2019

SCI MULTICLIENTSTUDIES

ELECTRIC LOCOMOTIVES – GLOBAL MARKET TRENDS

Forecast, Fleet, Suppliers, Procurement Projects

ELECTRIC LOCOMOTIVES – GLOBAL MARKET TRENDS
Forecast, Fleet, Suppliers, Procurement Projects

Available in English from 08th August 2019.
Now you can also purchase the ***data annex in Excel format*** *(see overview data sheets on page no. 5 for more information).*

Based on current developments in rail transport, this study, entitled "Electric Locomotives – Global Market Trends", delivers an analysis and sound estimate of the market for electric locomotives. Based on the successful preceding study from 2014 and experience from more than 2 500 projects in the field of railway technology, in the past few years SCI Verkehr has verified the central input data and optimised its forecasting methodology. We have reviewed and updated all chapters of the preceding study. In addition, SCI Verkehr has performed an improved product segmentation for valuation of installed bases and age structures.

In concrete terms, this MultiClient market study on electric locomotives includes:

- Regionally differentiated look to the worldwide market for electric locomotives including an in-depth analysis of important national markets
- Comprehensive analysis of the current fleet concerning operational purposes, quantities and age structures as well as future procurement potential up to 2023
- Overview of the most important drivers behind procurement and refurbishment
- Analysis of market shares of manufacturers as well as a forecast of new procurement and after-sales volumes (in EUR) for each region up to 2023
- Overview of electric locomotive manufacturers including a brief description of their current range of products and services
- A condensed presentation of the most important current and planned procurement as well as modernization projects of the market region
- A list vehicle fleets and the current electric locomotive deliveries devided by market regions in the annexe to the study

Explore our additional offer of the data annex in Excel format

- All in this study displayed figures and graphs concerning markets, installed bases and deliveries are transparently and comprehensively available
- Apply the data sets for an individual evaluation and configuration or to access and supplement available market data

All in all, the study provides a well-founded analysis of the worldwide market for electric locomotives. The study therefore provides both companies established in the railway industry as well as active and potential operators with important information for operational and strategic planning.

SCI Verkehr is an independent consultancy company for the mobility sector with activities around the world. We specialise in strategic advice to the railway and logistics industry. We have established an international network of professional experts. Our activities focus on companies in the transport and rail industry and in the transport operation, logistics and financial sectors, as well as the transport and economics departments at national, regional and municipal levels.

Your contact:

SCI Verkehr GmbH
Tel: +49 221 93178 20
Fax: +49 221 93178 78
E-mail: sales@sci.de

CONTENTS

DATA ANNEX IN EXCEL FORMAT (ADDITIONAL OFFER)

DATA SHEETS OVERVIEW

1 Market Overview

1.1 World Market Overview

1.2 Network length

1.3 Transport Performance

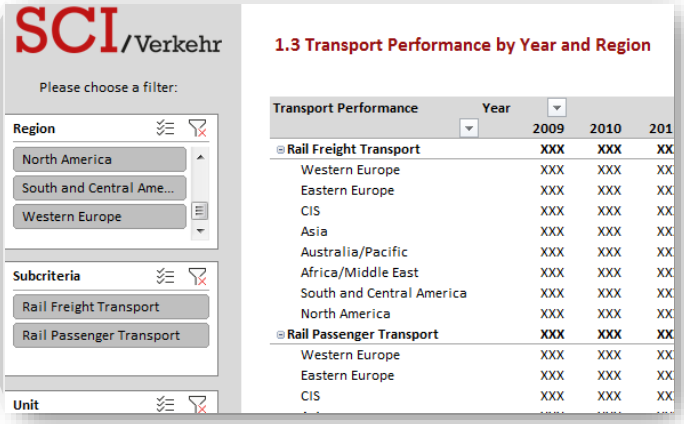
1.4 Market Volume

1,5 World Market Overview (Data)

1,6 Network length (Data)

1.7 Transport Performance (Data)

1.8 Market Volume (Data)



2 Installed Base

2.1 Installed Base Overview

2.2 Installed Base Operator/ Country

2.3 Installed Base Age

2.4 Installed Base Power

2.5 Installed Base Overview (Data)

2.6 Installed Base Operator (Data)

2.7 Installed Base Age (Data)

2.8 Installed Base Power (Data)

Product Subsegment	Subcriteria	Unit	Year	Value
Total	< 3.0 MW	Unit	2018	XXX
Total	< 3.0 MW	Unit	2018	XXX
Total	5.0 - 7.9 MW	Unit	2018	XXX
Total	5.0 - 7.9 MW	Unit	2018	XXX
Total	3.0 - 3.9 MW	Unit	2018	XXX
Total	5.0 - 7.9 MW	Unit	2018	XXX
Total	5.0 - 7.9 MW	Unit	2018	XXX
Total	< 3.0 MW	Unit	2018	XXX
Total	3.0 - 3.9 MW	Unit	2018	XXX
Total	4.0 - 4.9 MW	Unit	2018	XXX
Total	5.0 - 7.9 MW	Unit	2018	XXX
Total	4.0 - 4.9 MW	Unit	2018	XXX
Total	5.0 - 7.9 MW	Unit	2018	XXX
Total	< 3.0 MW	Unit	2018	XXX
Total	3.0 - 3.9 MW	Unit	2018	XXX
Total	4.0 - 4.9 MW	Unit	2018	XXX

