



Your Power

Traction energy 2022

INFR/ABEL

www.infrabel.be



Table of contents

1.	Introduction	3
2.	The use of the overhead contact line	5
	Minimum access package	5
	Rates	5
3.	Transport and distribution of traction current	6
	Additional service applicable while using the overhead contact line	6
	Rates	6
4.	Provision of traction current	7
	Optional additional service	7
	Purchase via Infrabel	7
	Purchasing strategy	7
	Mandate	8
	Rates	9
	Directly from a supplier	11
5.	How is your consumption determined?	13
	Energy meters	13
	Estimation	14
	Validation and reconciliation	14
6.	Invoices	15
7.	Software tools	16
	Transmission of train information	16
	Fill In	16
	Train Traction	16
	The importance of correct information	16
	Erex user interface	17
	Alcatras	17
8.	Definitions and abbreviations	18

1. Introduction

This leaflet is intended for railway undertakings (and if applicable for applicants¹ that are not railway undertakings) that operate electric locomotives on the Belgian railway network, as well as for those who are considering doing so.

Each electric multiple unit or locomotive is equipped with a pantograph. The pantograph forms the coupling point with the overhead contact line. It is there that the electricity is taken.

This electricity can be used for:

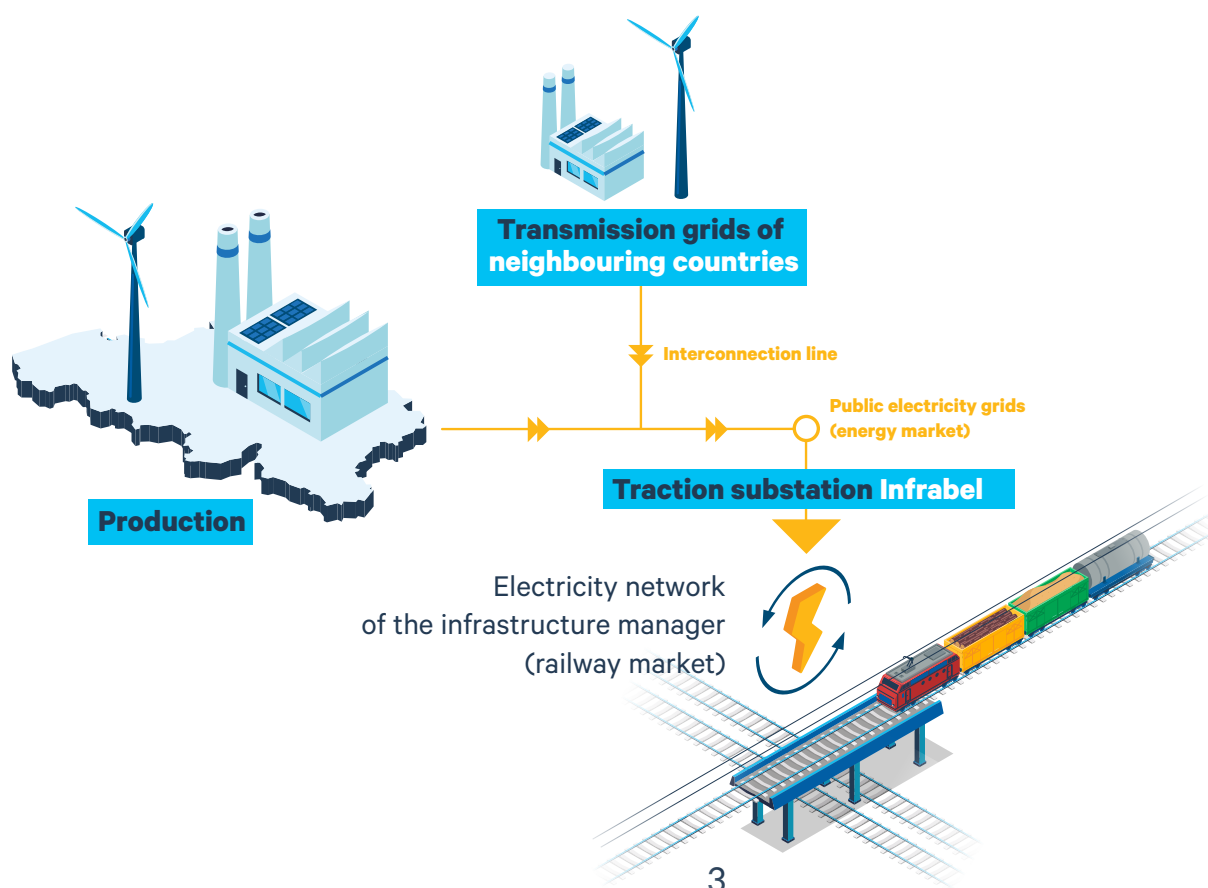
- driving the electric locomotives and/or multiple units;
- comfort services for passenger trains such as heating, lighting and air conditioning.

