient grid connections • Shared infrastructure may accelerate energisation in constrained areas
Market & Revenue	• Complementary charging profiles and duty cycles can improve infrastructure utilization • Centralised charging and energy management can improve operational efficiency
Technical & Infrastructure	• SPV/shared ownership structures can enable coordinated investment and governance • Shared sites may unlock economies of scale across charging and energy infrastructure
Investment & Delivery	• Enables access to strategic logistics locations where land and power are constrained • Potential to support future flexibility and smart energy optimisation at larger scale

Category	Key Risks / Barriers
Commercial	• Multi-party investment structures may be difficult to negotiate and govern • Individual operators may prefer to secure exclusive access to connection capacity
Operational	• Charging requirements, duty cycles, and operational priorities may not align across users • Shared operational control and scheduling increases coordination complexity
Contractual & Governance	• Complex SPV, land ownership and usage agreements may be required • Long-term access rights, cost allocation and exit mechanisms may be difficult to structure
Technical & Infrastructure	• Site design and charging configuration must accommodate multiple fleet requirements • Shared infrastructure introduces dependency on common assets and systems
Market & Delivery	• Delivery may require alignment between multiple counterparties and timelines • Financing and investment decisions may be slowed by governance complexity

 |

Baringa

Shared hubs and smart energy zones unlock larger-scale charging infrastructure, but value depends on site governance, capacity allocation, and access rights

Anchor Site & Land Ownership → User Access & Demand Commitment → Shared Charging Infrastructure → Grid & Energy Infrastructure → Operations & Optimisation → Energy Supply & Market Access → Commercial & Contracting

Key Activities	**Land rights & planning**	**Anchor demand commitment**	**Access rules & booking**	**Chargepoint ownership & operation**	**Grid connection & capacity rights**	**Private network & site energy assets**	**Zone scheduling & optimisation**	**Energy supply & flexibility route-to-market**	**Operations & maintenance (O&M)**	**Settlement & governance**
	Land rights, planning, site access, lease or concession model	Long-term fleet demand, access windows, capacity contracting	Bay booking, priority rules, user access, queuing	Charger ownership, uptime, tariff model, customer interface	Connection application, MIC, capacity allocation, curtailment rules	LV/HV network, metering, BESS/solar where relevant, site controls	Capacity booking, fleet prioritisation, charging schedules, load optimisation	Retail supply, tariff structure, flexibility participation	Maintenance of chargers, battery and solar assets	Access fees, capacity reservation, revenue sharing, shareholder agreements, exit rights
Typical Owners	Landowner, logistics site, industrial site host	Fleet operators, anchor tenant	Zone operator, CPO, site host	Fleet operator, CPO or infrastructure investor	Landowner, SPV, zone operator, DNO interface	Infrastructure investor / SPV / fleet operator	Zone operator, EMS provider, optimiser, CPO	Supplier, aggregator, zone operator	CPO, zone operator, specialist contractors	SPV, landlord, fleet operators, CPO, investors

Important Nuances

Capacity allocation is the central issue:

- Shared sites require clear rules for who gets access to power, when, and on what priority basis
- Allocation logic may matter more than technical design alone

Anchor demand makes the model investable

- Long-term fleet commitments or take-or-pay contracts may be needed to underwrite connection and infrastructure capex
- Anchor tenants can help de-risk first-of-a-kind developments

Governance can be a challenge

- Multi-party scheduling, cost sharing, exit rights and operational priority are likely to be the main barriers