3 Deliveries

3.1 Deliveries Segment

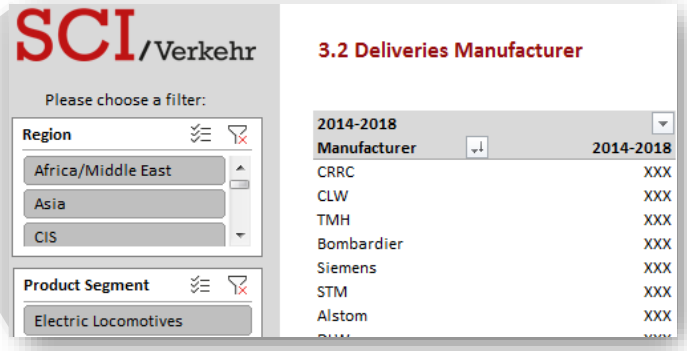
3.2 Deliveries Manufacturer

3.3 Deliveries Power

3.4 Deliveries Segment (Data)

3.5 Deliveries Manufacturer (Data)

3.6 Deliveries Power (Data)



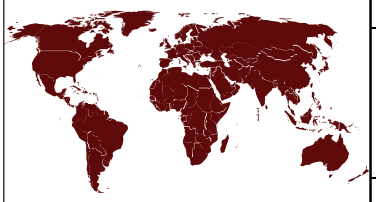
4 Additional Tables

4.1 Project Overview (Data)

4.2 Additional Figures

1 Executive Summary: The World Market for Electric Locomotives

1.1 Market Overview

World			E-Locomotives	Trend
	Installed base	Units 2018	XXX	↑
		Average development 2018-2023 (p.a.)	1.7%	
		Average age 2018 (in years)	23	
	Market for new vehicles	Average volume 2017-2019 (EUR million p.a.)	XXX	↘
		Average development 2018-2023 (p.a.)	-0.9%	
		Average volume 2022-2024 (EUR million p.a.)	XXX	
	Market for after sales	Average volume 2017-2018 (EUR million p.a.)	XXX	↗
		Average development 2018-2023 (p.a.)	2.8%	
		Average volume 2022-2024 (EUR million p.a.)	6 625	

↑ Boom/Strong Growth ↗ Small Growth → Stagnation ↘ Small Decrease ↓ Clear Decline

Volume: > +5%p.a.

Installed base: > +1.5%p.a. <-1.5% p.a.

Figure 1: Market overview for electric locomotives worldwide

Overall the worldwide market volume for new electric locomotives is already on a high level at EUR XX billion. Due to the high procurement announcement of China for the years 2019/2020 and the extension of manufacturing capacities in India, SCI Verkehr expects a further increasing market volume for new electric locomotives in short term.

[…]

Market Volume [EUR million]
World

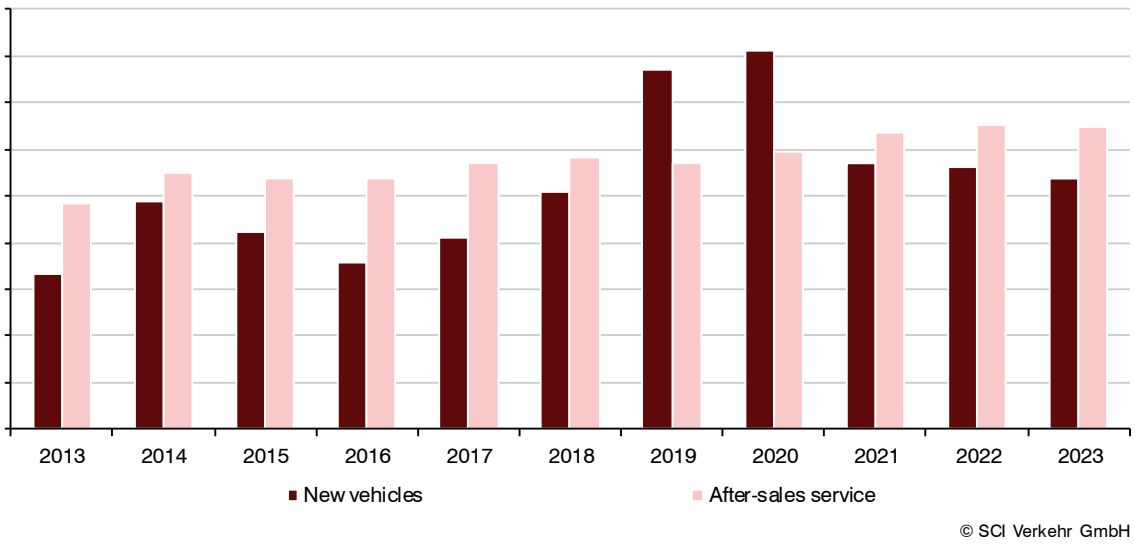


Figure 2: Market volume of new vehicles and after sales worldwide in the period 2013-2023

As the worldwide electric locomotive fleet has, in total, heavily increased from 2015 to 2018 by about XX%, the after sales market is currently also high with EUR 5.75 billion. The OEM market, as well as fleet and after sales market, are all expected to grow grow, as an increasing sensibility for emissions of the world's population is setting in and an increasing electrification degree, particularly in Asia is expected. Hence Asia is also the main driver for the expected fleet and after sales growth.