Infrabel has two types of traction systems:

- 3 kV direct current;
- 25 kV alternating current.

The overhead contact line is fed from a traction substation. This forms the connection to the public electricity grid. In total, Infrabel has about 85 access points to the public grid from which electricity is injected into the overhead contact lines.

The whole of the electrical installations at Infrabel's disposal is the rail traction network. This definition is broader than that of the overhead contact line. After all, it also contains all installations that serve to transform the electricity to another voltage, to control the signalling, to operate the level crossings and the points and to be used for the point heating. Infrabel has been appointed operator of the rail traction network.





Infrabel offers three services under the name Your Power:

- the use of the overhead contact line (minimum service);
- the transportation and distribution of traction current (additional service applicable while using the overhead contact line);
- the provision of traction current (optional additional service).

All these services are billed on the basis of energy consumption, in particular the number of MWh.

Electric propulsion is less costly than diesel

Electric propulsion is **more efficient** than diesel because less primary energy is used. Since less CO₂ is emitted, it is better for the environment. Of course, the other emissions that are generated are far lower when using electric traction.

The use of electric locomotives allows, among other things, the railway undertakings in the freight sector to transport **heavier loads**.

By driving in an energy-efficient way (also known as eco-driving) with a locomotive equipped with an energy meter and a Driving Advisory System, **the energy consumption can be reduced by 10%**.



2. The use of the overhead contact line

Minimum access package

Using the overhead contact line to supply the traction energy is invoiced as a direct cost. After all, there is a direct link between the number of trains that draw electricity from the overhead contact line and the costs associated with the maintenance of the overhead contact line. It is part of the minimum access package according to Belgian law. This cost is part of the infrastructure usage fee. The part of the infrastructure usage fee that relates to the wear and tear of the overhead contact line may only be charged to electric train transport.

Rates

In 2022, this cost will be EUR 14.395407/MWh. This cost is index-linked annually.

The tariff is published annually in December for the coming year in Annex F-2 of the Network Statement.

This can be found on Infrabel's [website](#) under the section “business”.

Roles within the electricity market

Supplier

The supplier is the party that sells the electricity to the final consumer. The supplier can have its own production installations, or it can also purchase the electricity from a producer or at an electricity exchange.

BRP

The Balance Responsible Party must ensure that it injects as much electricity into the grid in real time as it consumes. The supplier can take on this role or call on a specialised party.

System operator

The transmission system operator Elia manages the highest voltage levels and also the lines that interconnect with neighbouring countries. Most traction substations are connected to the Elia grid. The distribution system operators manage the low-voltage networks and the networks at 10 to 15 kV. About 25 traction substations are connected to the distribution networks. Infrabel is the operator of the rail traction network. This is a specific status that has been created within the electricity market.

End consumer

Any railway undertaking (or applicant not railway undertaking) can be regarded as a final consumer in the electricity market. The railway undertaking can purchase directly from a supplier or give Infrabel a mandate to do so.

3. Transport and distribution of traction current

Additional service applicable while using the overhead contact line

Infrabel is the sole organisation responsible for the transmission and distribution of electricity within its network, regardless of whether the railway undertaking uses Infrabel or another supplier of its choice for the supply of traction current.

After all, the railway undertakings have no connection to the public grid. Infrabel is the only party that has connections to the public electricity grids.

The part “transportation and distribution of traction current” under the Your Power service is therefore a mandatory cost for every railway undertaking making use of electric traction.

Transport and distribution of traction current (grid fee) includes:

- all costs for the connections of the traction substations at Elia and at the other distribution system operators (full network costs);
- taxes, fees, excise duties and other costs collected via the network operators;
- grid losses in substations and overhead contact lines;
- administrative costs for measuring and correctly allocating the energy to the railway undertaking and associated supplier.

