

## Example of calculation of electricity cost

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# 1 Example calculation

## 1.1 Introduction

The following example calculation aims to provide an understanding of how the cost for electricity for holding and traction current is calculated. Note that this is only an example. For current figures, see the [electricity price report](#) on our website. In other respects we refer you to the texts in the Network Statement, Chapter 6, to the sections on access to electricity for the holding of railway vehicles and the provision of traction motor current.

## 1.2 Charge for access to electricity for the holding of vehicles (6.3.3)

The cost charge for the heating of railway vehicles is based partly on a fixed cost per day on each allocated occasion the vehicle is connected to the power source, and partly a cost for electricity consumption.

**Table 1: Cost for access to train heating posts, locomotive heating posts and diesel heating posts**

Service	Charge
Access to train heating post, locomotive heating post or diesel locomotive heating post	x SEK / commenced day
Heating via a raised pantograph for vehicles with electricity meter	x SEK/raised pantograph and commenced day
Heating via a raised pantograph for vehicles without electricity meter	x SEK /raised pantograph and commenced day

The current value of x in the table can be found in section 6.3.3.

[electricity price report](#)

For vehicles with electricity meters which are held with a raised pantograph, electricity is included in the traction current charged, see rail network description section 6.3.4.1. For those vehicles with no meters or that use a train heating post, locomotive heating post or diesel heating post, see below for standard rates.

**Table 2: Templates for billing of energy consumption per vehicle type**

Vehicle type	Mean power in kW	
	April–October	November–March
Day carriage	2.9	9.2
Restaurant car	3.2	11.6
Couchette car	2.5	7.2
Sleeping car	2.5	7.2
Special-purpose cars	1.3	7.6
X1–X14	11.2	22
X2 loco	3	3
X2 car	5	12
X31	5	18
X50-53	5	15
Rc loco heating	2.5	2.5
Diesel motor car Y1	5	10
Diesel motor car Y2, Y31-32	5	18

The standard amounts are based on mean temperatures for the winter and summer periods and a calculated car temperature of between 12 and 14 degrees Celsius.

For vehicles where the table above applies and which lack electricity meters, the loss surcharge E = normal loss surcharge (1.14) for the calculations. For those vehicles that take power via a raised pantographs and which have a meter, electricity is included in the monthly charge for traction current (see example calculation 3 under 1.3).

## 1.2.1 Example calculation 1

Examples of calculation of energy consumption (conducted in 2011)

<b>Train type</b>	<b>Regina X 50-53 Without electricity meter</b>
Holding time days, April – October	214
Holding time – days, November – March	151
Holding time in hours/day	6
Electricity price, SEK/kWh	0.48
Network cost, SEK/kWh	0.09
Certificate, SEK/kWh	0.045
Loss surcharge = E	1.14
Estimated volume loss, SEK/kWh	0.015

*Current data as listed above can be seen in the electricity price report*

### Cost per kWh

(electricity price + network charge) x loss surcharge + electricity certificate + volume difference

$$(0.48+0.09 \text{ SEK}) \times 1.14 + 0.045 + 0.015 = \mathbf{0.7098 \text{ SEK}}$$

### Average power output:

April–October                      5 kW (as per table 2 above)

November–March                      15 kW (as per table 2 above)

### **Calculation:**

April–October                      214 days x 6 hours= 1,284 hours

November–March                      151 days x 6 hours = 906 hours

Assumed electricity price 0.7098 SEK/kWh

Cost: April–October                      5 kW x 1 284 hours x 0.7098 SEK/kWh gives SEK 4,556

Cost: November–March                      15 kWh x 906 hours x 0.7098 SEK/kWh gives SEK 9,646

In addition to the costs above, there is also a fixed cost per holding occasion, train heating post/locomotive heating post. (X in table 1 has been set at SEK 40 per started day = the annual charge for 2013).

The number of days are for the example year with the charge for 2013 for the train heating post//locomotive heating post which means 365 (214+151) days x SEK 40, i.e. SEK 14,600.

**The total cost in our example** for a year for a heating post: the preliminary figure is SEK 14,600 + 4,556 SEK + 9,646 = SEK 28,802.

*The electricity price, including certificate etc. above is only a calculation example. The price charged is based on the outcome of electricity trading for the month in question (see paragraph 6.3.4.1 and electricity price report).*

## 1.3 The supply of traction electricity

### 1.3.1 General information – traction current (6.3.4)

For vehicles that have electricity meters installed, the cost is invoiced based on the actual usage (example of how a cost is reported is shown in the calculation example 3 below). For vehicles with no meter, the charge is based on the reported transportation work and the standard values in accordance with table 1 below.

