

# One-stop Service with Ene-CAT and ECTT

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## 1. Providing One-stop Service

ECCJ conducts a factory survey designed to examine compliance with the Act on the Rational Use of Energy. This survey has found out that most business establishments have been implementing structural improvement and policy formulation (a, b and c in Fig. 1), but 30% of them have not been effectively functioning in terms of the energy conservation compliance level (d and e in Fig. 1). (See Fig. 1.)

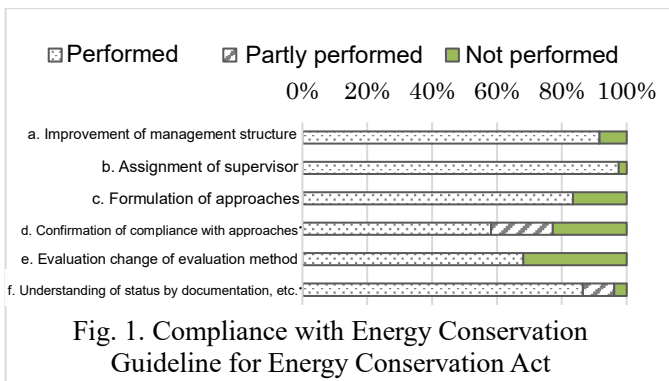


Fig. 1. Compliance with Energy Conservation Guideline for Energy Conservation Act

One of the reasons for delayed energy conservation is the difficulty of formulating an energy conservation plan.

Particularly in formulating the energy conservation plan, it is necessary to work out an energy review, a formulation process defined in the international standard ISO 50001. (See Fig. 2.)

In medium- and small-sized businesses, etc., however, the reality is that their facility personnel are busy with daily facility management, having no time to think about energy conservation measures and calculate an energy conservation amount.

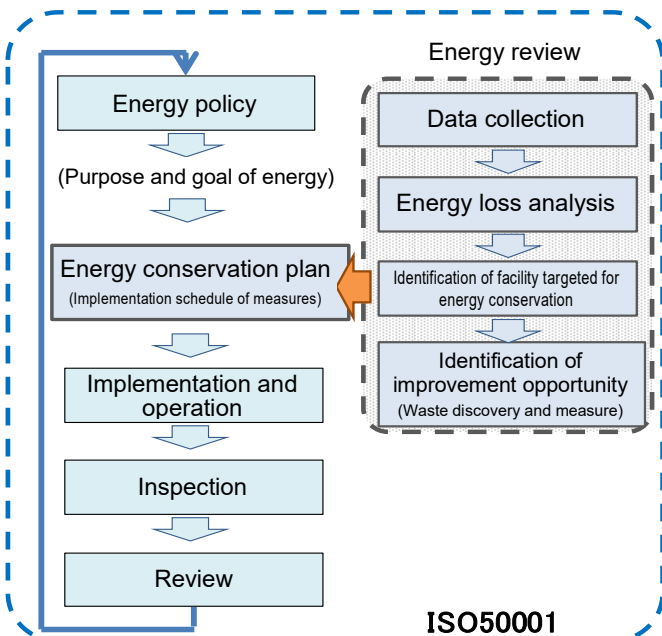


Fig. 2. Energy Conservation Plan Formulation Processes (Source: International Standard ISO 50001 Energy Review)

From a viewpoint of promoting energy conservation, ECCJ provides one-stop service with energy conservation audits by experts and energy conservation solutions (Ene-CAT and ECTT) developed by ECCJ for supporting type 1 energy managers in a series of energy conservation activities, in order to smoothly promote energy conservation of the business establishments.

## 2. Energy Conservation Audit

### (1) Energy conservation audit processes

Audit processes are a series of steps of energy data collection, energy loss analysis, identification of facility targeted for energy conservation and identification of improvement opportunity. Based on the “energy review” proposed by the international standard ISO 50001, the following describes the process steps.

#### 1) Data collection

The first step of energy conservation is to understand energy consumption of the currently used facilities and entire business establishment. An integral value of hourly or daily energy consumption will do as energy consumption for energy conservation audit; it is not necessary to understand it at real time. Collect energy data in rough numerical values.

#### 2) Energy loss analysis

It is general to present the collected energy data in a daily or month consumption graph. The ISO 50001, however, requests for energy loss analysis for each facility in order to identify the facility targeted for energy conservation. The following describes the concept of energy loss analysis for the utility facility and production line.