Infrabel pays the connection costs of the traction substations to the public high-voltage grids (Elia and the distribution system operators). These include the costs of managing the physical connection of the public grid to our traction substations and the costs of transporting the energy through the public grids.

The government imposes several obligations on the public grid operators. Several taxes, fees and other costs are also collected through the invoices of the public network operators.

We assume that 4% of the energy is lost between the connection to the public grid and the pantograph. Infrabel purchases the energy needed for this. These are called grid losses.

We have several IT applications to measure and allocate energy consumption. Costs for improvements, management and maintenance of these applications are taken into account.

In the case of a number of crucial tasks related to information processing, we collaborate with [Eress](#), a European partnership of several railway infrastructure managers with the aim of offering joint solutions for the measurement and allocation of energy consumption by trains to railway undertakings. This way we can share knowledge, but also save on investment costs.

Rates

In 2022 this cost will be 21 EUR/MWh.

The tariff is published annually in December for the coming year in Annex F-3 of the Network Statement. Interim adjustments are possible in the event of changes to the legislative or regulatory framework.

4. Provision of traction current

Optional additional service

In accordance with the Electricity Act, every end consumer has the right to choose his own electricity supplier. This also applies in the case of the railway undertaking (or if applicable the applicant not railway undertaking). However, a railway undertaking is not obliged to choose its own supplier. A railway undertaking can choose to purchase its electricity through Infrabel. That is the reason why the provision of traction current is an optional additional service.

You can only choose your own supplier for your total consumption. A further condition requires all electrical multiple units and locomotives to be equipped with energy meters. This is necessary in order to know the real consumption on a quarter-hourly basis. Without this, it is impossible to participate in the free electricity market.

To enable market forces to operate, Infrabel allocates an access point per region to each railway undertaking. After all, the electricity market is partly a regional competence.

The provision of traction current (commodity) includes:

- the energy cost;
- costs related to the balance between injection and off-take from the supplier within the Belgian control area;
- taxes, levies, excise duties and other costs collected through the supplier;
- CO2 emission rights.

As soon as a first railway undertaking wishes to exercise its right of free choice of supplier, Infrabel will contact Elia and the regulators of the electricity market. Taxes and levies may be invoiced via the supplier and no longer via the network operator. This also causes a shift in these costs from grid fee to commodity. Other costs can go from commodity to grid fee, especially if they are settled via Infrabel and not via the supplier.

Purchase via Infrabel

Purchasing strategy

Infrabel organises European calls for tenders in order to purchase energy. Infrabel starts purchasing electricity three to four years in advance.

The purchasing strategy is based on the following goals:

- to ensure the energy supply;
- to avoid sudden price fluctuations;
- to enable the railway undertakings to estimate the prices in advance;
- to obtain the lowest possible price.



In order to obtain these goals, the energy price is gradually fixed over a period of four years.

The energy price is fixed as follows:

The price is fixed ...	For energy consumption in ...				
	2020	2021	2022	2023	2024
three years in advance	25%		16,5%		25%
two years in advance	25%	28%	30,5%	40%	25%
one year in advance	25%	47%	28%	30%	25%
in the year of delivery	25%	25%	25%	30%	25%

Infrabel uses price formulas in the purchase contract with an electricity supplier. Prices are based on quotes on the electricity exchanges. The price for the part that is fixed more than a year in advance is based on the 'baseload price' for Belgium as quoted on Ice-Endex (forward market). The price for the part that is fixed during the year of delivery is based on the monthly average of the 'day-ahead prices' for Belgium as quoted on Epex Spot (spot market).

The price for the actual energy supply is based on the results of the European call for tenders and the changes to the energy indices for the supply period.

Mandate

Infrabel will ask large railway undertakings well in advance whether they wish to use this service. This concerns railway undertakings that represent more than 2.5 percent of the total estimated electricity consumption. This mandate allows Infrabel to start the purchase on time. It is necessary to provide the electricity supplier with the certainty that the purchased electricity will actually be consumed. This increases security of supply and spreads the financial risks as much as possible.