Site host role is strategic

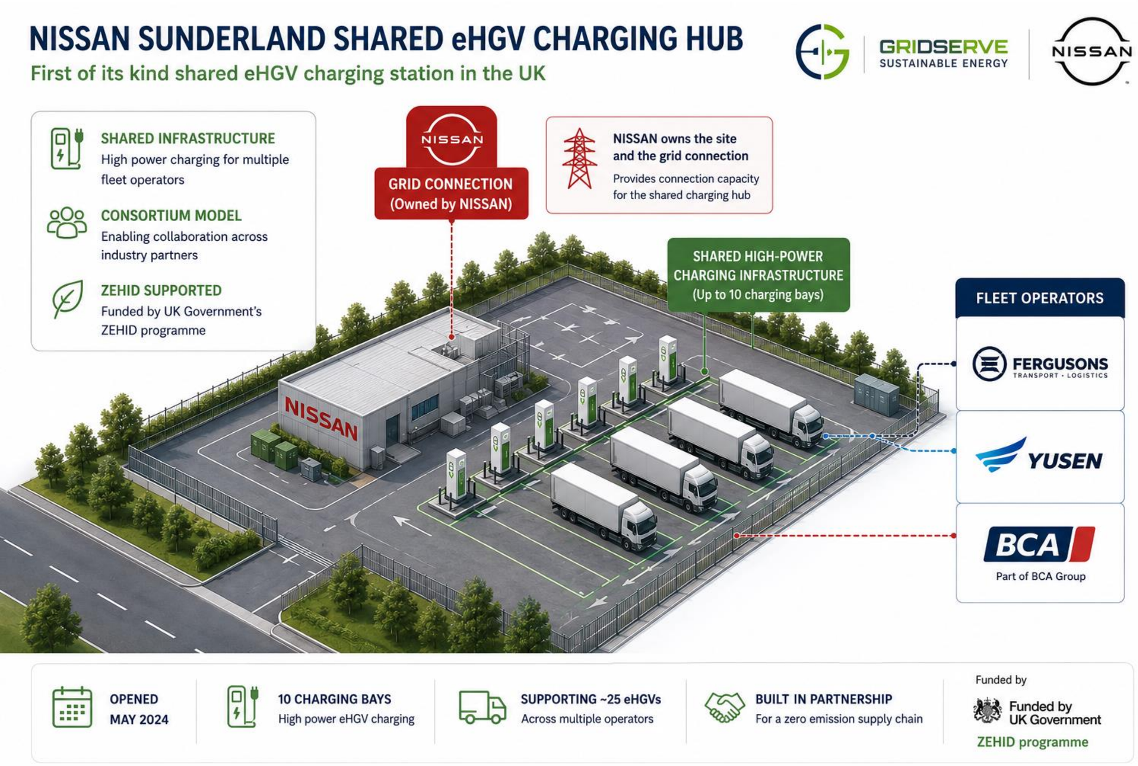
- Port, logistics parks, industrial sites and large depots may monetise land, connection capacity or complementary load profiles
- Existing hosts may become anchor sites for shared electrification

Shared models are best targeted in areas with clustered, large loads

- Most relevant where depot-only electrification would trigger major reinforcement or where multiple operators cluster around constrained logistics assets

Baringa

The Nissan Sunderland shared eHGV charging hub is an emerging consortium-led model for overcoming the high upfront cost of freight electrification infrastructure



Relevance to smart energy lever assessment

- Demonstrates a shared eHGV charging model linked to a major industrial destination with concentrated freight activity
- Illustrates how existing industrial sites may act as anchor locations for freight electrification infrastructure
- Highlights the role of "destination charging" where vehicles naturally dwell during loading, unloading or logistics operations
- Shows how shared infrastructure models may improve charger economics versus standalone depot charging
- Demonstrates potential to leverage existing site infrastructure and connection capacity to accelerate deployment
- Provides an early example of multi-party operational coordination across logistics operators and site hosts
- Highlights the role of public funding in de-risking first-of-a-kind freight charging infrastructure models

Areas	Emerging Insight
Site host role	Industrial operators may act as anchor hosts for shared charging infrastructure linked to their logistics ecosystem
Destination charging model	Charging infrastructure can align with vehicle dwell time at industrial and logistics destinations
Infrastructure	Shared usage across multiple operators may greatly improve charger utilisation and economics
Connection strategy	Existing industrial sites may offer advantages through available land, infrastructure and connection capacity
Operational coordination	Multi-party scheduling, access management and charging prioritisation are required
Commercial structure	Shared infrastructure models may require centralised governance and operational oversight
Investment model	Public funding currently helping de-risk early-stage shared charging deployments
Scalability potential	Similar models may emerge at ports, logistics parks, distribution centres and industrial clusters

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Regulatory & Market Enablers / Barriers

Regulatory and market enablers and barriers influence fleet operators' ability to roll out charging infrastructure across different sites. The table below outlines key enablers and barriers (first column) and their corresponding impacts on fleet operators.

