

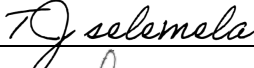



ANNEXURE A

SPECIFICATION

TECHNOLOGY MANAGEMENT SPECIFICATION

REQUEST FOR INFORMATION (RFI)

RENEWABLE ENERGY POWER PURCHASE PROGRAMME FOR TRACTION LOADS

Author:	Engineer Technology Management	T. Selemela	
Author:	Act. Snr Engineer Rail Network	T. Chetty	
Author:	Engineer Rail Network	Z. Mokhobo	
Approved & Authorised:	Principal Engineer Technology Management	K. Motupa	

Date: 14 October 2022

Circulation Restricted To:

Transnet and Relevant Third Parties

"I acknowledge that this document contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By accessing/using this document, I consent to the processing of personal information in accordance with the requirements of the Act. Personal information contained herein will only be used for purposes of this document."

© This document as a whole is protected by copyright. The information herein is the sole property of Transnet SOC Ltd. It may not be used, disclosed or reproduced in part or in whole in any manner whatsoever, except with the written permission of and in a manner permitted by the proprietors.

Table of Contents

1.0	SCOPE	3
2.0	OBJECTIVE OF THE RFI	3
3.0	BACKGROUND	4
4.0	DEFINITIONS	6
5.0	ABBREVIATION AND ACRONYMS.....	7
6.0	NORMATIVE REFERENCES	7
6.1	SANS STANDARD:.....	7
6.2	TRANSNET PUBLICATIONS:.....	7
7.0	SERVICE CONDITIONS	8
7.1	ENVIRONMENTAL CONDITIONS	8
7.2	MECHANICAL SERVICE CONDITIONS.....	8
7.3	ELECTRICAL SERVICE CONDITIONS	8
8.0	SUBSTATIONS GEOGRAPHICAL LOCATION	10
9.0	TECHNOLOGY COMPATIBILITY	10
10.0	TFR POWER DEMAND AND ENERGY CONSUMPTION	10
11.0	INFORMATION TO BE PROVIDED BY RFI RESPONDENTS.....	12
11.1	GENERAL	12
11.2	INFORMATION ON RESPONDENT'S RENEWABLE PROJECTS EXPERIENCE	12
11.3	INFORMATION ON PROPOSED PROJECT.....	13
11.4	INFORMATION RELEVANT TO TFR'S REPPP RFP	15
11.5	INFORMATION RELEVANT TO THE PROPOSED PROJECT POWER PURCHASE AGREEMENT	15
11.6	INFORMATION RELEVANT TO PROPOSED PROJECT FINANCING	16
	APPENDIX A: TYPICAL LOAD PROFILES FOR DIFFERENT ELECTRIFICATION SYSTEMS	17

LIST OF AMENDMENTS TO THE SPECIFICATION

Version No.	Date Issued	Remarks
01	30/06/2022	First publication
02	25/08/2022	Electrical Service conditions amended
		Objective of the RFI added
		TFR's traction substations power demand and energy consumption for selected corridors added
		Added information required on the proposed project, status of the project, Power Purchase Agreement, and project financing
03	01/09/2022	Joint venture project opportunity clarified
		Respondents are requested to indicate their technical capabilities
		PPA models revised
		Project models revised
		General language and grammar
04	14/10/2022	Information on the technology maturity/readiness level is requested
		Respondents are requested to indicate if they have previously undertaken renewable energy projects for traction loads
		Added demand and consumption statistics for Beaufort West to De Aar and Belville to Beaufort West
		Electrification diagram updated showing the section between Kaapmuiden to Phalaborwa non-electrified

1.0 SCOPE

- 1.1 This specification details Transnet's request for information (RFI) from the open market for the supply of alternative energy or green energy to Transnet Freight Rail's (TFR) traction power supply points. The information gathered from the RFI will be used to develop TFR's Renewable Energy Power Purchase Programme (REPPP) for traction loads.
- 1.2 This specification aims to guide industry into providing information to Transnet that will shape and form part of Transnet's short to medium term energy strategy with the focus points on sustainable energy supply, meeting carbon footprint targets, optimizing energy costs and enabling long term business sustainability within the operations of transporting commodities over rail infrastructure.
- 1.3 The main expected outcome on this RFI is to identify locations across South Africa's existing railroad infrastructure where renewable projects are taking place or are envisioned, establishing cost estimate information, technical feasibility/compatibility, Power Purchase Agreement (PPA) information, project financing information and estimated timelines for supplying energy for TFR's electrical traction loads.
- 1.4 Responses to the RFI may be localized and do not need to cover the whole country, corridor or region.

2.0 OBJECTIVE OF THE RFI

- 2.1 The objective of this RFI is to request information from the market to enable Transnet Freight Rail to procure renewable energy for TFR's traction loads across all corridors, nationwide.
- 2.2 This request for information is intended to support the investigation by Transnet on opportunities available in the market for renewable energy generation alternatives that can be implemented in the shortest lead time to commercial operation. Such opportunities to include purchasing of existing available renewable energy supply in the immediate term as well as joint development and investment projects, together with Transnet, that could provide such supply in the medium to long term.
- 2.3 It is in this context that Transnet intends to:
 - a) gain a better understanding of the renewable energy market, particularly for wind, solar and other energy sources which might be prevalent and / or relevant for the railway loads which are intermittent in nature.
 - b) gauge market appetite for commercial supply and/or investment for the TFR Renewable Energy Power Purchase Programme; and
 - c) refine the commercial assumptions for the initiative and design an appropriate procurement framework for the initiative roll-out.

3.0 BACKGROUND

- 3.1 Transnet Freight Rail is the largest operating division of Transnet. The division's primary business is to provide rail transport of commodities for the export, regional and domestic markets.
- 3.2 Transnet Freight Rail also transports a broad range of bulk general freight commodities and containerised freight. The division maintains a complex rail network of approximately 31 000 track kilometres (20 900 route kilometres) over which commodities are railed.
- 3.3 The diverse rail network comprises 1 500 kilometres heavy haul lines, and also includes 3 928 kilometres of branch lines that serve as feeders to main lines. The rail network service provides strategic links between ports, terminals and production hubs providing connectivity with Southern African railways to support regional integration. Infrastructure connectivity, coupled with close co-operation with other operating divisions and collaboration with key customers, enables the delivery of freight volumes across value chains.
- 3.4 In 2014 Transnet developed its energy policy and energy security and mitigation strategy to outline Transnet's commitment to energy security, energy efficiency and to serve as a driver to reduce its carbon footprint. One of the objectives of the policy is to promote and support the use of renewable and alternative energy sources and technologies to reduce energy cost and greenhouse gas emission. It is for this particular reason that TFR is embarking on an RFI to identify existing and envisioned renewable energy projects, as possible sources of alternative supply for traction substations.
- 3.5 The information obtained from the RFI shall be used to develop TFR's Renewable Energy Power Purchase Program.
- 3.6 TFR has decided to invite interested parties' participation, as part of its corporate strategy to introduce renewable energy into the TFR traction system. TFR both appreciates and encourages the inclusion of renewable energy proposals beyond and not limited to only popular market drivers solar and wind energy. This includes the incorporation of renewable energy sources such as or hybrids of hydroelectric power, biomass, geothermal or other and TFR would welcome alternate suggestions in this regard.
- 3.7 Energy supplies have developed over the last 10 years and with changes to legislation and new technology developments alternative energy suppliers to the state-owned entity (SOE) Eskom in South Africa have the potential to become feasible from both an economic and compatibility point of view. TFR has extensive existing rail infrastructure with the following main corridors: Ore-line Corridor (Sishen to Saldana mainly Iron ore export), North Corridor (Coal export corridor - from Lephalale to Richards Bay), North-East Corridor (Polokwane, Nelspruit, Phalaborwa, Komatipoort), Central Corridor (Botswana, Krugersdorp, JHB), Container Corridor (JHB to Durban), Cape Corridor (Hotazel to Kimberly, Bloemfontein, De Aar to PE and Cape Town). Figure 1 shows TFR's railway lines and different types of electrification systems; detailed location points may be requested by emailing the Supply Chain Services.