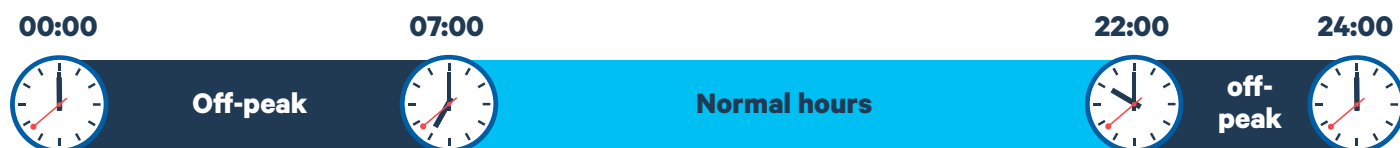
The other railway undertakings must also give Infrabel a mandate. They do this by means of an Annex to the user agreement.

Large railway undertakings can choose to do 'price clicks' themselves for part of their consumption. This part is then charged for on the basis of the prices clicked by the railway undertaking concerned. The prices published in the network statement are used for invoicing the remaining part. The railway undertaking must make this choice when issuing the mandate to Infrabel to purchase the electricity for it for a certain period.



Rates

Infrabel has two rate periods:



On Saturdays, Sundays and public holidays, the off-peak rate will apply.

In 2022 the following formulas will be applied:

- for normal hours: $70.83 \text{ EUR/MWh} + 0.25 * \text{Monthly Belix Base}$
- for off-peak: $49.47 \text{ EUR/MWh} + 0.25 * \text{Monthly Belix Base}$

The “Monthly Belix Base” is the average day-ahead price for Belgium for the month of delivery as quoted on Epex Spot.

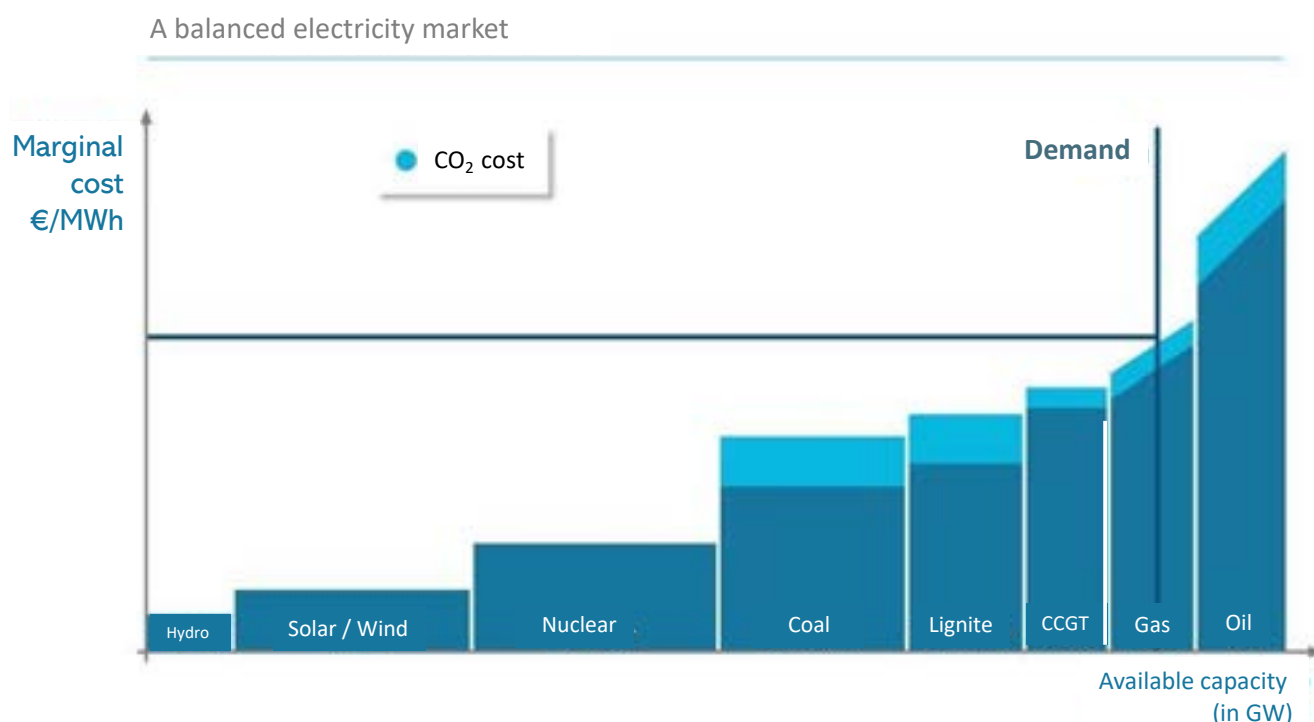
These tariff formulas are published annually in December for the coming year in Annex F-3 of the Network Statement. Interim adjustments are possible in the event of changes to the legislative or regulatory framework.