#### • Energy loss analysis for the utility facility

The utility facility is to convert primary energy into secondary energy, generating an energy loss at the time of conversion and distribution.

Now, exemplify a boiler. Assuming primary energy of city gas to be 100 and secondary energy after converted into vapor to be 90 as shown in Fig. 3, the difference of 10 is heat-discharged into the atmosphere as a conversion loss.

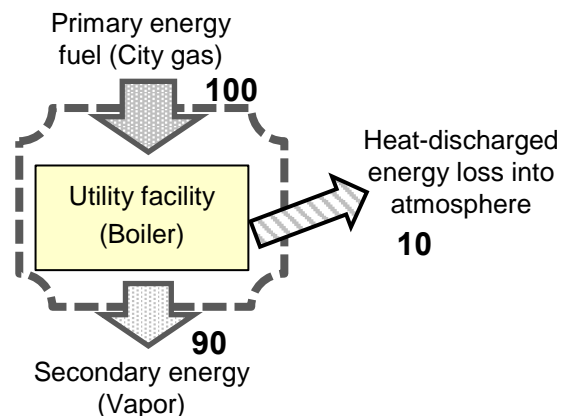


Fig. 3. Energy Loss at Utility Facility

- Energy loss analysis for the production line  
Possible energy losses at the production line include a) radiation from a heating furnace, etc. and b) standby energy loss, etc. in the case of an imbalanced cycle time between each of successive processes.
- 3) Identification of the energy conservation facility  
As a result of energy loss analysis in 2), identify the facility with large energy loss and high energy consumption as the target.
- 4) Identification of improvement opportunity
  - Once the facility targeted for energy conservation is identified, understand the status quo through on-site physical inspection, and energy measurement as required.
  - By analyzing the factors for energy loss by the differences between the regulations and standards of the Energy Management Manual and the status quo, and reviewing the regulations and standards as required, propose energy conservation measures, calculate an energy conservation amount for each measure item and formulate an energy conservation plan.

(2) Actual audit examples

ECCJ provides audit and consulting services for a fee instead of the busy facility supervisor. Centering on large-scale business establishments such as designated energy management factories, governmental facilities and local governmental facilities as target business establishments, ECCJ responds to audits to consulting before and after measures. Table 1 shows the results.

Table 1. Audit Cases (FY2019)

Facility	No. of audit cases
Governmental facilities	117
Local governmental facilities	6
Companies, etc.	3

(3) Actual examples

- Local governmental facilities

Local governmental offices, sports centers, etc. have large-scale spaces and have been updating heat sources as to air conditioning, but the overall systems have been left intact since their construction. For this reason, they cannot respond to increased personnel, changed purposes of use, etc., having problems such as irregular room temperature and heat accumulation, and showing poor adaptability to outer air temperature. (See Fig. 4.)

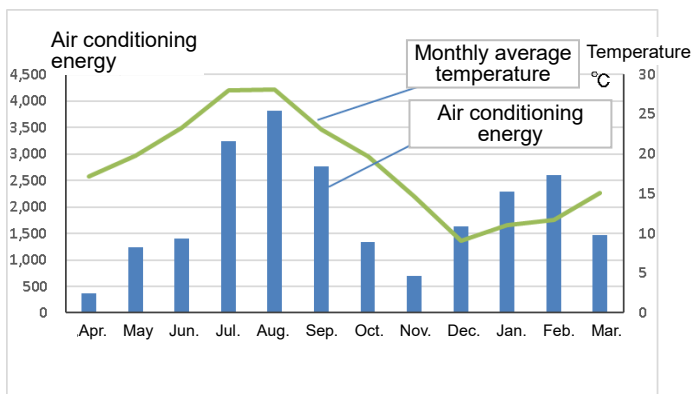


Fig. 4. Air Conditioning Energy vs. Temperature

The above figure shows that air conditioning energy doubled in September from June despite the same average temperature in both months. For this problem, we proposed to solve a room temperature difference and lower an air conditioning load in large spaces for energy conservation by introducing a circulator and reducing an excessive outer air inlet volume.