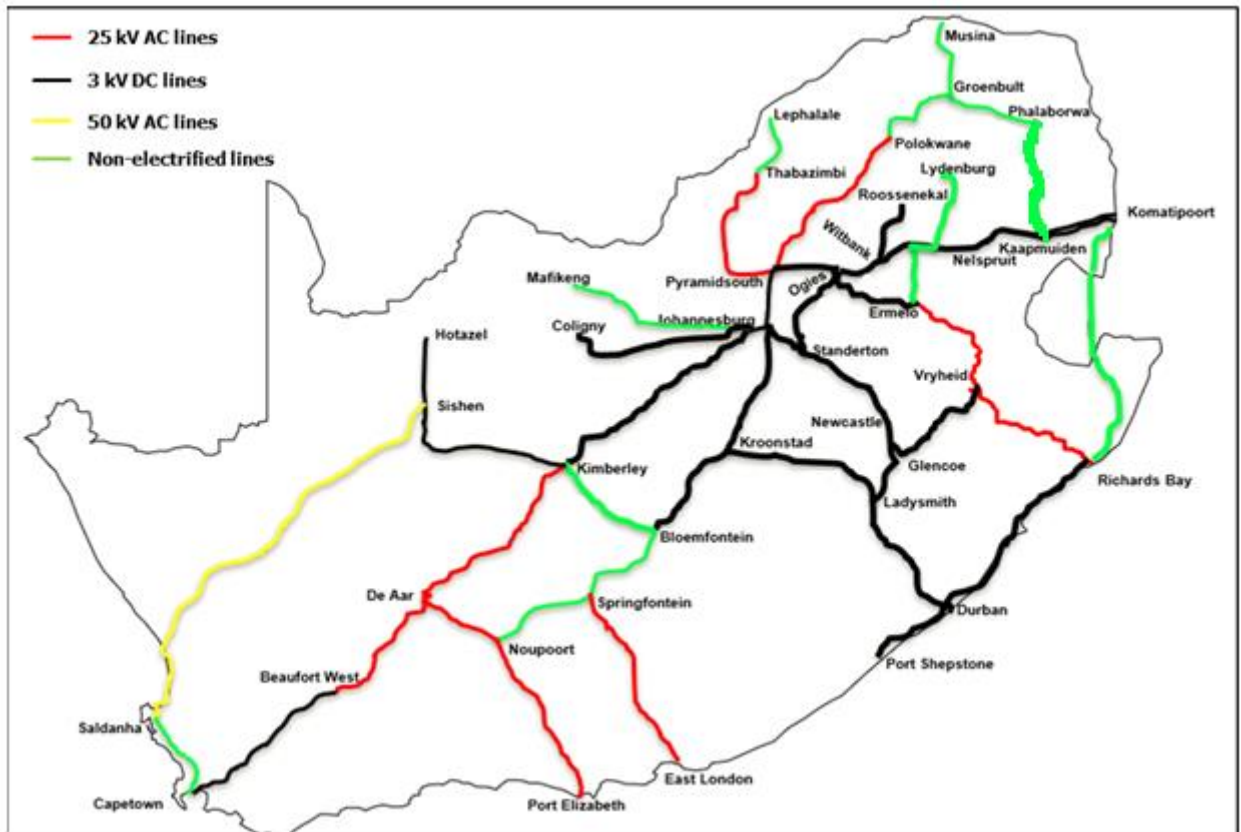


Figure 1 Transnet railway lines and electrification systems

3.8 TFR electrified railway lines utilize the following electrification configurations:

a. 50 kV AC Electrification (Sishen to Saldanha)

Each supply point (Traction Feeder Station) on the Ore Line is 180 km apart and are fed by two 40 MVA transformers that are owned and maintained by Eskom. The sections are electrically separated by neutral sections. An upgrade project is currently taking place to replace the two 40 MVA transformers with two 60 MVA transformers to feed the same 180 km sections of line. Details of where these upgrades are taking place can be requested by emailing from the Supply Chain Services.

b. 25 kV AC Electrification (Kimberly – De Aar – PE, De Aar to Beaufort West, Ermelo to Richards Bay, Thabazimbi to Pyramid,)

For 25 kV AC the point of supply varies based on the type of line and if it is supplied by a dedicated transmission line. Transnet's 20 MVA single phase traction transformer feeds 20 to 25 km sections of traction lines. The sections are electrically separated by Neutral Sections.

c. 3 kV DC Electrification (Hotazel to Kimberly, Cape Corridor, Container Corridor, Pyramid South to Ermelo, Nelspruit, Phalaborwa, Komatipoort).

As the oldest electrification type for traction, several configurations and ages of technology are in use. The traction transformer is paired to a diode rectifier unit to feed 6 to 15 km sections of traction lines. Sizing varies from 3 MW to 10 MW with double units that may be operated coupled. Each 6 to 15km feeding section is electrically isolated from the adjacent feeding sections by section insulators.

4.0 DEFINITIONS

4.1	Bid Response	All documents, whether attached or incorporated by reference, supplied by the bidder in response to an invitation to bid.
4.2	Bid	An invitation to suppliers to submit Bid offers or expressions of interest in accordance with set requirements; or A written offer in a prescribed form in response to an invitation by Transnet for the provision of Goods or Services
4.3	Commercial Operation Date	The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale.
4.4	Energy Yield	The electrical energy generated and expressed in megawatt-hours ("MWh"), delivered to the Power Delivery Point
4.5	Financial Close	The time when the project agreement and all financing and other agreements related to the project have been executed and delivered and all conditions to the effectiveness of the project agreement and project financing agreements have been satisfied
4.6	Neutral Section	Equipment on the OHTE and track magnets that electrically separates different phases. The locomotive equipment detects the track magnets and switches the locomotive off while passing through the earthed section
4.7	Regen	Regenerative braking, an operational state of a traction motor to electrically recover energy by converting kinetic energy from braking (slowing down) of an electric locomotive driven train
4.8	Respondent	A natural or juristic person or partnership (including joint ventures) who submits a completed RFI response form, together with all supporting documentation in response to an invitation to do so
4.9	RFI response	The completed response form, together with all supporting documentation
4.10	Traction Feeder Station	Traction feeder station – in the 50 kV AC environment Transnet receives the supply from Eskom at a TFS where all of the protection equipment to protect the traction transmission line is situated

5.0 ABBREVIATION AND ACRONYMS

5.1	AC	Alternating Current
5.2	BBBEE	Broad-based Black Economic Empowerment
5.3	BS	British Standards
5.4	DC	Direct Current
5.5	EPC	Engineering, Procurement and Construction
5.6	kV	Kilovolt
5.7	IEEE	Institute of Electrical and Electronics Engineers
5.8	IP	Ingress Protection
5.9	MVA	Megavolt-ampere
5.10	MW	Megawatt
5.11	MWh	Megawatt-hour
5.12	OHTE	Overhead Track Equipment
5.13	O&M	Operation and Maintenance
5.14	PPA	Power Purchase Agreement
5.15	PV	Photovoltaics
5.16	REPPP	Renewable Energy Power Purchase Programme
5.17	RFI	Request for Information
5.18	RFP	Request for Proposal
5.19	SANS	South African National Standards
5.20	SMME	Small, Medium and Micro Enterprises
5.21	TFR	Transnet Freight Rail
5.22	TFS	Traction Feeder Station

6.0 NORMATIVE REFERENCES

6.1 SANS STANDARD:

- 6.1.1 NRS 048-2 Electrical Supply – quality of supply Part 2: Voltage characteristics, compatibility levels, limits and assessment methods

6.2 TRANSNET PUBLICATIONS:

- 6.2.1 BBB5019 Requirements for traction transformers for 3 kV DC Traction Substations in accordance with BS 171 and IEC 60076-1.
- 6.2.2 BBG2415 25 kV AC Single Phase 20MVA transformer
- 6.2.3 BBH3181 Locomotive rollingstock – conformance to Quality of supply requirements

7.0 SERVICE CONDITIONS

7.1 ENVIRONMENTAL CONDITIONS

Altitude:	0 - 1800 m above sea level
Relative humidity	10% to 90%
Ambient temperature	-10° C to +55° C
Wind pressure	750 Pa (Average)
Lightning conditions	20 ground flashes/km ² per annum (Maximum)
Pollution	Heavily salt laden with industrial pollutants including diesel- electric locomotive emissions

7.2 MECHANICAL SERVICE CONDITIONS

- 7.2.1 Any technology or equipment information must state suitability to operate next to heavy haul freight rail operations. If enclosures are required IP ratings, shock and vibration standards must be provided.