How does the energy market work?

Electricity exchanges play a very important role in the electricity market. This is because the available capacity on the interconnection lines with neighbouring countries is determined via the power exchanges. In this way the different countries are linked to each other. This has the advantage that the price differences between the countries are usually limited.

The day-ahead market is especially important. There, the electricity is traded for supply the next day. The price is determined by supply and demand, with the most recently activated production unit determining the price. The supply curve is called the merit order. The marginal cost of renewable energy and nuclear power stations is very low. Power stations that still work on fossil fuels have a higher marginal cost. In this merit order, gas and coal sometimes change places.



At the end of 2021, there was a very significant increase in electricity prices. This was caused by a major increase in gas prices and CO₂ emission rights:

Forward gas price for 2022



Cost price for CO₂ emission rights



A gas price of 90 EUR/MWh together with a cost of 60 EUR/ tCO₂ results in an electricity price of 210 EUR/MWh when gas is used as a marginal production unit².

Directly from a supplier

A railway undertaking can conclude a contract directly with an energy supplier. The energy supplier must have a valid supply permit. You must also appoint a balance responsible party (e.g. your energy supplier).

As not a single railway undertaking has concluded a direct contract with a supplier as yet, there is still a simplified market constellation in which Infrabel is still regarded as the sole end consumer for the entire railway network in the energy market. Infrabel has a mandate from the railway undertakings and purchases for the railway sector as a whole. In the case of the free choice of suppliers, the railway undertaking becomes the end consumer in the electricity market. Infrabel then acts as operator of the rail traction network.

The railway undertaking's consumption is recorded by Infrabel, which communicates this volume to the electricity supplier. The supplier invoices the railway undertaking based on that volume. Elia, the transmission system operator, receives from Infrabel the volumes allocated on a quarter-hourly basis to the various balance responsible parties active on the rail traction network. In this way, Elia can invoice the imbalance on a monthly basis.

The balance responsible party:

- reports daily to Elia how much energy you will use;
- compensates for energy losses on Elia's transmission network;
- tries to achieve a balance between production/import and purchase/export;
- pays the costs of the imbalance to Elia.

At least three months before the start of the supply contract, you notify Infrabel of your supplier and balance responsible party. A change always takes effect on the first day of the month and remains valid for a minimum period of three months.

At present, no railway undertaking is exercising the right to choose its own supplier. Please bear in mind that the first application of this principle will take time because many processes still need to be fine-tuned (e.g. the exporting of data to Elia and the other market parties).





Guaranties of origin

After consultation with the railway undertakings, Infrabel has decided not to impose any obligations regarding the supply of renewable energy when purchasing the traction current. The origin of the electricity supplied is therefore unknown. For the scope 2 emissions from your CO₂ balance, the railway undertaking must use the residual mix for Belgium. This takes into account the export of guarantees of origin to other countries and is published annually by the [AIB \(Association of Issuing Bodies\)](#) for the preceding year.

Railway undertakings wishing to consume green energy can purchase guarantees of origin themselves and have them cancelled by a competent authority. If desired, the railway undertaking can ask Infrabel to assume these tasks. If a railway undertaking submits guarantees of origin for its entire consumption volume, its electricity consumption is CO₂ neutral. There is great variation in the quality of guarantees of origin.

The prices for a guarantee of origin are low, but vary greatly according to the year, the location of production and the production method (on average 0.15 euros in 2020 and 1.5 euros at the end of 2021). In the case of wind energy in the Netherlands, you still paid 7.5 euros in 2018 and 2019 (boosted by, among other things, purchasing for train traffic in the Netherlands). In 2020 this had fallen again to 2.5 euros.

5. How is your consumption determined?

Energy meters

If your trains are equipped with energy meters, the data from these meters is used to determine the consumption of your trains. Since 2014, an energy meter shall always be fitted to both new rolling stock and during the renovation of existing rolling stock.

