

User Guide to the

# Life Cycle Costing Tool

for Green Public Procurement of

## Road lighting & Traffic signals



# The LCC Tool for Road lighting and Traffic signals

## What is the LCC tool for?

The purpose of the tool is to encourage and facilitate the wide application of life cycle costing (LCC) among public authorities in the European Union, so that organisations can **make more cost-effective decisions** in their procurement processes for road lighting and traffic signals.

Purchasing price is only a small fraction of all costs of any given product or service. Calculating life cycle costs allows you to be aware of future expenditure and select more cost-effective solutions. To do so, the LCC tool allows you to consider:

- **Initial acquisition costs** (purchase and installation),
- **Operating and maintenance costs** (especially due to energy consumption and the replacement of parts),
- **Other costs** (such as insurance), and
- **Costs of environmental externalities**, namely those associated with climate change/CO<sub>2</sub> emissions due to the energy consumption during operation.

**This guide provides you with the key aspects to consider when using LCC in public procurement**, especially during the preparatory and tendering stages, and introduces briefly the main sections and elements of the LCC tool itself.

## Who is this tool intended for?

The LCC tool has been developed for procurement practitioners in public organisations in the European Union.

It is designed for procurement both below and above the thresholds for application of the EU procurement directives ([Directives 2014/24/EU on public procurement](#) and [2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors](#)).

However, it can also be used by private sector purchasers.

## For which products can this tool be used?

In line with the EU GPP Criteria, this user guide contains basic information to start using LCC in the procurement of:

- **Road lighting** in accordance with EN13201, that is, fixed lighting installations to provide good visibility to users of outdoor public traffic areas used by vehicles, bicycles and pedestrians during the hours of darkness for traffic safety, traffic flow and public security.
- **Traffic signals** in line with EN 12368, that is, fixed red, yellow and green signal lights for road traffic with 200mm and 300mm roundels.

Other types of outdoor lighting systems (for tunnels, parking lots, etc.) are not covered even though the recommendations could still apply.

## When to use the tool?

The tool has been designed to be used during tendering processes. However, that is not the only stage in a procurement process when it can be applied. You can use the tool:

BEFORE TENDERING
To assess the LCC of the current situation and roughly evaluate different solutions to help guide pre-tendering market engagement activities, or to narrow down different technological solutions.
DURING TENDERING
To compare offers during the evaluation and award of contracts, as foreseen in <a href="#">Directives 2014/24/EU on public procurement</a> and <a href="#">2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors</a> .
AFTER TENDERING
To evaluate the performance of the awarded solution in comparison to the previous situation or other offers, to monitor and communicate results and help prepare future tenders.

## I. Prior to the tendering process

Before starting the tendering process, it is important to know what your real lighting needs are, what solutions exist to cover them and which have lower life cycle costs. To do so you need to involve internal stakeholders and consult with the market.

Not all cost drivers are easily included in LCC; you should be aware of that and decide which elements to include in the LCC and which to consider separately as additional criteria, to select the best solution for your needs and for the environment.

### Determine your needs

Prior to tendering, you need to define the lighting needs of the specific project or on a larger scale if you intend to homogenise all your outdoor lighting systems over time.

#### **Rotterdam Lighting Plan and energy efficient procurement of street lighting**

The City of Rotterdam published a tender in 2012 for the purchase of three standard lighting fixtures for the whole city.

The objective was to reduce the diversity of lighting fixtures in the city, to optimise maintenance and repair works and to ensure that sustainability was considered in all aspects of the products' life cycle.

For the selection of proposals, total cost of ownership was considered in the evaluation criteria.

More information [here](#).

The needs will depend on the type of road, security requirements, time of the day, weather conditions, etc.

In this process, rethink the need to illuminate specific features for embellishment purposes to ensure that only those that really have value and interest are highlighted.

Consider also what lighting control systems might be required to satisfy the specific needs and maximise savings at the same time by regulating functioning times, adjusting lighting levels, etc.

### Identify solutions for those needs

There are many options to cover your needs in an environmentally friendly and cost-effective manner when you take your time to evaluate the options.

Consultation with internal stakeholders and the market is key, especially when retrofitting existing installations.