7.3 ELECTRICAL SERVICE CONDITIONS

- 7.3.1 Electric power for the operating of electrified traction systems is mainly supplied by Eskom. In some areas supplies are also obtained from local municipalities.
- 7.3.2 Expected proposals are to connect on the high voltage 3 phase utility network (primary) side of the Transnet traction substations. The distribution network voltage ranges between 22 kV to 220kV for various locations.
- 7.3.3 There are three basic traction systems in use at present - 3 kV DC, and 25 and 50 kV AC.
- 7.3.4 Train signalling supplies are obtained from 6.6/11 kV distribution lines. Alternatively in the 50 kV AC and some of the 25 kV AC lines, single-phase step-down points are connected to the Overhead Track Equipment (OHTE).
- 7.3.5 The 3 kV DC traction substations are all connected to the overhead track equipment in a parallel feeding arrangement
- 7.3.6 All three phases from the utility distribution line are connected to each 3 kV DC substation on the primary side of the transformer.
- 7.3.7 In the case of AC systems, the Eskom supply is stepped down at the substation to 25 kV single phase.
- 7.3.8 In order to balance the loading on the 3-phase supply network of the AC systems, it is essential that alternate sections of the AC traction systems be supplied from different phases and that phase breaks be provided between different sections.
- 7.3.9 The Sishen - Saldanha section is electrified at 50 kV single phase and is a direct feed from the Eskom 88 kV substations.
- 7.3.10 These three systems differ from each other with respect to the method of feeding the overhead track equipment.
- 7.3.11 The outdoor earth clearance for the various system voltages is indicated below:

Table 1 Traction substation ratings

Nominal System voltage	22 kV	33 kV	66 kV	88 kV	110 kV	220 kV
Outdoor earth clearance (mm)	320	430	770	1000	1450	1850

7.3.12 The traction substation ratings for the 3 kV, 25 kV and 50 kV systems are indicated below:

Table 2 Traction substation ratings

Parameters	3 kV DC system	25 kV system	50 kV system
Continuous power rating	3MW – 6 MW	20 MVA	40MVA-60MVA
2 hour rating	-	-	1.5 x Continuous
30 minutes rating	2 x Continuous	-	2 x Continuous
2 minutes rating	-	2 x Continuous	-
1 minute rating	3 x Continuous	-	-
10 seconds rating	3.5 Continuous	-	-
Nominal output voltage	3 kV	25 kV	50 kV
Nominal continuous output current	1500 A – 2000 A	800 A	800 – 1200 A
Busbar voltage range at substation during load conditions	2.5 – 3.3 kV	23 – 27.5 kV	45 – 55 kV
Average substation spacing	6-21 km	15-30 km	160 km

7.3.13 The insulation level in accordance with SANS 1019 is indicated in Table1 for medium and high voltage electrical systems.

Table 3 Standard voltages and insulation levels

Highest phase-to-phase RMS voltage for equipment (Um)	Nominal system RMS voltage (Un)	Rated lightning impulse withstand voltage peak	Rated short duration power frequency withstand r.m.s voltage
24 kV	22 kV	150kV	50 kV
36 kV	33 kV	200 kV	70 kV
52 kV	44 kV	250 kV	95 kV
72,5 kV	66 kV	350 kV	140 kV
100 kV	88kV	380 kV	150 kV
145 kV	132 kV	550 kV	230 kV
245 kV	220 kV	850 kV	360 kV
Insulation levels for highest voltage for equipment Um < 100 kV are based on an earth fault factor equal to $\sqrt{3}$ and for Um > 100 kV an earth fault factor equal to $0,8\sqrt{3}$.			

8.0 SUBSTATIONS GEOGRAPHICAL LOCATION

- 8.1 Figure 1 may be used to identify locations of interest. Detailed substation co-ordinates may be requested by respondents during the non-compulsory briefing session or by emailing the Supply Chain Services official.
- 8.2 Transnet retains the right to not disclose exact location information.
- 8.3 To ensure Transnet has a broad view of potential locations where energy supply projects can take place, the whole electrical network map is included in Figure 1 and submissions for any potential location are encouraged.

9.0 TECHNOLOGY COMPATIBILITY

- 9.1 The total power requirements for traction substations depends on geographical rail track factors (gradients and radius/curves), number of locomotives, number and type of wagons and loaded mass. Furthermore, operational factors such as train delays, speed restrictions and required minimum headway will result in varying energy consumption patterns. Respondents should indicate any additional infrastructure needed to run an uninterrupted TFR train service.
- 9.2 All locomotives operating on the AC networks have Regen capabilities and as such any supply point on these networks must be receptive to the Regen energy.
- 9.3 The graphs in Appendix A 1, 2 and 3 depict a 3-day 30min load profile of a typical 50 kV AC Track Feeder Station, 25 kV AC and 3 kV DC traction substation, respectively.
- 9.4 Each substation will have a unique load profile subject to the factors mentioned in clause 9.1. Although the general profile would be similar, adjacent substations consumption and demand would vary. The load curves provided in this document depict a typical load profile for the different types of electrification systems and should not be used to calculate the actual demand requirements.
- 9.5 As the locomotives operate in both motoring and generating mode, negative and positive capacitive and inductive energy is introduced to the system. This can be seen in the reactive power load curves in Figure 3 and 6 of Appendix A.
- 9.6 All locomotives in service comply with the NRS 48 part 2 requirements and have been accepted by Eskom representatives that attended the testing. Report BBH 3181 contains a summary of all locomotives tested.

10.0 TFR POWER DEMAND AND ENERGY CONSUMPTION

- 10.1 TFR's electrical power demand and energy consumption is indicated in Table 1. The data was analysed for the period between July 2021 and July 2022. The table is not complete but shows statistics for some of the selected lines.