The railway sector has established criteria that all energy meters must meet. These were approved by the European Commission. The essential requirements are laid down in the TSI on rolling stock (defined by [Regulation 2018/868](#) of the European Commission). More detailed requirements are included in the European standard, EN 50463. Products that comply with this standard also meet the essential requirements of the TSI.

An energy meter is built into a locomotive or an electrical multiple unit. It measures both the energy supplied via the overhead contact line and the braking energy supplied back. In addition, the GPS coordinates and the time of consumption are also stored. Infrabel takes the net volumes into account for invoicing. This means that the injected energy is subtracted from the extracted energy.

The readings are sent at least every four hours and before each intended shutdown of the energy meter. You must choose one infrastructure manager, who will receive the raw measurement data. Based on the GPS coordinates, this infrastructure manager will determine in which country the consumption took place and will then forward the measured values to the relevant infrastructure manager in that country (in accordance with [IRS 90930](#) of UIC).

You can also request that the measurement data be read by Infrabel. We do this by means of the DCS (Data Collecting System) from Eress. The condition is that the meter can transmit the data in accordance with the protocol laid down in the 2017 version of EN 50463.

Annex E.3 to the Network Statement contains more detailed requirements for energy meters, as well as several methods for transmitting the data.

Why do you need an energy meter?

Trains are major electricity consumers. Infrabel must have access to the actual energy consumption for any railway undertaking that wishes to freely choose its energy supplier. An energy meter is necessary for this.

An energy meter ensures that only the actual consumption is charged for. A railway undertaking that tries to consume less energy will therefore also pay less. Thanks to the energy meter, you have a return on energy-saving investments (such as Driving Advisory Systems and Automatic Train Operation).

Estimation

Missing measurement data will be estimated on the basis of average specific consumption (kWh/ton-km) per category (passengers, freight or high speed).

Infrabel is using the following formulas in 2022:

Passengers: $(36 + 0,8 * D1 + 0,8 * D2)$ Wh/tonne-km

High speed: $(42 + 0,8 * D1 + 1,0 * D2)$ Wh/tonne-km

Freight: $4 \text{ kWh/km} + 12 \text{ Wh/ton-km}$

These formulas are adjusted as soon as there is a major difference between estimated and actual consumption.

The following improvements to the estimation formulas are being explored:

- the use of more complex formulas;
- specific formulas for traction unit types for which we have sufficient measured energy consumption;
- allocating parking consumption based on traction unit type, temperature and parking duration;
- taking into account the difference in altitude over the train run;
- taking speed into account when crossing a national border.

A significant share of the consumption by passenger trains is used for heating or cooling purposes. This consumption depends on the outdoor temperature.

The above formulas use D1 and D2 for degree days based on the average temperature measured by the weather stations of Infrabel. To determine D1, every degree under 16.5°C is counted as one degree day. A day with an average temperature of 10°C therefore corresponds to 6.5 degree days. To determine D2, every degree above 20°C is counted as one degree day. The values D1 and D2 are defined on a daily basis.

Validation and reconciliation

Measurement data is compared with the estimated values. If the measurement data is likely incorrect, an alert will be displayed and estimated consumption will be used. The validation rules are also included in Annex F.3 to the network statement.

At the end of each month, an energetic reconciliation takes place. The sum of measured and estimated consumption is compared with the energy delivered from the traction substations into the overhead contact line. We are assuming grid losses of 4% in 2022 (purchased by Infrabel). The difference is settled to the estimated consumption (that hereby increases). This method supports the installation of energy meters on the trains. The cost of purchasing the losses falls under the section entitled “transportation and distribution of traction current” part of the Your Power service (grid fee).

6. Invoices

There is an advance and a settlement invoice.

The advance invoice is forwarded at the beginning of the usage month. At the end of October of year Y-1, Infrabel will draw up a table with the monthly advances that each railway undertaking will have to pay. This table is included in an Annex to the usage agreement. Advances will only be requested if the predicted annual consumption is greater than 3 GWh.

After each month of consumption, a settlement invoice follows, based on the measured and/or estimated consumption and according to the real rates. This invoice is sent around the tenth day of M+1.

All invoices are payable within 30 days.



7. Software tools

Transmission of train information

There must be a facility to link the measurement data to your trains. If that link cannot be made, we cannot assign the data to the right train journey. That is why you have to notify Infrabel of the composition of all your trains.