	Description	Impact on fleet operators
Flexibility markets	Participation in system operator flexibility markets enables assets to adjust demand or export in response to system needs in exchange for revenue.	Creates revenue opportunities but requires operational flexibility and market access capability.
Future policy developments	Evolving policy and regulatory frameworks governing eHGV rollout, EV charging, grid access, and flexibility markets.	Can unlock new opportunities or introduce uncertainty affecting investment decisions.
Funding opportunities	Public funding and incentives supporting eHGVs, charging infrastructure, and enabling grid upgrades.	Reduce upfront capital costs which can improve business case viability.
Aggregation/route-to-market	Third-party aggregators combine multiple assets to meet minimum thresholds and access flexibility markets.	Reduces barriers to market participation and improves revenue potential, but introduces dependency on commercial intermediaries.
Flexible connections	Connection arrangements whereby a customer's export or import of electricity is managed based upon contracted and agreed principles of available capacity, often used in grid constrained areas.	Offers lower-cost and faster connections, but introduces uncertainty around available charging capacity during constrained periods.
Shared connection	Multiple users share a single grid connection and allocated capacity.	Can reduce connection costs, but requires coordination with other users and may constrain charging availability.
Settlement/metering	Complex metering and settlement arrangements required to accurately allocate energy use and flexibility services.	Increases administrative burden and system complexity, particularly for shared assets or multi-use sites.
Network capacity constraints	Limited available capacity on the distribution network causing constraints or delays to required grid upgrade works.	Long wait times and high costs limit ability to connect to the grid.

Regulatory & Market Enablers / Barriers (cont.)

Enablers and barriers have been evaluated against the smart energy levers based on the corresponding suitability and positive or negative impact. This has been given below, with a Red-Amber-Green (RAG) rating used to show negative, non-applicable/slight positive and positive correlations respectively.

Applicability key

Applicability key
Positive
N/A, slight positive
Negative

	Smart Charging	BtM Solar and Battery	Shared Hubs / Consortium
Flexibility markets	Enables integration with flexibility markets by dynamically adjusting charging profiles and responding to system signals.	Battery storage enables active participation across multiple UK flexibility markets, independent of fleet operations.	Requires coordination across participants, increasing complexity in agreeing when and how to provide flexibility.
Future policy developments	Unlikely to be specific policy developments for smart charging.	Potential for targeted support to improve commercial viability, strong government desire for renewable rollout.	Unlikely to be specific policy developments for shared hubs.
Funding opportunities	Unlikely to be specific funding support for smart charging, though some potential for funding through future demonstration programmes.	Potential for targeted incentives (similar to FiT, SEG) to improve commercial viability.	Unlikely to be specific funding support for shared hubs, though some potential for funding through future demonstration programmes.
Aggregation/route-to-market	Potential for chargers to work together, but not necessary.	High potential to aggregate batteries, particularly for flexibility markets.	Natural aggregation across multiple fleets increases scale and market access potential, for example, with V2G technology.
Flexible connections	Potential to use smart charging to allow for a smaller connection.	Could limit negative impacts of flexible connection by storing power.	Exposure to curtailment risk increases; constrained periods may impact multiple operators simultaneously.
Shared connection	Smart charging could limit negative impact of shared connection by allowing fleet to be more adaptive.	Storage can support shared users by redistributing energy and reducing peak demand.	Aligns well with shared hubs.
Settlement/metering challenges	Improved visibility of charging profiles supports more accurate settlement and cost allocation.	Additional complexity due to co-located generation and storage flows requiring separate accounting.	High complexity due to multiple users, requiring robust metering, allocation, and commercial frameworks.
Network capacity constraints	Reduces impact of congestion by shifting demand away from peak periods.	Reduces grid reliance and peak demand, potentially lowering exposure to network constraints.	Cost-sharing benefits, but does not reduce underlying connection delays or reinforcement requirements.

Archetype Applicability & Scalability

Different sizes of fleet operations and charging locations will impact the applicability and scalability of different business models. The table below shows the key characteristics for each of these groupings when considering business models.