#### **Where do we begin?**

Start by assessing existing installations (characteristics of the different elements, control systems, energy audits, maintenance tasks, etc.) and analysing them against lighting need in each zone. This should identify what sections of the lighting system would most benefit from an upgrade to 1) reduce energy consumption, light pollution, waste generation and toxicity; 2) improve social wellbeing and 3) obtain financial savings.

Section 2.1. of the [EU GPP Criteria for road lighting and traffic signals](#) provides information on what aspects to assess.

In this analysis, evaluate whether it is best to retrofit existing installations (or parts thereof) or if it is worth replacing them completely with new systems that are more energy efficient and cost effective during their lifetime. Applying LCC to these options can help make more informed decisions and assess payback periods for the investments.

Several examples are included in Annex IV of the [Technical report accompanying the EU GPP Criteria for road lighting and traffic signals](#).

### Identify relevant cost drivers and parameters

Different solutions have different costs throughout their life cycle. Analysing the expenses and organisational changes of each potential solution at this preliminary stage will help you unveil “hidden” costs and better evaluate alternatives from an economic point of view.

Operation and maintenance costs - including associated externalities - will be particularly relevant, as well as interest costs in big investment projects, unless financed through energy service contracts or existing public funds.

When identifying cost drivers, make sure to provide clear and objective definitions and refer to industry-acknowledged standards to facilitate acceptance of the process and the provision of data by bidders (the [EU GPP criteria](#) can be a good starting point for this). If you are unsure about any of them, consult with internal stakeholders and/or the market to find out.

In addition to the cost drivers, you will also need to define the basic parameters for the LCC (evaluation period, discount rate, your electricity cost, etc.).

### Consult with relevant parties

It is important to involve and enter into dialogue with other departments of your organisation, suppliers and other parties with an interest in the project (such as neighbourhood associations, local chamber of commerce, social groups, etc.).

Internal departments can help identify and prioritise cost drivers and define the parameters for the LCC calculations (i.e. usage patterns, appropriate discount rate, electricity cost and CO<sub>2</sub>-eq emissions from your energy contract if you include externalities, etc.).

Suppliers will be helpful in identifying the product types and solutions on the market to best meet your needs, especially the type of information and standards available for the different cost drivers and parameters you want to consider in your procurement. Consulting with suppliers in advance also helps to ensure their acceptance of the use of LCC in the call for tenders.

Other parties will be able to identify other concerns that might affect the lighting requirements in different zones (for example, light intrusion in residential areas, use frequency of parks, safety issues, etc.).

Use all of this information in your decision process to select the type of solution you want, the criteria to consider and how LCC will be used in the tendering process.

#### Data needed from other units

Before using the LCC tool for procurement you must liaise with other departments or units within your organisation to gather all data needed for the LCC tool, as not all of it will be automatically available to you. In some cases, you may also need to consult other public sector bodies.

For example, you might need to identify the person in charge of the electricity supply contract to obtain the information on the cost of electricity (to be able to calculate operational costs) and associated CO<sub>2</sub>-eq emissions of your electricity (if you plan to include the associated externalities in the LCC calculation).

#### Using LCC prior to tendering process

The LCC tool can be used at this stage to help you select the type of solution to purchase or type of service to contract, by comparing different solutions using preliminary data gathered in the consultation process.

## II. How to use LCC during the tendering process

If in your tendering process you plan to use life cycle costs instead of pure acquisition price to evaluate economic offers, state it clearly in the tender documents, provide the LCC Tool with the common parameters to ensure transparency, ask for the data that you need for the LCC calculations and make sure to provide clear definitions and standards to ensure the comparability of offers.

Reflect on what additional environmental criteria to consider, to select the best solution, from an economic and environmental point of view.

### Decide your LCC parameters and environmental criteria

The LCC Tool has been designed to allow you to consider different cost categories and, at a preliminary stage, it is important to have the full costs picture for better planning. However, you do not need to include all these categories in the tendering process if there is a good reason to exclude them.

Some parameters, such as energy consumption or durability, will be part of LCC and therefore, evaluated in the awarding phase. However, minimum environmental performance levels should be defined to ensure that the acquired solutions are environmentally preferable from the start. This also applies to aspects not included in the LCC that should be included in the tendering documents to avoid light pollution, light intrusion and ecological disturbance.

