INDUSTRY REPORT ON STANDBY POWER AND DG MARKET

UPDATED INDUSTRY REPORT
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END USER CLASSIFICATION

The following classification highlights the primary segments along with their detailed sub-segments by sector:

Broader End User Segments	Key Sub-categories
Commercial	Hospitality
	Healthcare
	BFSI-banks
	Education
	Real estate-residential (houses & residential buildings and tower) & commercial (malls, supermarkets and office spaces)
	Retail
Infrastructure	Infra (airport, building, irrigation and water treatment, power plants, roads & bridges)
	Logistics
	Railways & metros
	Marine & shipping
Manufacturing	Manufacturing (auto, chemical & polymer, consumer, engineering, industrial parks, process & textile)
	Process Industries
	Dairy
	Mining
Agriculture	Agri
	Cold storage
	Aquaculture
IT/ Datacentres	ITES/IT parks, Datacentres (colocation, cloud based, edge & enterprise)
Telecom	Telecom
Govt. & Defence	GeM (Government e Marketplace) & Defence
Industrial	Manufacturing + Infrastructure
Others	EV charging stations, petrol stations and rentals

TABLE OF CONTENTS

1. Demand for standby power in India 5
1.1 Overview of standby power in India 5
1.2 Growing need for reliable/uninterrupted backup power 6
1.3 Power shortage/deficit across states and at national level 7
1.4 Key industries leading to demand generation for standby power in India 8
1.5 Datacentre- an emerging end user segment for standby power 9
1.6 Various products/solutions to service the standby power demand 10
2. Diesel Generators (DG) in India 12
2.1 DG market analysis- Market Overview 12
2.2 DG market analysis- by end user segments 16
2.3 DG market analysis- by kVA split (LHP, MHP & HHP) 19
2.4 Key regulations impacting the DG industry. 29
2.5 RECD installations with DG industry 31
2.6 Comparison of DGs with alternative backup power technologies: 32
2.7 DG industry analysis- Rental segment 33
3. MSLG (Medium Speed Large Generators) 35
3.1 Market overview 35
3.2 Performance Metrics and Advancements 35
3.3 Classification of MSLG Sets 36
3.4 Role of MSLG Sets in India 38
3.5 Market players of MSLG sets in India 38
3.6 Domestic Demand Drivers 39
3.7 Hyundai–Powerica Strategic Partnership 40
3.8 Global Outlook 40
4. Financial Benchmarking 41

1. Demand for standby power in India

1.1 Overview of standby power in India

Standby power is a critical component of India's energy infrastructure, ensuring continuity of operations during power outages or voltage fluctuations. With a growing population, rapid urbanization, and expanding commercial (real estate both residential & commercial), and infrastructure, the demand for reliable standby power solutions has intensified across the country. Power disruptions, which remain a concern in several regions despite improvements in grid reliability, have led to increased adoption of DGs (Diesel Generators), UPS systems, inverters, and battery storage solutions across diverse sectors such as commercial, manufacturing, IT/data centres, telecom, and infrastructure.

DGs have long been the backbone of India's standby power market, and they continue to maintain a strong foothold due to their proven reliability, fast response times, and ability to operate in diverse and demanding environments. Despite growing attention to sustainability, diesel-based solutions remain the preferred choice for critical applications across industries such as commercial, manufacturing, IT/data centres, telecom, and infrastructure. Their robustness and widespread availability ensure that demand for DGs will continue to grow for years to come, especially in areas with inconsistent grid supply or high-power reliability requirements.

At the same time, the standby power market itself is expanding, driven by factors like urbanization, smart city initiatives, and the digital transformation of key sectors. This growth is creating space for alternative technologies, such as solar-diesel hybrids and battery-based systems, which are emerging not as replacements, but as complementary solutions. While green energy options are gaining traction, particularly in IT parks and environmentally conscious commercial developments, their adoption is largely additive rather than substitutional.

Criticality of standby power

As energy demand surges across sectors, the reliability of power supply remains a critical factor influencing operational efficiency and quality of life. Despite significant strides in generation capacity and grid expansion, power outages persist as a widespread challenge in many regions of the country. Understanding the geographic distribution and frequency of these outages is essential for stakeholders aiming to invest in resilient infrastructure, energy backup solutions, and grid modernization initiatives.

Exhibit 1.1: Frequency and power outages in India, FY2025

Parameter	Details
Households experiencing outages	80% (All-India average)
Outage frequency	Daily/Weekly
Common outage duration	1–3 hours per day
Urban outage trend	0–2 hours/day (esp. in IT/offices)
Rural outage trend	5–7 hours/day
Government response rate (e.g. MSEDCL)	Only 30-35% of complaints addressed on time

Source: Stakeholder Interactions, PIB, CEA, Frost & Sullivan analysis

- Northern and Eastern regions report frequent power outages, often lasting 3–5 hours daily or several times a week, indicating infrastructural constraints and potential supply-demand mismatches.
- Western and Central India experience relatively moderate outage frequencies, with typical disruptions lasting 0–2 hours per day or occurring a few times weekly.

- Southern regions demonstrate a mixed trend. While some areas show minimal to no outages, suggesting stronger grid stability and infrastructure, others still experience occasional interruptions averaging 3–5 hours per week.

Urban pockets and industrial corridors across the country show better outage resilience, while rural and semi-urban zones continue to face chronic power instability. Industrial corridors have strong outage resilience due to robust infrastructure, smart grid technologies, proximity to power sources, prioritized maintenance, and investment in backup systems.

Exhibit 1.2: Role of standby power in economic loss mitigation in India, FY2025

Metric	Value
Economic loss mitigated by standby power	0.5-1% of India's GDP
Genset contribution to loss mitigation	70-75%
UPS systems contribution	25-30%
Battery backup coverage	2–6 hours (households)
Overall outage coverage by standby systems	1–8 hours/day (average)

Source: Stakeholder Interactions, PIB, CEA, Frost & Sullivan analysis

The exhibit 1.2 illustrates key insights into the utilization of standby power systems across India to reduce economic losses caused by power outages. It highlights that approximately 70-75% of establishments employ DG sets, demonstrating widespread recognition of the need for power backup in maintaining operational stability. The demand for DGs remains critical in urban regions due to the high-risk implications of power outages. Urban infrastructure, including hospitals, commercial hubs, data centers, and high-density residential complexes, cannot afford disruptions. Even short outages can lead to significant operational, financial, and safety risks, making reliable backup power solutions like DGs a necessity rather than a choice. Furthermore, the exhibit shows UPS system contribution to around 25-30% of usage, that is concentrated in commercial segment, indicating a strategic focus on protecting high-dependency infrastructure.

The duration of standby power usage varies significantly, ranging from 2 to 6 hours, and in some cases extending to 1 to 8 hours, reflecting the severity and frequency of power disruptions experienced in different operational environments. These figures emphasize the critical role of backup power in bridging the reliability gap, minimizing downtime, and ensuring continuity of services in sectors where even brief interruptions can lead to considerable economic impact.

1.2 Growing need for reliable/ uninterrupted backup power

India’s accelerating urbanization, digitization, and industrialization have significantly heightened the demand for reliable and uninterrupted power supply. Frequent power outages in both urban and rural regions have driven a parallel surge in the need for dependable backup power solutions, particularly in critical sectors such as commercial, manufacturing, IT/data centres, telecom, and infrastructure. The need for reliable/uninterrupted backup power in India is driven by a mix of structural, economic, and technological factors.

1. Power Supply Instability

-Grid unreliability in several parts of the country, especially rural and semi-urban areas.
-Frequent power cuts in tier-2 and tier-3 cities due to load shedding or infrastructure issues.
-Even in metros, brownouts or momentary outages can disrupt operations, particularly in high-dependency sectors.

2. Rapid Urbanization and Infrastructure Growth

-Commercial including real estate are expanding rapidly, increasing the pressure on the grid.
-Smart cities, metro rail projects, and real estate developments demand continuous power.

3. Manufacturing (Industrial) and Commercial Dependence

-Industries like manufacturing, commercial including healthcare, IT/ data centres require 24/7 power for uninterrupted operations.
-Manufacturing including process industries (e.g., steel, cement, chemicals) can incur massive losses during unplanned downtimes.

4. Growth of Data Centres and Digital Economy

-India's push toward data localization, cloud computing, AI and 5G is fuelling demand for hyperscale and edge data centres, all of which need high-reliability backup systems (DGs, UPS, battery banks).
-Commercial segment including BFSI and e-commerce cannot afford downtime, leading to dependency on backup systems / power sources

5. Commercial-Healthcare Sector

-Healthcare segment, especially ICUs, operating theatres, and diagnostic labs, require 100% uptime.
-The growth of telemedicine and health-tech platforms increases dependency on digital infrastructure, which in turn depends on continuous power.

6. Disaster Preparedness and Climate Resilience

-Increasing frequency of climate-related events (heatwaves, storms, floods) causes localized power disruptions.
-Mission-critical infrastructure (airports, transport hubs, emergency response centres) requires robust backup systems.

1.3 Power shortage/ deficit across states and at national level

India faces significant power shortages across various states, impacting both urban and rural areas. Exhibit 1.3 shows India's peak power demand has been steadily rising, increasing from 1,83,804 MW in FY2019–20 to 2,56,530 MW by FY2024–25. While supply has generally kept pace, there have been notable fluctuations in the power deficit—rising sharply to 4.0% in FY2022–23 and to peak at 4.3% in FY2024–25. These periods of shortfall highlight the challenges of maintaining consistent supply amid growing demand, especially during the summer season when consumption surges due to manufacturing (industrial), and commercial loads.

Exhibit 1.3: Power Shortage / Deficit in India, FY2025

Financial Year	Peak Demand (MW)	Peak Availability (MW)	Deficit (MW)	Deficit (%)
2019-20	1,83,804	1,83,004	800	0.4%
2020–21	1,90,198	1,87,788	2,410	1.3%
2021-22	2,03,014	2,00,570	2,444	1.2%
2022–23	2,15,888	2,07,231	8,657	4.0%
2023–24	2,43,271	2,39,931	3,340	1.4%
2024-25	2,56,530	2,45,615	10,915	4.3%

Source: Central Electricity Authority, Frost & Sullivan analysis

Region-wise, the Western region experienced the highest deficit in percentage terms at –8.9% (–6,855 MW), primarily due to supply-demand mismatches in states such as Gujarat and Madhya Pradesh. This was followed by the Northern region, which recorded a –7.6% deficit (–8,418 MW), largely driven by significant gaps in Punjab, Haryana, and Bihar. The Eastern region registered a –4.5% deficit (–1,554 MW), with notable shortfalls in West Bengal and Assam, partially offset by surpluses in smaller northeastern states like Sikkim and Arunachal Pradesh. Meanwhile, the Southern region reported the lowest deficit at –2.4% (–1,911 MW), primarily due to mismatches in Telangana, Kerala, and Karnataka. These figures underscore the persistent regional imbalances in power availability across India, highlighting the need for targeted interventions to bridge these gaps.

Exhibit 1.4: Power Shortage / Deficit across States and at the National level, FY2025

Region	Peak Demand (MW)	Peak Availability (MW)	Peak Surplus / Deficit (MW)	Peak Surplus / Deficit (%)
All India	2,98,945	2,80,207	-18,738	-6.2
North	1,10,060	1,01,642	-8,418	-7.6
West	76,346	69,491	-6,855	-8.9
South	78,714	76,803	-1,911	-2.4
East	33,825	32,271	-1,554	-4.5

Source: Central Electricity Authority, Frost & Sullivan analysis

Power shortages across various Indian states underscore the urgent need for infrastructure upgrades and more efficient energy management to meet rising electricity demands. These shortages are further exacerbated by climate change, as extreme weather events such as heavy rainfall, storms, and heatwaves increasingly contribute to power outages — a trend observed in recent years. Several states are witnessing varying levels of power shortages, with some managing better than others.

1.4 Power demand by key end user segments in India

The analysis of peak power demand across end-user sectors reveals that the industrial (manufacturing) and commercial segments continue to dominate India's power consumption landscape. In FY2025, the industrial segment is estimated to account for 109 GW of peak demand, expected to rise significantly to 159.3 GW by FY2030E, translating to a CAGR of 7.9%. This growth is underpinned by sustained industrialization, investments in manufacturing infrastructure, and Make-in-India initiatives.

The commercial sector, comprising real estate, retail spaces, hospitality, and healthcare, is projected to increase from 82.1 GW in FY2025 to 110.9 GW by FY2030E, reflecting a CAGR of 6.2%. Growth in this segment will be led by continued real estate expansion and increased energy intensity across modern commercial establishments.

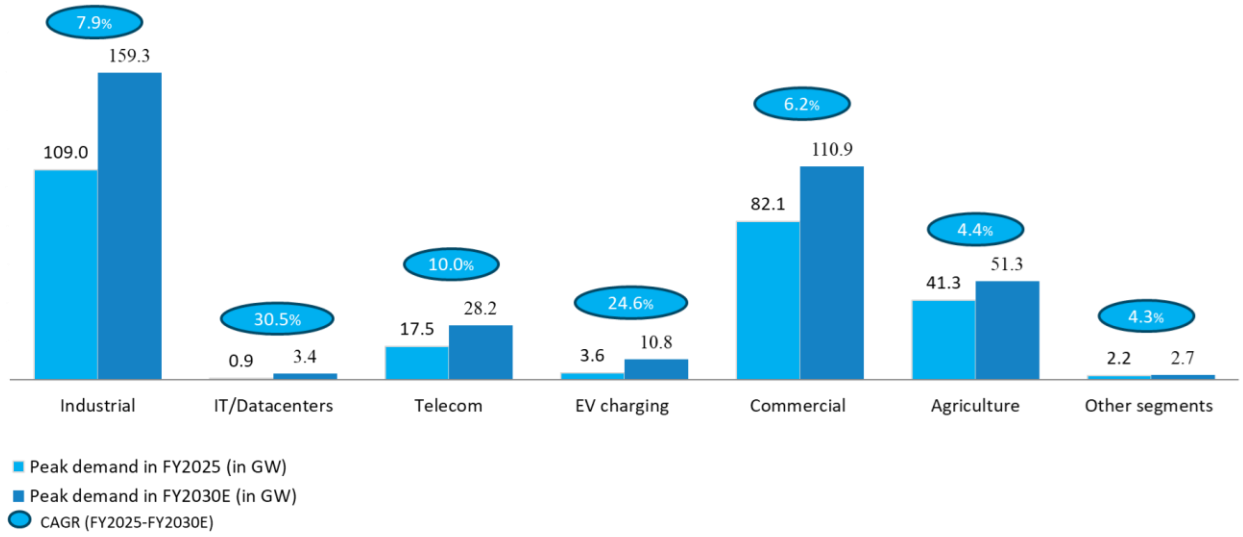
On the other hand, the agriculture sector is expected to see moderate growth from 41.3 GW to 51.3 GW (CAGR: 4.4%) owing to gradual electrification of irrigation and mechanized farming practices. Meanwhile, the "other" segments (including petrol pumps, rentals, and miscellaneous commercial usage) are expected to rise from 2.2 GW to 2.7 GW, with a relatively low CAGR of 4.3%.