Table 4 Power demand and energy consumption for various railway sections

Section	Energy Supply			Power demand & energy consumption	
	Firm Supply/ Supply voltage(s)	Utility/ Municipality	Tariff Structure	Combined NMD	TFR, Rail Network Monthly Average Consumption (Jul 2021 – Jul 2022)
Sishen - Saldanha	40 MVA x 7 50kV AC Traction	Eskom	Transflex 1	285 MVA	36 GWh

Hotazel - Kimberly	132 kV 3 kV DC Traction	Eskom	Transflex 1	199 MVA	10.74 GWh
Kimberley – De Aar	20 MVA x 7 132 kV 25kV AC Traction	Eskom	Transflex 1	49 MVA	3.4 GWh
De Aar – Gqerberha	20 MVA x 17 132 kV/220 25kV AC Traction	Eskom	Transflex 1	136 MVA	7.72 GWh
Ermelo – Richards Bay	20 MVA x 22 88 kV/132 kV 25kV AC Traction	Eskom/ Municipality	Transflex 1	166 MVA	26.42 GWh
Witbank- Ogies- Ermelo	5 MVA x 29, 10 MVA x 4 88 kV Eskom Supply 3kV DC Traction	Eskom	Transflex 1	65.5 MVA	9.54 GWh
Grootlaagte- Geluksplaas	5 MVA x 3 88 kV Eskom Supply 3kV DC Traction	Eskom	Transflex 2	13 MVA	0.6 GWh
Richards Bay (Nsesi & RBCT)	12 MVA, 25 MVA 132 kV Municipality Supply 25kV AC Traction	uMhlathuze Municipality	Time of Use Tariff - Enerflex	16.44 MVA	2.9 GWh
Thabazimbi- Pyramid South	20 MVA x 10 88 kV/132 kV Eskom Supply 25kV AC Traction	Eskom	Transflex 1	60.6 MVA	2.13 GWh
Pyramid South - Greenview	4.5 MWx3, 6 MW 88kV Eskom Supply 3kV DC Traction	Eskom	Transflex 1	16 MVA	0.466 GWh

Greenvview-Ogies	3 MW x 6, 4.5 MW x 8, 5 MW x 2 42 kV/88 kV/132kV Eskom Supply 3kV DC Traction	Eskom	Transflex 1	84 MVA	5.64 GWh
Beaufort West – De Aar	20 MVA x 9 132 kV Eskom Supply 25kV AC Traction	Eskom	Transflex 1	22.5MVA	1.13 GWh
Beaufort West - Bellville	33 kV, 66 kV x 22, 132 kV x 26 Eskom Supply 3kV DC Traction	Eskom	Transflex 1	141.5 MVA	2.0 GWh

11.0 INFORMATION TO BE PROVIDED BY RFI RESPONDENTS

11.1 GENERAL

- 11.1.1 Drawings and documents shall be written in English.
- 11.1.2 The information provided shall be properly indexed, readable and capable of being opened using Microsoft Office, PDF reader or Windows photo viewer.
- 11.1.3 The RFI Response submitted should be as comprehensive as possible and include the information requested below and any supporting documentation in respect thereof.
- 11.1.4 Metric system for units is preferred. However, that should not deter the respondents from submitting information.
- 11.1.5 Respondents are requested to provide as much detail as possible about their project(s) including the necessary commercial arrangements which have been put in place or still need to be put in place. Such information will assist Transnet in determining the readiness of the market for a possible Renewable Energy Power Purchase Programme and may inform the design of the RFP procurement process.

11.2 INFORMATION ON RESPONDENT'S RENEWABLE PROJECTS EXPERIENCE

- 11.2.1 The Respondent is requested to provide the following information about renewable energy projects they have executed:
 - a. Name of the Respondent.
 - b. The main business of the Respondent, with regards to the energy project e.g., trader, generator of energy or investor.
 - c. Company experience in years, in conducting renewable energy project studies, modelling, design, installation and/or integration.
 - d. Renewable energy projects the Respondent has developed and/or implemented whether in a municipal, national or other context?
 - e. Size of the renewable energy projects developed and/or implemented in MW, size of total land used, type of technology used, duration of project broken down into the following phases: development, design, approvals, construction and commissioning.
 - f. Skill transfer undertaken during the execution of the projects in design, operation and maintenance of the plants.

- g. The name and contact details of the person appointed by the Respondent as its representative if the TFR's Project Manager wishes to engage on the submitted projects details.
- h. Whether the Respondent has undertaken a renewable energy project for traction loads.

11.2.2 Respondents are requested to indicate their existing capability with regards to renewable energy projects by ticking the applicable box in the table below:

Description	Yes	No
Project financing		
Development and modelling of renewable energy projects		
Engineering, Procurement and Construction (EPC) of renewable energy projects		
Operation and maintenance of renewable energy plants		
Development of Power Purchase Agreements		
Embedded Generation Installation (EGI) compliance testing		
Training of staff on various stages of renewable energy projects		

11.3 INFORMATION ON PROPOSED PROJECT

11.3.1 The Respondent is requested to provide information on any existing projects with spare capacity which may be utilised to supply power to TFR's traction substations. Similar information to that contained in 11.3.2 below should be provided, where applicable.

11.3.2 The Respondent is requested to provide the following information about development projects they propose for the TFR Renewable Energy Power Purchase Program, either as a standalone or as a joint investment with Transnet:

- a. Provide overview of the project scope, background and estimated upfront capital cost and estimated O&M cost per year over the proposed PPA period
- b. Describe the proposed project location and land size. Detail to be provided where relevant on the status of discussions / agreements for land security purposes.
- c. Proposed renewable energy technology and indicate the maturity/readiness level of technology using the table below.

Technology maturity/readiness level	Description	Tick applicable box
9	Actual system in operational environment	
8	System complete and qualified	
7	System prototype demonstration in operational environment	
6	Technology demonstrated in relevant environment	
5	Technology validated in relevant environment	
4	Technology validated in lab	

3	Experimental proof of concept	
2	Technology concept formulated	
1	Basic principle observed	

- d. Provide details on the capacity of the proposed power generation facility, If the facility is existing, provide information about any excess capacity and forecasted increase in demand.
- e. Propose energy storage technology for traction loads which are intermittent e.g. Batteries, super-capacitors, flywheel, etc. and the maturity of the technology and indicate the maturity/readiness level of the technology using the table below.

Technology maturity/readiness level	Description	Tick applicable box
9	Actual system in operational environment	
8	System complete and qualified	
7	System prototype demonstration in operational environment	
6	Technology demonstrated in relevant environment	
5	Technology validated in relevant environment	
4	Technology validated in lab	
3	Experimental proof of concept	
2	Technology concept formulated	
1	Basic principle observed	

- f. Indicate major components for the generation plant and estimated lead time for procurement and delivery.
- g. Indicate whether the power generation facility can readily (modularly) be increased in capacity.
- h. Provide international specification adoption with standardized practices and regulations published by either statutory bodies such as SANS, IEC, BS or IEEE.
- i. Indicate whether generation connection capacity assessment at the proposed location has been completed by Eskom or Municipality. If the report is available, it should be submitted as part of the RFI submission. Where relevant details of any interactions with the relevant transmission and/or distribution network owners regarding the connection options for the proposed project.
- j. Discuss integration capability of power generation facility to operate as hybrid of other renewable energy alternatives.
- k. Indicate expected Energy Yield per annum (MWh) over the PPA period.
- l. Indicate the annual DC output degradation rate of the proposed technology if applicable.
- m. Estimate generation losses and transmission losses per kilometre.
- n. Estimate potential carbon emission savings for TFR per MWh generated due to the usage of the proposed plant.
- o. Provide details on an indicative tariff. Detail to also be provided on the energy charge and capacity charges (where relevant) as well as any other components of the tariff including wheeling, expected annual escalations and variable costs.

- p. Will the energy output of the plant be linked to the train schedule, or will the excess energy produced by the plant be stored in a storage facility for later use by trains?
- q. Provide indicative cost of operation and maintenance per annum for proposed power generation facility over the PPA period.
- r. Recyclability of renewable energy plant components, end-of-life disposal scheme and estimated salvage value.
- s. Indicate the required environmental approvals and the progress made in obtaining any outstanding regulatory approvals / authorisation and anticipated timelines.
- t. Expected service life of the plant.
- u. Indicate the project spatial requirements as well as any need for civil and electrical services from TFR or other entities for the implementation of the proposed project.
- v. Indicate the anticipated project contribution to economic development including job creation during construction and operations, skills development, local content value, and use and development of SMMEs.
- w. Indicate potential vulnerabilities such as theft, environmental, micro and macro-economic factors that have the potential to disrupt the power supply service.
- x. If the power generation facility is existing, details are requested on the anticipated refurbishment or expansion (if any) to be undertaken for the facility.