**Table 3: Standard charges for billing of electricity cost**

Passenger services	Wh/gross tonne-kilometre
Locomotives <130 km/h	31.4
Locomotives >130 km/h	33.9
X2 > 160 km/h	30.8
X2 > 160 km/h	34.5
X1/X10 SL services (trains with passengers)	85.5
X10 Gothenburg local services (Göteborgs lokaltrafik) and Skånetrafiken trains	72.7
Other multiple-unit trains (mean value)	53.9
Freight traffic	Wh/gross tonne-kilometre
Wagon-load trains, Rc locos/Ma locos	19.5
Iron ore trains (the Iron Ore Line)	11.6
Intermodal trains	21.2
Freight trains > 130 km/h	33.9
Museum services	Wh/gross tonne-kilometre
Museum vehicles in accordance with the Railway Act (2004:519), chapter 3. (4§) section 4.	20

**Table 4: Loss surcharge**

Vehicle type	Loss surcharge*
Rc, Rd	E x 1.08
Ma	E x 1.07
IORE	E
Dm	E x 1.13
BR 185, BR 241, BR 242, Re	E
BR 189, BR 441, BR 141	E
BR 142	E x 1.03
BR 161	E x 1.04
X2	E
X3	E
X31–32	E
X40	E
X50–55	E
X60–62	E
X1	E x 1.03
X10–14	E x 1.03
Museum vehicles in accordance with the Railway Act (2004:519), chapter 3. (4§) section 4.	E

\* E = normal loss surcharge = 1.14

The total loss surcharge varies from vehicle to vehicle type according to the above table.

### 1.3.2 Calculation example 2 – Rc locomotive without an electricity meter

The examples below are from 2011. For a current example, see the electricity price report and the tables above.

**Assumptions:**

Train type	Rc loco
Gross weight tons	1000
Distance km	500
Consumption as per table Wh	19.5
Loss surcharge (E x 1.08 as per table 4)	1.23
Calculated volume difference, SEK/kWh	0.015
Electricity price, SEK/kWh	0.48
Network cost, SEK/kWh	0.09
Certificate, SEK/kWh	0.045

*For up to date price information, see the electricity price report*

**Cost estimate in accordance with the information above:**

An Rc locomotive uses 19.5 Wh/gross tonne-km. The distance is 500 km and with a gross weight of 1,000 tonnes, this means 500,000 gross tonne-km.

Used kWh = 500,000 gross tonne-km x (19.5/1000) kWh = 9,750 kWh

Estimated price per kWh = Loss surcharge x (electricity trading price + network charge) + electricity certificate + calculated volume difference.

$1.23 \times (0.48 + 0.09 \text{ SEK}) = 0.7011 + 0.045 \text{ SEK electricity certificate} + 0.015 \text{ SEK}$   
in the calculated volume difference produces the estimated price of 0.7611 SEK.

This means  $9,750 \text{ kWh} \times \text{SEK } 0.7611/\text{kWh} = \text{SEK } 7,421$

### 1.3.3 Calculation example 3 – Rc locomotive with an electricity meter

**Assumptions:**

<b>Train type</b>	<b>Rc loco</b>
Usage as per meter kWh	10 000
Loss surcharge (E x 1.08 as per table 4)	1.23
Electricity price, SEK/kWh	0.48
Network cost, SEK/kWh	0.09
Electricity certificate, SEK/kWh	0.045

*For up-to-date price information, see the electricity price report*

Consumption to be multiplied by the estimated price/kWh which is (loss surcharge) x (electricity trading price + network charge) + (price electricity certificate)

$1.23 \times (0.48 + 0.09 \text{ SEK}) + 0.045 \text{ SEK} = (0.7011 + 0.045)$  produces a forecast cost of 0.7461 SEK per kWh

If the Rc locomotive used 10,000 kWh according to the meter it will cost in this example  $10,000 \times 0.7461 = 7,461 \text{ SEK}$

*The electricity price, including the electricity certificate etc. above is only a calculation example.*

The forecast electricity price in the electricity price report should only be regarded as an indication of the price level.

Starting from 2009, Trafikverket will bill the railway undertakings at the prevailing electricity price including network charges on an hourly basis. Vehicles that have meters with time resolution will be billed at the prevailing electricity price on an hourly basis. Other railway undertakings will be billed with the mean price that results when the time-resolve volume and cost has been deducted.