Market Environment/Transport Market

Infrastructure:

The global railway network has a length of about XX million km. Almost 30% of railway lines worldwide are electrified. The largest line network, which can be found in North America, is mainly non-electrified. Western and Eastern Europe have the highest network density and the highest degree of electrification together with Asia. While the worldwide network was relatively stable, the electrification degree increased over the last years; particularly in Asia due to large investments of China and India in the electrification of the railway network.

Region	Mainline railway network 2018 [km]	Degree of railway electrification 2018 [%]
Western Europe	XXX	59
Eastern Europe	88,000	XXX
North America	XXX	2
South/Central America	96,600	3
Asia	267,100	XXX
Africa/Middle East	XXX	15
CIS	191,400	XXX
Australia/Pacific	XXX	11
Total	**XXX**	**29**
		© SCI Verkehr GmbH

Figure 3: Length of rail networks and electrification degrees worldwide

Electric locomotives are of high importance in regions and countries with a high degree of electrification. In Western Europe, Eastern Europe, CIS and Asia, freight transport usually makes use of electric locomotives.

[…]

8 The Market for Electric Locomotives in Africa/Middle East

Market overview

Africa/Middle East			E-Locomotives	Trend
	Installed base	Units 2018	XXX	↗
		Average development 2018-2023 (p.a.)	1.0 %	
		Average age 2018 (in years)	23	
	Market for new vehicles	Average volume 2017-2019 (EUR million p.a.)	XXX	↓
		Average development 2018-2023 (p.a.)	XXX	
		Average volume 2022-2024 (EUR million p.a.)	300	
	Market for after sales	Average volume 2017-2019 (EUR million p.a.)	300	↘
		Average development 2018-2023 (p.a.)	XXX	
		Average volume 2022-2024 (EUR million p.a.)	XXX	
↑ Boom/Strong Growth ↗ Small Growth → Stagnation ↘ Small Decrease ↓ Clear Decline				
Volume:				
Installed base:				

Figure 4: Market overview electric locomotives in Africa/Middle East

The market volume for electric locomotives in the region of Africa/Middle East amounts to around EUR 590 million per year and is currently on a very high level. This is mainly caused by the extensive procurement projects of new electric locomotives by the South African rail freight company Transnet in the last years. SCI Verkehr expects that this high level of new vehicles cannot be sustained in the next years, as other markets account for significantly lower volumes. […]

Market environment/transport market

Political unrest in Northern Africa has impacted mainline passenger rail much more than other forms of rail transport. To a large extent, this can be attributed to Egypt, Africa's leading national long-distance passenger and commuter rail market. Although several national economies still face unstable socio-economic conditions, gradual economic stabilisation has taken place. Whereas stagnation rules in South Africa, the other subregions remain on a moderate growth path.

Infrastructure:

The Africa/Middle East region has the least dense railway network of all market regions. This is not only due to insufficient development but specific geographical characteristics (e.g. desert). The landscape of existing networks is rather scattered. Only Iran and South Africa feature a coherent network which covers larger parts of the national territory. As for the other countries, infrastructure has grown to either a number of large-scale routes or some small networks between industrial sites, capitals, and ports. Most international links exist between Iran and its neighbours, in the Western Maghreb, the eastern part of Sub-Saharan Africa and, above all, in Southern Africa and the Cape region. Existing rail infrastructure does not allow through services neither across Africa or the Middle East in either direction or between both parts of the region (i.e. across the Egyptian Israeli border). Even after completion of the Gulf Railway scheme (which will bring mainline railway services to Kuwait, Bahrain, Qatar and Oman) and standard-gauge access to Uganda, Rwanda and Burundi, still a dozen of countries remain without any railway infrastructure at all.

[…]

Africa/Middle East – Network length 2018		
Length of railway network [km]	Electrification degree [% of network length]	Important voltage systems
XXX	15%	3 kV DC 25 kV 50 Hz AC
		© SCI Verkehr GmbH

Figure 5: Length of rail networks and electrification degrees in Africa/Middle East

[…]

Passenger rail transport

Traditionally, mainline railways in the region are used for freight transport. So far, most passenger trains on the African railway networks are transporting commuters. However, long-distance services will add a growing contribution in this field. In recent times, efforts have been made into developing high-quality passenger rail transport on long distances as well as for commuters. […]

Africa/Middle East – passenger rail transport in 2018		
Transport performance [million pkm]	CAGR 2018-2023	Share of passenger rail transport in modal split
67,200	XXX	XX%
		© SCI Verkehr GmbH

Figure 6: Transport performance of passenger rail transport in Africa/Middle East

Rail freight transport

The main rail freight market in the region by far is South Africa, which is responsible for about two thirds of the region's rail freight performance. Road transport dominates in most countries expect South Africa, where rail has a XX% market share. The goods transported by rail reflect local economic activities. Most countries transport large amounts of mining products, such as iron ore and coal, as well as petroleum and chemicals. The modal split for rail freight transport is currently at around XX% in the region. Container transport is still at a comparatively low level in Africa but is expected to increase in the near future.