11.4 INFORMATION RELEVANT TO TFR'S REPPP RFP

- 11.4.1 Should Transnet release an RFP for the proposed project that will form part of the REPPP, the Respondent is requested to:
- a. Provide the anticipated time (in months) that is required to prepare and submit a Bid Response for the following proposed projects:
 - i. Joint investment development project (Self generation)
 - ii. Electricity wheeling project (Pure power purchase)
 - b. Provide the anticipated time (in months) to achieve Commercial Operation Date, following Financial Close of the proposed self-generation project.
 - c. Provide the anticipated key risks relevant to the implementation of the proposed project.

11.5 INFORMATION RELEVANT TO THE PROPOSED PROJECT POWER PURCHASE AGREEMENT

- 11.5.1 In respect of the proposed power facility, the Respondent is requested to provide the following information:
- a. Indicate which of the below proposed PPAs would the Respondent be more likely to enter and provide a comprehensive motivation for the preferred structure of the PPA.

PPA pricing structure	Description
Fixed price nominal	Fixed electricity price (with no inflation) for the duration of the PPA contract
Fixed price with escalation (stepped)	Starting electricity price that rises according to a contractual profile. The steps may be in nominal terms (without inflation) or in real terms with inflation indexation on top
Fixed price with inflation indexation	Starting electricity price that rises annually with inflation, typically measured by changes in a consumer price index (CPI)
Other (please specify)	Please describe the proposed PPA pricing structure

- b. Provide factors that will determine the PPA duration.
- c. Indicate how the different PPA durations (e.g. 10, 15 or 20 years) will affect the proposed tariffs

- d. If the PPA pricing structure is not fixed nominal or fixed price with inflation indexation, what will the PPA price escalations be based on
- e. For an existing facility, please indicate how will the current PPA contracts with other off takers affect the proposed PPA with TFR.

11.6 INFORMATION RELEVANT TO PROPOSED PROJECT FINANCING

11.6.1 The Respondent is requested to provide a general background on how the Respondent intends to finance the overall project, including as much detail as possible with respect to:

- a. How the Respondent proposes to finance the project, whether self-financing or borrowing from investors. If borrowing what will be the anticipated debt/equity split?
- b. Agreement required between TFR and Respondent for project financing.
- c. Indicate which of the below project models would the Respondent be more likely to enter and provide comprehensive motivation for the preferred structure. The Respondent can propose a different model to those shown in the Table below.

Proposed project model	Transnet own generation	Wheeling (With the option of transfer)	Wheeling (Without the option of transfer)
Project scope	Joint venture partnership, equity/debt split, develop, design, build, operate, maintain and transfer to TFR or concession after the PPA period	Generator connection, wheeling agreement, PPA and the option to transfer the facility to TFR or concession after the PPA period	Generator connection, wheeling agreement and PPA without the option of transfer of the facility to TFR after PPA period
Conceptual Description	New generation facility to be located within Transnet land or land owned by a third party that could be acquired and incorporated into the Transnet land reserves. The Respondent embarks on a joint venture with Transnet to develop the project, finance project, EPC the project and operates the facility for a period equal to the PPA period, including training of TFR staff before transferring facility to TFR. Both TFR and the partner will cover the capital cost. TFR will pay back the partner's cost and debt through the PPA. TFR is the off-taker.	Existing generation facility with spare capacity is located outside TFR servitude and is operated and maintained by the Respondent. Energy is sold back to TFR at an agreed upon tariff with the project transferred to TFR after the PPA period. The capital cost of the plant shall be covered in the PPA. TFR is the energy off-taker. Training of TFR staff to be undertaken by the Respondent.	Existing generation facility is located outside TFR servitude and might be outside the respective municipal boundaries and is operated and maintained by the Respondent. Energy is sold back to TFR at an agreed upon tariff and the project will remain the ownership of the developer after the PPA period. TFR is the primary energy off-taker.

END

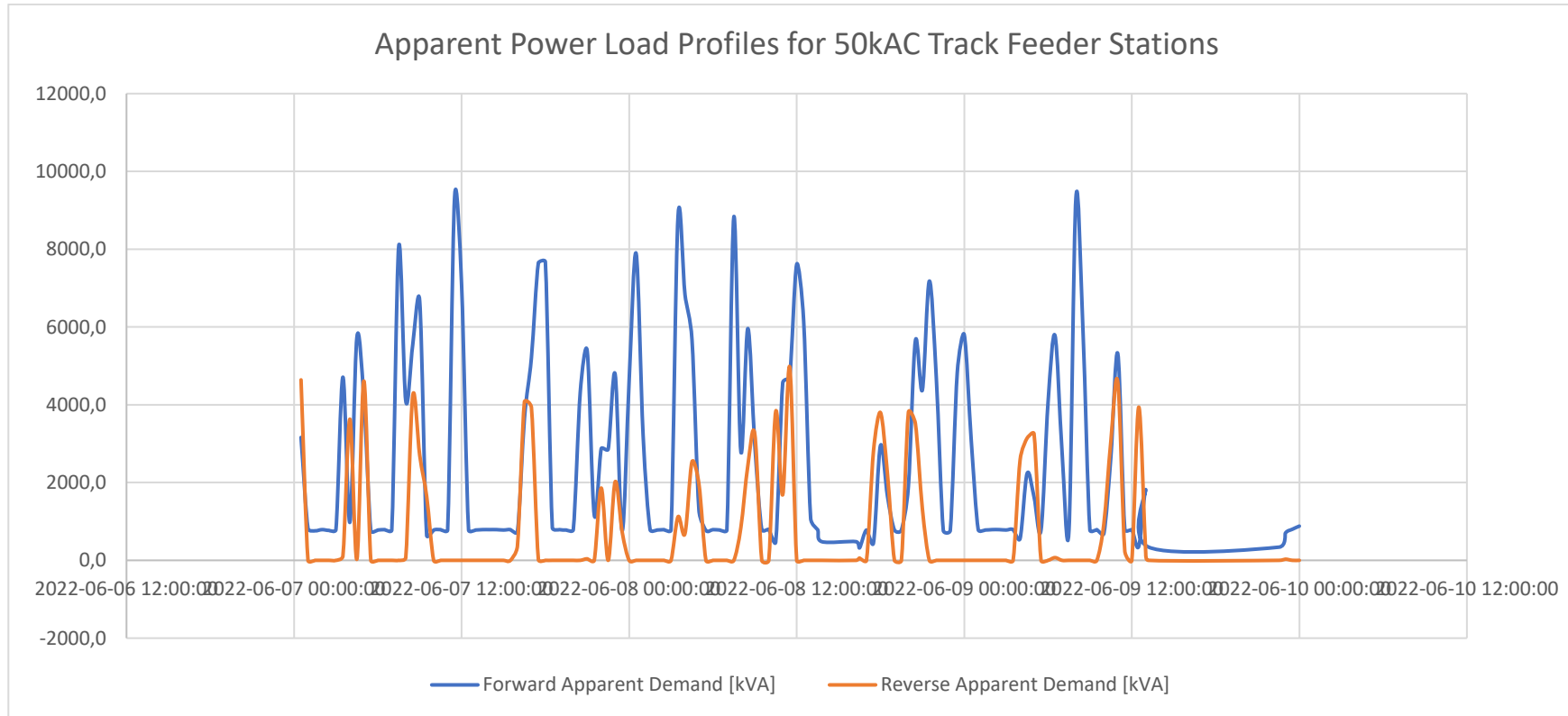
APPENDIX A: TYPICAL LOAD PROFILES FOR DIFFERENT ELECTRIFICATION SYSTEMS**50KVAC TRACK FEEDER STATION TYPICAL LOAD PROFILES**