#### EU GPP Criteria for road lighting and traffic signals

Use the EU GPP Criteria for road lighting and traffic signals to identify relevant environmental criteria -and industry standards - for this product group:

[http://ec.europa.eu/environment/gpp/eu\\_gp\\_criteria\\_en.htm](http://ec.europa.eu/environment/gpp/eu_gp_criteria_en.htm)

#### Can we define other award criteria linked to energy consumption?

As road lighting and traffic signals are energy-consuming products, operation costs based on energy consumption have been included in the LCC Tool. As energy consumption in usage will be included in the LCC and thus considered as part of the costs award criterion, this should not be duplicated elsewhere in the award criteria.

However, it is perfectly possible to combine LCC with technical specifications which set minimum requirements for energy-efficiency. It is also possible to combine LCC with award criteria based on other aspects of environmental performance such as upright light output or lighting correlated colour temperature to minimise light pollution and disturbance.

### Should we consider CO<sub>2</sub> externalities in the LCC or as a separate award criterion?

The procurement directives make it clear that LCC can include costs of environmental externalities, as well as costs directly incurred by the owner or user. To do this, it must be possible to determine and verify the cost of the externality - and this is the case for CO<sub>2</sub>-eq emissions based on energy consumption.

You can choose whether to include the cost of CO<sub>2</sub>-eq emissions in the LCC, or whether to apply a separate award criterion for it.

If you choose to include them in the tool, the externality cost of CO<sub>2</sub>-eq emissions will have to be specified. At the EU level, a report for DG Transport on the “[Update of the Handbook on External Costs of Transport](#)” by Ricardo-AEA from 2014, proposed a central value of 90 EUR/tonne (in 2010 prices) from a range between 48-168 EUR. In some countries, the Government might provide other figures. Therefore, practitioners will need to specify the costs for the climate change externality making sure that the figure they use is in line with the requirements defined in article 68.2 of [Directive 2014/24/EU on public procurement](#). In the tool, it is proposed to use 90 EUR/tonne CO<sub>2</sub>-eq.

If you apply a separate award criterion based on CO<sub>2</sub>-eq emissions, you may assign a higher weighting to this than it would have had if considered within the LCC. This approach may make sense if you are particularly concerned about the climate impact of the solution you purchase.

Cost drivers included in the LCC tool and used to evaluate the economic offers in the contract award	Other aspects to include in the tender as technical specifications, award criteria or contract clauses
<ul style="list-style-type: none"> <li>Acquisition and installation costs</li> <li>Service and maintenance costs (based on products durability)</li> <li>Operation costs (Energy consumption) ←</li> <li>Fees, taxes and other costs</li> <li>Externalities (CO<sub>2</sub>-eq emissions linked to energy consumption)</li> </ul>	<ul style="list-style-type: none"> <li>Service requirements</li> <li>Technical specifications of the lighting system (luminaires efficacy, dimming controls, etc.)</li> <li>Minimum energy efficiency (lower energy consumption is evaluated as part of the LCC operation costs linked to energy consumption)</li> <li>Other environmental criteria (e.g. ratio of upward light output, light correlated colour temperatures, etc.)</li> </ul>

Note: Based on [Directive 2012/19/EU on waste electrical and electronic equipment \(WEEE\)](#), producers are responsible for financing the collection, treatment, recovery and environmentally sound disposal of electric and electronic waste. It is assumed that all products include, in their purchase price, those waste management costs and, therefore no end of life costs have been included in the tool.



### Define it clearly in the tender documents

Be transparent on how you will evaluate the offer, especially on how the economic offer will be evaluated and then weighed against other award criteria. Inform bidders in the tender documents that you will evaluate the economic offer using a life cycle costing approach and include the LCC tool to be transparent and simplify explanations.

The tool should include the parameters defined by the contracting authority for the LCC calculations (section A).

For each parameter, define in the tender documents exactly what is included and, if relevant, what standard they have to comply with, to obtain comparable offers.

#### Energy consumption of the installation

For road lighting installations, the EU GPP Criteria define a maximum Annual Energy Consumption Index (AECI, in kWh/m<sup>2</sup>.year) which is calculated based on the different operational power modes of the installation, time in each of those power modes and area to be lit.

If you include that criterion in your tender documents, the tool will use the provided AECI and area to be lit to calculate operation costs.

If you do not require it, the tool will calculate operation costs using the power modes and time in each mode defined by you and the different power levels of the luminaires proposed by bidders.

To facilitate data input in the tool, request bidders to present the appropriate information through the “Bidder response sheet” of the tool, making sure that, for each type of pole in the project there is a column for the bidders to input their data.

Bidders have to provide all the required data in order to calculate LCC and be eligible for award of the contract. Making suppliers aware of this as part of preliminary market engagement and in the tender documents is important for a successful tender.

#### New installations, retrofitting and different contractual options

The tool has been designed to be flexible and to be used in different types of contracts, be it for the supply of lighting elements, the installation of new road lighting or traffic signals, or the renovation of installations through different contractual models, such as energy service contracts or light-as-a-service contracts.

To use it, analyse the different cost parameters available in the tool and request information for those that are relevant in each case.

For example, in retrofitting projects you might not require information on poles if you only change the luminaires from an existing installation. However, in new installations, this information will be necessary as pole types and disposition will be defined by bidders based on the lighting needs and luminaires proposed.

In energy service contracts, depending on the characteristics and duration of the contract, you might require only information on the service cost (which would include acquisition, installation, operation and maintenance costs) and on the installation's energy consumption if you want to include externality costs in the overall LCC.

Based on these considerations, decide what parameters will be necessary and adapt the tool accordingly.

### Establish contract clauses

Make sure to include contract clauses in the tender documents to allow monitoring of compliance with the awarded proposal and to:

- Apply sanctions for non-compliance with the declared information to keep contractors accountable for their offer's performance; or if deemed suitable,
- Provide financial bonuses in case the monitored results are better than those estimated in the offer.

### How to consider durability criteria

Durability of road lighting and traffic signals installations are key in their overall life cycle costs, as they greatly influence maintenance costs.

For some elements specific international standards exist (such as test IES LM-80 for measuring lumen maintenance of LED light sources). For others, standard references are not available, therefore you will have to accept other relevant industry testing procedures.

To mitigate risks, include specifications regarding minimum warranty periods (as in the EU GPP Criteria) and include contract performance clauses to allow monitoring and sanctions.

### Evaluate offers

With the information provided in the bids, you can evaluate the economic offers based on the life cycle costs calculated with the LCC Tool.

Each bidder will complete the LCC tool with their information in the “Bidder response sheet” and LCC will be calculated automatically.

LCC results are shown per column (i.e. per pole of the installation) and in total (i.e. aggregating the results of each column). To be fully transparent, make sure to communicate in the tender documents which figures will be used to evaluate offers.

Once you have the LCC results for each bid, you will need to calculate the cost score for each of them based on the cost award criterion weighting and formula indicated in the tender documents.

By combining this with the other award criteria established in the tender documents, you will be able to select the most economically advantageous tender.

Furthermore, the tool allows you to see the results of each column graphically in the “Graphic results” sheet. You can also use this tab to compare the results of different offers (up to 10). To do so, copy the aggregated results of each offer in a different column of the “Graphic results” sheet of the LCC tool.



### Steps to complete and use the LCC Tool

#### 1 Decide the cost categories to be included in the LCC and the offers' structure

The tool has been designed to include different cost categories and options. If for some of them, namely "other costs", you do not have the appropriate data, exclude them from the calculations. Also decide what energy data must be provided to evaluate operation costs due to energy consumption, what replacement costs will be used to evaluate maintenance costs, and decide if you will include the environmental externalities or not. Based on those decisions, show or hide (don't delete) the unused cost categories both in the "Inputs and Results" as well as in the "Bidder response sheet".

Also, based on the installations included in the tender, define how each offer should be presented, so that bidders know where to input their data and how it will be aggregated when several columns of the tool are used for the same offer.

#### 2 Complete Section A (green box) of the LCC Tool with your parameters

The tool will use data provided by the bidder and parameters provided by you, the contracting authority, to calculate life cycle costs. Based on the cost categories decided, fill in section A of the "Inputs and Results" sheet of the tool with your parameters (evaluation period, discount rate, electricity costs, replacement costs, etc.). This will be the basis for the calculations and should be included in the tool provided in the tendering documents, to ensure transparency.

Make sure to protect all sheets of the tool except the "Bidder response sheet", so that bidders cannot tamper with them accidentally, but can still input their data in the appropriate cells and see their results.

#### 3 Request bidders to complete the "Bidder response sheet" of the tool

In the tender documents, require bidders to present the appropriate information through the "Bidder response sheet" of the tool and to protect that sheet when sending their offers to ensure that no data manipulation can happen during the evaluation process.

The information in this sheet is linked to the "Input and Results" sheet so it is important to keep the provided structure to ensure the correct calculation of LCC results.

#### 4 Use the LCC results to evaluate the cost award criterion

As different formulas and weightings are used by contracting authorities to evaluate economic offers, the LCC tool does not itself calculate a score for each tender - but provides the cost value to be included in this calculation. Calculate the cost score for each bid based on the LCC results and the cost award criterion weighting and formula indicated in the tender documents.

By combining this with the other award criteria established in the tender documents, you will be able to select the offer with the best overall results.

### Tool functions overview

The LCC Tool contains six sheets, but the main one is the “LCC Inputs and Results” where the LCC parameters and information is compiled and results presented.

- 1 As a public authority, you have to complete section A - **green box**.
- 2 Brief explanations and recommendations are provided in pop-up comments to guide you on the information to be provided in each parameter included in the tool. Hover over the cell to read the comment.
- 3 Click on the [+/-] sign at the top to show or hide more columns to describe different pole lines in your project, and on the left to hide or show certain cost drivers and parameters.
- 4 Several cost drivers and parameters are foreseen in the tool which might or might not be relevant for your project. If irrelevant, hide the corresponding lines to avoid inputting data. Remember to also hide these from the “Bidder response sheet” to ensure coherence. This might be the case different types of luminaires if you have less than 5 different ones in the pole line or if you decide not to include the environmental externalities.
- 5 Data provided by bidders through the “Bidder response sheet” are automatically copied and shown in section B - **turquoise box**. Click on the [+/-] sign to show or hide them. Costs and other data to be provided by bidders require appropriate definitions in the tender documents to ensure comparability of offers. Make sure that these are properly included (e.g. the norm for the useful lifetime of the lamps or specific maintenance tasks).
- 6 LCC costs are presented in section C - **black box** - by cost category; and provided by pole line as well as aggregated for the whole project. The formulas used to calculate the final life cycle costs are explained in the “Definitions and Formulas” tab of the LCC tool. The graphic representation of results is provided in the “Graphic results” tab in the form of a bar chart showing the contribution of each cost category to the LCC results.
- 7 The tool also provides you with the estimated total energy consumption and CO<sub>2-eq</sub> emissions of each installation and for the whole tender for the duration of the evaluation period.

**LCC Inputs & Results**

As a public authority, remember to input data only on the WHITE cells in section A. Click on the top [+/-] button to compare up to 10 products.

**A. Data provided by the contracting authority: Common parameters for the calculation of life cycle costs**

**1 Identification of the installation:**

**2** c\* Type of installation: [CLICK TO CHOOSE] [CLICK TO CHOOSE]  
 c\* Reference of the installation (and pole line if relevant):  
 c\* Number of poles of the same type in the installation: units

**Basic parameters for the calculations of LCC:**

Country: [CLICK TO CHOOSE] [CLICK TO CHOOSE]  
 Currency: [CLICK TO CHOOSE] [CLICK TO CHOOSE]  
 c\* LCC evaluation period: years 0  
 c\* Discount rate (optional): % 0.0%

**Basic parameters for the calculation of operation costs:**

Electricity price: kWh 0.000  
 c\* Electricity annual price increase (optional): % 0.0%  
 c\* Energy consumption will be evaluated based on:  
 c\* Area to be illuminated by the installation: m2 [CLICK TO CHOOSE] [CLICK TO CHOOSE]  
 c\* Operating hours of luminaire type 1:  
 Operating hours of luminaire type 2:  
 Operating hours of luminaire type 3:  
 Operating hours of luminaire type 4:  
 Operating hours of luminaire type 5:

**Basic parameters for the calculation of maintenance costs:**

c\* Maintenance costs will be evaluated based on:  
 c\* Replacement costs of luminaires: luminaire [CLICK TO CHOOSE] [CLICK TO CHOOSE]  
 Replacement costs of light sources: luminaire  
 Replacement costs of ballast/control gear: luminaire  
 Other annual maintenance costs: luminaire/year pole