Fill In

The composition of freight trains can be sent via “Fill In”, an application on the [Business Corner](#). The European vehicle number is used as a unique reference: e.g. 918801302301.

Below the label ‘Locomotive number’, you can enter the European vehicle number for your locomotives. All information on this sheet and the “Fill In” application can be found on the [Business Corner](#). Feel free to contact us should you have any further questions.

Train Traction

Train Traction is also available on the [Business Corner](#). It can be used to notify the traction composition for freight trains and for passenger trains. It also allows for the communication of traction unit changes during a train-run.

This application doesn’t permit to declare the content of the wagons of freight trains. Train Traction is available in the form of an XML generator. This generates an XML file in the correct format. It is also possible to exchange this data automatically via such an XML file between your application and the application Train Traction at Infrabel.

The importance of correct information

If the European vehicle number for the traction unit is not entered in due time and correctly, the train in question cannot be charged for based on the energy meter. It is possible to amend the information regarding train composition in Fill In up to 4 days after the departure of the train (before D+4 at 4 pm). The same rule applies for Train Traction.

The mass of the train is also entered into our system. We register the passage of your train at various locations. Using all these data, we can calculate the ton-km per train journey and per rate period. If you want to make use of the free choice of supplier, we must have already received the correct traction composition by noon on the day following the day on which the train journey began. We need this to correctly assign the data from the energy meters. The train journey data will be forwarded on D+1 at 7 pm to our Settlement System (a common application within the Eress partnership). The non-validated consumptions must already be forwarded on D+2 before 4 am to the transmission system operator Elia and to the balance responsible party selected by the railway undertaking.

Erex user interface

[Erex](#) is the system that Infrabel uses to determine consumption for each train journey.

In order to remain transparent for our customers, we provide a user interface. This user interface can be used to monitor consumption (both measured and estimated) in detail.

For more information about the possibilities offered by this interface, and to request a log-in, please contact energie@infrabel.be.

Each month, you will receive a Settlement Report. This report contains all information that is used in order to draw up the monthly invoice.

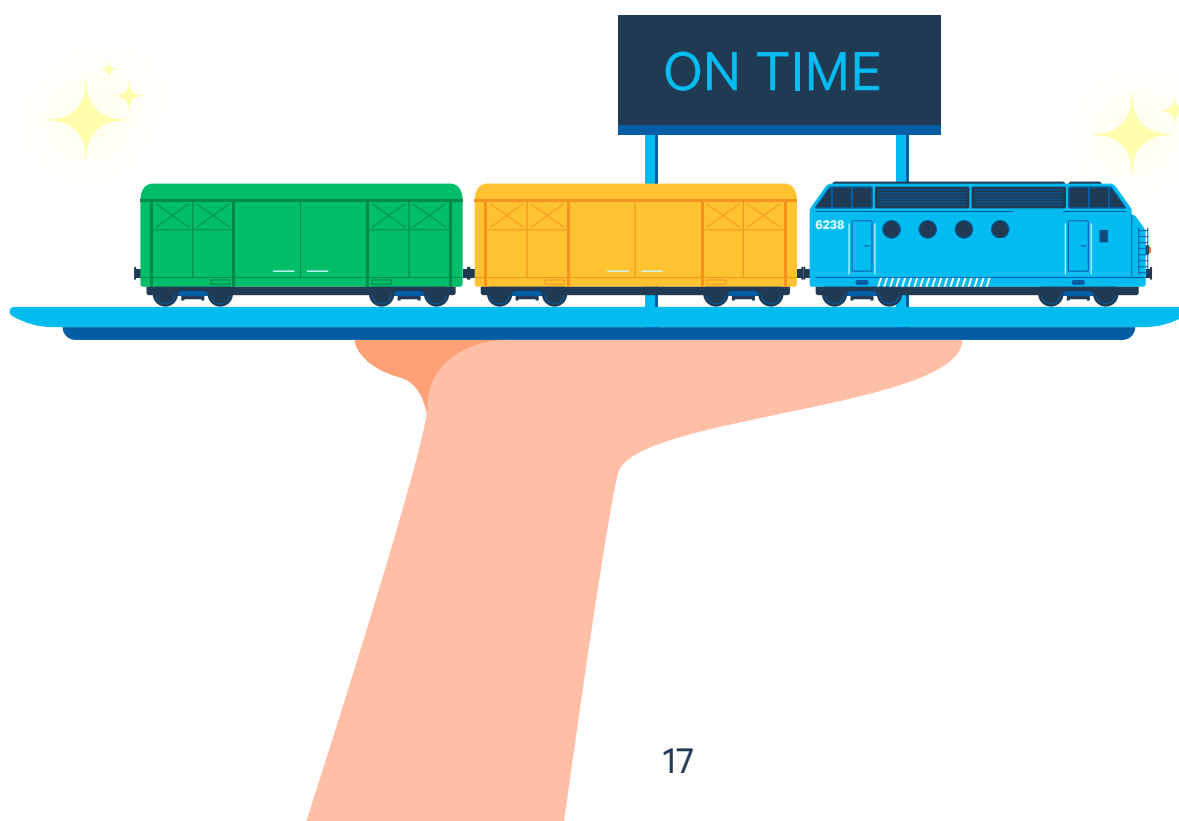
You can also request to receive a Train Run Energy Report each month. This report can be requested at energie@infrabel.be. The Train Run Energy Report contains the following information for each train journey: the applied categories, the composition, the region, the coordinates of the start and end point, the measured or estimated consumption, the mass and the distance covered.