Africa/Middle East – rail freight transport in 2018		
Transport performance [million tkm]	CAGR 2018-2023	Share of rail freight transport in modal split
XXX	1.9%	22%
		© SCI Verkehr GmbH

Figure 7: Transport performance of rail freight transport in Africa/Middle East

[…]

Installed base/age structure

Around 2,500 electric locomotives are currently being operated in Africa and the Middle East. The total installed base has significantly increased in the last years based on comprehensive procurement projects, notably in South Africa. The South African fleet is primarily used for freight mainline services. Yet the low degree of electrification of the lines often makes the use of diesel traction unavoidable.

[…]

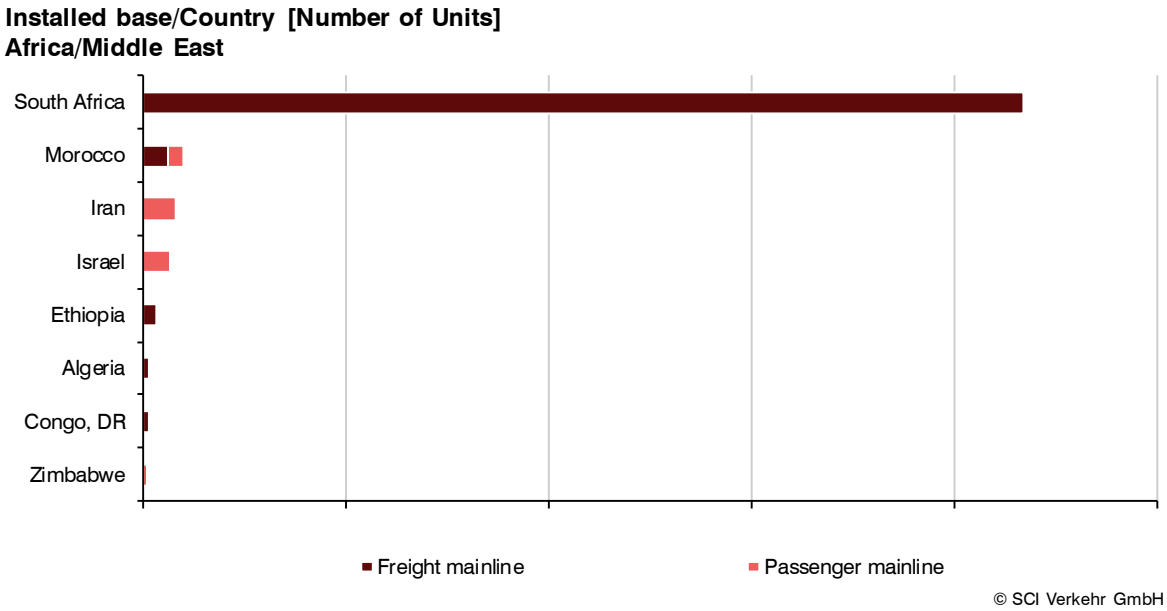


Figure 8: Installed base overview for electric locomotives Africa/Middle East in 2018 by country (number of locomotives)

Most of the electric locomotives are operated in rail freight transport, with only a few exclusively operated in passenger transport. In freight transport, the locomotives are mainly used in mainline operation to pull ore and coal trains. About one third of them can be considered as heavy mainline locomotives.

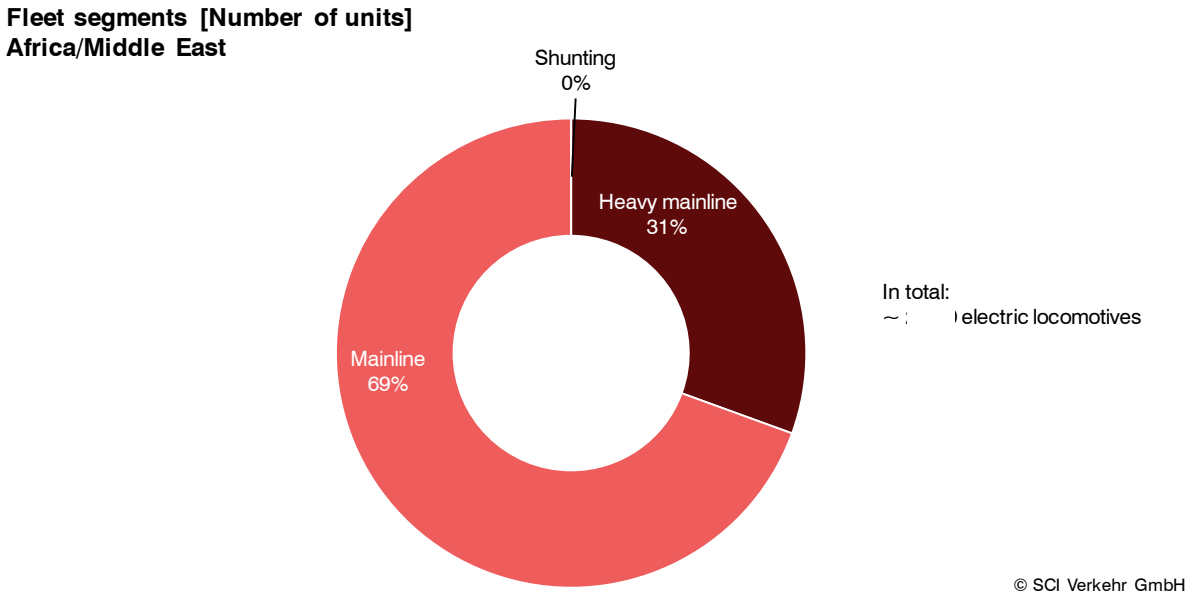


Figure 9: Operational area for electric locomotives in Africa/Middle East (number of locomotives)

For the main part of the currently installed fleets, the vehicles have been either procured until 1985 or from 2010 until today. Hence, the replacement process of old rolling stock has only begun and is expected to be continued in the next decade. Due to the extensive electrification projects in Africa and the Middle East, this distribution of locomotives will significantly change in the long term.