- Oil storage base

An entire oil tank had been heated at 60°C by vapor so as to always feed high-viscosity heavy fuel oil C for power plant. Conventionally, vapor feed had been turned off when the temperature increased to 62°C, and turned on at 59°C. We proposed to halve a heating quantity by turning off vapor feed at 60.5°C to stop excessive temperature rise.

### 3. Energy Conservation Solutions (Ene-CAT and ECTT)

It is an option to ask an expert to conduct an energy conservation audit. Normally, however, it is more desired that the audit is conducted by the facility supervisor familiar with the operating status of the facilities and actual energy consumption status. In response to this, we provide energy conservation solutions (Ene-CAT and ECTT) capable of implementing energy conservation audit processes up to formulation of the energy conservation plan by linking energy data to the EMS. The following outlines these solutions and describes their cases.

(1) Ene-CAT (energy conservation support tool)

1) Internal configuration of Ene-CAT

As shown in Fig. 5, Ene-CAT is internally configured with 3 layers of the energy loss visualization screen, Energy Management Manual for the facilities and energy conservation amount calculation sheets, centering on the visualization screen. User-friendliness is improved by mutually connecting related files in the layer, and the energy reduction effect and energy loss reduction status by energy conservation measures are reflected on the visualization screen through common database. It is also possible to calculate a degree of effect of the energy conservation amount of individual facilities on overall intensity improvement, contributing to formulation of the mid- and long-term plan of the Act on the Rational Use of Energy.

This internal configuration allows an energy loss analysis in the energy review of the ISO 50001 to identification of improvement opportunity in a functional manner.

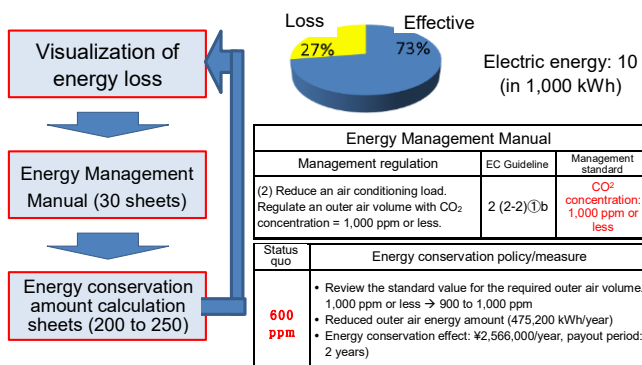


Fig. 5. Internal Configuration of Ene-CAT

## 2) Ene-CAT function

In order to identify the facility targeted for energy conservation, an energy loss amount is displayed in a pie chart to visualize an energy loss. (See Fig. 6.)

In order to identify the facility with large energy loss and consider energy conservation measures, Ene-CAT provides a mechanism to extract new energy conservation measures by reviewing the regulations and standards of the Energy Management Manual of the Act on the Rational Use of Energy. Specifically, by clicking on the facility name in the energy loss visualization screen (Fig. 6), the desired Energy Management Manual is invoked to present an energy conservation measure for each regulation of the Manual. Select an applicable measure and calculate an energy conservation amount according to the energy conservation amount calculation sheets. There are more than 200 kinds of energy conservation amount calculation sheets.

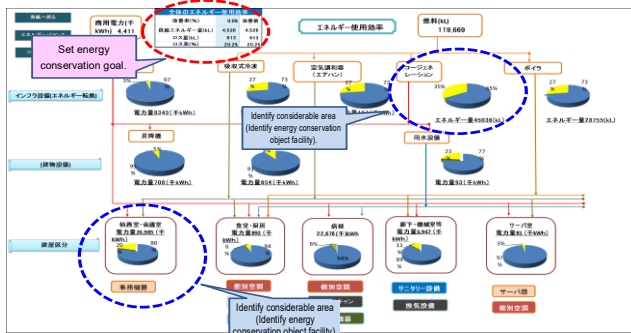


Fig. 6. Visualization Screen of Ene-CAT

## 3) Ene-CAT introduction cases

So far, there are 4 application cases to the factories and 30 application cases to the office buildings. There are few applications to the factories because the production lines consist of specialized equipment, requiring many individual finishing touches and more labor and time for introduction. We will increase application cases for each business category to disseminate Ene-CAT.

It is easy to apply to the office buildings because they have common facilities. Recently, however, there are cases of combining multiple facilities to build a system to interchange and complement the heat, presenting an issue of effective application to the system.

<Introduction cases to commercial buildings (hospitals, universities, etc.)>

Introduction to the office building has been mainly done through a system accompanied by data linkage to the BEMS of the building. (See Fig. 7.)

Linkage to the BEMS has allowed them to visualize monthly energy loss of the facility, understand the changing energy loss of the air conditioning facility with sharp seasonal fluctuations of energy consumption, consider appropriate energy conservation measures as well as shorten a PDCA cycle period to confirm and pick an effective energy conservation effect.

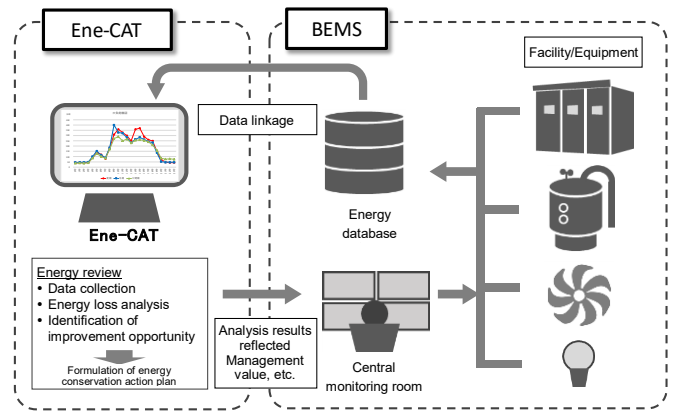


Fig. 7. Data Linkage to BEMS

<Introduction case to the factory - 1>

Ene-CAT was introduced to a FA machining line which manufactures elevator guide rails. As shown in Fig. 8, the FA machining line begins with removal of black scales by shot blast, followed by bend correction, coating, NC machining, surface finishing, cutting, and so on. In this FA machining line, efficiency had been lowered by defective products, correction of defective warpage, etc. Particularly, correction of warpage is not completed in one attempt because springback has to be considered. Based on the idea of regarding an energy amount to repair a reworked item as a loss, the amount of money required is visualized to enhance a worker's awareness as shown in Fig. 8.

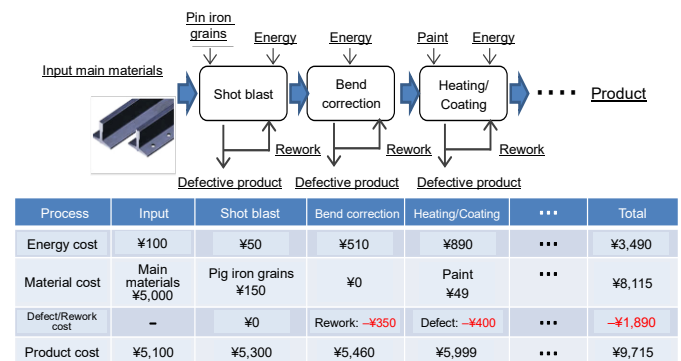


Fig. 8. Application Example of Ene-CAT to Factory

<Introduction case to the factory - 2>

The following describes an example of a factory where vapor control systems are manufactured. Using vapor to inspect, research and develop the products, many vapor flowmeters are installed to visualize usage. An improvement issue is exposed and an improvement effect is confirmed by vapor loss analysis with Ene-CAT, contributing to continuous promotion of energy conservation activities. (See Fig. 9.)

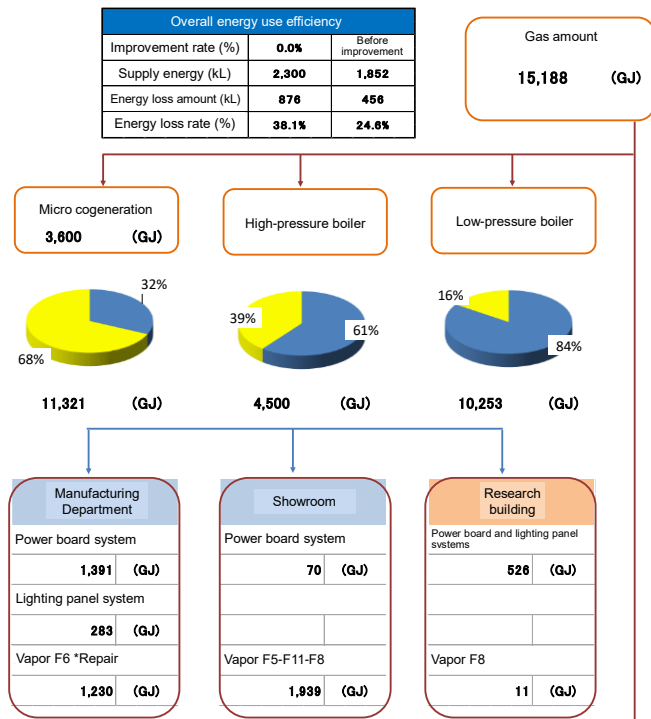


Fig. 9. Energy Loss Analysis Results of Vapor Facility

#### 4) Future development of Ene-CAT

Conventionally, energy conservation has been promoted and supported for people. Since energy conservation audit technology is needed to some extent in handling Ene-CAT, we are promoting a system capable of directly controlling the equipment through AI-based optimum control and IOT-based comfortable control as a developed version of Ene-CAT free from specialty in the future.

Table 2. Future Development of Ene-CAT

	Aim	Item	Description	Sampling	Delivered to
Energy conservation promotion and support	Energy conservation plan	Building of 1% intensity	Calculation of energy conservation potential by energy loss analysis and energy conservation calculation sheets	Monthly	Companies, universities, hospitals
	Energy conservation measure	Visualization of and measure for energy loss	Analysis based on current data, calculations, etc.	Spot	Manufacture of mechanical parts, universities, hospitals
	Improved Energy Management Manual	Preparation of Energy Management Manual	Preparation of Energy Management Manual sheets	Monthly	Oil storage, hospitals, others
Equipment control	Optimum control	Office buildings, supermarkets	Link to optimum control software	15 times/min.	Suburban store
	Comfortable control	PMV	Radiation air conditioning, desiccant	15 times/min.	Under demonstration
	Failure detection Aging	Defective air conditioner, mechanical failure, vapor leakage	Comparison with steady operating condition	1 time/sec. and /min.	Under development

PMV: Predicted Mean Vote

Implemented as the examples of equipment control was demonstration projects to use AI to control air conditioning, showcases, etc. of suburban stores at real time. A consumed energy amount was minimized in a comfortable environment felt by people. As equipment control, this system controlled air conditioners, showcases and desiccant every 30 minutes to optimize the temperature and humidity according to the outer air temperature and the changing number of shoppers, achieving approx. 30% energy conservation compared with existing stores in the neighborhood.

#### (2) ECTT (Energy conservation support tool for buildings)

ECTT is a tool to simply indicate an effect of energy conservation and potential for energy conservation when various energy conservation measures are implemented. It has been developed for the purpose of supporting the energy conservation plan having an energy usage target value and evaluation of energy conservation management. It is mainly intended for not only single-use commercial buildings, but also mixed-use ones mainly used for offices. It can be downloaded from the website of ECCJ; we support its utilization for a fee.

##### 1) Data input

###### • Building information

Other than data input of area, total floor area, specifications of roof, outer wall and window glass, heat source facility, area by department, air conditioning system and actual building energy usage, standard values are used to simplify data input. (See Fig. 10.)

##### 2. Building information (Input the details)

- Roof specification: Reinforced concrete construction, internally insulated, exposed waterproof (50-mm insulation)
- Outer wall spec.: Reinforced concrete construction, externally insulated (50 mm)
- Glass spec.: Ordinary glass, 8 mm
- Window opening rate (%):

	North	East	South	West
25	25	25	25	25
- Main heat source facility (Central heat source facility only)

Model	Units	Fuel	Rated output (kW/unit)	Rated input	COP	Operational order				
						Summer Day: Night	Intermediate Day: Night	Winter Day: Night		
Turbo chiller	2	Electricity	Cooling	kW/unit	4.00	1	1	1	1	1
Boiler	2	Gas	Heating	MJ/h/unit	0.80	1	1	1	1	1

Fig. 10. Input Example of Building Information

###### • Inputting the energy conservation measures

Classify 78 items of energy conservation measures specialized in commercial buildings as listed in Table 3 and calculate energy conservation for each category of measures I, II and III, and when the 78 items are freely selected. By assuming already introduced measures to be “implemented”, calculate energy consumption for each category of measure when the “unimplemented” measure is implemented.