		Description	Business model implications
Fleet Size	Small fleet	Fleets which operate fewer than 5 vehicles per depot.	Typically require only minor grid reinforcement; limited ability to scale or co-host multiple fleets; lower capital availability; comparatively low infrastructure investment requirements. Likely to benefit from shared charging due to economies of scale achieved by integrating multiple fleets. Smart charging and installation of assets also useful but limited due to smaller power requirements.
Fleet Size	Medium fleet	Fleets which operate between 5 and 50 vehicles per depot.	May have some capital availability; increasing need for grid upgrades; may operate across multiple sites; greater operational and infrastructure complexity due to geographic spread. Benefits from smart charging and installation of assets due to larger fleet size meaning greater aggregate power of vehicles. Also benefits from shared charging due to potential to achieve economies of scale.
Fleet Size	Large fleet	Fleets which operate greater than 50 vehicles per depot.	Likely more capital to invest; much more complexity in fleet operations; requirements for large upgrades and infrastructure investment; potential for extra vehicles to cover routes if certain vehicles are low charge. Less likely to benefit from shared charging due to limited ability to achieve further economies of scale. Large benefits from asset installation due to large power requirements enabling these models. Smart charging less applicable due to long-distance travel, but still some benefits.
Location	Depot	Sites which are owned or leased by the fleet operator to hold their vehicles.	Investment typically led by the fleet/site owner; high level of operator control; easier integration with operations; requires upfront capital and planning. Fleet activity at depot sites benefits smart charging as vehicles are often at site with some known schedules. Asset installation allows for fleet to use cheaper energy, which is very helpful. Consortium approach may be beneficial but brings difficulties due to desire to optimise site.
Location	Destination	Sites owned by customers where fleets can charge while vehicles are stationary.	Often constrained by space and site priorities; limited incentive for non-logistics site owners to invest; additional complexity around metering, billing, and cost allocation. Likely to not benefit from smart charging due to limited time at site. Asset installation may be beneficial, but likely to not bring strong ROI due to limited time at site. Shared charging likely essential if multiple fleets deliver to site.
Location	Dedicated En-Route	Sites which are owned by a third-party to allow a variety of fleet operators to charge their vehicles.	Requires high reliability and utilisation to be viable; greater investment opportunity and scalability; typically more space available; business case supported by multi-user demand and long-term planning certainty. Likely to not benefit from smart charging as long vehicle stay is not desirable. Some benefits to asset install, but likely not as applicable due to short vehicle stay. Charging for multiple fleets required for business model, so potential synchronicity for shared charging smart lever.

Archetype Applicability & Scalability

The fleet size and location archetypes have been viewed alongside the smart energy levers to determine which business models are most applicable and scalable. This has been shown below, with a RAG rating used to demonstrate negative, non-applicable and positive correlations respectively.

Applicability key

- Positive
- N/A
- Negative

		Smart Charging	BtM Solar and Battery	Shared Hubs / Consortium
Fleet Size	Small fleet	Limited but useful opportunity to shift charging to off-peak periods; high scalability given high number of this fleet type and dominance of day drivers. (N/A)	Modest cost and revenue benefits; can defer or reduce the need for grid upgrades, but limited scale reduces overall impact. (N/A)	Enables access to larger capital pools and shared infrastructure; can accelerate deployment timelines compared to standalone investment; high scalability given large number of fleets this size. (Positive)
Fleet Size	Medium fleet	Useful opportunity to shift charging to off-peak periods; having more vehicles may mean more opportunities to take advantage of smart charging. (Positive)	Greater opportunity to invest in battery storage; allows participation in off-peak charging and capture of price differentials. (Positive)	Potential to reduce upfront capital requirements; benefits vary depending on operational needs and may be less compelling than for smaller fleets. (Positive)
Fleet Size	Large fleet	Useful opportunity to shift charging to off-peak periods; likely have more day + night drivers or long-haul trampers, reducing the possibility for smart charging. (N/A)	Stronger business case due to economies of scale; can significantly reduce peak demand, lower grid upgrade requirements, and optimise energy costs. (Positive)	May be less attractive; could introduce unnecessary complexity given sufficient scale and capital for dedicated infrastructure; may be beneficial for long-haul trampers and highly utilised vehicles. (N/A)
Location	Depot	High value due to controllability; enables flexible scheduling and optimisation of charging aligned to fleet operations. (Positive)	Strong potential to reduce energy costs and grid upgrade requirements; can provide additional revenue streams and increase site flexibility. (Positive)	Likely only used where charging is not possible at the fleet's own depot; shared charging close to depots can reduce costs through shared infrastructure but adds coordination complexity and may not suit all operators. (N/A)
Location	Destination	Generally less critical; charging is often opportunistic and less controllable, limiting optimisation potential. (Negative)	Limited viability unless utilisation is high; investment typically unattractive without frequent or predictable usage. (N/A)	Naturally suited to shared use across operators; aligns well with multi-user charging demand at these sites. (Positive)
Location	Dedicated En-Route	Sites aim for high utilisation and will not want vehicles stopped in a bay for a long time. (Negative)	Viability depends on site constraints; operators may have capital to invest, but benefits depend on grid connection and utilisation levels. (N/A)	Naturally suited to shared use across operators; though business case relies on aggregating demand from multiple fleets and achieving high utilisation. (Positive)