Alcatras

Alcatras is Infrabel's energy management system. This allows Infrabel to fulfil its tasks as grid operator on the electricity market. The system is built around access points. These are points where electricity is taken from or injected into the grid.

Each railway undertaking has an access point per region. This represents the global decrease on a quarter-hourly basis. This data comes from Erex.

A railway undertaking can access Alcatras through the [Business Corner](#) so that it can view its access point information.



8. Definitions and abbreviations

Business Corner

Secure B2B-website, reserved for the clients of Infrabel

The clients of Infrabel can use a range of applications to reserve their routes online, download rules and administrative documents, consult transport and invoice data, enter the composition and tonnage of trains, ...

DAS (Driving Advisory System)

A DAS is an application that can be added to the train driver's tablet PC or that can be integrated into the driver's station. Such a DAS can be stand-alone (S-DAS). In that case, it only has the timetable and a description of the infrastructure (including permitted speed and gradient).

Infrabel is also working to develop a capability to send data in real-time to a DAS. These then become connected (C-DAS). From the end of 2022 onwards, we will be able to send out speed recommendations to avoid conflicts. We are also examining how to provide more extensive information so that an intelligent app on the train can also provide advice to the train driver without causing conflicts.

Elia (Operator of the Belgian transmission system)

Elia manages the 30-kV to 380-kV electricity grids. All large power stations and interconnection lines with neighbouring countries make use of these voltages. Most traction substations are connected to Elia's grid. Electricity cannot be stored easily. Elia also ensures that at any given moment, there is a balance between the supplied or produced energy on one side and the offtake or consumed energy on the other. Elia invoices this service to the party that has caused the imbalances.

Network statement


[The network statement](#) is the document that provides a detailed description of the network, general traffic rules, periods, procedures and criteria in connection to charging rules and allocation of railway infrastructure capacity. It also contains all other information that is necessary to submit a demand for railway infrastructure capacity. The network statement is drawn up on behalf of railway undertakings and other parties with an interest in transportation by rail.

TSI (Technical Specification for Interoperability)

A TSI is a document that lists the essential requirements for a particular subsystem, e.g. rolling stock or infrastructure. For example: all new trains in Europe must fulfil the TSI for rolling stock. These TSIs can be found on www.era.europa.eu.

Footnotes

1. *Applicants may apply for train paths, but do not have a license to drive trains themselves. They use a railway undertaking as a traction operator for that.*
2. *The efficiency of a gas-fired power station is approximately 50%. So, to produce 1 MWh of electricity you need 2 MWh of natural gas. If the gas price is 90 EUR/MWh, this results in 180 EUR/MWh for electricity. The emissions of a gas-fired power plant are 0.5 tCO₂/MWh. At a cost of 60 EUR/tCO₂, this increases the cost of electricity by 30 EUR/MWh. In summary, the electricity price from natural gas is approximately equal to double the gas price plus half the CO₂ price.*



**Would you like to know more about our services?
Or discuss your rail projects with our team?
Take a look at our website or contact our Account Managers!**

 <https://infrabel.be/en/business>

 accountmanagement@infrabel.be



Scan me