**Other costs incurred by the authority (optional):**

c\* Other initial one-off costs: /pole  
 c\* Insurance, taxes and fees: /year.pole  
 c\* Interest costs: /year.pole  
 c\* Other annual costs: /year.pole

**Basic parameters for the calculation of environmental externality costs (optional):**

CO<sub>2-eq</sub> emissions of the national electricity mix: kg CO<sub>2-eq</sub>/kWh 0.000 0.000  
 or  
 c\* Insert CO<sub>2-eq</sub> emissions of your electricity contract: kg CO<sub>2-eq</sub>/kWh  
 c\* Cost of CO<sub>2-eq</sub>: /t CO<sub>2-eq</sub> 0.00

**B. Data provided by bidders: Information about their offer (provided THROUGH THE BIDDERS RESPONSE SHEET)**

**C. LCC Results (per pole line and in total)**

Investment costs (acquisition & installation)		0.00	0.00
Operation costs		0.00	0.00
Maintenance and service costs		0.00	0.00
Other costs		0.00	0.00
Externalities costs		0.00	0.00
<b>Life cycle cost</b>		<b>0.00</b>	<b>0.00</b>
<b>Energy use</b>	kWh	0.00	0.00
<b>CO<sub>2-eq</sub> emissions</b>	kg CO <sub>2-eq</sub>	0.00	0.00

## III. After the tendering process

Monitor compliance with the tender requirements and performance levels promised by the contractor; apply sanctions or bonuses if appropriate; identify lessons for future tenders; communicate results to motivate internal acceptance and buy-in and promote replication by other stakeholders.

### If LCC was part of the tender

Ensure that your contract explicitly mentions the performance levels included in the bidder response sheet as part of the terms.

Monitor performance during contract management to ensure compliance with claims made by contractors - for example in relation to maintenance frequency and costs or the energy performance of equipment by testing them according to the standard defined in the tender specifications - and apply sanctions when non-compliance is found (in line with Article 70 of [Directive 2014/24/EU on public procurement](#)).

Use this stage to record relevant information for the next tender (e.g. if there was enough competition, if bidders provided all relevant information in the appropriate way, etc.). This will allow you to improve results in future similar calls for tenders.

### If LCC was not included in the tender

If LCC was not used during the tendering process but you requested information for all relevant parameters (especially related to operation and maintenance costs), use the LCC Tool to estimate the life cycle costs of the different offers - including the awarded one - and compare between them and to the current situation, if data was identified in the preparatory stage. This will help you develop a baseline of data to inform contract management and future tenders.

### Communicate results

Use all this information to communicate results and plan measures for future tenders. This is especially important if you changed the type of solutions acquired and the results can help to motivate acceptance, buy-in and further improvements.

If possible, share your experience (successes, draw-backs and lessons) with other authorities to encourage replication. One way to share your results at the European level is through the European Commission's collection of [GPP Good Practices](#), published regularly in the EC [GPP News Alert](#).



## Background and acknowledgments

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As set out in the Communication "Public Procurement for a Better Environment" (2008), the European Commission is encouraging public authorities to green their purchasing decisions. In this context, life cycle costing is considered as a useful tool that could deliver financial savings as well as reductions in the environmental impact of purchases made by public authorities.

The European Commission would like to facilitate the wide use of LCC by providing tools that can help the application of LCC among public authorities in the European Union and commissioned this work.

For its development, the project team has referred to other existing tools, guidelines and data sources, namely:

- [Technical specifications of the Life cycle costing \(LCC\) calculation tool](#) produced by Studio Fieschi & soci Srl and Scuola Superiore Sant'Anna for the European Commission DG-Environment, under service contract N°070201/2014/692192/SER/ENV.F.1 (July 2016).
- [LCC-calculation for procurement of outdoor lighting systems](#) by the Swedish National Agency for Public Procurement (November 2016).
- For the CO<sub>2</sub>eq emissions of national electricity mix: [Thinkstep AG Environmental Footprint datasets](#) -data developed in the framework of the Commission Environmental Footprint pilot phase (2013-2018) and valid until December 2020.

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