Figure 2 50kVAC Traction Substation Apparent Demand

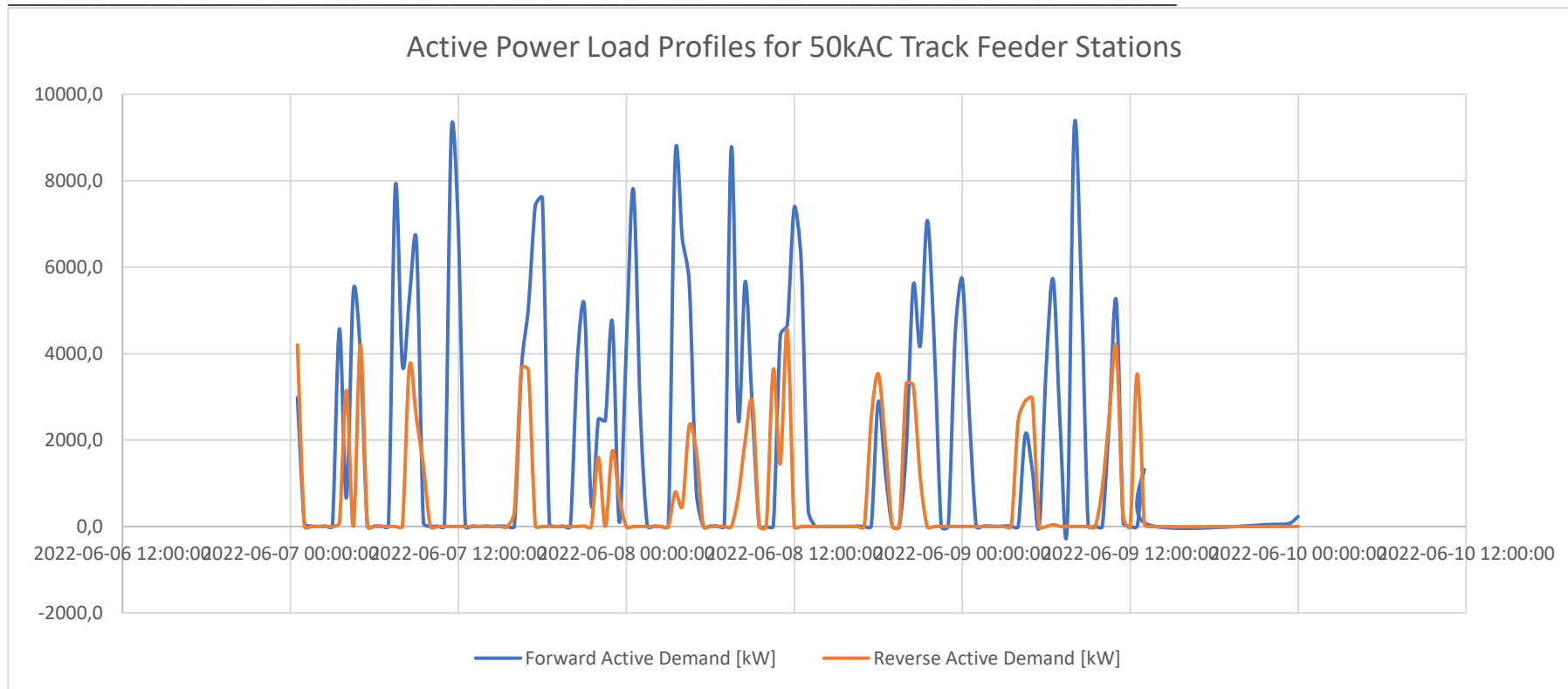


Figure 3 50kVAC Traction Substation Apparent Demand

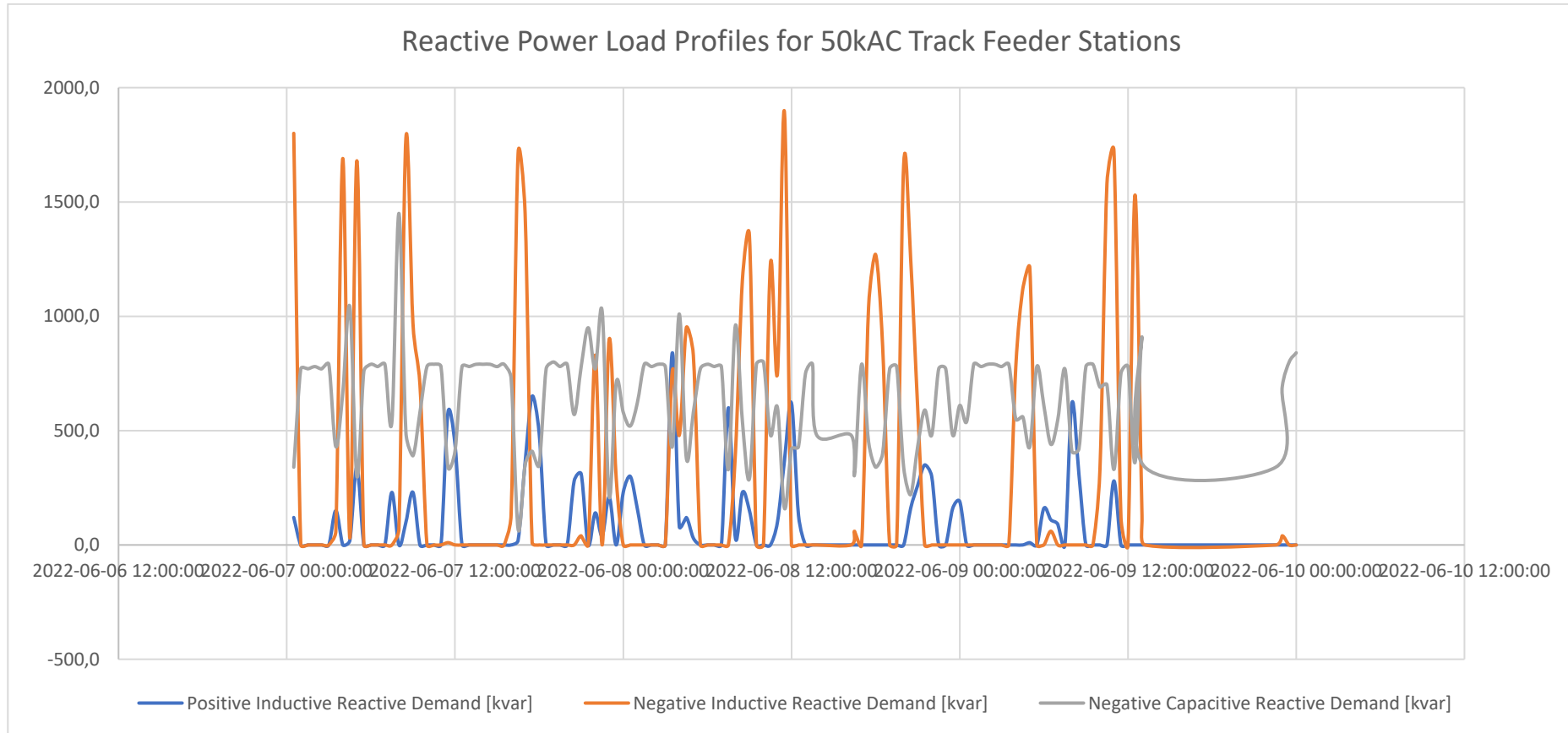
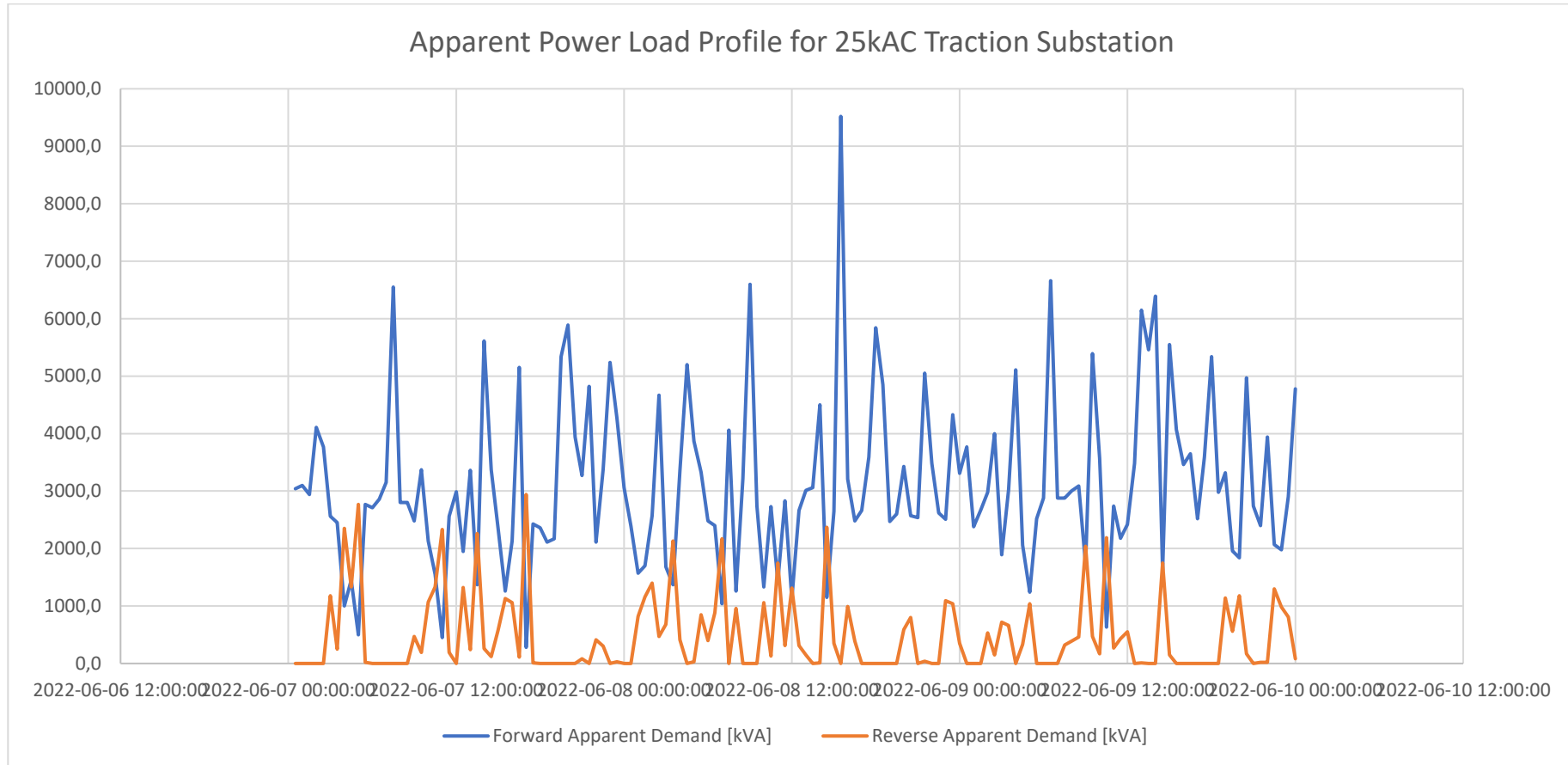