Real-World Examples & Emerging Models

CATAPULT Energy Systems

Smart Charging[1]

EO Charging have developed their EO Hub, an energy management service that automates load management across charging stations within a depot.

The customer, Go-Ahead Croydon, was able to nearly double its electric bus fleet, now operating 42 buses with a low-power supply.

Energy can be allocated to priority vehicles, with 12 x 180kW chargers and 8 x satellite chargers being managed.

The EO Hub can manage the delivery of >8MW per night, despite site power supply only being 1.5MW.

Onsite Solar and BESS[2]

Lombard Shipping have taken their HGV electrification journey forward by integrating solar PV and battery storage into their operations at their Ipswich site, delivered by SolarEdge.

Their system produces 118MWh/year, with a payback time of 5.5 years and a self-consumption rate of 81%. This reduces reliance on grid imports.

The installation includes 226 x 500W (113kWp) solar panels, alongside a 102.4kWh battery system. 6 x 22kW charging stations have also been installed at their site.

Shared Sites[3]

First Bus provides fast, high-power charging for fleet operators through its 'Electric Vehicle Charging Partnerships'.

This allows secure, restricted access to facilities across First Bus sites, with partnerships already established with Welch Group and Samworth Brothers, both of which operate eHGV fleets.

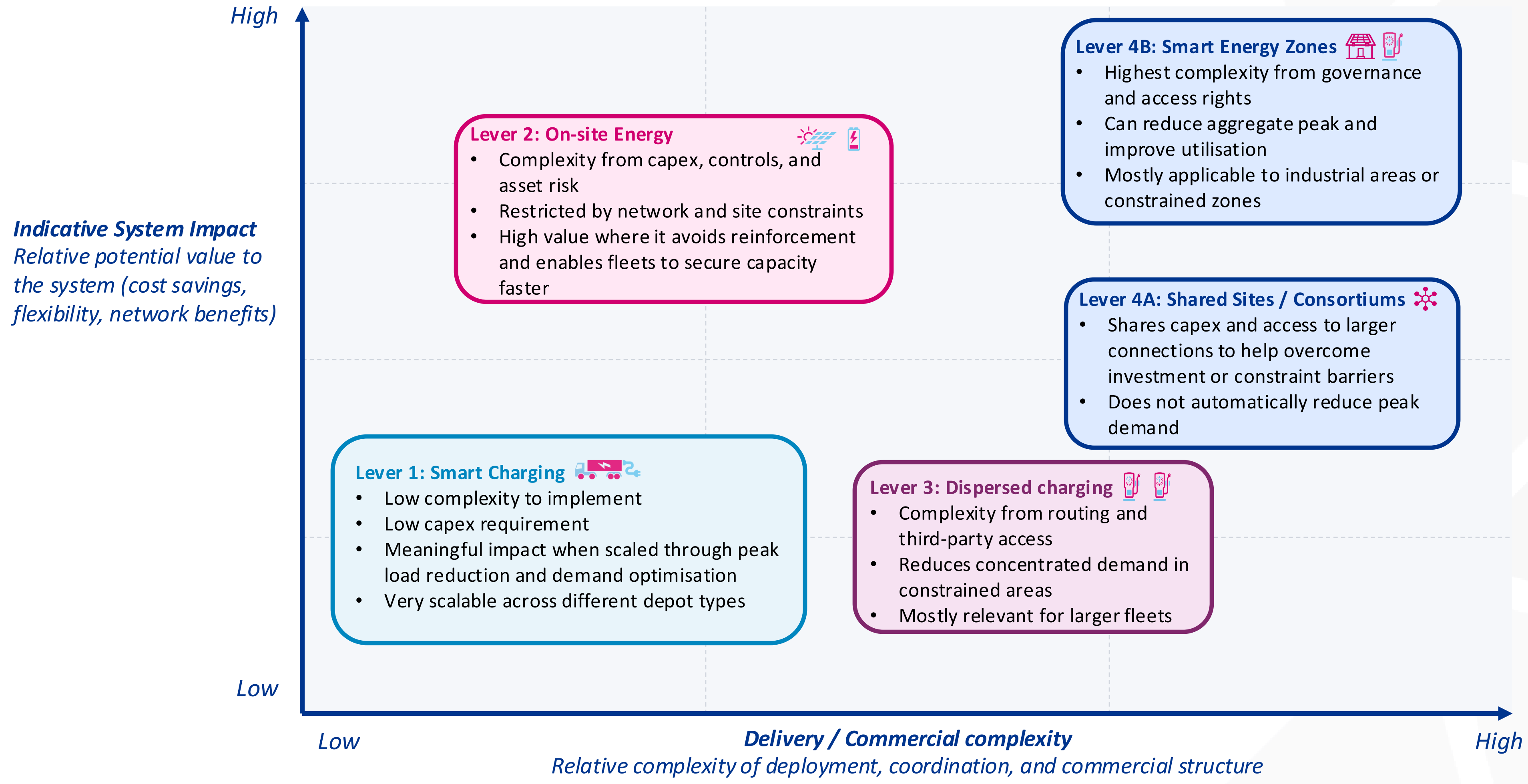
First Bus have deployed rapid charging infrastructure across ten operational depots nationwide, from the Southwest to Scotland.

Their Glasgow Superhub allows charging for 49p/kWh, though only for a limited time.

1. https://www.eocharging.com/stories/eo-charging-launches-energymanagement-solution
2. https://insightenergy.uk/case-study-commercial-ecosystem-lombard-shipping; https://www.businessgreen.com/news/4525793/lombard-shipping-unveils-cost-cutting-solar-battery-ev-charging-hq
3. https://www.firstbus.co.uk/about-us/ultra-rapid-electric-vehicle-charging; https://welchgroup.co.uk/collaborative-charging-hub-proves-game-changer-for-regional-electric-hgv-routes