Among the fastest-growing segments:

- **IT/Datacentres**: Projected to witness a sharp rise in demand from 0.9 GW in FY2025 to 3.4 GW in FY2030E, registering the highest CAGR of 30.5%, driven by rising hyperscale data centre investments and cloud infrastructure deployment.
- **EV Charging**: Set to grow from 3.6 GW to 10.8 GW (CAGR: 24.6%) owing to increased electric vehicle penetration and supportive government policies.
- **Telecom**: Expected to increase from 17.5 GW to 28.2 GW, growing at a CAGR of 10.0%, fuelled by 5G rollout, tower infrastructure expansion, and rising mobile data usage.

This broad-based expansion in power demand underscores the growing importance of resilient power backup systems including diesel generator sets as critical enablers of uninterrupted operations across both traditional and emerging sectors. The rising peak demand also points to increased pressure on grid infrastructure, reinforcing the case for localized backup solutions, particularly in power-intensive sectors like IT, EV, and telecom.

Exhibit 1.5: Power demand by key industry segments, in GW, FY2025 vs FY2030E



Other segments include petrol stations, rental etc.
Note: "E" refers to Estimated

Source: CEA, PIB, Electric Power Survey 2024, Frost & Sullivan analysis

1.5 Datacentre- an emerging end user segment for standby power

AI and Digitalization Drive India's Data Centre Expansion:

- Data centres are essential for enabling digital services across key sectors such as commercial including BFSI, telecom, and govt. & defence.
- Uninterrupted power supply is a critical operational necessity for data centres, ensuring 24/7 uptime for mission-critical applications.

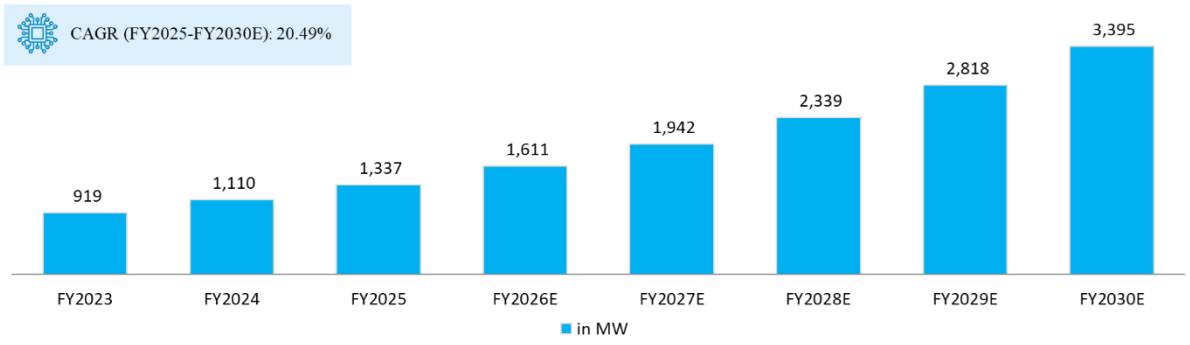
India's data centre demand is rising rapidly due to:

- Accelerated digitalization and cloud adoption.
- Explosive growth in data consumption.
- Rising use of OTT platforms, e-governance, fintech, and e-commerce.
- Increasing regulatory push for local data storage.
- AI adoption is a key driver, requiring high-performance computing and large-scale data processing—necessitating more advanced and localized data centre infrastructure.

<u>Market outlook:</u>

- India's data centre power capacity was 0.919 GW in FY2024 and increased to 1.337 GW in FY2025.
- It is projected to reach 3.395 GW by FY2030, representing a strong CAGR of ~20.5% (FY2025–FY2030).
- The rapid expansion of data centres is driving a sharp increase in demand for standby power solutions, as resilient and scalable power infrastructure is critical to ensure uninterrupted operations and uptime.

Exhibit 1.6: Data center capacity in India, FY2023-FY2030E (in MW)



Source: Press release, Industry news and Frost & Sullivan analysis

Critical datacentre operations:

Data centres serve as the foundational infrastructure for an increasingly digital global economy. They enable critical services across sectors including commercial including BFSI, telecom, and govt. & defence. In view of the mission-critical nature of these operations, the assurance of uninterrupted power supply is not merely a technical requirement, but a fundamental operational necessity.

Exhibit 1.7: Consequences of inadequate standby power provisioning for Data centres

Risk Category	Indicative Impact (Non-Monetary)
SLA Penalty Exposure	High — Penalties may escalate rapidly with each minute of downtime
Downtime Cost (Per Minute)	Very High — Reflects compounded impact on operations, client services, and recovery efforts
Brand & Reputation Impact	Severe — One major outage may require prolonged trust rebuilding campaigns
Regulatory Consequences	Moderate to High — Non-compliance can lead to investigations, sanctions, or operational audits
Client Attrition Likelihood	10–20% of affected customers may consider alternative service providers
Backup Infrastructure Benchmark	Typically accounts for 10–15% of overall data center infrastructure investment

Source: Stakeholder Interactions, PIB, CEA, Frost & Sullivan analysis

It is imperative that data centre operators maintain adequate standby power capacity to ensure continuity of service during grid outages or power disruptions. The failure to do so exposes operators to significant risks, both operational and contractual.

Most data centres operate under rigorous Service Level Agreements (SLAs) that commit to exceptionally high levels of uptime—typically 99.99% or above. Any deviation from these commitments due to insufficient power backup can lead to severe financial penalties, legal liabilities, and long-term reputational damage.

1.6 Various products/ solutions to service the standby power demand

India's growing demand for reliable and uninterrupted power across diverse sectors such as commercial, manufacturing, IT/data centres, telecom, and infrastructure, has reinforced the need for a wide array of standby power solutions. Diesel and gas generator sets continue to be the mainstay, especially in large-scale applications such as commercial, manufacturing, IT/ data centres, and telecom where dependable backup is critical. Inverter-based systems also play a key role in homes and small businesses, offering accessible solutions for shorter power

outages. While newer technologies like battery-based systems are gaining visibility, they complement conventional setups.

Battery solutions—ranging from lithium-ion and lead-acid batteries used in modern UPS systems to emerging Battery Energy Storage Systems (BESS)—are finding their niche in specific applications such as data centres, smart cities, and renewable-integrated infrastructure. While Battery Energy Storage Systems (BESS) and other renewable storage solutions offer significant environmental advantages, their development and adoption in the Indian context remain in the nascent stages.

Factors such as high initial costs, limited domestic manufacturing capacity, and the need for regulatory support contribute to a slower pace of deployment. On a medium-term basis, it is estimated that these back up power technologies may take another few years to achieve cost parity and operational reliability comparable to traditional standby power solutions like DGs, especially in critical infrastructure and commercial segments. However, the core of India's standby power landscape continues to be built around diesel and gas-based systems, which offer unmatched scalability and robustness. As demand grows across segments—from residential and SMBs (Small-Medium sized Businesses) to mission-critical sectors like healthcare and data infrastructure—the market is expanding, with traditional and modern technologies coexisting to meet a broad spectrum of power backup needs.

Exhibit 1.8: Products and Solutions to service the standby power demand

Category	Product/Solution	Capacity Range	Key Market Segments
Generator Sets	Diesel Generator Sets (DG Sets)	5 kVA – 3,500+ kVA	• Commercial (including real estate both residential and commercial, BFSI, healthcare, hospitality, education) • Telecom • IT/ Data Centers • Others including EV Infra • GeM • Manufacturing (including process industries)
	Gas Generator Sets (CNG/LPG)	10 kVA – 500 kVA	
Battery Systems	Lead-Acid Batteries (VRLA, Flooded)	7Ah – 200Ah+	
	Lithium-ion Batteries	2kWh – 1MWh+	
	Nickel-Cadmium & Others	50Ah – 500Ah+	
UPS Systems	Offline/Standby UPS	Up to 2 kVA	
	Line-Interactive UPS	0.5 – 5 kVA	
	Online/Double Conversion UPS	1 kVA – 800 kVA+	
	Modular UPS Systems	10 kVA – 2 MW+	
Inverter Systems	Home Inverters	600 VA – 3 kVA	
	Commercial Inverters	3 kVA – 20 kVA	
BESS	Containerized BESS	250 kWh – 10 MWh+	
	Hybrid Solar + Battery Systems	1 kW – 500 kW+	

Source: Secondary Research, Frost & Sullivan analysis

Power backup implications:

- Strong and scalable diesel and gas generator demand will continue, especially for Tier III and Tier IV type data centres.
- Battery-based solutions (UPS, BESS) are gaining traction, offering supplementary support for specific applications like load balancing and energy efficiency.
- The expanding market supports coexistence of traditional and green power solutions, rather than a complete shift.

2. Diesel Generators (DG) in India

2.1 DG market analysis - Market Overview

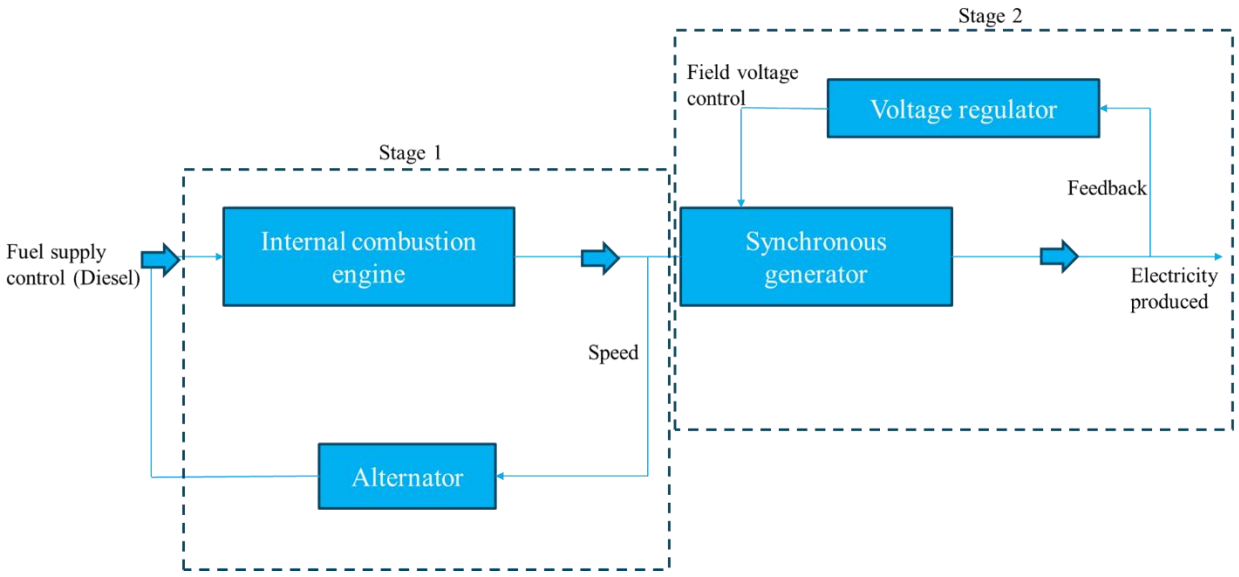
2.1.1. Product Overview:

Working principle of DGs:

The DG operates by converting mechanical energy into electrical power through a coordinated system of key components. The internal combustion engine burns diesel to produce mechanical energy, an alternator and transmits rotational speed to a synchronous generator. the synchronous generator converts this mechanical input into electrical energy. The voltage regulator monitors the generator's output and adjusts the field voltage to ensure stable and consistent electrical output, even with load variations.

Exhibit 2.1 highlights the flow: the engine's rotational energy powers the generator, this coordinated system, with feedback loops between the generator and the voltage regulator, ensures dependable power delivery, making DGs a reliable solution for both backup and primary electricity needs, particularly in areas with unstable grid supply.

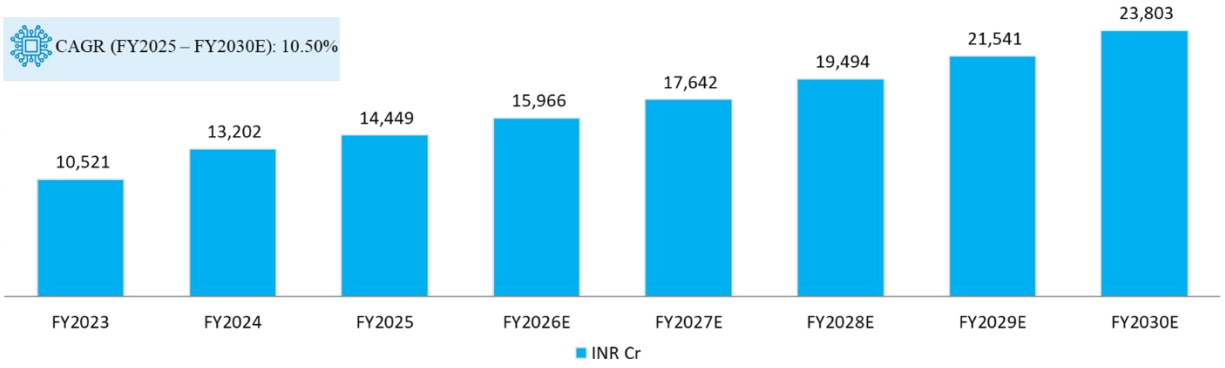
Exhibit 2.1: DG working principle



Market size of Indian DG market industry:

India's DG industry is deeply interlinked with the country's industrialization, urban expansion, and digital infrastructure development. Exhibit 2.2 shows overall performance of DGs in FY2025, with total market size across key regions in FY2025 to be around INR 14,449 Cr. Similarly, the market size in FY2023 & FY2024 were INR 10,521 Cr. & INR 13,202 Cr. Respectively. The exhibit 2.2 indicates a balanced demand distribution across the country, underscoring the widespread reliance on DGs for backup power in both urban and rural settings. Demand was primarily fuelled by infrastructure development, telecom expansion, IT/datacentres, commercial growth, and the continued need for power reliability in Tier II and Tier III cities. The overall market grew with 25% in FY2024 compared to FY2023.

Exhibit 2.2: Overall DG market size, in value (INR Cr) (FY2023-FY2030E)



Source: Frost & Sullivan analysis

The major reason was pre-buying of CPCB2 DGs before the transition period surged the demand in market in end of FY2024 and start of FY2025. This surge in demand recorded the highest numbers of DGs in a financial year with a slowdown in subsequent quarters post the transition. Growth continues through FY2026E at ₹15,966 Cr to ₹23,803 Cr by FY2030E. This upward trend reflects a robust and consistent increase in market demand or investment, underpinned by positive economic or sectoral drivers.

2.1.2. Overview of DGs by Capacity and Operational lifespan:

DG (DG) sets are essential backup power solutions is classified by capacity to meet varied requirements across commercial and manufacturing applications. Low Horsepower (LHP) units (7.5–160 kVA) are appropriate for light residential and commercial applications, providing a lifespan of 15,000–20,000 hours or 10–15 years with proper maintenance. Medium Horsepower (MHP) units (180–500 kVA) cater to moderate commercial loads, providing 20,000–25,000 hours or 12–18 years with good servicing. High Horsepower (HHP) units (Above 500 kVA) are designed for heavy industry and critical infrastructure applications, with lifespan depending on use and maintenance. These categories guarantee dependable power based on specific uses, addressing India's energy challenges in the context of frequent power outages.