Figure 4 50kVAC Traction Substation Reactive Demand

25kVAC TRACTION SUBSTATION TYPICAL LOAD PROFILES

*Figure 5 25kVAC Traction Substation Apparent Demand*

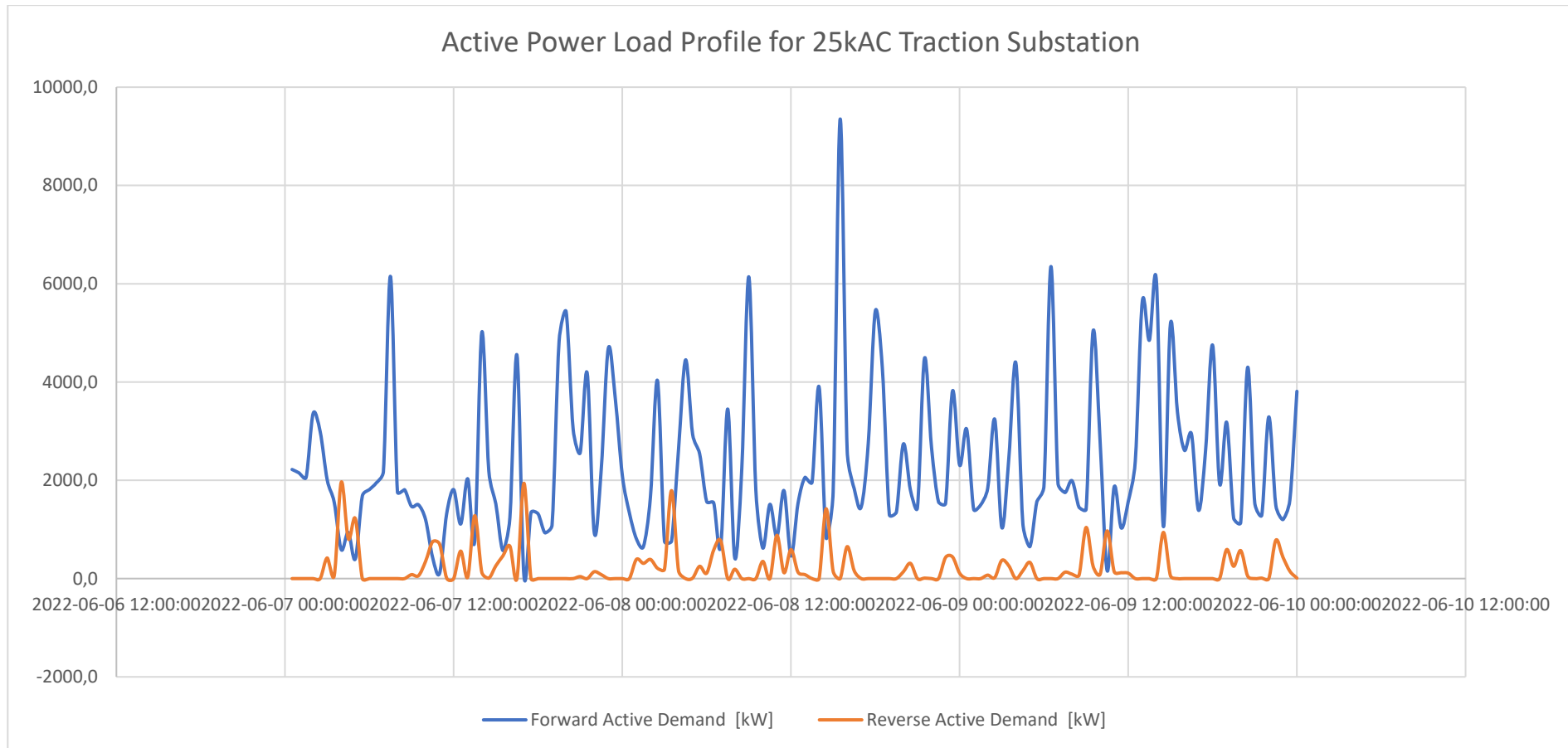


Figure 6 25kVAC Traction Substation Active Demand