No single smart energy lever is universally optimal, deployment depends on balancing impact, complexity, and scalability

Illustrative qualitative assessment of smart energy levers across impact, complexity, and scalability dimensions



Key implication

- Higher-impact solutions increasingly rely on coordination between multiple assets, parties and sites
- Trial selection should therefore focus on locations where operational need, network constraints and commercial incentives are naturally aligned

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Smart energy levers should be prioritised based on scalability, network benefit and trial suitability rather than energy cost savings alone

TOP FIVE CONCLUSIONS

1 Smart charging should be considered the baseline capability for eHGV electrification
- Lowest-cost solution across all archetypes
- Most scalable and commercially mature intervention

2 BESS and solar primarily create value by reducing connection requirements
- Reduced MIC by ~25–65% across modelled scenarios
- Value driven by avoided reinforcement and connection enablement

3 Smart energy levers shift investment behind the meter rather than eliminating infrastructure costs
- Lower connection costs broadly offset by additional DER investment
- Key question becomes where infrastructure investment sits

4 Depot characteristics matter as much as depot size
- Sites with concentrated charging demand derive significantly greater value from flexibility assets
- Duty cycle should be a core trial selection criterion

5 Network constraints increasingly dominate economics as depots scale
- Larger depots achieve lower LCOEs
- Connection cost, availability and delivery timelines become the primary challenge

RECOMMENDED TRIAL FOCUS

1 Primary Trial Site: Constrained Medium or Large eHGV Depot

Site characteristics
- Existing connection constraint, delay, or high reinforcement cost
- Concentrated charging demand (medium/large fleet)
- Ability to deploy smart charging and on-site BESS
- Operationally realistic fleet duty cycles

Trial objective

Demonstrate whether smart charging and on-site energy assets can reduce required import capacity and enable earlier electrification without compromising fleet operations.