Age structure of installed base [Number of Units]
Africa/Middle East

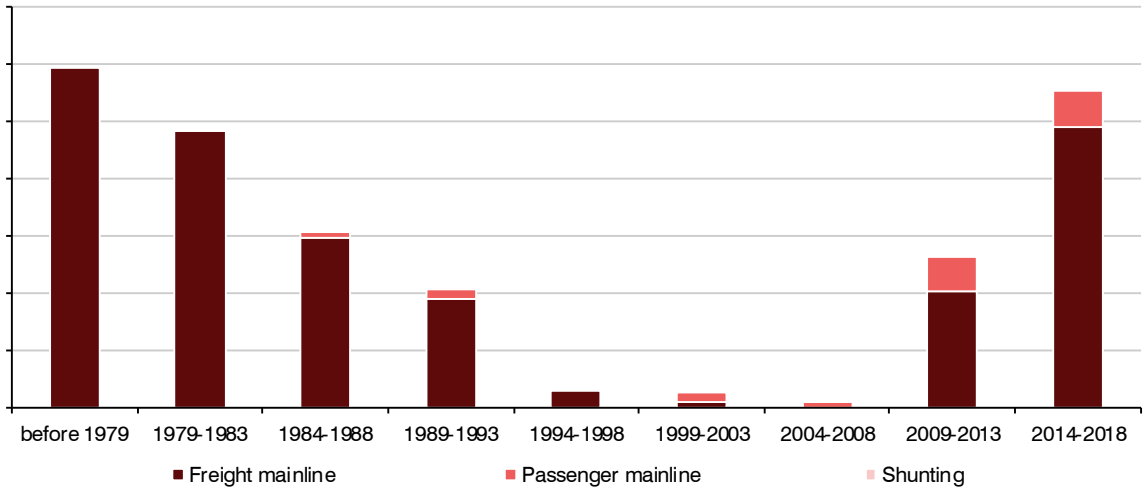


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Figure 10: Age structure of installed base in Africa/Middle East (Number of Units)

[…]

Operators/owners

More than 85% of the total fleet is operated by South African state railway Transnet. The following railway companies of Morocco (ONCF), Iran (RAI), Israel (IR) and Ethiopia (ECR) together account for about 10%, the rest is divided among smaller operators or mining companies.

Manufacturers/products/market shares

During the last five years, more than two thirds of the delivered electric locomotives has been built by Chinese manufacturer CRRC. […]

Delivery/Market shares 2014 - 2018 [Number of Units]
Africa/Middle East

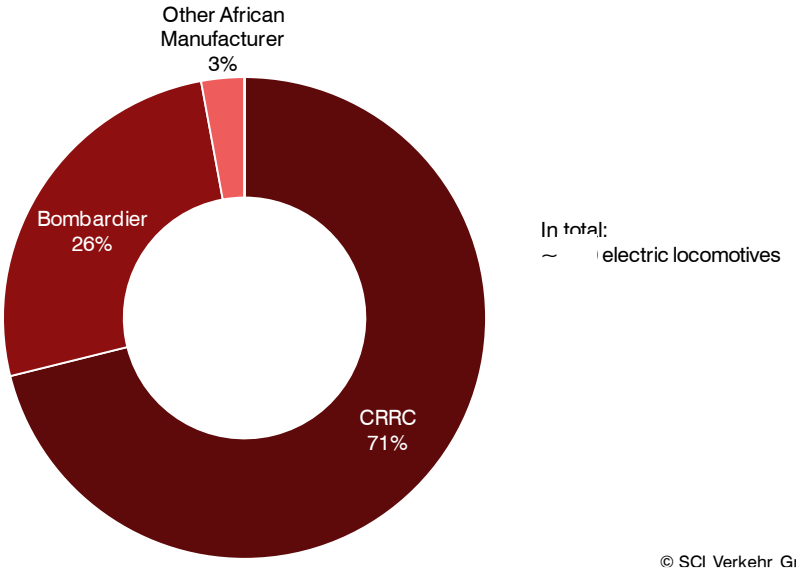

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Figure 11: Market shares for electric locomotives in Africa/Middle East in the period 2014–2018 (number of locomotives)

[…]

The most important modern locomotives ordered in the last few years are the following series:

- The Transnet Freight Rail **Class 19E** is a four-axle, multi-system 3 kV DC and 25 kV AC electric locomotive with a continuous power output of 3,000 kW. It was manufactured in a joint venture including Mitsui, Toshiba, UCW and DCD. The Class 19E was the first AC locomotive in South Africa to incorporate regenerative as well as rheostatic electric braking. They were placed in service on the Coallink line from Ermelo to Richards Bay and relieved some Class 7E, 7E1 and 7E3 electric locomotives on the Coallink line for use elsewhere.
- The Transnet Freight Rail **Class 20E** is a four-axle, multi-system 3 kV DC and 25 kV AC electric locomotive with a power output of 3,000 kW built by Chines CSR Zhuzhou. The locomotive body is a welded monocoque design, constructed of steel plates and profiled members. The Class 20E is equipped with a wireless data transmission system, which can send the locomotive operation status, fault data and energy consumption data via GSM and Wi-Fi to a trackside station for analysis.
- […]