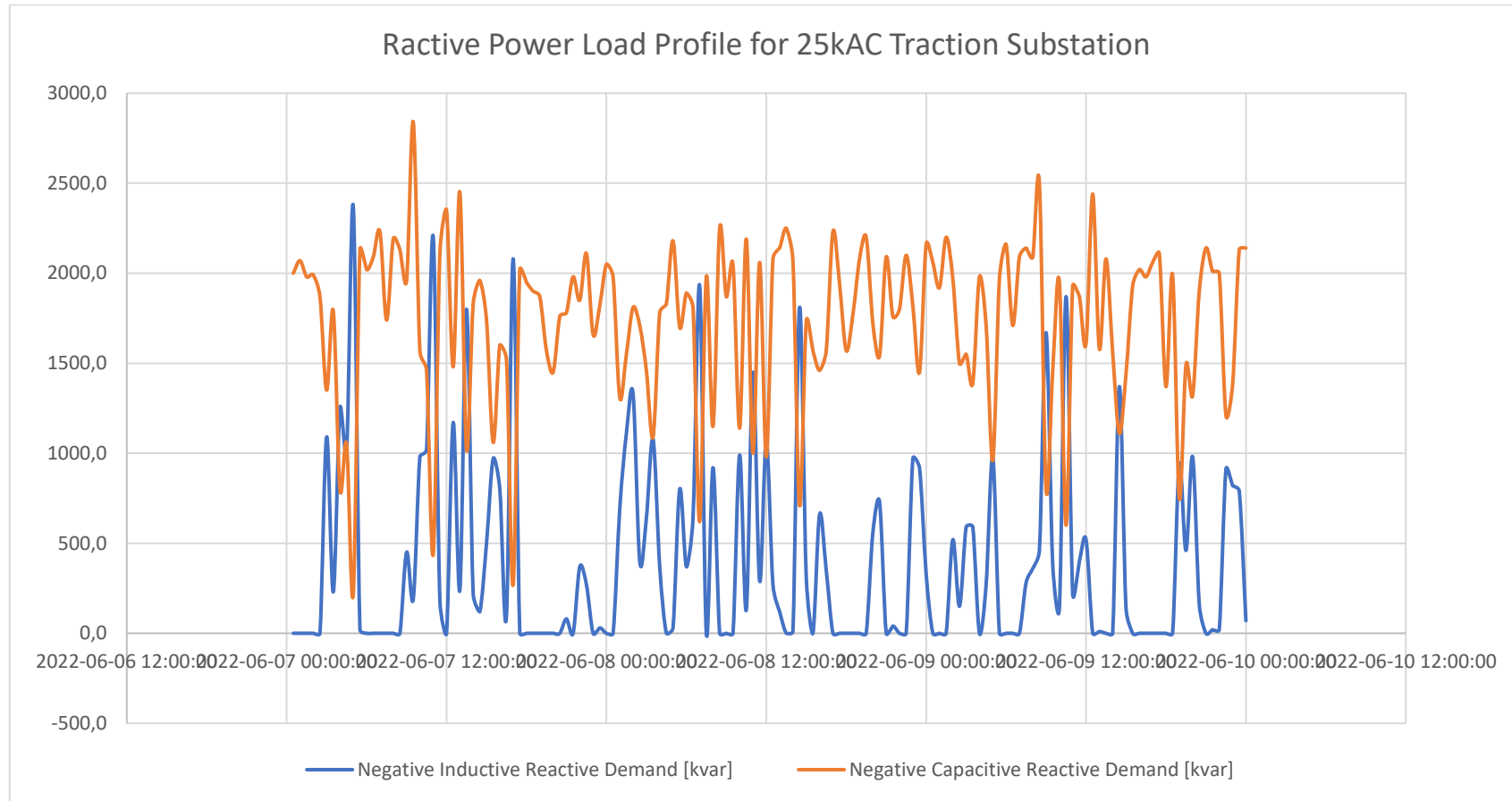
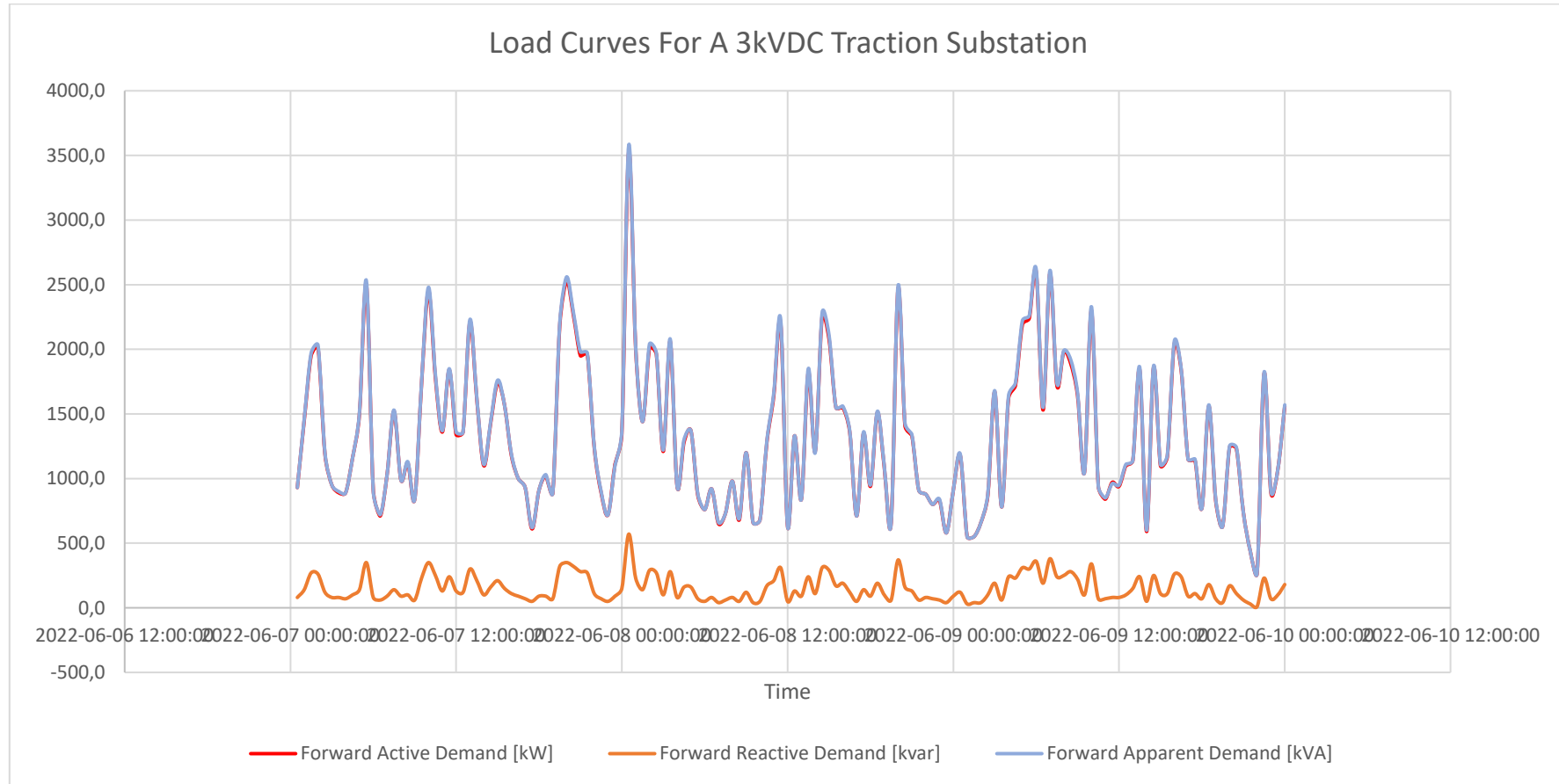


Figure 7 25kVAC Traction Substation Reactive Demand

3kVDC TRACTION SUBSTATIONS TYPICAL LOAD PROFILES

*Figure 8 3kVDC Traction Substation Load Demand*