Key hypotheses to test
- ✓ BESS can substitute for a portion of firm network capacity
- ✓ Lower-MIC configurations remain operationally viable
- ✓ Behind-the-meter assets can defer or avoid reinforcement costs
- ✓ Combined solutions improve connection deliverability in constrained locations

Success measures
- Reduction in required MIC (%)
- Connection cost avoided (£)
- Connection time accelerated (months)
- Impact on fleet operations and vehicle readiness
- Whole-life economics versus conventional connection approach

2 Optional Secondary Site: Shared Charging Hub / Consortium Model

Purpose

Test governance, commercial structures, and capacity-sharing arrangements rather than core technical feasibility.

Suitable locations
- Ports
- Logistics parks
- Industrial clusters
- Multi-user charging hubs

Key questions
- How should capacity rights be allocated?
- What commercial structure attracts investment?
- Can pooled demand unlock otherwise uneconomic connections?

The strongest opportunity for Future Fleet is not demonstrating lower charging costs, but demonstrating how smart energy assets and flexible operation can enable fleets to electrify sooner and with lower connection requirements in constrained parts of the network.

Appendices

Detailed modelling assumptions

Acronym table

Detailed financial modelling assumptions

Parameter	Unit	Assumption	Source	Notes
Project life	years	20	Baringa assumption	Modelled from 2027–2046
Discount rate	%	6%	Baringa assumption	Used for discounted NPV calculations
Wholesale energy prices	£/MWh	Annual profile	Baringa projection	
Retail / non-energy costs	£/yr	Annual profile	Baringa projection	Includes policy / network / supplier cost components
Balancing Mechanism value	£/yr	Model output	Baringa projection	Modelled by scenario based on asset operation
Ancillary Services revenue	£/yr	Model output	Baringa projection	Revenue sensitive to BESS size, operation and market participation
Capacity Market revenue	£/kW/yr	£20/kW/yr	Baringa assumption	Applied to derated BESS capacity
Capacity Market derating	%	79%	Baringa assumption	Used to calculate annual CM revenue
Battery capex	£/kWh	£600/kWh	Baringa assumption	Applied to installed BESS storage capacity
Battery O&M	£/MW/yr	£21,500/MW/yr	Baringa assumption	Within assumed £18k–£25k/MW/yr range
Battery round-trip efficiency	%	85%	Baringa assumption	Used in battery operation modelling
Battery depth of discharge	%	90%	Baringa assumption	Technical operating parameter
Battery degradation	%/yr	2%/yr	Baringa assumption	Time-based degradation assumption
Solar capex	£/kW	£750/kW	Baringa assumption	Applied to installed solar capacity
Solar O&M	£/MW/yr	£21,500/MW/yr	Baringa assumption	Same central O&M assumption as BESS
Solar inverter replacement	£	£1,500	Baringa assumption	One-off replacement cost if solar installed
50kW overnight charger capex	£/charger	£15,000	Baringa assumption	Applied to overnight depot charging assets
200kW handover charger capex	£/charger	£26,000	Baringa assumption	Applied to handover charging sensitivity
Connection capex case	£	-	UKPN working assumption	Depends heavily on the site, does not scale £/MW linearly

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Detailed vehicle configuration modelling assumptions

Parameter	Unit	Overnight charging vehicles	Handover charging vehicles	Notes
Daily energy requirement	kWh/vehicle/day	500	350	Based on WP2 outputs
Battery capacity	kWh/vehicle	625	554	Based on WP2 outputs
Minimum state of charge	%	20%	20%	Based on WP2 outputs
Charging power limit	kW/vehicle	50	200	Aligned to charger type used in each duty cycle
Charging window	time	17:00–05:00	02:00–03:00 and 17:00–18:00	Reflects dwell time output from WP2
Charging utilisation assumption	–	Vehicles plug in and become available to charge upon return to depot		-