Market volume and market development

Drivers of procurements	Brief description	Relevance	Trend
Infrastructure	– Electrification strategies remain predominantly limited to major corridors and regional networks. The only exemptions so far are Algeria and Ethiopia. – Since access to crude oil at low prices is relatively easy in the regions, most operators prefer waiving additional investment for electrification.	▪▪▪▫	➔
…	– …	▪▪▪▪	↗

Relevance for procurements: ▪▪▪▪ = very high, ▪▪▪▫ = high, ▪▪▫▫ = medium, ▪▫▫▫ = low, ▫▫▫▫ = none
5-year trend: ↑ = strongly increasing, ↗ = increasing, ➔ = constant, ↘ = decreasing ↓ = strongly decreasing

Figure 12: Drivers of procurement in Africa/Middle East

As the current market volume is high due to Transnet's procurements, SCI Verkehr expects a distinct slowdown in the next years, at least from 2020 on. […]

Market Volume [EUR million]
Africa/Middle East

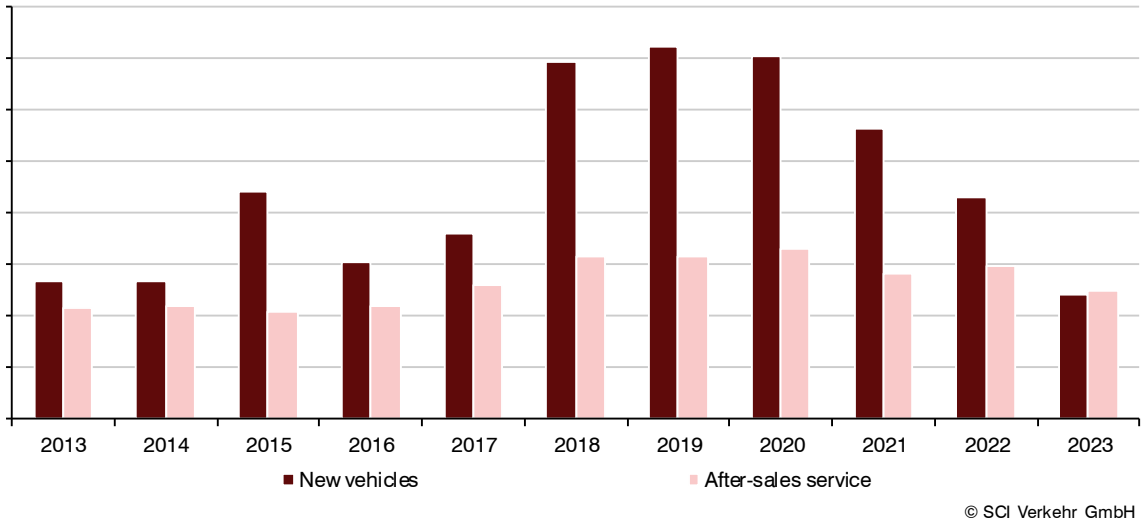

Figure 13: Market volume of new vehicles and after sales Africa/Middle East in the period 2013–2023

[…]

Important current and planned procurement projects

Country	Vehicle type	Units	Power [kW]	Delivery	Remarks
Israel	Traxx AC	62 (+32)	5 600	2017-2019	In September 2015, Bombardier Transportation signed a contract to provide 62 Traxx AC locomotives to Israel Railways (IR). The first unit arrived in August 2017; the remaining deliveries will be completed in 2019. Based on the list price, the order is valued at approximately EUR 230 million (USD 262 million). The contract also includes an option for an additional 32 locomotives. IR will use the locomotives primarily in passenger transport for push-pull services on the Tel Aviv – Jerusalem line.
Morocco	Prima M4	30	5 500	2019-2021	In February 2018, Alstom has been awarded a contract with ONCF for the supply of 30 electric Prima locomotives. The contract – which is the result of an international tender launched by ONCF in March 2017 – is worth around EUR 130 million. While the 30 locomotives will be manufactured in Alstom's Belfort plant, the Alstom team in Morocco will ensure after sales services and maintenance.

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Figure 14: Important current and planned procurement projects in Africa/Middle East (without countries considered in detail)

8.1 South Africa

Market environment/transport market

Electric locomotives in South Africa are only operated in rail freight transport. Transport services are mainly performed for transportation of raw materials from the mines to the ports. The modal split for rail freight transport is around 30%. The modal split of rail passenger transport is around 5%, however no electric locomotives are operated for passenger services in South Africa.

All major cities are connected by rail, and South Africa's railway system is the most highly developed in Africa. Transnet Freight Rail (TFR) is the South African state-owned rail transport company, formerly known as Spoornet. It is the largest freight hauler in Africa. South Africa has also opened the door to private rail operators, with Transnet calling for expressions of interest from private sector companies to operate branch railway lines or feeder lines.