Exhibit 2.3: Operational lifespan

Capacity Category	Power Range (kVA)	Operational Lifespan (Hours)
LHP	7.5–160	15,000–20,000
MHP	180-500	20,000–25,000
HHP	>500-3000+	25,000–35,000

Source: Stakeholder Interactions, Frost & Sullivan analysis

2.1.3. Manufacturers/engine supplier in DG industry:

India's DG sets manufacturing landscape is shaped by a mix of global giants, domestic conglomerates, and specialized engine makers. Cummins India and Caterpillar (CAT) are the key players in high-capacity industrial DG sets catering to manufacturing, data centres and infrastructure segment, offering global engine technology and a strong service ecosystem. Kirloskar Oil Engines, Cummins, Greaves Cotton, and Mahindra Powerol are primary players in the mid to low power segments, catering to India's rural, telecom, and SME sectors. Ashok Leyland and Eicher Engines leverage their automotive engine expertise to offer robust DG sets solutions primarily in the low to mid-power range across commercial and infrastructure applications. Specialist manufacturers like Baudouin and Perkins India supply to high-capacity and export-oriented markets, while TMTL (TAFE Motors), and Escorts Kubota focus on compact, fuel-efficient DG sets tailored for agricultural and rural needs. This ecosystem supports India's growing demand for reliable power across diverse geographies and applications.

DG Engine Suppliers

Company	Power Range (kVA)
Cummins India Ltd.	7.5 – 3750
Kirloskar Oil Engines (KOEL)	7.5 – 2020
Mahindra Powerol	5 – 625
Greaves Cotton	5 – 2500
Ashok Leyland	5 – 250
Caterpillar	7.5 – 3500+
Baudouin	100 – 4000
Perkins India	5 – 2500
Eicher Engines	5 – 35
TMTL (TAFE Motors)	40 – 125
Escorts Kubota Ltd.	7.5-58.5

Note: the above list is non-exhaustive as it includes other local and global players catering to smaller audience.

Several domestic Generator Original Equipment Manufacturers (GOEMs) in India play a vital role in the low to high kVA DG market by offering a wide range of power solutions. Key players include Powerica, Jackson & Co, Kala DG sets, Sterling Generators, Jakson Limited, Sudhir Power Limited, DPK Engineers, GMMCO, Supernova DG sets, Ojus Power, and Perfect House. These companies primarily operate as OEM assemblers, sourcing engines from established brands like Cummins, KOEL, Perkins, Mahindra, and Ashok Leyland, and integrating them with other components viz. alternator / generator, batteries, panels, canopy etc. to produce a complete DG set that caters to various commercial and manufacturing applications. Their product offerings typically span from 5 kVA to 3500+ kVA, addressing diverse customer needs from small-scale backup power to large-scale industrial energy solutions. These GOEMs serve as critical channel partners in the customisation, assembly, and supply of DG sets to customers.

2.1.4. Raw Material Analysis

India's DG manufacturing industry primarily depends on engines supplied by large domestic and international manufacturers. Beyond engines, it relies heavily on local sourcing for structural materials like steel, cast iron, sheet metal, and lubricants. Batteries, radiators, and wiring are also largely produced locally. However, critical components such as turbochargers, precision fuel injectors, control electronics, and copper for alternators are mostly imported. Acoustic insulation materials also see high import dependency. While the mechanical supply chain is strong, key performance and emission-related parts expose the sector to global supply risks, highlighting the need for greater localization in these areas.

Exhibit 2.4: Raw Material Analysis

Raw Material / Component	Import Dependency	Remarks
Cast Iron / Steel (All Grades)	Low	Abundantly available domestically; used in engine blocks, chassis, enclosures, exhaust
Aluminum (Radiators, Parts)	Low	Largely available locally; limited import for specialized radiator fins
Copper (Alternator Windings)	Low	Raw copper manufacturing, refining and winding done locally
Turbochargers	High	Mostly imported; used in CPCB IV+ and high-performance DG sets
Fuel Injectors & Precision Parts	High	Precision components typically imported for quality and emission standards
Control Electronics (ICs, PCBs)	High	Microcontrollers, sensors, and ICs imported (China, Taiwan)
Rubber (Hoses, Seals)	Low	Domestic availability for general rubber; specialty compounds often imported
Coolants	Low-Moderate	Base chemicals domestic; additives and high-performance blends partially imported
Filters (Oil, Fuel, Air)	Low	Local assembly; key filtration media often imported
Sheet Metal (CRCA)	Low	Strong domestic manufacturing base; used in enclosures and chassis
Acoustic Insulation (Foams, Rockwool)	Low	Produced locally for soundproof enclosures
Wiring & Cables	Low	Widely manufactured in India for basic applications

Raw material pricing trends:

Over the past two fiscal years, the pricing trends for key raw materials—steel, iron ore, and copper—used in DG manufacturing have seen a mix of softening and volatility. Domestic steel prices declined by about 10.5% average year-on-year in FY2025 due to a surge in imports from China, global oversupply, and falling input costs like coking coal. Similarly, aluminium prices remained relatively stable or slightly declined, driven by global

price drop and lower demand from China. This trend has provided cost stability for manufacturers relying on locally sourced materials. Conversely, copper prices have shown more resilience, increasing by around 2.4% supported by a modest global economic recovery that is driving industrial demand. Additionally, strong demand from the DG (DG) set segment for electrical components, where copper is critical, has further boosted consumption.

Exhibit 2.5: Raw Material Price Analysis

Raw Material	Price in 2024	Price in 2025	% Change (2024 to 2025)	Key Factors influencing the demand fluctuations
Steel	₹70,000–₹80,000/MT	₹66,000–₹70,000/MT (Q2 FY2025.	-5.7% to -12.5% (avg. -10.5%)	• Lower construction demand • Increased use of recycle steel • Stabilized global supply chains • Higher domestic output
Aluminum	₹2,20,000–₹2,40,000/MT	₹2,10,000–₹2,30,000/MT	-4.2% to -4.8% (avg. -4.5%)	• Global price drop (4.98% since Jan 2025) • Subdued demand from China • Increased domestic scrap recycling
Copper	₹8,00,000–₹8,50,000/MT	₹8,20,000–₹8,70,000/MT	+2.4% to +2.5% (avg. +2.5%)	• Modest global rise (~5% in 2024) • Strong DG set demand (electrical components)

Source: Statista, news articles, Frost & Sullivan analysis

2.2 DG market analysis- by end user segments

The exhibit illustrates the end-user segmentation of the diesel generator (DG) market in India, presenting the respective market share and application description across various industries. The commercial sector—including hospitals, hotels, malls, offices, and real estate—accounts for the largest share at 32–34%, driven by the need for uninterrupted power in critical services such as healthcare, hospitality, and retail establishments.

The telecom sector represents the second-largest segment with a 16–18% share, reflecting the sector's dependence on reliable backup power to ensure continuous operation of telecom towers, network hubs, and communication systems. Manufacturing industries, encompassing process industries, dairy, mining, automotive, chemical, and industrial parks, follow closely with a 15–17% share, underpinned by the need to maintain uninterrupted operations in energy-intensive production environments.

Infrastructure applications—including airports, metros, marine, and road and bridge projects—contribute 12–14% of the market, highlighting the role of DGs in supporting essential transport and civic infrastructure. IT/data centres, with a 3–5% share, emphasize the growing importance of DGs in ensuring data integrity and uptime for critical digital infrastructure.

Government and defence segments account for 3–5%, serving mission-critical installations that demand high reliability. The remaining 7–8% share is attributed to the 'Others' category, which includes emerging applications such as EV charging stations, petrol pumps, and rental power solutions, catering to specialized and mobile power requirements.

Overall, the segmentation reflects the widespread and diverse deployment of DG sets across India's economy, with the commercial, telecom, and manufacturing sectors forming the backbone of demand, while emerging and niche applications continue to expand their presence.

Exhibit 2.6: Key end user segments DGs cater to

Industry	Share (%)	Description
Commercial (Hospitals, Hotels, Malls, Offices, Real estate)	32-34%	Backup power for critical services in healthcare, hospitality, retail, and commercial buildings.
Telecom	16-18%	Ensures continuous power supply for telecom towers, network hubs, and communication systems.
Manufacturing (Process industries, dairy, mining, auto, chemical, industrial parks etc)	15-17%	Supports uninterrupted operations in industrial and process plants, including heavy manufacturing sectors.
Infra (Airports, Metros, Marine, Roads & bridges, etc)	12-14%	Provides power for infrastructure projects and transport hubs to maintain essential services.
IT/Data Centres	3-5%	Guarantees reliable backup power to maintain uptime and protect data integrity in IT and data centre facilities.
Government & Defence	3-5%	Powers critical government installations and defense operations requiring high reliability.
Others (EV charging, petrol pumps, rentals)	7-8%	Covers diverse uses such as railways, marine, and emergency services in specialized applications..

Source: Frost & Sullivan analysis

Positive impact of DGs on key end user segments:

Commercial: DGs play a critical role in ensuring business continuity across commercial premises such as office buildings, shopping malls, real estate complexes, hostels, hospitals and restaurants. During power outages, they provide backup power for lighting, elevators, escalators, HVAC systems, and IT infrastructure, helping avoid operational disruptions. In airports, DGs ensure the functioning of vital systems like runway lighting, air traffic control equipment, and baggage handling operations, thereby maintaining passenger safety and schedule reliability. Similarly, in metro networks, the power essential services including signalling systems, platform lighting, communication networks, and emergency response systems to guarantee passenger safety and prevent transit delays. DGs are a cornerstone for Indian hospitals, ensuring continuous operation of life-saving equipment like ventilators and surgical lights amidst frequent power cuts.

By mitigating the risks of power interruptions, DGs prevent revenue loss, uphold service quality, and support customer comfort in high-footfall commercial hubs. As India's commercial segment continues to expand rapidly, DGs remain integral to enabling resilient and uninterrupted operations in the face of grid instability.

Telecom: In Telecom industry DGs play a vital role by supplying backup power to cell towers to ensure continuity of network operations during outages. Disruptions can suspend crucial services such as emergency communications and digital transactions that impact millions of users. DGs provide non-stop network operation, supporting India's telecom backbone as the keystone of the digital economy with assistance for EV-related connectivity services.

Manufacturing: DGs play major role in India's processing and manufacturing industries like steel, cement, chemicals and EV battery manufacturing by driving machinery and production lines in case of repeated power outages. They avert expensive production halt and spoilage of material, which may disrupt supply chains and damage business reputation, particularly in the manufacturing business. DGs guarantee uninterrupted operation, facilitating India's industrial expansion and competitiveness in overseas markets.

Infrastructure: In the infrastructure sector, DGs ensure uninterrupted operation of critical transport and civic systems. At airports, it powers vital systems like runway lighting, air traffic control equipment, and baggage handling, maintaining passenger safety and schedule reliability. In metro networks, DGs support signalling systems, platform lighting, communication networks, and emergency response functions to guarantee safe and timely operations. DGs also contribute to resilience in marine ports, bridges, and road infrastructure, making them integral to India's transport and urban development.

Data Centres: DGs are indispensable for India's data centres, supporting the growing digital economy by ensuring uninterrupted power for servers and cooling systems. They prevent costly downtime and data loss, maintaining operational continuity for industries like BFSI, IT/datacentres, etc. that rely on constant connectivity. As India's digital infrastructure expands, DGs play a pivotal role in delivering the uptime needed for a seamless online experience.

Government & Defence sector: The government and defence sectors in India are expected to remain key contributors to diesel generator (DG) demand growth, anchored by critical infrastructure resilience requirements and reinforced through sustained public investment. India's captive power generation capacity stood at approximately 79.3 GW in FY 2023–24, of which 18.3 GW is oil-based, predominantly diesel-powered. Within this, installations across defence establishments, border infrastructure, central and state administrative facilities, hospitals, metro rail systems, and disaster response centres are estimated to account for 10–15% of the installed diesel-based capacity, translating to 1.8–2.7 GW dedicated to these sectors today. The Union Budget 2025 further reinforces this trajectory by allocating significant capital expenditure, including a ₹3 trillion allocation for metro and transport resilience projects, coupled with targeted funding for hospital and telecom networks, where DG-based standby systems remain indispensable for ensuring operational continuity. This growing emphasis on mission-critical infrastructure, combined with the ongoing electrification and digitalization of public services and defence operations, is expected to drive DG demand in these sectors at an estimated 6–8% annual growth rate through 2030, potentially increasing dedicated capacity to ~3–3.5 GW by the end of the decade.

EV Charging Stations: India's rapidly growing EV charging infrastructure is emerging as a significant opportunity for the standby power segment, particularly DGs. With the public network expected to grow from around 20,000 stations hosting ~75,000 chargers today to nearly 100,000-150,000 stations with ~375,000 chargers by 2030, the peak power demand is projected to reach ~10.8 GW by FY2030. This growth, driven by a rising share of high-capacity DC fast chargers in urban centres and along highways, will add considerable stress to local grids and increase the risk of outages at critical high-throughput hubs. To maintain service reliability and uptime commitments, especially in regions with weaker grid infrastructure, station operators are increasingly deploying standby diesel generators, often complemented by battery energy storage and solar-hybrid systems. As charging stations scale in number and size, the demand for reliable, scalable backup power solutions such as DGs remain the most proven and immediate option. As per CEA, the total electricity consumption in March 2025 was 148.48 BU whereas in April 2024, it was 144.25 BU.

Commercial (Residential realty): The residential power demand in India has been witnessing a steady increase, driven by urbanization, improved electrification, and rising per capita electricity consumption. In Tier 1 cities, with an estimated population of approximately 12.4 million, the residential segment exhibits high electricity demand due to greater household density, higher appliance penetration, and energy-intensive lifestyles. The per

capita annual electricity consumption in these urban centres is around 1,395 kWh, with residential usage contributing significantly to overall electricity consumption.

Tier 2 cities, accommodating an estimated 260 million people, represent a substantial share of residential power demand. The growing adoption of modern electrical appliances and improved access to reliable electricity have driven residential demand in these regions to approximately 8.81 TWh annually, reflecting the demographic scale and rising living standards.

In Tier 3 regions, which include smaller towns and rural areas with an estimated 135 million population, the residential power requirement remains significant and continues to grow as electrification expands, and lifestyles improve. The residential demand in these areas is estimated at around 4.58 TWh annually, underscoring the ongoing transformation in India's less urbanized regions.

Others: DGs are a saviour for various industries such as EV stations (covered in above para as an exclusive segment), rental, petrol stations, etc. At home, they drive basic appliances, providing comfort during outages, especially in rural areas. In agriculture, DGs drive irrigation pumps, avoiding crop damage. For EVs, they cater to charging stations in grid-impractical areas, providing mobility. In defence, DGs power vital military facilities, ensuring operational readiness. They provide seamless ground operations and safety systems at airports. DGs are essential to the daily lifestyle, economic stability and national security of these industries.

2.3 DG market analysis- by kVA split (LHP, MHP & HHP)

The DG (DG) market in India plays a critical role in ensuring uninterrupted power supply across manufacturing, commercial, and residential sectors, particularly in regions with unreliable grid infrastructure. Driven by growing energy demand, infrastructure development, and the need for backup power in key sectors like telecom, infrastructure, IT/datacentres, commercial, and manufacturing, the DG market has witnessed steady growth. As urbanization and digitalization accelerate, especially in Tier II and Tier III cities, the demand for low-to mid-range DG sets are surging, while large-scale infrastructure and IT and data centre investments are fuelling growth in high-capacity DG sets.

The drop in FY2025 is primarily attributed to pre-buying of DG sets in FY2024 ahead of anticipated transition period of CPCB2 to CPCB4, which led to an all-time high number in FY2024. On value basis, due to rise in prices of CPCB4 units, the market seems to be on a growth trajectory.

Low horsepower DGs (7.5 – 160 kVA):

Low horsepower DG (DG) Sets in the range of 7.5kVA to 160kVA are compact, fuel-efficient power backup solutions primarily designed for small to medium-scale applications. These DG sets are powered by diesel engines and are widely used for providing reliable electricity during power outages, a common issue in India due to inconsistent grid supply. They cater to a variety of segments, including:

- **Commercial (Real estate) Sector**: Used in individual homes, small apartment complexes, and gated communities for powering essential appliances like lights, fans, refrigerators, and water pumps. Also utilized in telecom towers, small hotels, restaurants, retail outlets and increasingly in charging stations especially in semi-urban areas, where grid reliability is inconsistent.

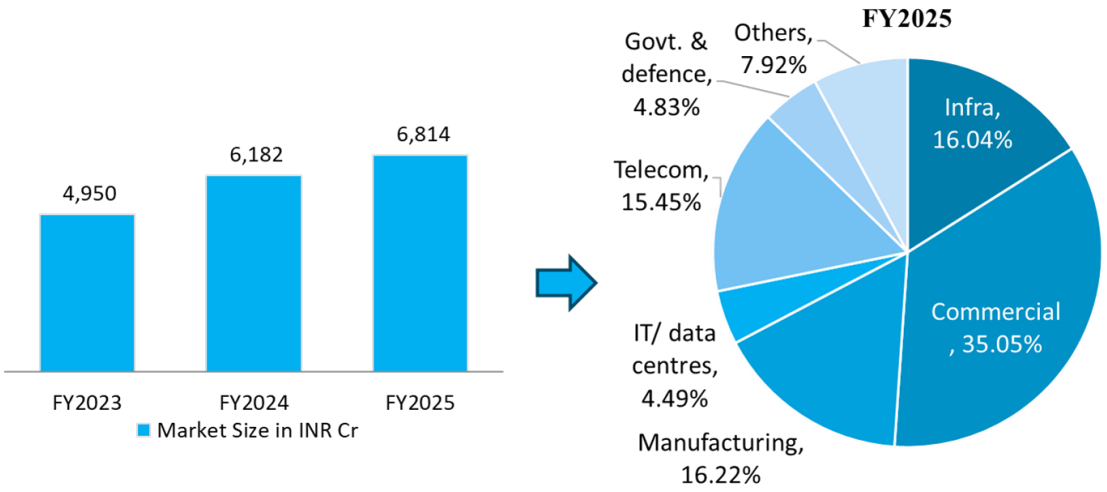
- **Small Businesses**: Serve small retail shops, offices, clinics, and workshops where power reliability is critical for operations, but high-capacity DG sets are unnecessary.

- **Manufacturing including industrial Applications**: Employed in small-scale manufacturing units and warehouses for backup power during outages.

- **Rural and Semi-Urban Areas**: Often used in areas with limited grid access, such as agricultural farms for irrigation pumps or rural healthcare centres.

The LHP market clocked a sizable market in FY2025 with revenues of INR 6,814 Cr – a 10.2% growth from previous year FY2024. Exhibit 2.7 depicts that commercial dominates at 35.05%, reflecting significant reliance on the product, likely for backup power in commercial, manufacturing, infra and telecom projects.

Exhibit 2.7: LHP market size and share of end user segments (in value)

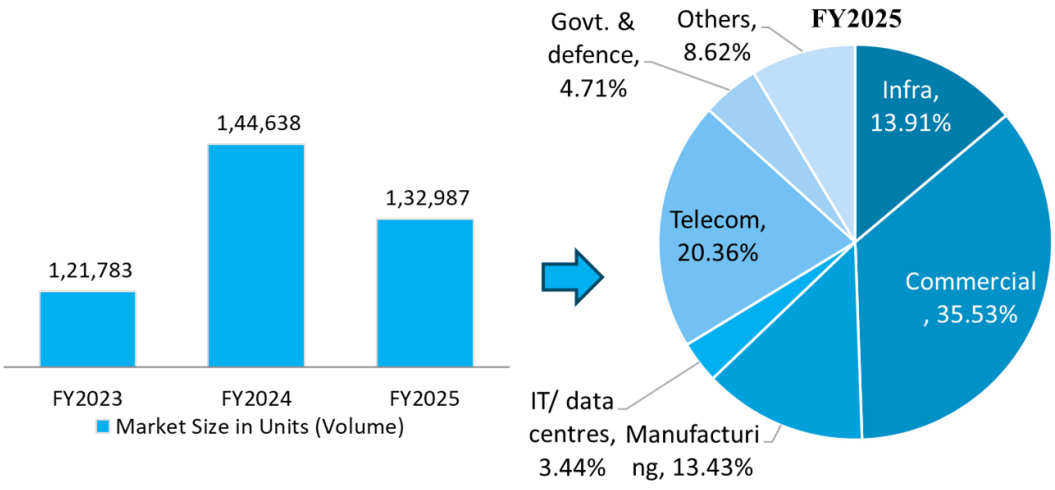


Source: Frost & Sullivan analysis

Telecom accounts for 15.45%, driven by the need for reliable power in telecom towers, especially in rural areas. The manufacturing sector accounts for 16.22%, indicating usage in small to medium-scale manufacturing units. Also, various commercial projects drive the LHP market including residential realty, education, hospitality etc.

Whereas on volume basis, in FY2025, the LHP market recorded a volume of 1,32,987 units, following a peak of 1,44,638 units in FY2024 and a prior volume of 1,21,783 units in FY2023, indicating a de-growth in the FY2025 as anticipated.

Exhibit 2.8: LHP market size and share of end user segments (in volume)



Source: Frost & Sullivan analysis

The market is predominantly driven by the commercial sector, which accounts for 35.53% of the total volume, followed by telecom with 20.36% and manufacturing with 13.43% segments. Infra segments contribute to

13.91%, while government & defence, IT/datacentres, and others collectively make up the remaining share. This distribution highlights the dominance of infrastructure-related demand, with emerging opportunities in niche sectors like IT/data centres.

Growth drivers for LHP segment:

- **Unreliable Power Supply**: Frequent outages in rural and semi-urban areas, with rural tele-density at 58.22% (2024), drive demand for backup power in households, farms, and telecom towers.
- **Small Business Growth**: Expansion of small businesses like retail shops, clinics, and restaurants in Tier-2 and Tier-3 cities requires affordable DG sets for operational continuity.
- **Commercial (Residential realty) Demand**: Increased construction of homes and small apartments in states like Uttar Pradesh and Bihar fuels need for DG sets to power essential appliances.
- **Competitive Pricing**: 30-40% unorganized market share with simpler technology makes LHP DG sets accessible to a wide customer base.
- **Rural Electrification Initiatives**: Government programs highlight grid reliability gaps, encouraging adoption of LHP DG sets as a cost-effective solution.

Key players in LHP segment of DG market:

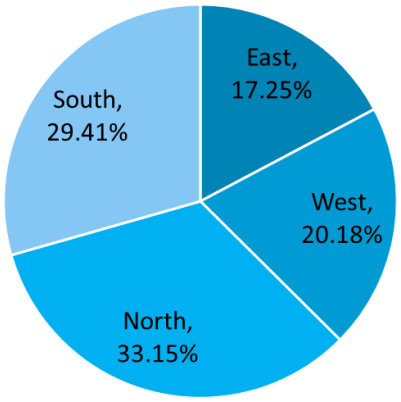
The LHP DG sets market (in value terms) in FY2025 is moderately competitive, with a few leading players holding a strong presence due to their brand reputation, product reliability, and widespread channel network. The market remains fragmented in lower-capacity segments, where price competition is particularly intense. The key players based on their overall market positioning is as follows:

1. Kirloskar Oil Engines Limited (KOEL)
2. Mahindra Powerol
3. Cummins India Limited
4. Other players such as Eicher TMTL, Escorts Kubota, Greaves Cotton, Ashok Leyland etc. collectively make up the remainder of the market, adding to its fragmented nature.

Region wise analysis for LHP market:

The low horsepower (LHP) DG market (7.5–160 kVA) in India shows marked regional diversity, driven by varying levels of infrastructure development, power reliability, and sectoral needs. In Northern India with 33.15% market share, particularly in Delhi NCR, Punjab, and Uttar Pradesh, demand is robust from residential societies, small healthcare setups, educational institutions, and commercial establishments where frequent power outages still occur in tier-2 and tier-3 cities. Western region with 20.18% share, led by Maharashtra and Gujarat, shows strong adoption in small-scale industries, retail chains, and ATMs, with increasing preference for silent, CPCB IV+ compliant DG sets in urban hubs like Mumbai and Ahmedabad. LHP DG sets serve essential backup roles in coaching centres, clinics, and rural households.

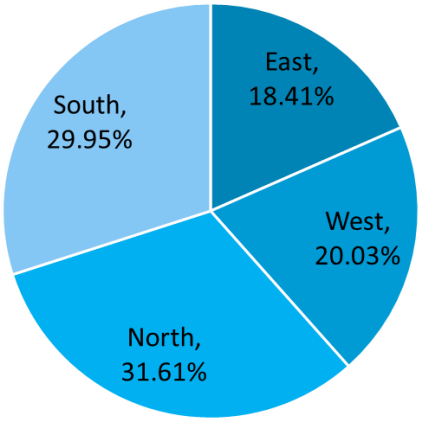
Exhibit 2.9: Region wise share of LHP DG market, FY2025 (in value)



Source: Frost & Sullivan analysis

Southern region with 29.41% share including Karnataka, Tamil Nadu, and Telangana states exhibits significant demand driven by real estate (Commercial) including IT parks, educational institutions, hostels, and private hospitals; cities like Bengaluru, Chennai, and Hyderabad are key demand centres with strong aftermarket support networks. In Eastern region with 17.25%, the market is sustained by weaker grid reliability, particularly in Bihar, Jharkhand, and Odisha.

Exhibit 2.10: Region wise share of LHP DG market, FY2025 (in volume)



Source: Frost & Sullivan analysis

In volume terms, the North region leads with a 31.61% share, followed closely by the Southern region at 29.95%, indicating strong demand in these two regions. The West and East regions account for 20.03% and 18.41% respectively, showing relatively lower but still significant market presence.

Medium horsepower DGs (180 – 500 kVA):

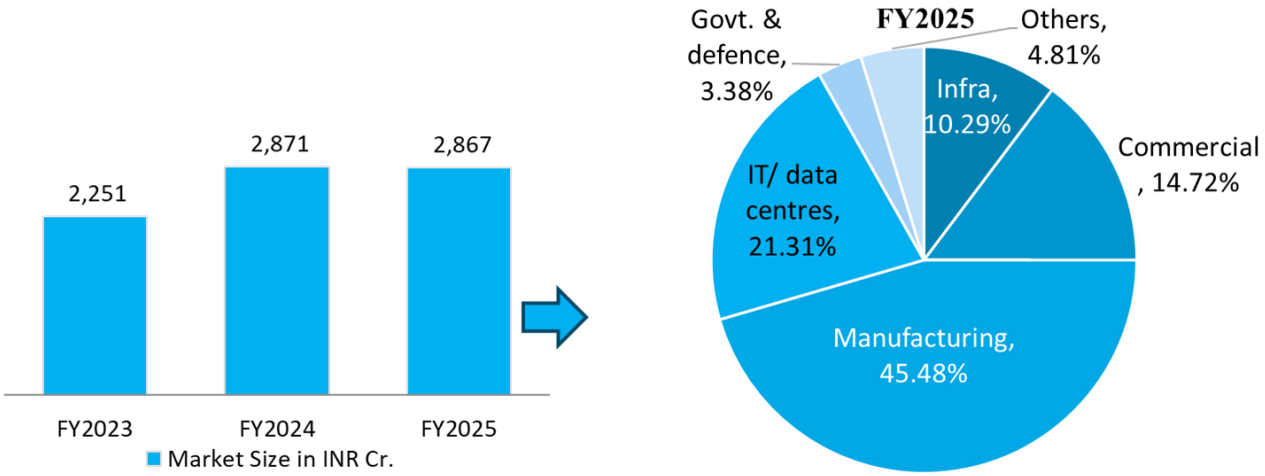
Medium horsepower DG (DG) Sets in the 180 kVA to 500 kVA range are designed for mid-sized power backup and prime power applications, offering a balance of capacity, efficiency and reliability. These DG sets are typically diesel-powered, soundproof and CPCB-compliant, ensuring low noise and emission levels suitable for urban and semi-urban environments. They cater to a variety of segments in India, including:

- **Commercial (Real estate) Sector**: Used in medium-sized commercial establishments like shopping malls, hotels, hospitals, and office complexes to ensure uninterrupted operations during power outages.

- **Manufacturing Sector**: Employed in medium-scale manufacturing units, textile mills, and food processing plants for critical processes and machinery operation.
- **Infrastructure Projects**: Support construction sites, railway stations, and quarries where reliable power is needed for heavy equipment and temporary setups.
- **Telecom**: Power telecom towers and small data centres, especially in areas with unreliable grid supply, to maintain connectivity and operations.

The MHP market grew by approximately 27% from INR 2,251 Cr in FY2023 to INR 2,871 Cr in FY2024, maintaining a stable value of INR 2,867 Cr in FY2025. Exhibit 2.11 highlights that the manufacturing sector remains the dominant end-user, accounting for 45.48% of the market value, underscoring its dependence on medium horsepower DGs for uninterrupted operations. IT/data centres contribute a significant 21.31%, reflecting the rising need for reliable backup power in India's expanding digital infrastructure and data centre applications. The commercial segment follows with a 14.72% share, supported by demand from business establishments and real estate developments. Infrastructure projects represent 10.29% of the market, while government & defence and other niche segments contribute smaller shares of 3.38% and 4.81%, respectively, indicating steady but limited demand. This distribution reinforces the importance of MHP DGs in driving industrial and digital growth while serving critical and emerging applications.

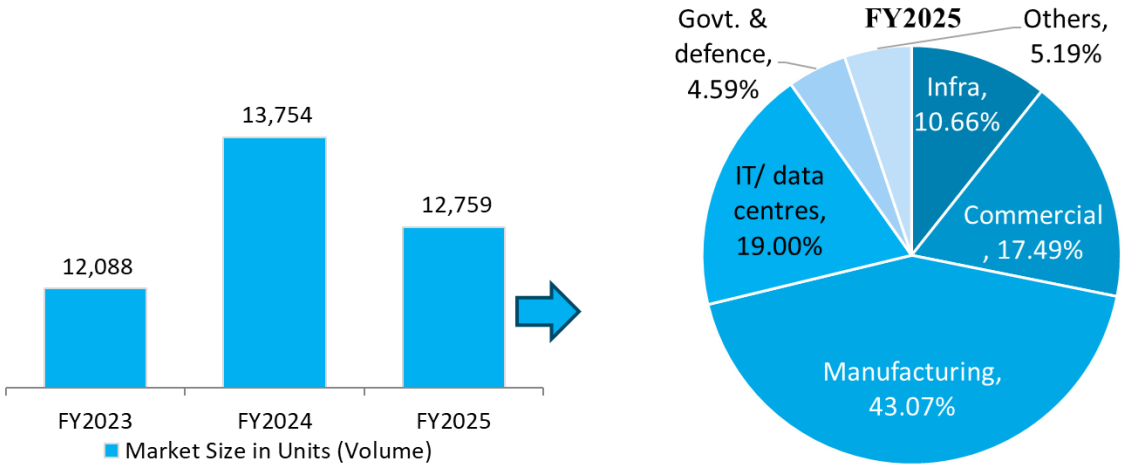
Exhibit 2.11: MHP market size and share of end user segments (in value)



Source: Frost & Sullivan analysis

Exhibit 2.12 depicts a moderate growth in the MHP market from 12,088 units in FY2023 to a peak of 13,754 units in FY2024, followed by a slight decline to 12,759 units in FY2025, indicating a stable yet slightly fluctuating market trend. The end-user segmentation for FY2025 shows that the manufacturing sector remains the largest contributor, accounting for 43.07% of the market volume, reflecting its strong industrial demand. IT/data centres follow with a notable 19.00% share, driven by the increasing digital infrastructure needs. The commercial segment holds 17.49%, underscoring steady demand from commercial and business establishments. Smaller yet steady shares come from infrastructure (10.66%), government & defence (4.59%), and others (5.19%), highlighting a balanced demand across diverse applications.

Exhibit 2.12: MHP market size. and share of end user segments (in volume)



Source: Frost & Sullivan analysis

Growth drivers for MHP segment:

- **Commercial (Real estate) Sector Expansion**: Growth in hospitals, hotels, and office complexes in urban centres like Bengaluru and Mumbai drives demand for reliable backup power.
- **Manufacturing Development**: Medium-scale manufacturing units (e.g., textiles, food processing) in Gujarat and Tamil Nadu require MHP DG sets to avoid production downtime.
- **Datacentre Growth**: India's data centre power demand is projected to grow significantly from an estimated 1.1 GW in 2025 to approximately 3.3 GW by 2030, reflecting a CAGR of around 24% over the period increasing reliance on MHP DG sets for uninterrupted datacentre operations.
- **Emission Norm Compliance**: CPCB IV+ standards push manufacturers to offer fuel-efficient, eco-friendly DG sets, appealing to environmentally conscious buyers.

Key players in MHP segment of the DG market:

The MHP DG sets market (in value terms) in FY2025 is characterized by a strong presence of established players, driven by their technological expertise, reliability, and extensive service network. Despite this concentration, the market retains a fragmented structure due to contributions from several manufacturers offering competitive solutions. The key players based on their overall market positioning are as follows:

1. Cummins India Limited
2. Kirloskar Oil Engines Limited (KOEL)
3. Greaves Cotton
4. Other players such as Mahindra Powerol, Greaves Cotton, Baudouin, etc., collectively contribute to the remaining market share, adding to its fragmented nature.

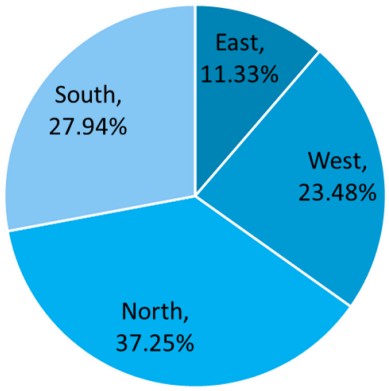
Region wise analysis for MHP market:

The medium horsepower (MHP) DG market (180–500 kVA) in India is driven primarily by manufacturing, commercial, and institutional users who require reliable backup power for mid-sized operations. Northern India accounts for the largest share around 37.25% of the market driven by strong demand from manufacturing clusters, infrastructure projects, educational campuses, and hospitals in states like Delhi, Uttar Pradesh, Punjab,

and Haryana. These DG sets are commonly used for large office complexes, construction sites, and institutional campuses where uninterrupted power is essential.

Southern India, contributing 27.94%, sees significant uptake in IT/ITES campuses, industrial parks, and healthcare infrastructure across cities like Bengaluru, Hyderabad, and Chennai. This region emphasizes quality, service support, and compliance with CPCB IV+ norms, especially in tech-driven urban centres. Western India holds 23.48% of the MHP market, driven by the presence of MSMEs, logistics hubs, and commercial real estate in Maharashtra and Gujarat. Cities like Pune, Mumbai, and Ahmedabad show consistent demand for reliable DG sets solutions to support production and commercial operations. Meanwhile, Eastern India represents a smaller share at 11.33%, yet MHP DG sets remain critical in industrial belts and infrastructure projects across West Bengal, Odisha, and Jharkhand, especially where power supply remains unpredictable.

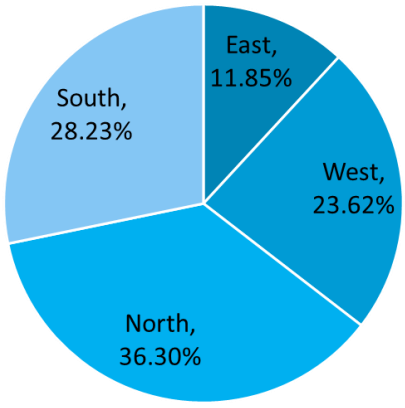
Exhibit 2.13: Region wise share of MHP DG market, FY2025 (in value)



Source: Frost & Sullivan analysis

In volume terms, North region leads with 36.30%, driven by its concentration of industrial hubs, commercial expansion and infrastructure projects that demand reliable power backup. The South follows with 28.23%, supported by strong IT, manufacturing, and urban development in cities like Bengaluru, Chennai, and Hyderabad. The West holds 23.62%, reflecting its robust industrial base in states like Maharashtra and Gujarat. The East, with 11.85%, lags due to relatively slower industrialization and infrastructure development.

Exhibit 2.14: Region wise share of MHP DG market, FY2025 (in volume)



Source: Frost & Sullivan analysis

High horsepower DGs (Above 500 kVA):

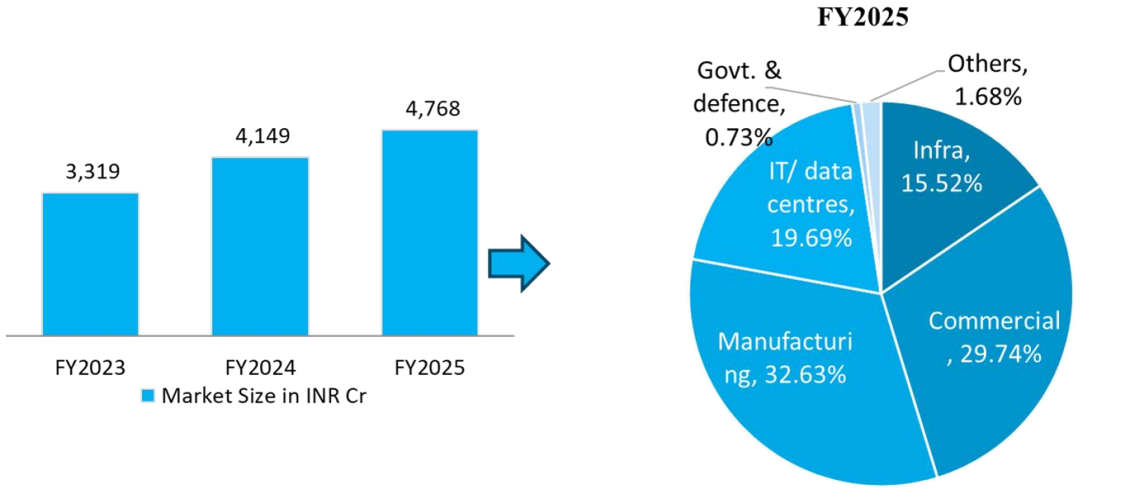
High Horsepower DG (DG) Sets, with capacities above 500 kVA, are heavy-duty power solutions designed for large-scale applications requiring significant power output. These DG sets are typically diesel-powered, often containerized for portability, and equipped with advanced technologies like Power Command digital control systems (as seen in Cummins models) to ensure reliability and efficiency.

Key segments they cater to include:

- **Manufacturing Sector**: Large manufacturing units, oil & gas, mining, and petrochemical industries use these DG sets for continuous or prime power to support heavy machinery and critical processes.
- **Commercial (realty) Sector**: Large commercial complexes, and shopping malls rely on these DG sets for standby power to ensure uninterrupted operations.
- **Infrastructure Projects**: Major construction projects, such as metro rail systems, highways, and airports, utilize these DG sets for powering equipment in remote or grid-unstable areas.
- **Government and Defence**: Used in military bases, government facilities, and public infrastructure projects for emergency and continuous power needs.
- **Telecom and IT/datacentres**: Large data centres and telecom hubs in urban areas require these DG sets to support high energy demands and ensure connectivity.

The HHP market grew from INR 4,149 Cr. in FY2024 to INR 4,768 Cr. in FY2025. Exhibit 2.15 illustrates the end user segment split in FY2025 with manufacturing leading at 32.63%, reflecting significant reliance on high horsepower DGs for in heavy industries like oil & gas, mining, and manufacturing large-scale. The commercial sector follows at 29.74%, driven by the need for continuous power in construction projects, commercial complexes, and townships. IT/datacentre holds 19.69% of the share and the remaining segments—Government & Defence and others constitute the rest, with Government & Defence typically around 0.73% (as per prior analysis) for military and public infrastructure applications.

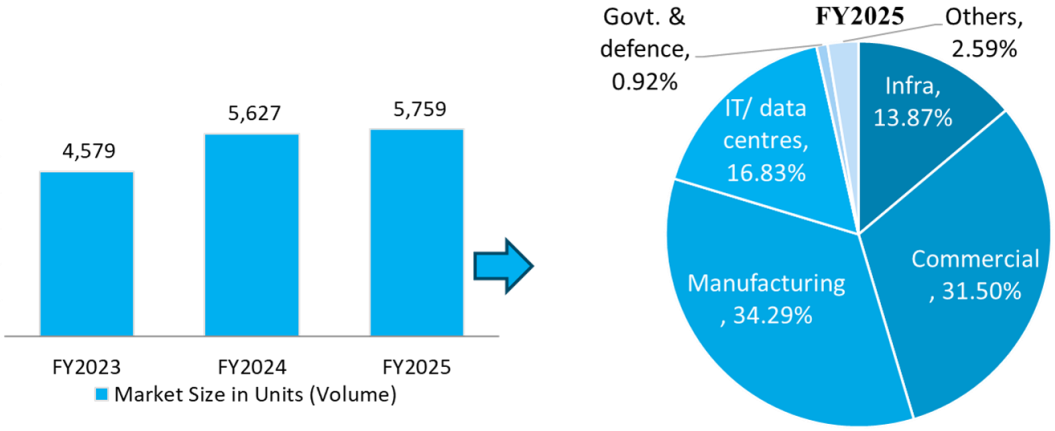
Exhibit 2.15: HHP market size and share of end user segments, FY2025 (in value)



Source: Frost & Sullivan analysis

Exhibit 2.16 shows a steady upward trend in market volume, growing from 4,579 units in FY2023 to 5,627 units in FY2024, and further to 5,759 units in FY2025, indicating consistent demand growth.

Exhibit 2.16: HHP market size and share of end user segments, FY2025 (in volume)



Source: Frost & Sullivan analysis

Growth drivers for HHP segment:

- **Industrial Expansion:** Rapid growth in heavy industries like oil & gas, mining, petrochemicals, and manufacturing drives demand for HHP DG sets to ensure continuous power for large-scale operations, especially in areas with limited grid access, such as Gujarat and Odisha.
- **Data Centre Boom:** The expansion of data centres in urban hubs like Mumbai, Chennai, Hyderabad and Bengaluru fuels the need for HHP DG sets (e.g., Cummins' 2500-2750 kVA models) to provide uninterrupted power for critical operations.
- **Infrastructure Mega-Projects:** Government initiatives, including metro rail expansions, airport developments, and highway projects like the Delhi-Mumbai Expressway, require high-capacity DG sets for construction and operational power needs in remote or grid-unstable regions.
- **Unreliable Grid Infrastructure:** Frequent power outages in industrial belts like Uttar Pradesh and Jharkhand necessitate HHP DG sets for both emergency and prime power, ensuring operational continuity in large facilities.
- **Emission Compliance and Innovation:** Stringent CPCB IV+ norms drive manufacturers to develop cleaner, more efficient HHP DG sets, increasing adoption in regulated sectors like data centres and commercial complexes while appealing to environmentally conscious buyers.

Key players and their market share:

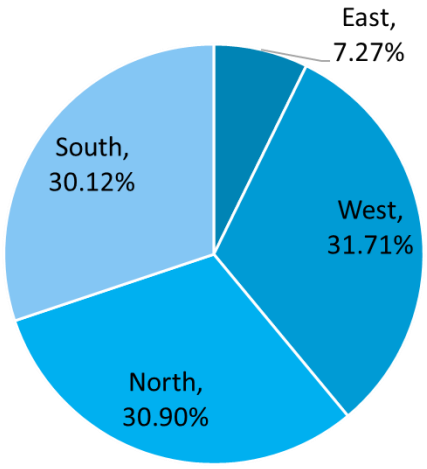
The HHP DG sets market (in value terms) in FY2025 is led by a few established players with strong technological expertise, reliable high-capacity models, and extensive support networks catering to large-scale infrastructure, manufacturing, and data centre applications. The market remains partially fragmented due to the presence of specialized manufacturers. The key players based on their overall market positioning are as follows:

1. Cummins India Limited
2. Perkins
3. CAT (Caterpillar)
4. Other players such as Baudouin, JCB, MTU etc. collectively contribute to the remaining market share, reflecting a competitive landscape in this high-capacity segment.

Region wise analysis for HHP market:

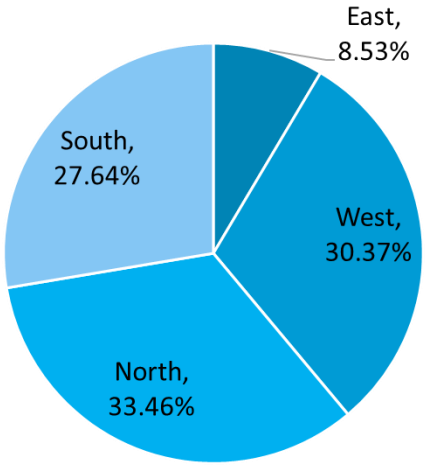
The high horsepower (HHP) DG market (500–3000 kVA) in India serves mission-critical applications across sectors such as large-scale manufacturing, infrastructure, data centres, airports, and government utilities. Southern India has a share of 30.12% of the national market, fuelled by rapid growth in IT and data centre infrastructure, especially in Bengaluru, Chennai, and Hyderabad. These cities demand high-capacity backup systems to ensure uninterrupted power for digital services, large hospitals, and industrial parks. Western India, with a 31.71% share, is driven by significant demand from heavy industries, refineries, ports, and commercial real estate in Maharashtra and Gujarat. Northern India contributes 30.90%, with strong demand from infrastructure projects, transportation hubs, construction firms and public sector facilities across Delhi NCR, Uttar Pradesh, and Punjab. In contrast, Eastern India holds just 7.27% of the HHP market, primarily supporting select manufacturing projects and government installations in West Bengal, Odisha, and Jharkhand. Overall, HHP DG sets demand is shaped by large-scale operations that require high reliability and regulatory-compliant, high-efficiency systems across India.

Exhibit 2.17: Region wise share of HHP DG market, FY2025 (in value)



Source: Frost & Sullivan analysis

Exhibit 2.18: Region wise share of HHP DG market, FY2025 (in volume)



Source: Frost & Sullivan analysis

Exhibit 2.18 shows that in volume terms, North leads with 33.46%, followed closely by the West at 30.37%, indicating strong demand in these regions likely due to large-scale infrastructure, manufacturing, and commercial sector developments. The South holds 27.64%, reflecting its robust IT infrastructure, manufacturing, and urban growth. In contrast, the East accounts for only 8.53%, suggesting a slower adoption of high-capacity power solutions.

2.4 Key regulations impacting the DG industry.

The CPCB-4+ (Central Pollution Control Board - Stage IV Plus) emission norms for DG sets in India came into effect from July 2023, replacing the earlier CPCB-II norms. These norms are harmonized with the EU Stage V standards and significantly tighten the permissible limits for NOx, PM, CO, and HC.

Scope:

- Applies to up to 800 kW engine output DG sets.
- Includes both diesel and gaseous fuel-based DG sets.
- Mandatory for OEMs, engine manufacturers, and importers.

Exhibit 2.19: Regulations impacting the DG industry

Parameter	CPCB-II (g/kWh)	CPCB-4+ (g/kWh)	Reduction (%)
NOx	9.2	0.4 – 0.9	~90%
PM (Particulate)	0.85	0.015 – 0.04	~95%
HC	1.3	0.19 – 0.4	~70%
CO	3.5	0.5 – 1.0	~80%

Source: Central pollution control board, Frost & Sullivan analysis

Government regulatory support:

The Indian government has recognized the importance of reliable backup power, particularly for critical sectors like healthcare, data centres, and industries, while promoting environmental sustainability. Support mechanisms include:

Subsidies and Incentives: The government offers subsidies for adopting cleaner technologies, such as CNG-based DG sets or hybrid systems combining diesel with renewable energy sources like solar. Programs like the National Solar Mission encourage integrating solar power with DG sets for backup solutions.

Regulatory Framework: The Commission for Air Quality Management (CAQM) in the NCR has implemented policies to phase out older, high emission DG sets and promote CPCB IV+ compliant units. Financial assistance is provided for retrofitting existing DG sets with RECDs.

R&D Funding: The Ministry of New and Renewable Energy (MNRE) funds research into low-emission backup power technologies, including hydrogen-based DG sets and battery storage systems.

Rental Solutions: Companies like Modern Hiring Services offer CPCB IV+ compliant DG sets on rent, supported by government policies that ease compliance costs for small and medium enterprises (SMEs).

Compliance with Environmental Laws

Compliance with CPCB IV+ norms is mandatory for all DG sets manufacturers, importers, and users in India. Key aspects include:

Certification Requirements: Manufacturers must obtain Type Approval and Conformity of Production (COP) certificates for each DG sets model, ensuring adherence to emission and noise standards. Testing is conducted by agencies like the Automotive Research Association of India (ARAI).

Penalties for Non-Compliance: Non-compliant DG sets face fines, seizure, or operational bans, particularly in pollution-sensitive areas like the NCR. The National Green Tribunal (NGT) enforces strict penalties for violations.

Retrofit Mandates: In-use DG sets must be upgraded with RECDs to achieve a minimum 70% PM reduction. The CAQM mandates dual-fuel operation in areas with gas infrastructure, aligning with the Graded Response Action Plan (GRAP) to curb air pollution during high-pollution periods.

DG sets emission norms India vs other countries

Country	Latest Norm (Year)	Equivalent to	Key Highlights
India	CPCB-4+ (2023)	EU Stage V	Covers <800 kW, very stringent.
USA	Tier 4 Final	Independent	Similar to EU V but allows flexibilities.
EU	Stage V (2019)	Baseline	Benchmark for global best practice.
China	CN Stage IV (2020)	Between Tier 3-4	Less stringent than EU and India.
Brazil	PROCONVE M5	Approx. EU III	Delayed rollout of stricter norms.

*Note: The above list is non-exhaustive**

The timeline for retrofitting DGs (DGs) with Retrofit Emission Control Devices (RECDs) has been clearly defined by regulatory authorities, particularly for the National Capital Region (NCR). As per directives from the Commission for Air Quality Management (CAQM), all in-use DGs between 125 kW and 800 kW in areas with gas infrastructure were required to be retrofitted with RECDs and dual-fuel kits (enabling 70% gas and 30% diesel operation) by 30 September 2023. From 1 October 2023 onward, operation of non-compliant DG sets is strictly prohibited, regardless of pollution levels or GRAP phases. For smaller DG sets (19–125 kW), dual-fuel operation is mandated, with limited usage allowed during GRAP periods only if equipped with RECDs. Other states have implemented similar mandates with staggered timelines: Maharashtra required retro fitment within 120 days from June 2023, Karnataka set a deadline of 31 March 2024 for older DGs (61–800 kW), and Tamil Nadu has given a 180-day compliance window from its latest notification in April 2024. These regulations are aimed at reducing particulate matter (PM) emissions by at least 70%, contributing to improved urban air quality and aligning with national emission control efforts.

India's CPCB IV+ norms are competitive globally, particularly due to the adoption of BS-VI fuel and a unified standard for all fuel types. However, they are less stringent than US Tier 4 Final and EU Stage V for NOx and PM, reflecting a balance between environmental goals and industrial affordability.

Price rationalization after CPCB4+

Following the implementation of the CPCB IV+ emission standards, the Indian DG sets market has experienced significant price rationalization driven by the need to comply with stringent environmental regulations. The adoption of advanced emission control technologies, such as selective catalytic reduction (SCR), diesel particulate filters (DPF), and electronic fuel injection systems, has led to a notable price hike of 15–20% for CPCB IV+ compliant DG sets compared to their CPCB II counterparts. This is reflective of the increased manufacturing costs and the use of BS-VI compliant low-sulphur diesel. In addition to the technology costs, the implementation of CPCB IV+ norms has introduced longer development cycles and more rigorous certification processes, further contributing to price escalation. Manufacturers are now required to undergo extended testing protocols, emissions validation, and type approval procedures through accredited agencies such as ARAI and ICAT. These added steps increase lead times and operational overheads, as suppliers must adapt their supply chains, invest in new tooling and training, and ensure compliance at every stage of production. Industry experts anticipate further price revisions in the near future as manufacturers and suppliers work toward a market-fit price point that aligns with consumer expectations and regulatory compliance. This revision process is expected to be supported by government subsidies, rental solutions, and improved fuel efficiency, which could mitigate the financial impact on end-users while ensuring sustainable adoption of CPCB IV+ DG sets.

2.5 RECD installations with DG industry

In urban areas like the National Capital Region (NCR), air pollution has become a critical issue due to the emissions from DGs. These DG sets, often outdated, release harmful pollutants such as Particulate Matter (PM), Hydrocarbons (HC), Carbon Monoxide (CO), and Nitrogen Oxides (NOx), contributing significantly to poor air quality and health risks. Retrofit Emission Control Devices (RECDs) are essential as they can be installed on existing DG sets to reduce these emissions, helping older generators meet current environmental standards without the need for costly replacements.

By integrating RECDs, legacy DGs can continue to operate while significantly minimizing their environmental impact. This solution is vital for improving air quality in densely populated urban regions, ensuring compliance with stringent regulations, and supporting sustainable development goals.

RECD Type	Description
Diesel Particulate Filter (DPF)	Physically captures PM from exhaust; often uses active regeneration
Diesel Oxidation Catalyst (DOC)	Converts CO and HC into CO_2 and water vapor
SCR + DPF Combo	Used for NOx and PM control; best for high-capacity DG sets

The Indian government has implemented robust regulations to enforce the use of RECDs for in-use DGs, driven by the National Green Tribunal (NGT), CPCB, and state pollution control boards (SPCBs). These regulations aim to curb air pollution in non-attainment cities (where air quality exceeds National Ambient Air Quality Standards) and align with the NCAP launched in 2019.

Key Regulatory Requirements:

NGT Mandate (O.A. No. 681/2018, August 6, 2019): The NGT ordered the retrofitting of emission control devices on in-use DGs to reduce PM by at least 70%. This applies to DG sets of 125 kVA and above in the NCR and other polluted regions.

CPCB Guidelines (PCLS/12/2021-22, February 1, 2022): RECDs must be type-approved by one of four CPCB-recognized laboratories:

- Automotive Research Association of India (ARAI), Pune
- International Centre for Automotive Technology (ICAT), Manesar
- Indian Institute of Petroleum (IIP), Dehradun
- Vehicle Research Development Establishment (VRDE), Ahmednagar Type approval ensures compliance with emission and particulate diagnostics standards for DG sets up to 800 kW (1000 kVA).

CAQM Directives (NCR): In the NCR, in-use DG sets must either operate in dual-fuel mode or be retrofitted with RECDs achieving ≥70% PM reduction. Non-compliant DG sets face operational bans during high-pollution periods under the Graded Response Action Plan (GRAP).

State-Level Mandates: States like Karnataka, Tamil Nadu, and Goa have issued deadlines for retrofitting DG sets with RECDs:

- Karnataka: Karnataka State Pollution Control Board (KSPCB) mandated RECDs for DG sets ≥125 kVA by March 2022, with a minimum 70% PM capture efficiency.
- Tamil Nadu: Tamil Nadu Pollution Control Board (TNPCB) extended deadlines to September 30, 2022, for non-attainment cities and March 31, 2023, for other areas due to limited RECD availability.
- Goa: Goa State Pollution Control Board (GSPCB) requires type-approved RECDs for DG sets 125–1000 kVA.

Certification and Testing: RECDs must be ISO-marked and certified by CPCB, ARAI, ICAT, IIP, or Indian Oil Corporation's R&D Centre. Testing ensures compliance with PM, CO, HC, and NOx reduction targets.

Penalties: Non-compliance results in fines, DG sets seizure, or operational bans, enforced by SPCBs and the NGT.

Key RECD players/manufacturers for DGs (upto 800 kW/1000 kVA) in Indian market:

Based on the Central Pollution Control Board (CPCB) document dated 24-02-2025, there are few players that are certified Retrofit Emission Control Device (RECD) manufacturers for DGs (up to 800 kW/1000 kVA). The list of players includes Cummins India Ltd., Chakr Innovation Pvt. Ltd., Platino Automotive Pvt. Ltd., and Maxmoc Motor Works India Pvt. Ltd

Note:

- *Phase I* refers to DG sets engines complying with emission norms as specified in GSR 371(E) dated 17.05.2002.
- *Phase II* refers to DG sets engines complying with emission norms as specified in GSR 771(E) dated 11.12.2013, as amended.
- *ICAT* stands for International Centre for Automotive Technology, Manesar, Haryana.
- *ARAI* stands for The Automotive Research Association of India, Pune, Maharashtra.

2.6 Comparison of DGs with alternative backup power technologies:

With the growing emphasis on energy resilience and sustainability, organizations are exploring various backup power solutions beyond conventional DG (DG) sets. Alternatives like battery energy storage systems (BESS), solar-plus-storage combinations, and gas generators offer certain advantages in specific contexts. However, these technologies differ significantly in terms of deployment practicality, operational flexibility, and backup reliability—especially in the diverse and challenging conditions found across India.

The table below presents a qualitative comparison of DGs against key alternative backup technologies:

Parameter	DG (DG) Sets	Battery Storage Systems (e.g., Lithium-Ion)	Solar + Battery Systems	Gas Generators
Physical Footprint	Requires dedicated space, but well-established in both urban and remote deployments. Scalable and manageable with proper planning.	Compact and quiet but needs added infrastructure (inverters, cooling) that limits space advantage.	Large area required for solar panels plus battery housing; installation complexity increases.	Smaller footprint, but safety protocols and ventilation will increase the usable space.
Flexibility	Unmatched. Performs reliably across urban, rural, and off-grid areas. Can scale from small setups to industrial loads.	Limited to grid-connected environments; impractical for remote or high-load use cases.	Dependent on weather and daytime availability. Limited flexibility during prolonged outages.	Viable only where gas supply is reliable—mainly urban industrial zones.
Cost-Effectiveness	Proven low lifecycle cost in high-power, long-duration scenarios. Widely used in commercial, manufacturing, and critical sectors.	Suitable only for short duration needs. Higher replacement frequency due to battery life cycles.	Costly to deploy and maintain; better for sustainability-focused projects than practical backup.	Variable cost performance; dependent on fuel supply logistics and pricing.
Reliability & Runtime	Highly reliable during long outages. Operates continuously for hours or days if diesel is available—ideal for mission-critical sectors.	Reliable only for 2–4 hours; recharge delays make them unsuitable for extended outages.	Performance varies with weather. Inconsistent output in cloudy or night-time conditions.	Moderate runtime; vulnerable to gas supply interruptions.
Suitability in India	Optimal for India's diverse and growing power backup needs—across airports, data centres, hospitals, farms, metros, and more.	Best for controlled urban environments with low power needs and limited outage duration.	Ideal only for niche applications with strong sustainability goals and stable climate conditions.	Limited to metros with access to piped gas and robust infrastructure.

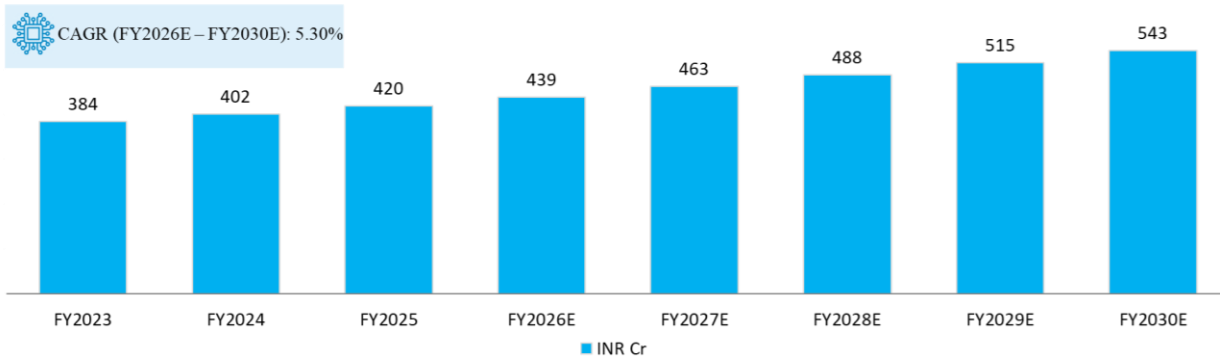
2.7 DG industry analysis- Rental segment

In today's dynamic business environment, the demand for rental generator sets has surged, driven by the need for flexible and cost-effective power solutions. Companies operating on an operational expenditure (OPEX) model, such as those in quick commerce like Blinkit and Zepto, often prefer rental DG sets to avoid the substantial capital expenditure (CAPEX) associated with purchasing permanent backup power equipment.

Rental DG sets provide a temporary yet reliable power source, essential for businesses that require immediate and scalable power solutions without long-term financial commitments.

Rental DG sets offer the advantage of mobility and ease of deployment, making them ideal for construction sites, events, and emergency situations. By opting for rental DG sets, companies can ensure uninterrupted operations, maintain flexibility in their financial planning, and adapt quickly to changing power requirements. This approach not only supports operational efficiency but also aligns with sustainable business practices by reducing the need for permanent installations and promoting resource optimization.

Exhibit 2.20: DG-rental segment market size



Source: Stakeholder Interactions, Frost & Sullivan analysis

The rental DG sets market in India is projected to expand at a moderate but steady pace, driven by sectoral demand and regulatory shifts. Exhibit 2.20 shows the growing trend of rental DG sets market, with the market valued at INR 420 Cr in FY2025 and is projected to grow to INR 543 Cr. in FY2030E.

Key Growth Drivers:

Infrastructure Development: Government initiatives like the National Infrastructure Pipeline (NIP) (INR 102 lakh crore investment from 2020–2025), Smart Cities Mission, and Bharat Mala are fuelling construction activities, increasing the need for rental DG sets at project sites without grid access.

Unreliable Grid Infrastructure: Frequent power outages, especially in rural and semi-urban areas, drive demand for rental DG sets as a cost-effective backup power solution.

Telecom and IT/datacentres Demand: Sectors like IT, data centres, telecom (with 118.9 crore subscribers as of 31st December 2024), and manufacturing rely on DG sets to ensure operational continuity during power disruptions. Telecom towers dominate commercial applications.

Cost Optimization: Renting DG sets eliminate high capital expenditure (CAPEX) and maintenance costs, making it attractive for businesses, especially small and medium enterprises (SMEs). Rental solutions also provide flexibility for short-term or emergency needs.

CPCB IV+ Compliance: The mandate for CPCB IV+ compliant DG sets (effective July 1, 2023) has increased rental demand, as businesses prefer renting compliant units over retrofitting or purchasing new ones, which are 20–50% costlier due to advanced technologies like SCR and DPF.

3. MSLG (Medium Speed Large Generators)

3.1 Market overview

Medium-Speed Large Generator (MSLG) sets are critical for delivering base load/continuous duty application/standby power to India's industrial and strategic sectors during power outages. Operating at 500–1000 revolutions per minute (RPM), these generators deliver power outputs of 3 megawatts (MW) to 10 MW units or multiple thereof. They utilize diesel, natural gas, or dual-fuel systems to drive an internal combustion engine, producing electricity via an alternator. Designed for rapid response, MSLG sets start within 20-45 seconds, ensuring reliability in emergencies. Their robust design suits India's diverse conditions, from coastal humidity to inland heat. With fuel efficiency of 190 GMS per kilowatt-hour (kWh) and a lifespan of upto 200,000 hours (20-25 years with maintenance).

3.1.1 Function and Operation

MSLG sets convert fuel combustion into mechanical energy, which an alternator transforms into electricity for emergency power. Medium-speed operation balances efficiency and durability. Systems include air or water cooling and advanced controls like Supervisory Control and Data Acquisition (SCADA) and Automatic Voltage Regulators (AVR) for precise operation. Synchronization allows multiple units to form a microgrid, ensuring stable standby power for critical facilities, with diesel sets excelling in rapid load acceptance.

3.1.2 Applications

MSLG emergency DG sets, particularly diesel-based, provide standby power in:

- Liquified Natural Gas (LNG): For unloading of LNG from ships.
- Refineries: Emergency power to prevent production halts
- Nuclear Power Plants: Backup for safety systems
- Steel and Heavy Industries: Outage protection
- Remote and Off-Grid Areas: Emergency power for mining and industrial facilities.

3.2 Performance Metrics and Advancements

The Medium-Speed Large Generator (MSLG) emergency DG sets are engineered to deliver robust, reliable standby power for critical applications, with technical specifications tailored to meet demanding industrial and strategic needs. These sets offer a power output of 3MW to 10 MW of single units and multiple thereof enabling them to support high-capacity requirements in sectors such as oil refineries, nuclear power plants, Fertiliser plants, LNG terminals, steel plants, cement plants, automobiles and heavy industries. Operating at engine speeds of 500–1000 RPM, MSLG sets strike a balance between fuel efficiency and durability, ensuring consistent performance under varying loads compared to high-speed alternatives. Designed with a robust diesel engine core, these generators deliver high-capacity power to support vital sectors such as oil refineries, nuclear power facilities, ensuring continuity during grid failures where even brief outages can disrupt operations or safety systems. Their medium-speed operation optimizes the balance between fuel efficiency and mechanical longevity, enabling sustained performance under fluctuating loads compared to high-speed counterparts, which are less suited for prolonged emergency use.

Exhibit 3.1 lists technical specifications for MSLG sets ensuring reliability for emergency use.

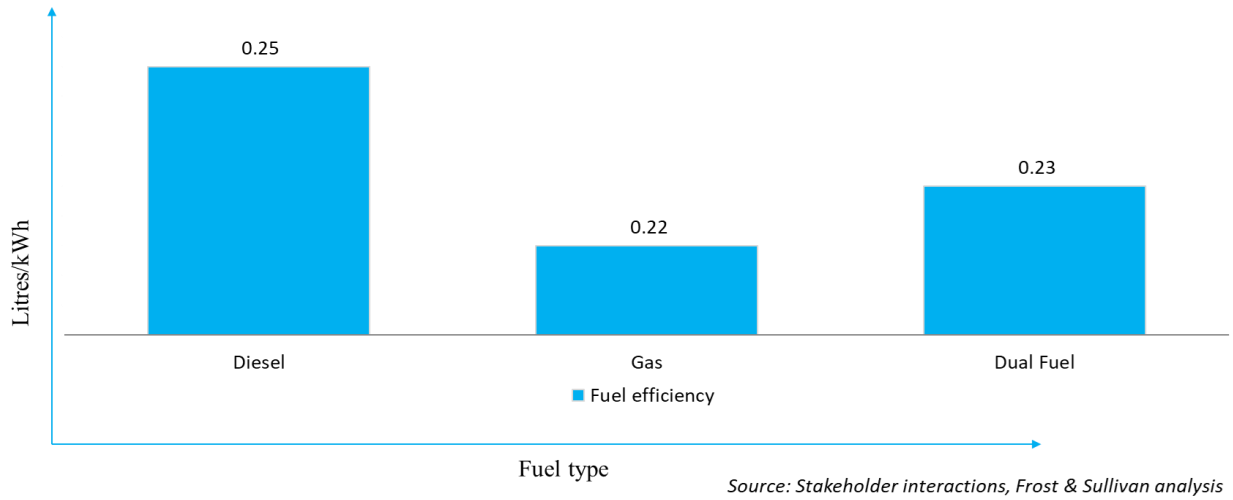
Exhibit 3.1: Technical Specifications of MSLG Emergency DG Sets

Parameter	Specification
Power Output	3MW and above
Engine Speed	500–1000 RPM
Synchronization	Supports parallel operation
Cooling Technologies	Air and water cooling
Automation	SCADA, AVR
Fuel Efficiency	190 Gms/kWh
Operational Lifespan	200,000 hours (20-25 years)

Cooling technologies, including air and water cooling, maintain optimal operating temperatures in harsh environments, such as India's coastal humidity or inland heat up to 50°C, radiator coolers systems are provided to save water and dissipate heat emanated from combustion. Advanced automation systems, including Supervisory Control and Data Acquisition (SCADA), and Automatic Voltage Regulators (AVR), enable precise monitoring and control, reducing downtime by 20% through real-time diagnostics and load management. Fuel efficiency with 190 Gms/kWh, with diesel-based sets achieving reliable performance.

3.2.1 Fuel Efficiency

Exhibit 3.2: Fuel efficiency by fuel type



Source: Stakeholder interactions, Frost & Sullivan analysis

Exhibit 3.2 highlights the fuel efficiency of MSLG emergency DG sets, with diesel at 0.25 liters/kWh, gas at 0.22 liters/kWh, and dual fuel at 0.23 liters/kWh.

3.3 Classification of MSLG Sets

MSLG emergency DG sets are classified by fuel type, with diesel leading due to its reliability. Exhibit 3.3 provides the classification.

Exhibit 3.3: MSLG Set Types by Fuel

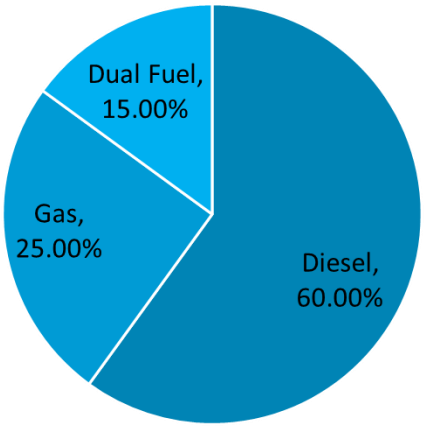
Fuel Type	Characteristics	Primary Advantage
Diesel	High energy density, rapid response	Reliability in emergencies
Gas	Lower emissions, cleaner operation	Emission compliance
Dual-Fuel	Fuel flexibility, adaptable to supply	Efficiency and cost optimization

3.3.1 Fuel Type Distribution

- **Diesel**: 55-60% market share, preferred for refineries and nuclear plants.
- **Gas**: 20-25% market share, used in LNG terminals and smart cities.
- **Dual-Fuel**: 10-15% market share, used in areas with variable fuel supply.

Exhibit 3.4 shows the 2025 market distribution of MSLG emergency DG sets, with diesel commanding 60%, gas 25%, and dual-fuel 15%. Diesel's dominant share reflects its high energy density and rapid start-up (8–10 seconds), making it indispensable for critical applications like nuclear plant safety systems and refinery backups, where reliability outweighs its higher operating costs. Its 60% share underscores its preference in sectors like Steel Industries and Nuclear Power, where outages can halt production or compromise safety. Gas-based sets, holding 25%, are gaining traction in LNG terminals and smart cities due to 30% lower CO2 emissions, aligning with urban sustainability goals. Dual-fuel sets, at 15%, offer flexibility in regions with inconsistent fuel supply, providing 10–15% cost savings in gas mode, particularly for rural industrial zones. Diesel's lead is driven by its proven performance in high-stakes scenarios, but challenges include diesel price volatility (2–3% annual rise).

Exhibit 3.4: MSLG Market distribution by fuel type



Source: Stakeholder interactions, Frost & Sullivan analysis

Regulatory pressures and expanding gas infrastructure may boost gas's share to 20% by 2030, yet diesel's reliability ensures its dominance. Manufacturers investing in diesel emission controls and efficiency (e.g., SCR, turbocharging) can maintain competitiveness, while hybrid diesel-gas systems offer a bridge to sustainability. Stakeholders should prioritize diesel for critical infrastructure while monitoring gas adoption in urban markets, balancing reliability with regulatory and economic shifts through 2030.

3.4 Role of MSLG Sets in India

In FY2025, India's electricity consumption reached 1,650 TWh, with a peak demand of 260 GW, driven by industrial growth, urbanization, and cooling needs. Grid instability in regions like Gujarat, Tamil Nadu, and Maharashtra, with outages, necessitates diesel-based MSLG/ emergency DG sets for standby power. Applications include:

- **LNG Terminals**: Backup for gas processing.
- **Refineries**: Emergency power to prevent losses.
- **Nuclear Power Plants**: Safety system backup.
- **Steel and Heavy Industries**: Outage protection.
- **Smart Cities and Data Centres**: Backup for digital infrastructure.
- **Rural Electrification**: Emergency power in remote areas.

4.1 Regulatory and Policy Drivers

- Smart city initiatives, targeting 100 cities by 2030, drive 3.5 GW of demand for reliable backup, with diesel preferred for its rapid response.
- The Electricity Act 2023 promotes grid reliability but acknowledges outages, sustaining diesel MSLG's role.
- Rural electrification programs, aiming for 100% coverage by 2027, boost diesel demand in off-grid industrial and mining operations.

3.5 Market players of MSLG sets in India

The MSLG market players is led by both domestic and global players. Exhibit 3.5 lists key manufacturers, in the Indian market for medium-speed large generators (500–1000 RPM, 1–10 MW), the segment is dominated by a few established global OEMs known for robust design, high reliability, and compliance with emission norms. The top three market players in this segment are Powerica Ltd. (a key Caterpillar partner), Wartsila, and MAN Energy Solutions.

- **Powerica Ltd,** has emerged as a prominent player in India by offering a comprehensive range of turnkey solutions, supported by a strong service network and fuel-flexible offerings.
- **Wartsila** is recognized for its advanced dual-fuel and gas generator technology, offering highly efficient, low-emission solutions catering to industrial and critical infrastructure needs.
- **MAN Energy Solutions** complements the market with its technologically advanced, fuel-efficient generators, known for meeting stringent emission standards and offering long operational life.

Together, these players command a significant share of the MSLG market in India, serving sectors such as refineries, marine, and critical manufacturing facilities where medium-speed reliability is paramount.

Exhibit 3.5: MSLG Emergency DG Set Market Players

Market Players	Description	Key Strength
Powerica Ltd.	Turnkey solutions across multiple fuel grade MSLG sets	Extensive service network and highly customization. Techno-commercially competitive offering latest technology with high reliability cost effective power solutions for critical requirements. Offering solution with flexibility of fuels, Gas/diesel/dual fuel.
Wartsila	Diesel, Gas, Dual fuel Engine generators	Latest technology, fuel efficient, Emission-compliant designs
MAN, Energy Solutions	Diesel, Gas, Dual fuel Engine generators	Latest technology, fuel efficient, Emission-compliant designs

3.6 Domestic Demand Drivers

The demand for Medium-Speed Large Generators (MSLGs), particularly diesel-based, is witnessing sustained growth in India's heavy industrial and infrastructure sectors. These generators, typically ranging from 3-MW to 10 MW and beyond, play a pivotal role in ensuring uninterrupted power supply in critical applications where grid failure can result in catastrophic safety, financial, or operational consequences.

MSLGs are distinguished by their ability to offer high output, fuel efficiency, long runtimes, and durability—making them the preferred choice for sectors that require both sustained power capacity and emergency response reliability.

1. LNG Terminals:

Power Reliability for High-Risk Coastal Operations

LNG terminals are critical nodes in India's gas infrastructure, often located in remote or coastal regions with vulnerable grid connectivity. These facilities require constant power to operate cryogenic storage tanks, compressors, and safety systems. Given the flammable nature of LNG and the operational complexity, power disruptions can lead to severe safety risks, environmental hazards, and economic losses.

MSLGs serve as a robust backbone for emergency power at these terminals. MSLGs are preferred due to their fuel availability, rapid ramp-up capability, and independence from the gas being handled. With India's emphasis on increasing gas share in the energy mix, new LNG terminals and expansions are likely to drive increased demand for MSLGs in the ~~2–6~~ 5-9 MW and multiples thereof, often deployed in redundant (N+1) configurations.

2. Oil Refineries:

Safeguarding Continuous Processing in Mission-Critical Plants

Refineries are among the most power-sensitive industrial operations. A power outage, even of a few minutes, can cause shutdowns, lead to unstable chemical reactions, or result in costly downtime. Moreover, emergency systems such as flaring, fire suppression, and environmental controls are fully dependent on backup power sources.

Medium-speed diesel generators, often installed in multi-unit banks (e.g.,5-9 MW and multiples thereof, ensuring rapid takeover in the event of grid loss. Their high reliability, low maintenance interval, and capacity for extended operations make them ideal for refinery environments where multi-hour backup may be needed. With refinery capacity expansion planned under India's energy security roadmap, this sector remains a key driver for high-capacity MSLG systems.

3. Steel and Metallurgical Industries:

Maintaining Process Continuity in Energy-Intensive Operations

Steel production processes, particularly in integrated plants with blast furnaces, rolling mills, and electric arc furnaces, demand uninterrupted power to maintain process integrity. A sudden power failure can cause molten metal to solidify in furnaces or ladles, risking equipment damage and plant safety.

To prevent such risks, medium-speed generators in the 5–10 MW range are increasingly being deployed as emergency power sources. These are not intended to carry full plant load but to maintain safe shutdowns, power control systems, cooling fans, and automation systems. Diesel is the fuel of choice given its energy density, supply flexibility, and ease of long-term storage.

4. Nuclear Power Plants:

Non-Negotiable Redundancy for Reactor Safety

In nuclear power plants, uninterrupted power supply is critical—not just for productivity, but for life safety and regulatory compliance. Emergency Diesel Generators (EDGs) are mandated by nuclear regulators to power essential systems such as cooling pumps, neutron flux monitors, and control rod drives in the event of main power failure.

Medium-speed diesel generators (often in the 4-9 MW category) are custom-designed to meet nuclear-grade standards, including seismic resistance, EMP shielding, and thermal robustness. These units must operate flawlessly for extended durations (up to 72 hours) in a loss-of-coolant accident (LOCA) scenario.

As India expands its nuclear capacity with upcoming reactors under NPCIL, there will be steady, specification-driven demand for MSLG systems, often requiring rigorous factory acceptance testing (FAT) and post-installation compliance protocols.

3.7 Hyundai–Powerica Strategic Partnership

Powerica's strategic partnership with Hyundai Heavy Industries (South Korea) enhances India's MSLG~~D~~ capabilities. Hyundai's robust engine designs, combined with Powerica's localized integration and service network across 20+ Indian cities, have driven projects like:

- **BPCL Kochi Refinery**: 3.4 MW for baseload and backup power.
- **GSPC Mundra**: 2X3.132 MW for continuous operation.

Hyundai's global inquiry forwarding to Powerica strengthens its ability to handle complex, high-capacity orders, boosting India's export potential by 10–15% annually.

3.8 Global Outlook

MSLG sets from India, particularly diesel-based, are exported to regions with unreliable power grids, meeting critical standby power needs. In 2025, key markets include West Africa, South Asia, East Africa, Southeast Asia, and Southern Africa, with MSLG sets favoured for their rapid response (20-45seconds) and reliability. South

Asia and East Africa rely on MSLG sets for industrial and infrastructure backup, while Southeast Asia's urban growth drives demand for construction applications. Southern Africa's mining sector benefits from diesel MSLG's off-grid reliability. These exports, supported by market players like Powerica and Caterpillar, leverage India's cost-effective production, though challenges include rising diesel costs and international emission standards.

Emerging economies, particularly in Asia-Pacific, Africa, and Latin America, will drive MSLG demand due to rapid industrialization, urbanization, and unreliable power grids. The Asia-Pacific region, led by India and China, is projected to dominate the emergency generator sets market, with a CAGR of 9.3% through 2030, fuelled by power outages and infrastructure growth. Africa, especially West and East Africa, faces a grid shortfall, making diesel MSLG sets critical for industrial and mining applications. Powerica received order for 2x5.227 MW MSLG for prestigious and world's largest Fertiliser Plant being set up in western Australia.

4. Financial Benchmarking

Exhibit 4.1: Revenue from the operation of key competitors, value (in INR Crores), Revenue from Operations (Generator Business in INR Crores), Revenue from Operations (Wind Business in INR Crores), FY2022 – FY2025

Competitors	Revenue from Operations (INR Cr.)				Total Income (INR Cr.)				Revenue from Operations (Generator Business, INR Cr.)				Revenue from Operations Wind Business INR Cr.)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Powerica	NA	2,378.26	2,210.00	2,653.27	NA	2,422.42	2,356.77	2,710.93	NA	1,968.87	1,907.20	2,255.19	NA	409.39	302.80	398.08
Jackson and co	2041.62	2095.36	2968.55	NA	2,074.40	2,115.46	3,002.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kala Gensets	215.93	304.31	NA	NA	216.34	304.38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sterling Generators	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DPK Engineers	15.85	24.55	39.99	NA	16.43	24.72	40.23	NA	NA	NA	NA	NA	NA	NA	NA	NA
Supernova Gensets	244.38	472.06	511.71	NA	246.21	474.99	515.57	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ojus power	117.55	144.48	173.27	NA	118.04	144.83	173.79	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfect House	193.81	207.79	370.62	NA	209.03	210.26	377.93	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.2: Revenue from the operation of key players, value (in INR Crores), Revenue from Operations (Generator Business in INR Crores), Revenue from Operations (Wind Business in INR Crores), of engine manufacturers, FY2022 – FY2025

Engine Manufacturers	Revenue from Operations (INR Cr.)				Total Income (INR Cr.)				Revenue from Operations (Generator Business, INR Cr.)				Revenue from Operations Wind Business INR Cr.)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Kirloskar Oil Engines ltd	4,021.98	5,023.80	5,898.32	6,349.13	4,048.71	5,049.49	5,926.96	6,395.71	NA	NA	NA	NA	NA	NA	NA	NA
Cummins India ltd	6,170.92	7,772.09	9,000.20	10,390.69	6,414.11	8,080.24	9,378.27	10,837.61	NA	NA	NA	NA	NA	NA	NA	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.3: % Generator business revenue of revenue from operations, % Wind business revenue of revenue from operations, EBITDA from Generator Business (INR Crores), EBITDA from Wind Business (INR Crores), FY2022 – FY2025

Competitors	% Generator business revenue of revenue from operations				% Wind business revenue of revenue from operations				EBITDA from Generator Business (INR Cr.)				EBITDA from Wind Business (INR Cr.)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Powerica	NA	82.79%	86.30%	85.00%	NA	17.21%	13.70%	15.00%	NA	204.88	245.37	188.31	NA	163.54	142.55	163.57
Jackson and co	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kala Gensets	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sterling Generators	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DPK Engineers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Supernova Gensets	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ojus power	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfect House	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.4: % Generator business revenue of revenue from operations, % Wind business revenue of revenue from operations, EBITDA from Generator Business (INR Crores), EBITDA from Wind Business (INR Crores) of engine manufacturers, FY2022 – FY2025

Engine Manufacturers	% Generator business revenue of revenue from operations				% Wind business revenue of revenue from operations				EBITDA from Generator Business (INR Cr.)				EBITDA from Wind Business (INR Cr.)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Kirloskar Oil Engines ltd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cummins India ltd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.5: Renewables business- % of total revenue from ops, EBITDA (in INR Crores), EBITDA Margin (in %), PAT (in INR Crores), FY2022 – FY2025

Competitors	Renewable business- % of total revenue from ops.				EBITDA (INR Cr.)				EBITDA Margin (%)				PAT (INR Cr.)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Powerica	NA	17.21%	13.70%	15.00%	NA	333.21	362.45	345.66	NA	14.01%	16.40%	13.03%	0.00	106.45	226.11	175.83
Jackson and co	NA	NA	NA	NA	82.42	103.23	165.06	NA	4.04%	4.93%	5.56%	NA	74.72	73.71	119.39	NA
Kala Gensets	NA	NA	NA	NA	12.01	18.21	NA	NA	5.56%	5.99%	NA	NA	7.28	10.76	NA	NA
Sterling Generators	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DPK Engineers	NA	NA	NA	NA	-2.99	-1.88	3.52	NA	-18.86%	-7.67%	8.79%	NA	-4.37	-2.85	2.43	NA
Supernova Gensets	NA	NA	NA	NA	4.56	11.44	15.42	NA	1.86%	2.42%	3.01%	NA	1.68	6.96	10.06	NA
Ojus power	NA	NA	NA	NA	3.04	5.27	6.52	NA	2.59%	3.65%	3.76%	NA	0.33	2.24	1.79	NA
Perfect House	NA	NA	NA	NA	11.05	11.78	33.68	NA	5.70%	5.67%	9.09%	NA	18.02	7.27	27.70	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.6: Renewables business- % of total revenue from ops, EBITDA (in INR Crores), EBITDA Margin (in %), PAT (in INR Crores), of engine manufacturers, FY2022 – FY2025

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Engine Manufacturers	Renewable business- % of total revenue from ops.				EBITDA (INR Cr.)				EBITDA Margin (%)				PAT (INR Cr.)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Kirloskar Oil Engines ltd	NA	NA	NA	NA	412.67	737.79	1,029.57	1,191.67	10.26%	14.69%	17.46%	18.77%	170.87	331.65	439.70	475.82
Cummins India ltd	NA	NA	NA	NA	979.21	1,455.72	2,014.82	2,346.81	15.87%	18.73%	22.39%	22.59%	933.74	1,228.15	1,720.58	1,999.94

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

EBITDA = PBT + (Finance Cost + Depreciation + Amortization) – Other Income - Exceptional items; EBITDA Margin: EBITDA / (Revenue from Operations)

Exhibit 4.7: PAT Margin (in %), RoCE (in %), RoE (in %), Trade Receivables (in days), FY2022 – FY2025

Competitors	PAT Margin (%)				RoCE (%)				RoE (%)				Trade Receivables (in days)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Powerica	NA	4.39%	9.59%	6.49%	NA	58.11%	43.47%	27.02%	NA	13.40%	26.50%	17.53%	NA	40	53	55
Jackson and co	3.60%	3.48%	3.98%	NA	15.20%	20.17%	35.40%	NA	9.00%	8.15%	11.94%	NA	151	118	120	NA
Kala Gensets	3.36%	3.54%	NA	NA	12.68%	17.58%	NA	NA	11.94%	15.38%	NA	NA	48	54	NA	NA
Sterling Generators	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DPK Engineers	-26.62%	-11.52%	6.03%	NA	-18.74%	-15.03%	15.73%	NA	-37.31%	-35.10%	30.72%	NA	06	05	24	NA
Supernova Gensets	0.68%	1.47%	1.95%	NA	8.92%	24.90%	36.16%	NA	4.26%	15.03%	17.55%	NA	55	63	57	NA
Ojus power	0.28%	1.55%	1.03%	NA	10.04%	25.42%	23.49%	NA	3.31%	19.92%	13.50%	NA	10	14	19	NA
Perfect House	8.62%	3.46%	7.33%	NA	26.79%	9.98%	30.62%	NA	18.53%	6.61%	21.74%	NA	31	44	32	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.8: PAT Margin (in %), RoCE (in %), RoE (in %), Trade Receivables (in days), of engine manufacturers, FY2022 – FY2025

Engine Manufacturers	PAT Margin (%)				RoCE (%)				RoE (%)				Trade Receivables (in days)			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Kirloskar Oil Engines ltd	4.22%	6.57%	7.42%	7.44%	20.96%	16.64%	17.85%	16.67%	8.21%	15.13%	17.72%	16.65%	43	38	38	40
Cummins India ltd	14.56%	15.20%	18.35%	18.45%	54.87%	38.19%	50.45%	56.34%	18.15%	22.53%	27.82%	28.22%	74	75	85	80

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

PAT Margin = PAT / Total Income; ROCE = [(PBT + Finance cost)/ Capital Employed] where Capital Employed = Total Equity + Long term borrowing + Short term borrowing + Deferred Tax Liability (net); ROE = PAT / (Average Total Equity); Trade Receivables (in days) = (Average Trade Receivables/Revenue from Operations)*365

Exhibit 4.9: Trade Payables (in days), Inventory (in Days), Net debt/Equity, Net debt/EBITDA, FY2022 - FY2025

Competitors	Trade Payables (in days)				Inventory (in days)				Net Debt/Equity				Net Debt/ EBITDA			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Powerica	NA	36	50	36	NA	31	45	28	NA	0.31	0.16	0.24	NA	0.74	0.40	0.75
Jackson and co	113	97	107	NA	30	41	40	NA	0.05	-0.04	-0.11	NA	0.52	-0.40	-0.70	NA
Kala gensets	15	13	NA	NA	29	12	NA	NA	0.42	0.35	NA	NA	2.24	1.45	NA	NA
Sterling Generators	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DPK Engineers	108	157	210	NA	132	142	227	NA	0.68	1.48	1.54	NA	-2.18	-5.27	4.00	NA
Supernova gensets	78	94	81	NA	80	66	55	NA	0.43	-0.18	-0.17	NA	3.78	-0.83	-0.70	NA
Ojus power	35	31	50	NA	54	37	52	NA	0.66	0.14	1.08	NA	2.20	0.34	2.36	NA
Perfect house	36	56	42	NA	69	101	67	NA	-0.09	0.00	-0.10	NA	-0.88	0.02	-0.43	NA

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Exhibit 4.10: Trade Payables (in days), Inventory (in Days), Net debt/Equity, Net debt/EBITDA of engine manufacturers, FY2022 - FY2025

Engine Manufacturers	Trade Payables (in days)				Inventory (in days)				Net Debt/Equity				Net Debt/ EBITDA			
	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025	FY2022	FY2023	FY2024	FY2025
Kirloskar Oil Engines ltd	52	49	49	41	35	40	40	34	0.86	1.28	1.36	1.56	4.32	3.98	3.52	4.00
Cummins India ltd	59	54	57	55	44	42	39	35	-0.20	-0.18	-0.21	-0.33	-1.05	-0.71	-0.70	-1.07

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

Trade Payables (in days) = (Average Trade Payables/Revenue from Operations)*365; Inventory (in days) = (Average Inventory/Revenue from Operations)*365; Net debt/Equity: (Long term borrowing + Short term borrowing – Cash and cash equivalents – Other Bank balances) / Total Equity; Net debt/EBITDA: (Long term borrowing + Short term borrowing – Cash and cash equivalents – Other Bank balances) / EBITDA. (In Net debt/Equity and Net debt/EBITDA calculations, negative values indicate positive cash position).

Potential threats/risks to the DG businesses:

1. **Performance of Core End-User Segments (Slowdown / Boom)**
    - Real Estate: Sector activity - new commercial and residential project launches, sectoral performance, new investments etc. are likely to impact the DG procurement, which typically serves building backup loads.
    - Industrial Activity: Contraction in manufacturing output (notably in textiles, auto ancillaries, and heavy engineering) is likely to impact demand for DGs used for process continuity and machine operations.
    - Infrastructure & Construction: Slower rollout of infrastructure projects, particularly in roads, smart cities, and warehousing, can impact offtake of DGs for temporary power setups at sites.

2. **Emergence of Alternative Technologies**
    - Battery Energy Storage Systems (BESS): Rapid adoption in urban commercial buildings and IT parks, where power backup needs are predictable. BESS offers silent operation, zero emissions, and is often paired with rooftop solar is likely to impact demand for DGs.
    - Despite these threats, the DG industry is evolving through technological innovation (e.g., Bladon's microturbine jet DGs), hybrid integration, and resilient demand in mission-critical sectors like data centres, telecom, and infra.
3. **Stricter Emission Regulations:**

The introduction of more stringent emission norms is likely to increase compliance costs, lead to design modifications, and lengthen development cycles for OEMs. For end users, especially in cost-sensitive sectors, this could result in delayed purchase decisions or re-evaluation of backup power strategies. However, the shift towards advanced DG technologies, ensuring their continued relevance in sectors where reliability and high-power density remain non-negotiable.