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Glossary of terms

BESS	Battery Energy Storage System	Battery asset used to store electricity and discharge to site load, export or flexibility markets.
BM	Balancing Mechanism	Market mechanism for the System Operator to balance system electricity demand and generation supply capacity.
BtM	Behind-the-meter	Assets located on the customer side of the grid connection, such as batteries, solar PV or chargers.
Capex	Capital expenditure	Upfront investment cost for assets, infrastructure or connection works.
CBA	Cost-benefit analysis	Assessment comparing the costs and benefits of intervention options.
CM	Capacity Market	Market mechanism to ensure that there is sufficient reliable capacity to meet demand.
CPO	Charge point operator	Manages and operates charging sites for electric vehicles.
DFES	Distribution Future Energy Scenarios	Distribution network forecasts used to assess future local energy demand and network needs.
DfT	Department for Transport	UK Government department responsible for transport policy.
DNO	Distribution Network Operator	Responsible for operating and maintaining the electricity distribution network within a specific area, bringing energy from the transmission system to lower voltages.
DUoS	Distribution Use of System	Charges for using the electricity distribution network.
EMS	Energy Management System	Software/control system used to optimise charging, site demand and behind-the-meter assets.
EPC	Engineering, Procurement and Construction	Delivery model or contractor role responsible for designing, procuring and constructing infrastructure.
ESC	Energy Systems Catapult	Future Fleet project partner contributing modelling and business model inputs.
eHGV	Electric Heavy Goods Vehicle	Heavy goods vehicle powered by electricity.
EV	Electric Vehicle	Vehicle powered by electricity.
FES	Future Energy Scenarios	National energy scenarios used to assess possible future energy system pathways.
FiT	Feed-in Tariff	Legacy policy mechanism that provided payments for small-scale low-carbon generation.
GB	Great Britain	Refers to Great Britain-level modelling or extrapolation.
HGV	Heavy Goods Vehicle	Road freight vehicle above the relevant weight threshold.
HV	High Voltage	High-voltage electricity distribution network level.
kVA	Kilovolt-ampere	Unit of apparent electrical power, often used for connection capacity.
kW	Kilowatt	Unit of electrical power.
kWh	Kilowatt-hour	Unit of electrical energy.
LCOE	Levelised Cost of Energy	Average charging energy cost over the project life, expressed in p/kWh or £/kWh.
LV	Low Voltage	Lower-voltage distribution network level used for local electricity supply.
MIC	Maximum Import Capacity	Maximum agreed import capacity for a site connection.

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Glossary of terms

MW	Megawatt	Unit of electrical power.
MWh	Megawatt-hour	Unit of electrical energy.
NEC	Non-energy costs	Environmental taxes, distribution and transmission costs levied on system users.
NPV	Net Present Value	Discounted value of future costs and revenues over the project life.
O&M	Operations and Maintenance	Activities and costs required to operate, maintain and repair assets.
OEM	Original Equipment Manufacturer	Manufacturer of vehicles, chargers or related equipment.
Opex	Operating expenditure	Ongoing operating costs.
PV	Photovoltaic	Solar electricity generation technology.
SC	Smart Charging	Managed charging that optimises timing or power level to reduce costs, peaks or grid constraints.
SEZ	Smart Energy Zone	Coordinated shared energy system where multiple loads, assets and users are managed together.
SLA	Service Level Agreement	Contractual commitment on service availability, reliability or performance.
SPV	Special Purpose Vehicle	Legal entity created to own, finance or operate specific project assets.
UKPN	UK Power Networks	Distribution network operator for the relevant project licence areas.
V2G	Vehicle-to-Grid	Technologies that enable vehicles to exchange electricity or data with the grid.
WP	Work Package	Defined project workstream or delivery package.
ZEHID	Zero Emission HGV and Infrastructure Demonstrator	UK programme supporting zero-emission HGV and infrastructure trials.

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