[…]

Installed base/age structure

Currently, the total locomotive fleet in South Africa consists of approx. XXX locomotives. With around XXX units, the electric locomotive fleet accounts for around 56% of the total fleet. With most of the locomotives procured between the 1960s and 1980s, but also a significant amount during the last 10 years, the average age of electric locomotives is rather high at about 23 years. Especially mainline DC locomotives with an age of about 40 years account for the high average number. […]

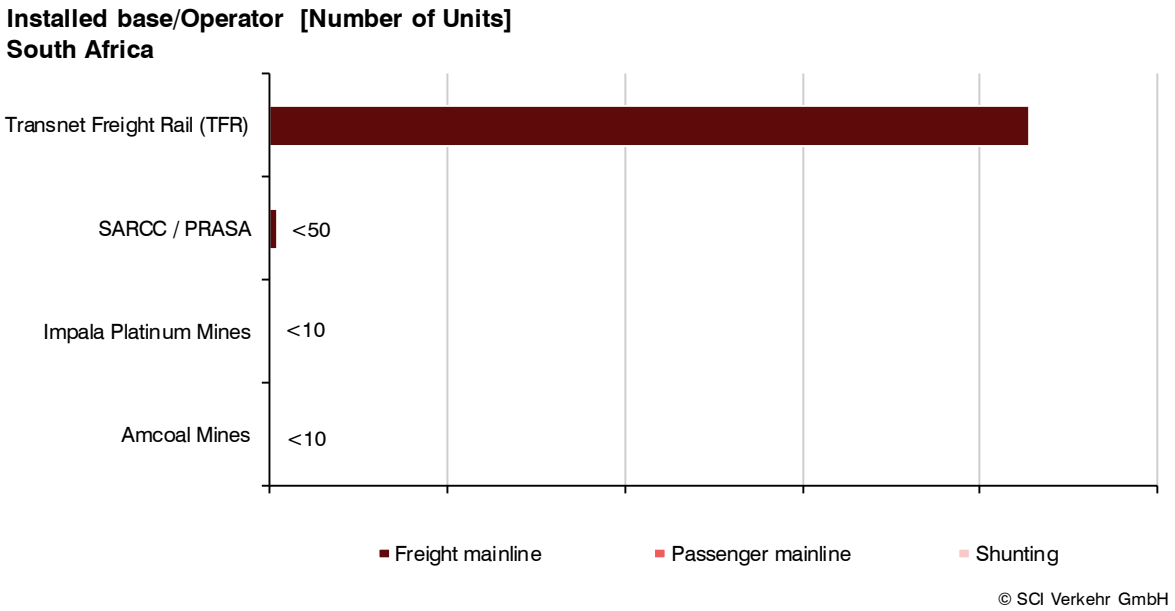


Figure 15: Electric locomotive fleet per operator in South Africa

[…]

Important current and planned procurement projects

Vehicle type	Units	Power [kW]	Delivery	Remarks
21E / CRRC	~100	3,000	2014-2015	In March 2014, Transnet ordered 100 Class 21E multi-system locomotives from former CSR Zhuzhou. In the same year, the first locomotives have been rolled out. They are placed in service on the 25 kV AC Coallink line between Ermelo and the Richards Bay Coal Terminal. About 60% of the units have been manufactured locally in South Africa.
…	…	…	…	…

© SCI Verkehr GmbH

Figure 16: Important current and planned procurement projects in South Africa

All current and planned procurement projects are part of Transnet's biggest ever order of locomotives from March 2014 of a total of 1,064 units. This order is worth about SAR 50 billion (approx. USD 4.7 billion) and has been signed with with four international suppliers. Bombardier and CRRC have been selected fot the supply of electric locomotives. In line with South Africa's intention to develop its manufacturing capacities, local production is done in cooperation with Transnet's Engineering plants in Koedoespoort, Pretoria and Durban. Transnet further plans to increase its own production capacity as well as those of suppliers and manufacturers in the country in order to improve the South African position in the global market for rolling stock production.

On 25th August 2016, Bombardier Transportation has opened its new 6,000 m² production site and headquarters in Johannesburg. The facility produces the company's Mitrac high-power propulsion equipment for use in Transnet's Traxx Africa locomotive project. The site, which is the first of its kind in Africa, is also home to a testing centre for high-power traction converters and electrical cubicles and will become the headquarters for Bombardier Transportation in South Africa starting in October 2016. The traction transformers are delivered by ABB, which won an order worth around EUR 44 million from Bombardier for the supply of the components.

Important current and planned modernization projects

Vehicle type	Units	Operation	Period	Remarks
18E	7	Static converter replacement	2014-2015	In 2014, Strukton Rolling Stock delivered new static converters for Transnet's Class 18E locomotives. The static converters replaced the current motor alternators which were suffering from high maintenance costs and obsolescence issues. The contract consists of deliveries for a first set of seven locomotives with options for more deliveries.

Figure 17: Important current and planned modernisation projects in South Africa

More generally, the South African Parliament announced the start an extensive modernisation programme of both fleet and infrastructure in October 2017. This includes the refurbishment of the existing fleet, depot modernisation and the signalling renewal programme in Gauteng, KwaZulu-Natal and the Western Cape regions. These initiatives are seen as correctives for years of under-investment in the railway system in South Africa. However, no concrete measures have been observed for the electric locomotive segment so far.