Table 3. Categories of Energy Conservation Measures (ECTT)

Category	Description	Quantity
Measure I	Operational improvements such as setting change	38 items
	• Alleviation of room setting temperature	
Measure II	• Adjustment of cold water outlet temperature	20 items
	Small-scale repair and renewal	
	• Introduction of total heat exchanger	
Measure III	• Introduction of motion detector	20 items
	Large-scale repair and renewal	
	• Renewal of high-efficiency heat source equipment	
	• Renewal to LED lighting	

## 2) Calculation and evaluation of potential for energy conservation

Considering an energy conservation amount in the case of implementing all of unimplemented energy conservation measures based on the current energy usage, Fig. 11 shows the results of calculating current potential for energy conservation. “Target” located in the middle is a predicted value in the case of implementing part of unimplemented energy conservation measures, indicating the future target of energy management.

The following lists the examples of utilization.

- Utilized for quantitative evaluation of energy conservation efforts

In the case of implementing the measures with high energy conservation effect, it is evaluated that potential for energy conservation is reduced, indicating “full implementation of energy conservation measures”.

- Utilized for the energy conservation plan and energy management

Available for the energy conservation plan and energy management by estimating how much potential for energy conservation there is for the current commercial buildings mainly used for offices.

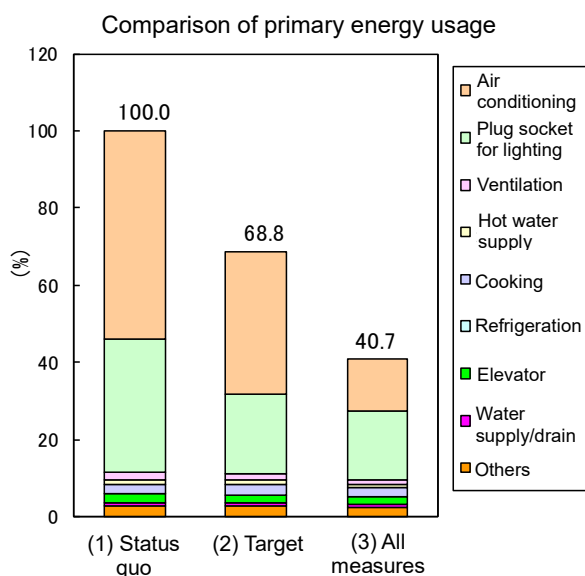


Fig. 11. Calculation of Potential for Energy

## 4. Supporting the Report to the Administration

Since a periodical report in FY2017, a business operator class assessing system was initiated for the purpose of enhancing energy conservation promotion activities. The business operators achieving 1% reduction of the 5 fiscal years' average intensity (S Class) are made public. Those not achieving are evaluated as A Class. Of them, those inactive in energy conservation are evaluated as B Class. ECCJ provides consulting particularly for the B-class business operators. The following describes an example of consulting. A storage amount had been used as a denominator of intensity at an oil storage base. As a result of analysis, however, it was found out that storage itself

did not consume energy; energy consumption was high in oil transport for checking for an oil leak from a tank and vapor cleaning inside the tank, clarifying that the current intensity is not suitable to the actual situation. As a result of proposing a new intensity, accordingly, this business operator was evaluated as S Class. We also support reporting to the local government and related government ministry/agency.

## 5. Providing One-stop Service

We provide energy conservation consulting with the energy conservation solution tools as one-stop service. (See Table 4.)

Table 4. Details of One-stop Service

Item (Example)	Object/Description
Energy conservation measure for factory	Quantification of energy flow analysis and equipment control measure with Ene-CAT
Energy conservation measure for building	<ul style="list-style-type: none"> <li>• Simple analysis and proposal of measure with ECTT</li> <li>• Reduction of air conditioning load and optimum control from viewpoint of human evaluation such as PMV</li> </ul>
Energy conservation audit	Energy conservation audit of building/factory and equipment for implementing improvement proposal by expert
Business expansion with energy conservation	Advice for expanding energy conservation service at own company
Support of report to administration	Support of and advice for report to local government and related government ministry/agency

Consulting: <http://www.eccj.or.jp/education/cons.html>

○Inquiry counter

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