Market volume and market development

As the South African market is decisively shaping the continent's development, the market outlook is similar to those of Africa in general. In South Africa, an increase of volumes until 2020 is expected due to further deliveries as part of Transnet's large frame contracts. From 2020 on, a distinct slowdown is expected, as there are no further large orders of this extent. For the continued operation of many older locomotives in the fleet, comprehensive after-sales services will be necessary.

[…]

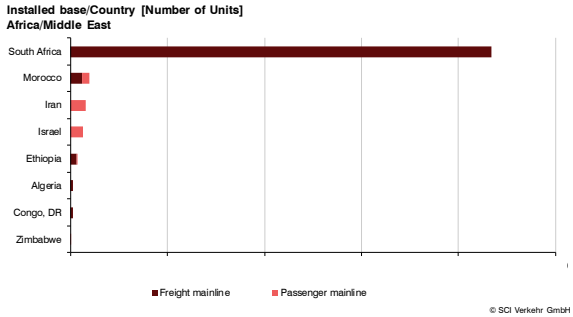
1 Annex: Fleet structures

[…]

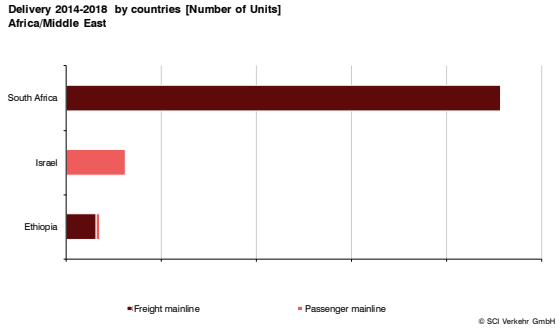
1.7 Africa/Middle East

Overview

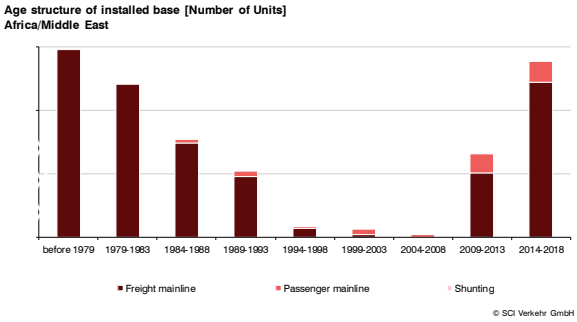
Installed Base / Country



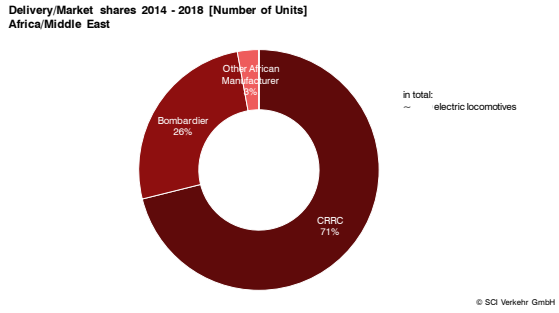
Delivery 2014 – 2018 / Country



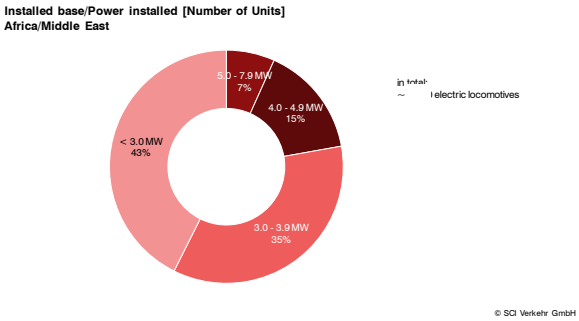
Installed Base / Age distribution



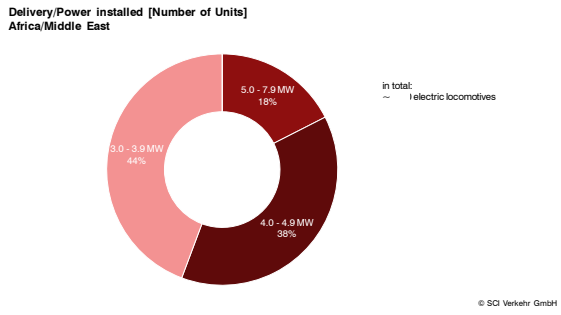
Delivery 2014 – 2018 / Market Shares



Installed Base / Power installed



Delivery 2014 – 2018 / Power installed



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Bestellung MultiClient Studie

Electric Locomotives - Global Market Trends 2019

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Büro Köln

Vor den Siebenburgen 2
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SCI/Verkehr

Büro Hamburg
SCI Verkehr GmbH
Schanzenstraße 117
20357 Hamburg
Tel.: 49 (0) 40 5071970
Fax: 49 (0) 40 50719720

Büro Köln
SCI Verkehr GmbH
Vor den Siebenburgen 2
50676 Köln
Tel.: 49 (0) 221 931780
Fax: 49 (0) 221 9317878

Büro Berlin
SCI Verkehr GmbH
Wilhelmine-Gemberg-Weg 6
Eingang I
10179 Berlin
Tel.: 49 (0) 30 2844540
Fax: 49 (0) 30 28445420

E-Mail: info@sci.de
www.sci.de

Impressum: