

ICAO ICEC API

User Guide

v1.1

Table of Contents

Table of Contents.....	2
Introduction to the ICAO ICEC API User Guide.....	3
Introduction to WSO2API Manager.....	3
Account Creation	3
Sign-in.....	4
Application Creation.....	5
Subscription Process	6
Keys Generation Process	8
Testing with TRY OUT Option	9
Accessing the API through a third-party software.....	12
Requests the output of Carbon Emissions.....	20
UN methodology	24

Introduction to the ICAO ICEC API User Guide

Welcome to the ICAO ICEC API user guide. This API is for every entity which wants to benefit from ICAO’s methodology for calculating the amount of CO₂ Emissions attributed to air travel.

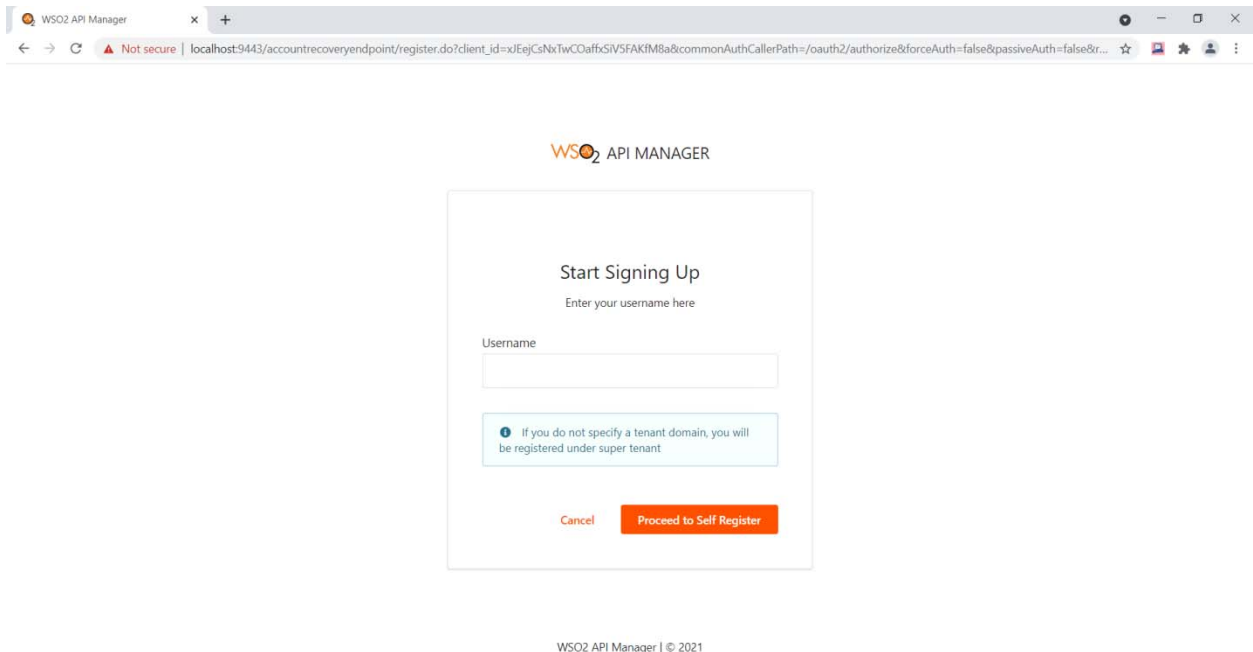
Introduction to WSO₂API Manager

WSO₂API Manager is a third-party, complete solution for API design and publishing, chosen by ICAO, which acts as an intermediary between users and the ICAO ICEC methodology. In addition, it provides instant insights to end-users and admins through the WSO₂ Data Analytics Server.

Account Creation

To create an account in WSO₂ API Manager, Access the API STORE (<https://bas.icao.int:9443/devportal>), click on “Sign In” and follow the steps below:

1. Enter a user name and click on the Proceed to Self Register button.



2. Fill in your information
3. Accept the Privacy Policy conditions and click on Register.

The screenshot shows a web browser window with the URL `localhost:9443/accountrecoveryendpoint/signup.do`. The page title is "Create New Account". Below the title, it says "Fill in the form below to complete registration". The form contains several input fields: "First Name", "Last Name", "Password", "Confirm password", "Email", "Organization", "Telephone", "IM", "Country", "Mobile", and "URL". Below the form, there is a blue box with text: "When you sign in, we use a cookie in your browser to track your session. You can read our [Cookie Policy](#) for more information." Below this box is a checkbox with the text "I hereby confirm that I have read and understood the [Privacy Policy](#)". To the right of the checkbox is an orange "Register" button. At the bottom left of the form area, it says "Already have an account? [Sign in](#)".

Sign-in

Once registered, you can sign-in WSO2 API Manager by entering your username and password and clicking on Continue.

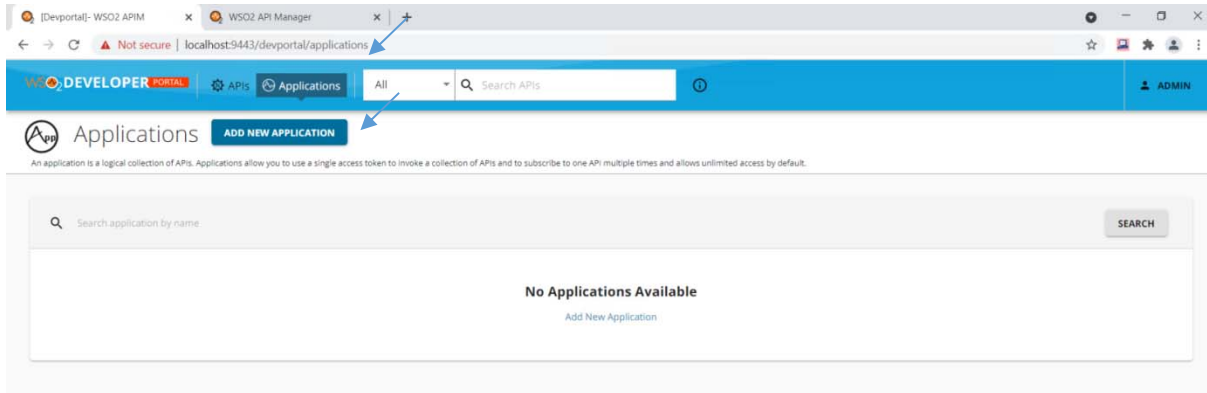
The screenshot shows a web browser window with the URL `localhost:9443/authenticationendpoint/login.do?client_id=xjEejCsNxTwCOaffxSIV5FAKfM8a&commonAuthCallerPath=%2Foauth2%2Fauthorize&forceAuth=false&passiveAuth=false...`. The page title is "WSO2 API MANAGER". The main content is a "Sign In" form. It has two input fields: "Username" and "Password". Below the "Password" field is a link "Forgot Password?". There is a checkbox "Remember me on this computer". Below the form, there is a yellow box with text: "We use browser cookies to track your session to give better experience. You can refer our [Cookie Policy](#) for more details." Below this box is another yellow box with text: "By signing in, you agree to our [Privacy Policy](#)". At the bottom left of the form area, there is a link "Create Account" and an orange "Continue" button. At the bottom of the page, it says "WSO2 API Manager | © 2021".

Application Creation

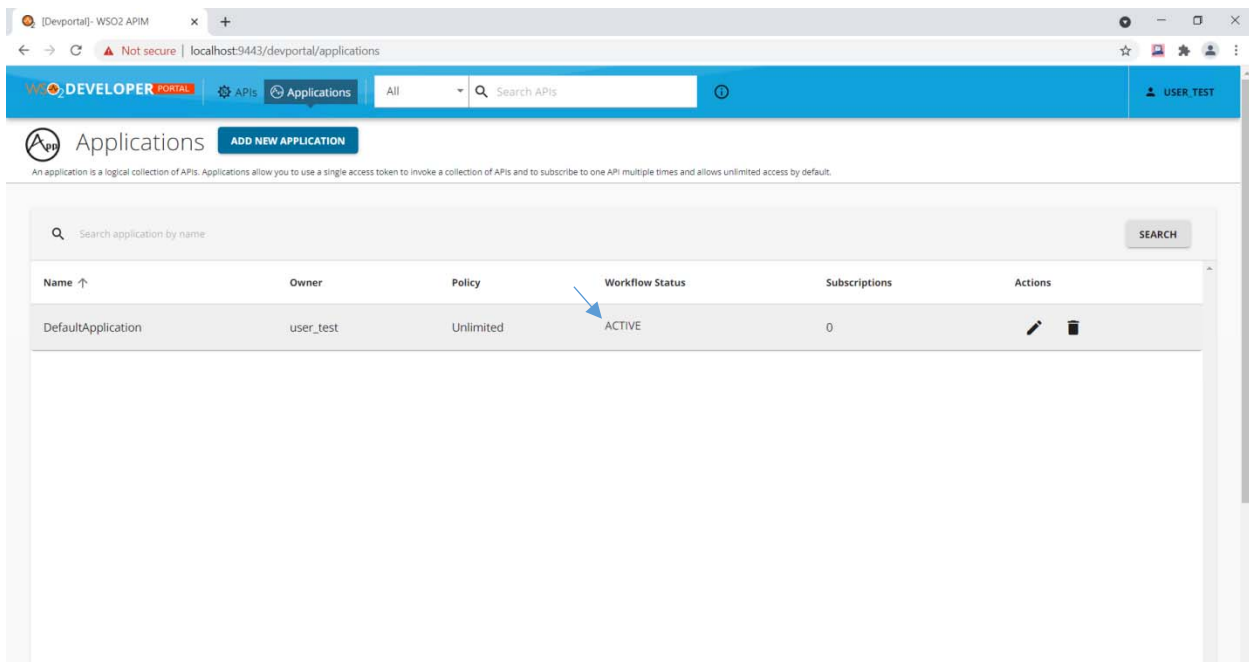
Before you are able to use the ICAO ICEC API for the first time, you need to create an application. This process should be repeated with each new subscription you request.

To create a new application, follow the steps below:

1. Navigate to Applications, located in the page header.
2. Click on the Add New Application button and enter your details.



Once created, your application will appear as Active.



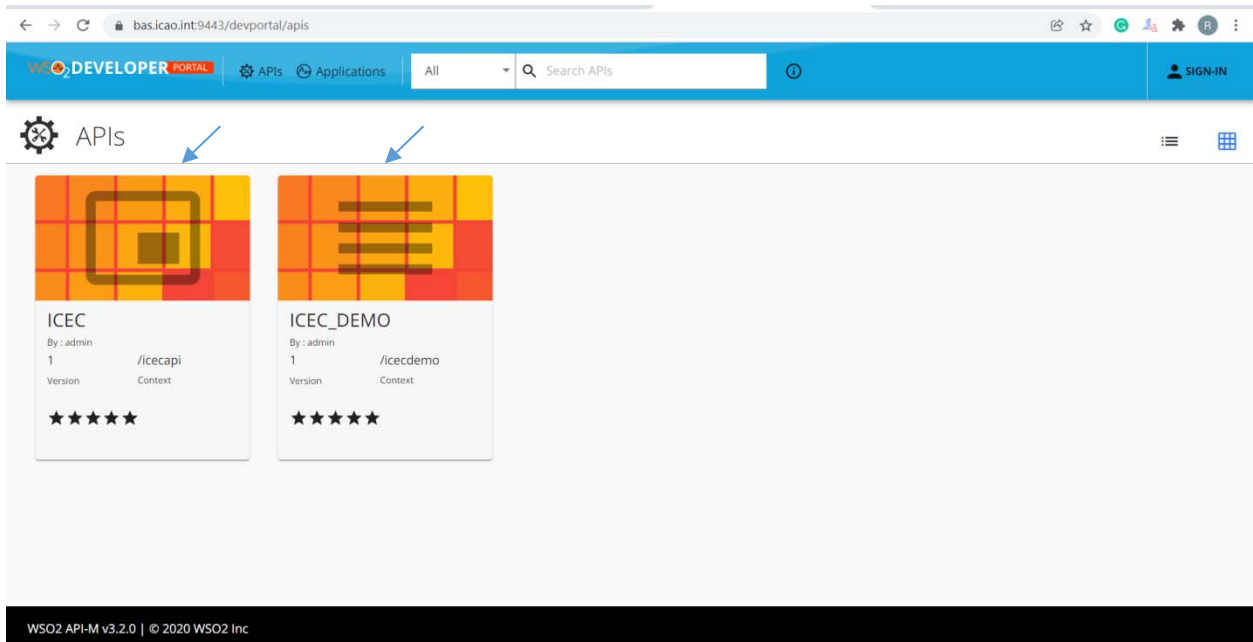
As mentioned above, once you have used up all available API calls and if you wish to purchase additional ones, you will need to repeat the application creation process and request another subscription i.e., you will be creating a new application for each individual API subscription. This is required to prevent you from losing calls on currently active subscriptions.

An application named DefaultApplication is already created in WSO2. It is recommended that its name is changed to ICEC_Application to avoid confusion in case you are already using or intend to use other ICAO APIs.

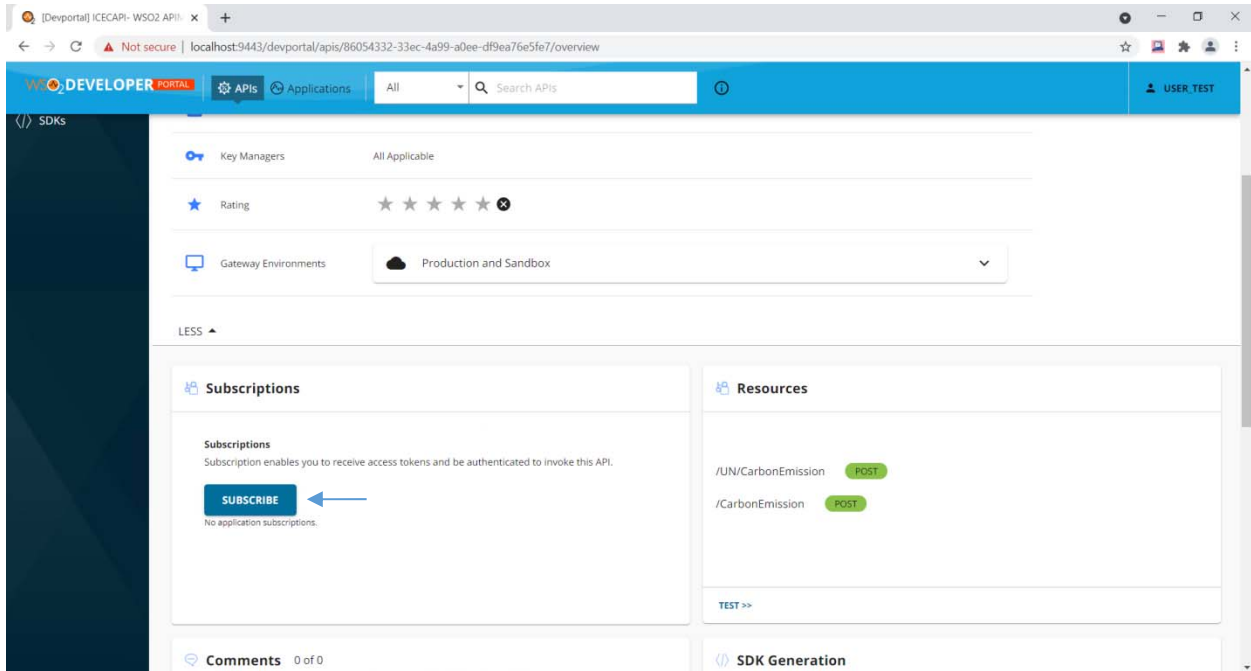
Subscription Process

After you have created your application, e.g., the ICEC application below, you can proceed with subscribing to the ICAO ICEC API by going through the following steps:

1. Go to APIs, located in the page header.
2. Click on the ICEC icon you had already purchased a tier for or click on the ICEC_DEMO icon if you want to try it.

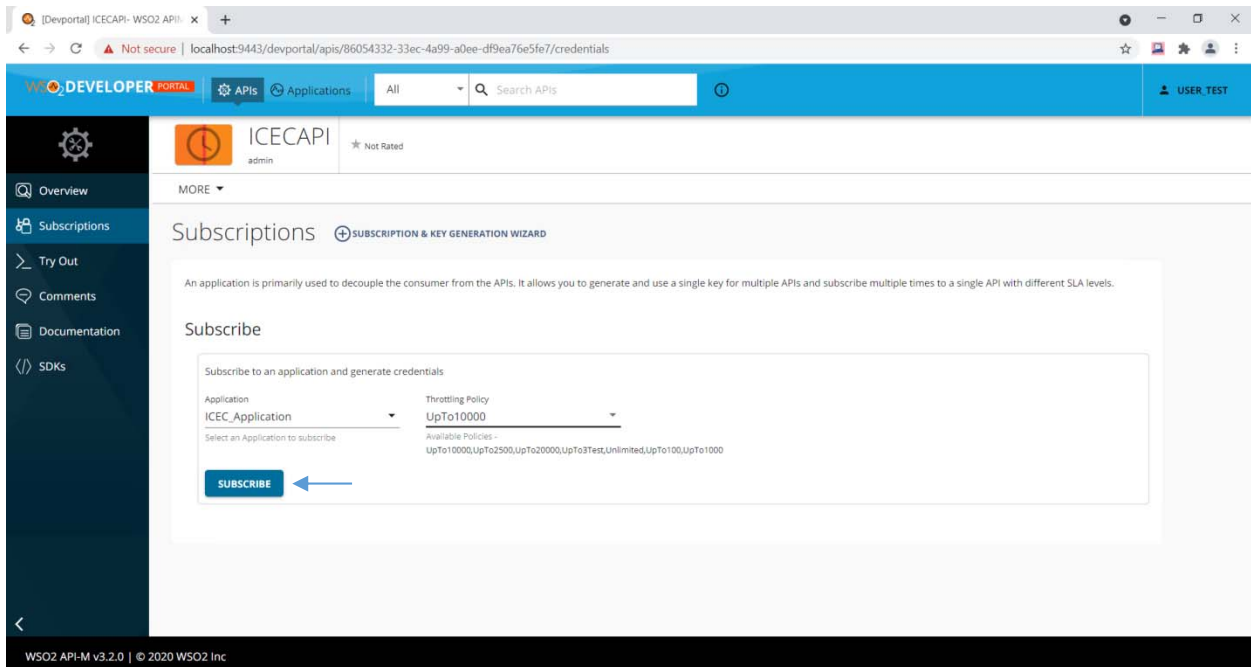


3. Click on the Subscribe button.



4. Choose your desired quota limit from the Throttling Policy drop-down menu.

5. Click on the Subscribe button.



At this stage, your application status will appear as ON_HOLD. The admin will be notified of your subscription request via email.

After approval is granted, your application status will change to UNBLOCKED.

Please note that, whether you are testing the ICAO ICEC API or purchased API calls, your subscription request will always have to be approved by an admin.

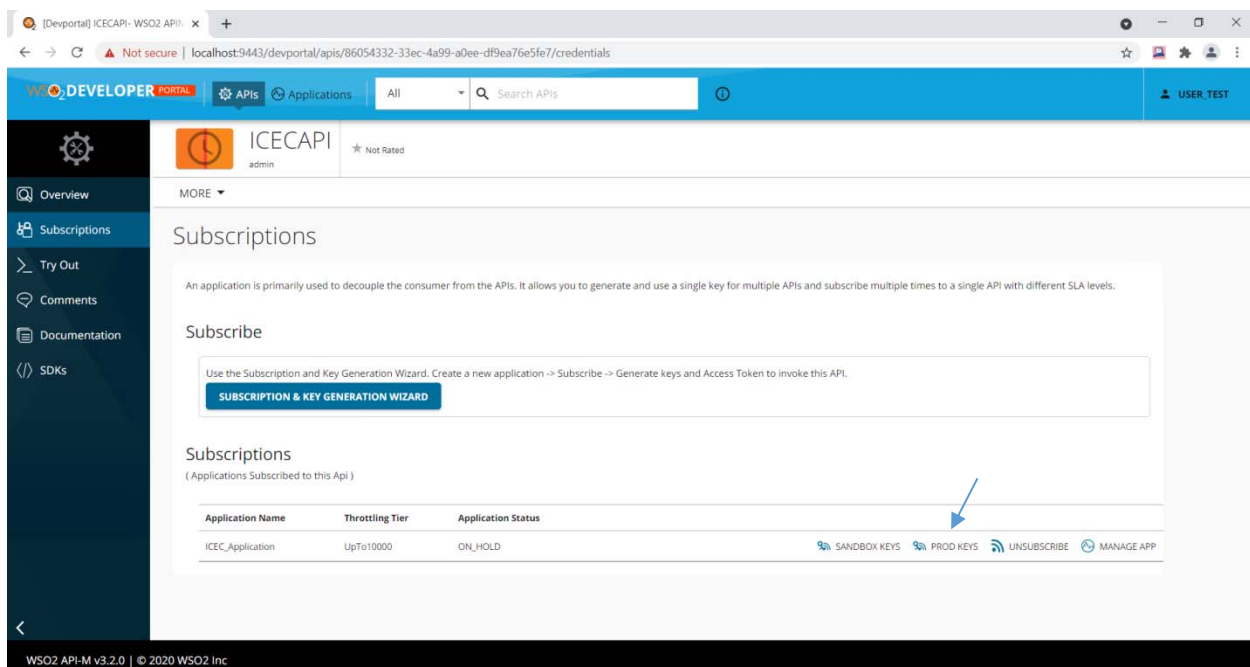
Keys Generation Process

For your ICAO ICEC API subscription to be activated, you need to generate keys referred to as production keys.

Once you get to the Keys Generation process, you would need to select PROD KEYS from the bottom right part of the screen.

To generate production keys, follow the steps below:

1. Click on PROD KEYS on the bottom right of the screen below

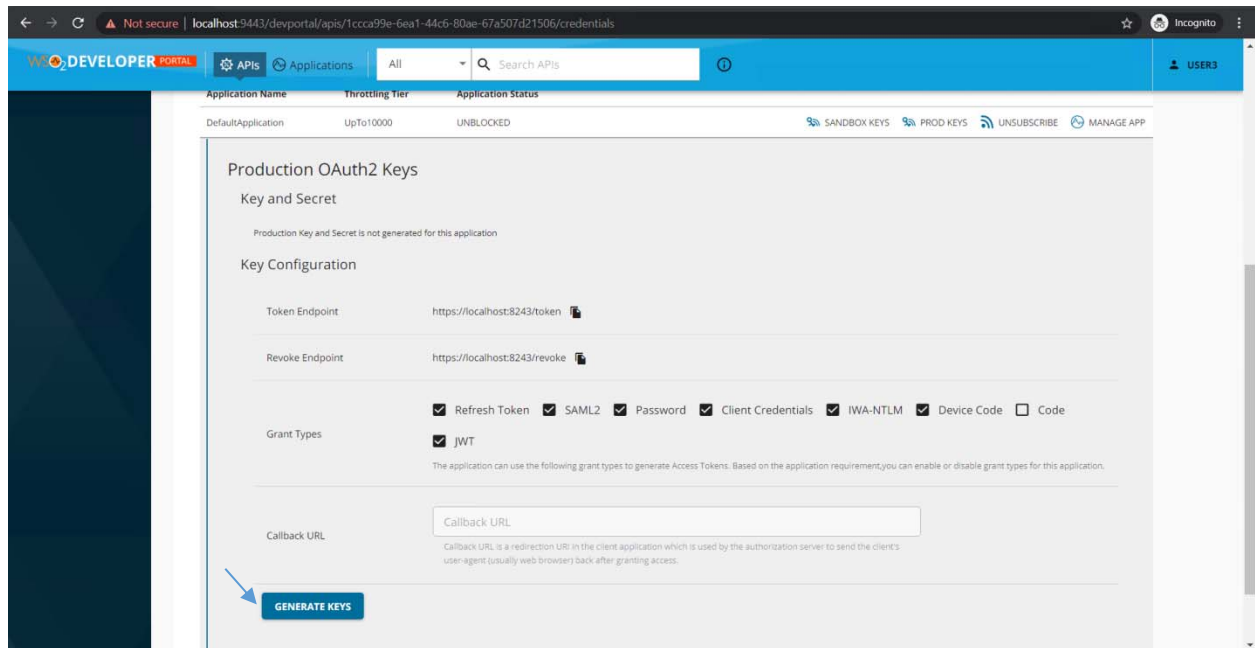


The screenshot shows the WSO2 Developer Portal interface. The top navigation bar includes 'DEVELOPER PORTAL', 'APIs', 'Applications', and a search bar. The user is logged in as 'USER_TEST'. The main content area is titled 'Subscriptions' and includes a 'Subscribe' button labeled 'SUBSCRIPTION & KEY GENERATION WIZARD'. Below this, a table lists subscriptions for the 'ICECAPI' application. The table has columns for 'Application Name', 'Throttling Tier', and 'Application Status'. One entry is shown: 'ICEC_Application' with a throttling tier of 'UpTo10000' and a status of 'ON_HOLD'. To the right of this entry are four buttons: 'SANDBOX KEYS', 'PROD KEYS', 'UNSUBSCRIBE', and 'MANAGE APP'. A blue arrow points to the 'PROD KEYS' button.

Application Name	Throttling Tier	Application Status	SANDBOX KEYS	PROD KEYS	UNSUBSCRIBE	MANAGE APP
ICEC_Application	UpTo10000	ON_HOLD				

2. Click on the GENERATE ACCESS KEYS button.

WSO2 API Manager will create the keys and secrets needed to generate a token that will enable you to call the ICAO ICEC API and also allow you to use the TRY OUT option on the API STORE portal.

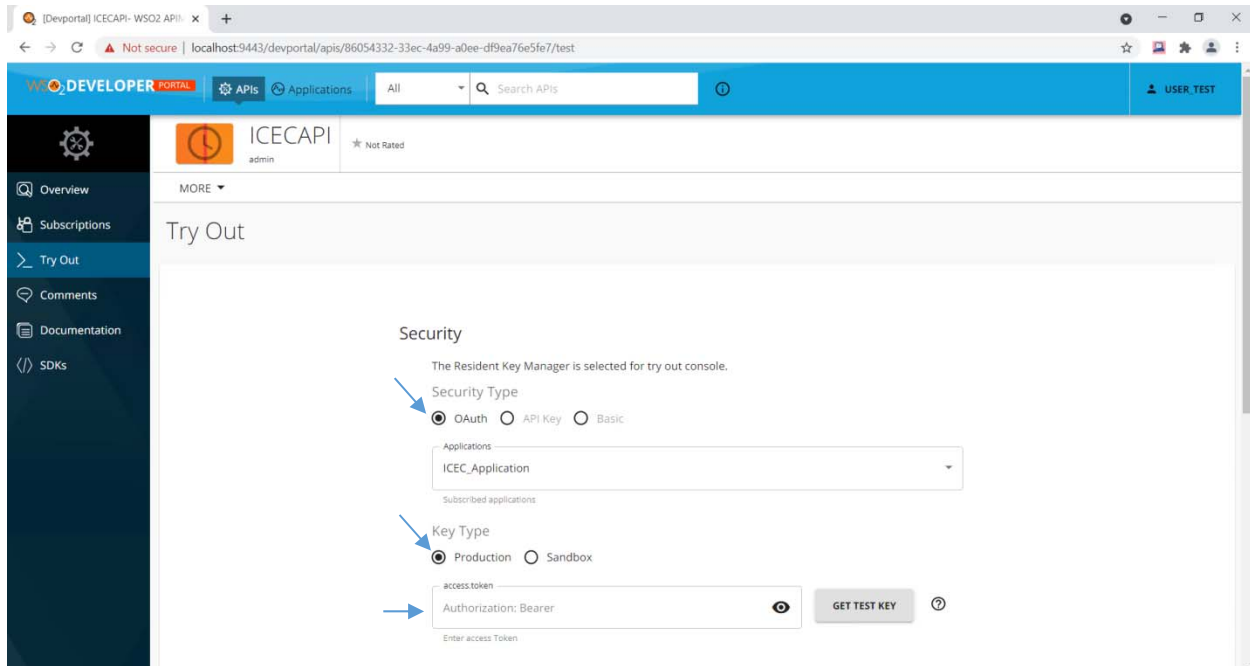


Testing with TRY OUT Option

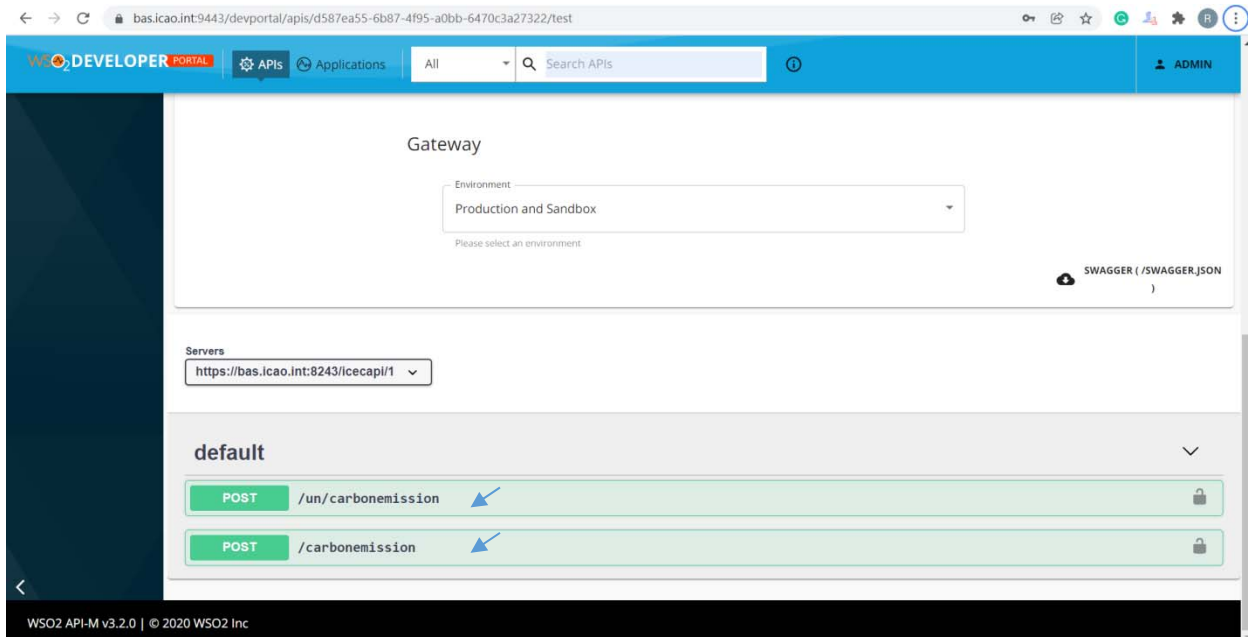
When trying out the ICAO ICEC API, you can proceed with generating a key.

Follow the steps below:

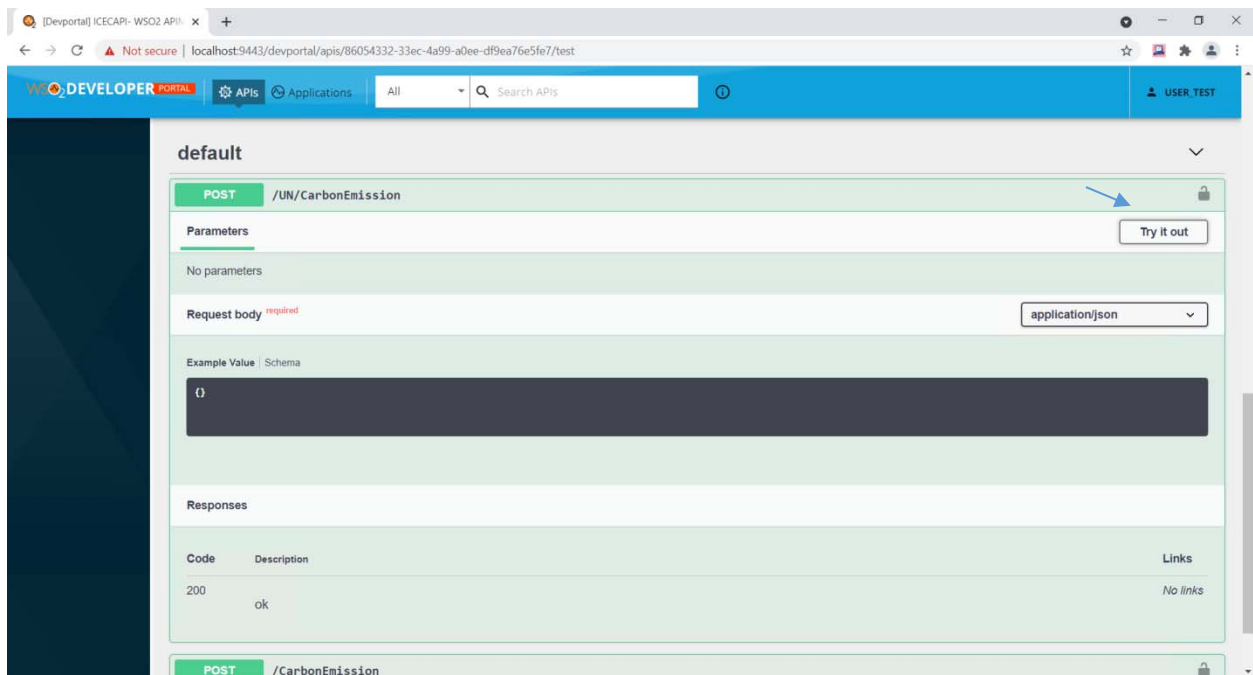
1. Navigate to Try Out on the left side menu.
2. Make sure the OAuth radio button is checked.
3. Make sure the Applications drop-down menu is showing ICAO ICEC API.
4. Select the Key Type. Check the Production radio button if you have already purchased a subscription.
5. Make sure the Access Token drop-down menu is showing Authorization: Bearer.
6. Click on GET TEST KEY.



7. Navigate to the bottom right of the screen and click on the POST button for the user role assigned to you by an admin (UN Carbon Emission vs Carbon Emission).

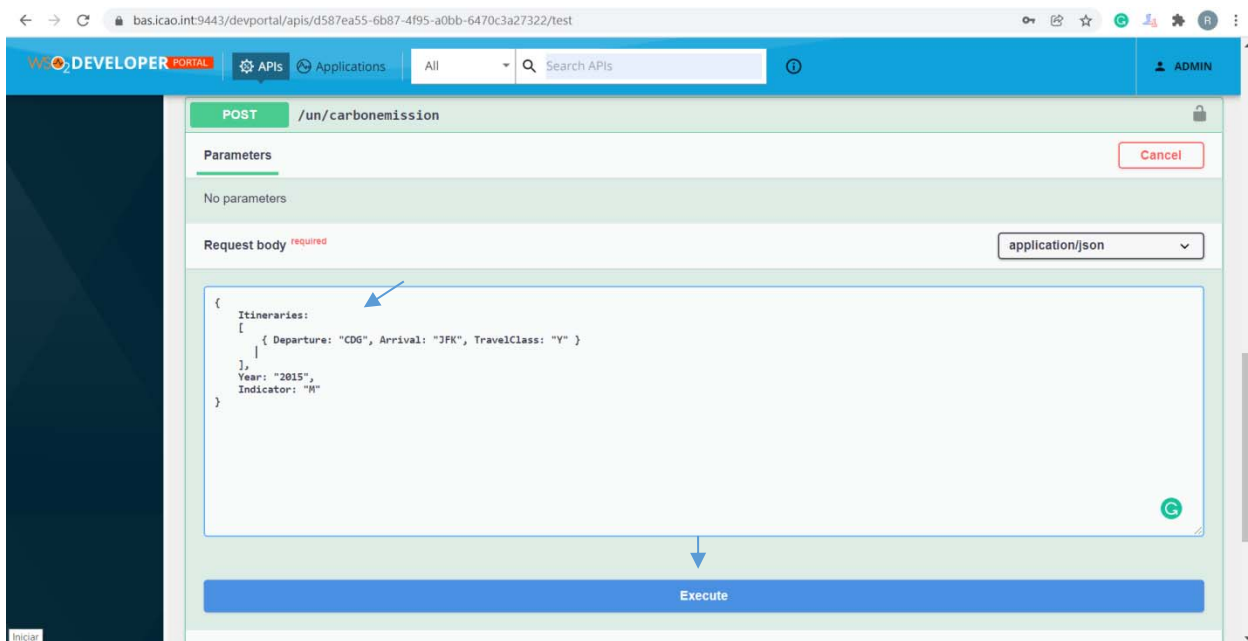


8. Once clicked, the respective role functionality will expand. Click the Try It Out button.

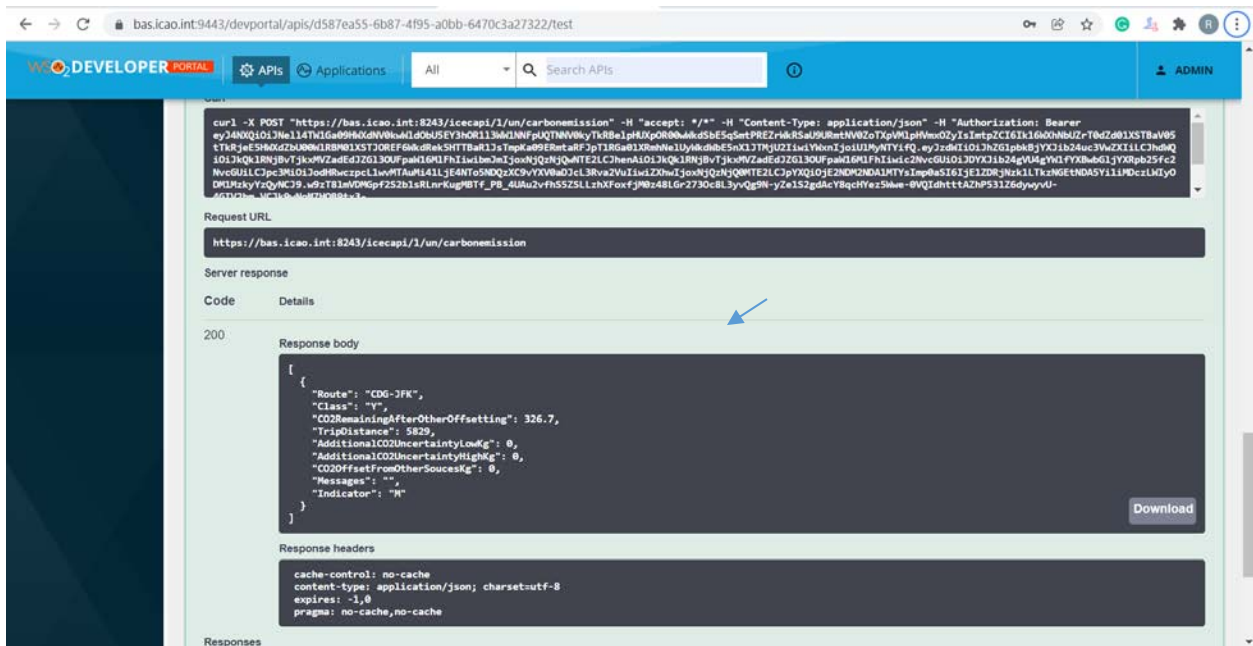


9. Enter the parameters in the Request Body field.

10. Click on Execute at the bottom of the screen.



11. Scroll down to see the results



Accessing the API through a third-party software

Authentication tokens

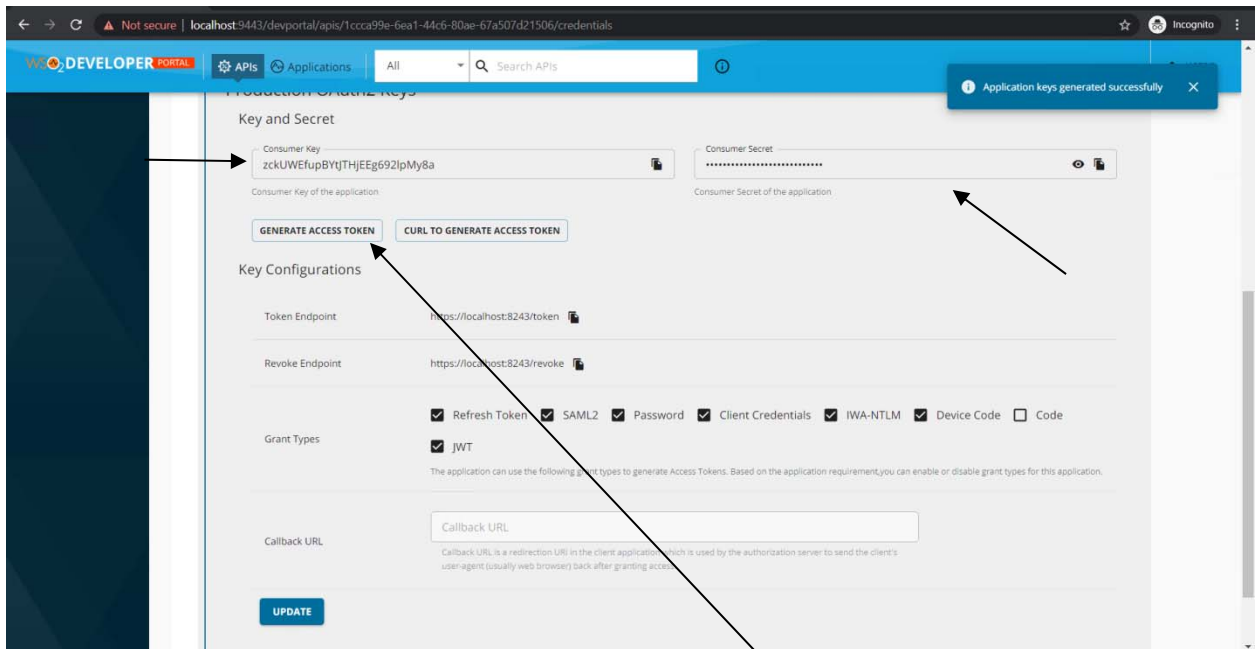
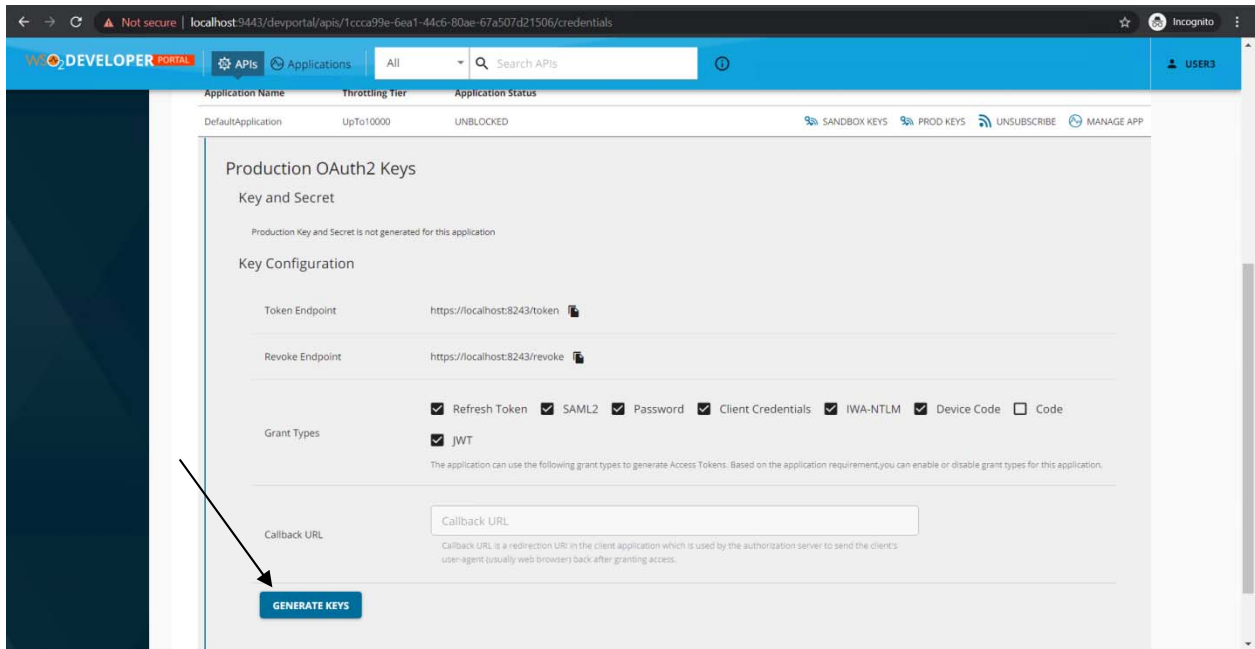
To make a web API call, you must supply an authentication token on the call. The token acts like an electronic key that lets you access the API.

Authentication token expires

Access tokens issued by the Authorization Server expire one hour after they are issued. When an access token expires, then the application should request another access token.

Invoking the Token API to generate the tokens

Get a valid **consumer key** and **consumer secret** pair. Initially, you generate these keys through the API Store by clicking Generate Keys on the Production Keys tab of the application.



You have the option to generate a Token by clicking on the “Generate Access Token” button on the **API Store**.

Invoking the Token API to generate the tokens

1. Combine the consumer key and consumer secret keys in the format consumer-key:consumer-secret and encode the combined string using base64 (<http://base64encode.org>).
2. Use the following sample cuRL command to obtain the access token.

Format:

```
curl -k -d "grant_type=client_credentials" -H "Authorization: Basic <Base64-encoded-client_key:client_secret>" -H "Content-Type: application/x-www-form-urlencoded" https://bas.icao.int/token -v
```

Example:

```
curl -k -d "grant_type=client_credentials" -H "Authorization: Basic cEJ6dUlaaEdwaGZRbWRjVVgwbG5IRmlpdXh3YT00U0pnV19qTU56aGpIU284OGJuZVhtTnFNMjRh" -H "Content-Type: application/x-www-form-urlencoded" https://bas.icao.int:8243/token -v
```

Response

```
> POST /token HTTP/1.1
> Host: xxxx:8243
> User-Agent: curl/7.54.0
> Accept: */*
> Authorization: Basic
cEJ6dUlaaEdwaGZRbWRjVVgwbG5IRmlpdXh3YT00U0pnV19qTU56aGpIU284OGJuZ
VhtTnFNMjRh
> Content-Type: application/x-www-form-urlencoded
> Content-Length: 29
< HTTP/1.1 200 OK
< X-Frame-Options: DENY
< Cache-Control: no-store
< X-Content-Type-Options: nosniff
< Pragma: no-cache
< X-XSS-Protection: 1; mode=block
< Content-Type: application/json
< Date: Thu, 18 Jan 2018 12:54:32 GMT
< Transfer-Encoding: chunked
{"access_token":"4c27f899-6f9c-3217-b974-3ceb5a409ac3","scope":"am_application_scope default","token_type":"Bearer","expires_in":723}
```

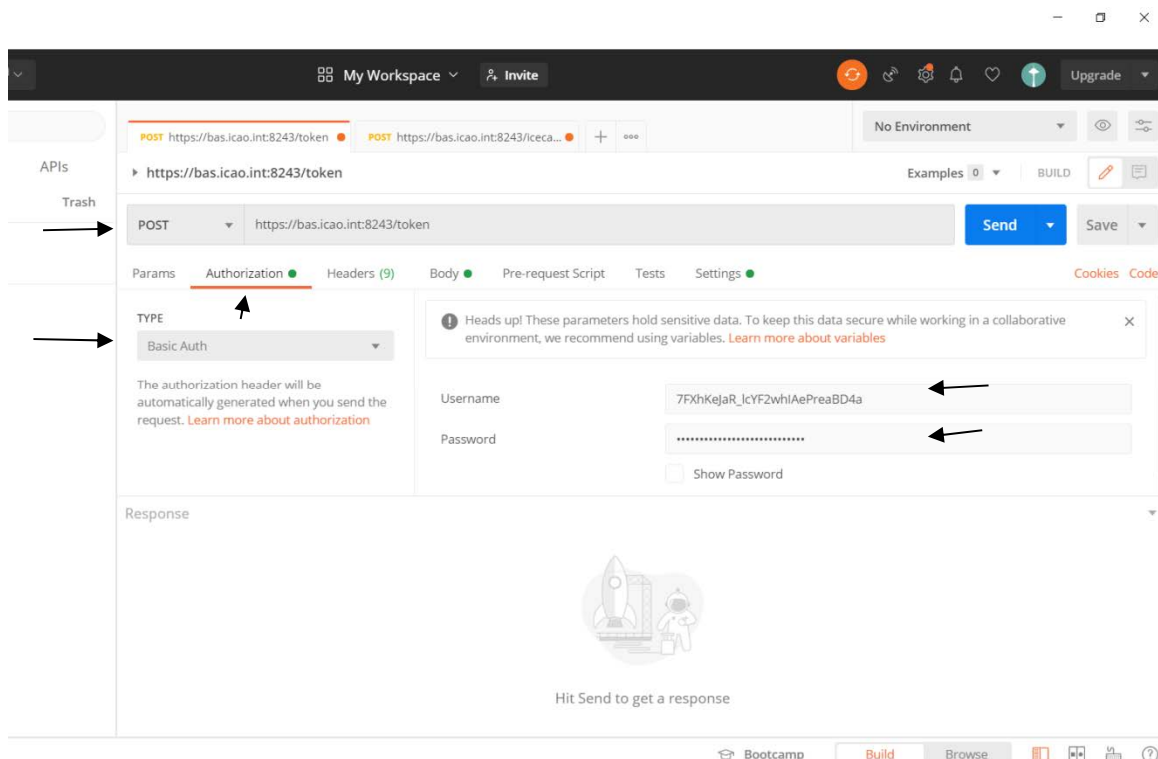
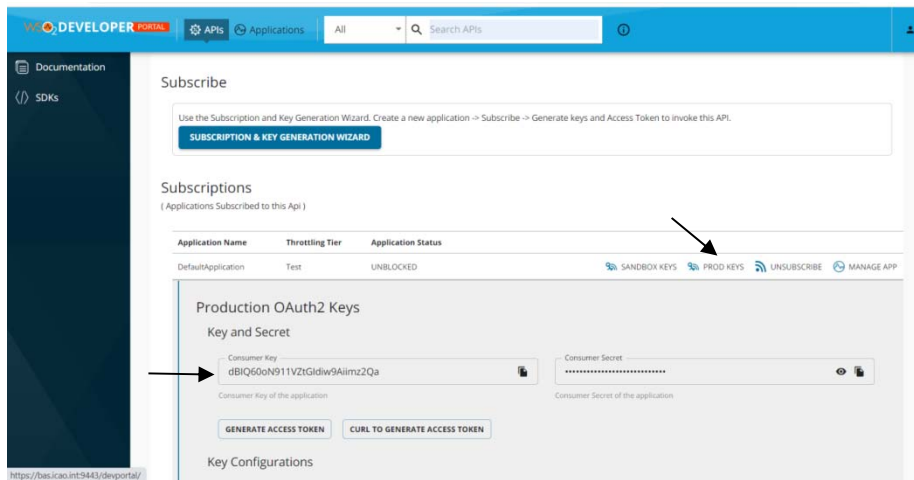
(source: <https://docs.wso2.com/display/AM210/Client+Credentials+Grant#format>)

Example with using Postman

1. Select the Method POST
2. Type the URL <https://bas.icao.int:8243/token>

On the tab Authorization:

1. Select the type Basic Auth
2. Fill the username field with your Consumer Key
3. Fill the Password field with your Consumer Secret
(to get your consumer key and secret, click on Subscriptions on the left menu, click on Prod Keys)



On the tab Body:

1. Select the option: x-www.form-urlencoded
2. Grant_type = password
3. Username = the username you use to login to the API Store
4. Password = the password you use to log in to the API Store
5. Scope = the scope you were assigned for (Carbon or UN)
6. Click on Send and get the access token

The screenshot shows a REST client interface with the following details:

- Method:** POST
- URL:** https://localhost:8243/token
- Body Type:** x-www-form-urlencoded (selected)
- Body Parameters:**

KEY	VALUE	DESCRIPTION
<input checked="" type="checkbox"/> grant_type	password	
<input checked="" type="checkbox"/> username	user2	
<input checked="" type="checkbox"/> password	xxxxxx	
<input checked="" type="checkbox"/> scope	carbon	
Key	Value	Description
- Status:** 200 OK
- Time:** 436 ms
- Size:** 1.37 KB
- Response Body (JSON):**

```

{
  "access_token":
  "eyJ4NXQiOiJNe114TWlGa09HWkdNV0kwW1d0bU5EY3hOR113wW1NNFpUQTNNV0kyTkRBelpHUxpOR00wkdSbE5qSmtPREZrWkRSaU9URmtNV0ZoTxpVM1pHVmxOZyIsImtpZCI6Iik16WkxhNnUzrT0dZd01XSTBaV05tKkRjeE5HwXZBU00w1RBm01XSTJOREF6WkdRek5HTTBar1JmTpkA09ERmtaRfJpT1RGa01XRmhNe1UyWkdWbE5nX1JTMjU2IiwiaWF0Ij0iOiJpUzE2bzFoSHZPOGZ3SEdQUM3Q0dUWUd2M1FhIiwic2NvcGUiOiJkZWZhdWx0IiwiaXNzIjoiaHR0cHM4XC9cL2xvY2FsaG9zdDo5NDQzXC9vYXV0aDJcL3Rva2VuIiwiaXhwIjoXNjI5NDA2ODA0LzYyOjE2Mjk0MDMyMDQsImp0aSI6IjRiNDQzZjd1LTA5NjEtNDc0ZS1hZjNmLTEyYzA0MDI0YzAzMyJ9LjIzPiIQF5qF0peaV1_Gni0tw8CYE0SvKQ27cd0VtUraSpi5HBY484iYTG45DKr6dY55TuU4z045XrF_hb1mJQQUz4HjBmZ50YvX10eh4Ck_A0c-fbH8JQ-5hJjAh0cT6hGDM3xDIpybXOK_hx1n9pJ00IZgFEK9Z0em6B67DOXP_2pFch7Vm1iqV15fkF-Vm66fVmbmgTBoNnxJ7-df2ha6kPBj8PLdEgnMa41JQLZncnj8RjPgvSuH65F9uWAteth51FixEmX-QS5kx"
}

```

Revoking access tokens

After issuing an access token, a user or an admin can revoke it in case of theft or a security violation. You can do this by calling the Revoke API using a utility like cURL. The Revoke API's endpoint URL is <https://bas.icao.int:8243/revoke>.


```
RINTgtYTMyy04ZTIhYWQ5YmYwMDMifQ.VD23nViK6Np1U8SQxulxrEVFZpnPT7dpr3UN0xm
--PSLBRXucWgrdse9qig922o9CWGj4IYxdsdHnwzz3Vh-i1-114jGnf_o6K-
ITmO2m0SyCORzo5PwMYbeZpkKM9slWahrGJm18XqGu7aRZiEnN8cLCke-
DsnQVJJcCaS_jTniAD_-DCk5VBUTdQP1yiekq-A5QjKp_dKAjMF-
8PQPXpMU526fXMMauFTz65EEZ-
BpwAvfSBwLnSGI1GQp7xF9VWytCBAWt4ZvK6e7Y6hrwH1p7KT4Nli6PZv6RxbalW0mI9vqknS
JRhWtn0GQcw1FSymMi-QOo0M7LgwlP7ypuw" -H "Authorization: Basic
OVRrNVJLZWFhVGZGeUpRSkRzam9aZmp4UkhjYTpDZnJ3ZXRual9ZOTdSSzFTZWiwQWx
1aXdVvMth" -H "Content-Type: application/x-www-form-
urlencoded"<a href="https://bas.icao.int:8243/ revoke">https://bas.icao.int:8243/ revoke
```

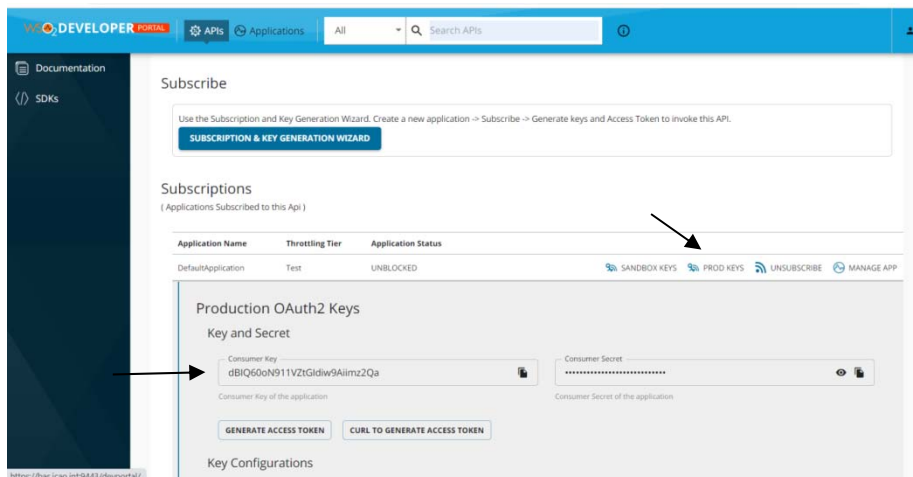
(source: <https://apim.docs.wso2.com/en/3.2.0/learn/api-security/oauth2/token-revocation/>)

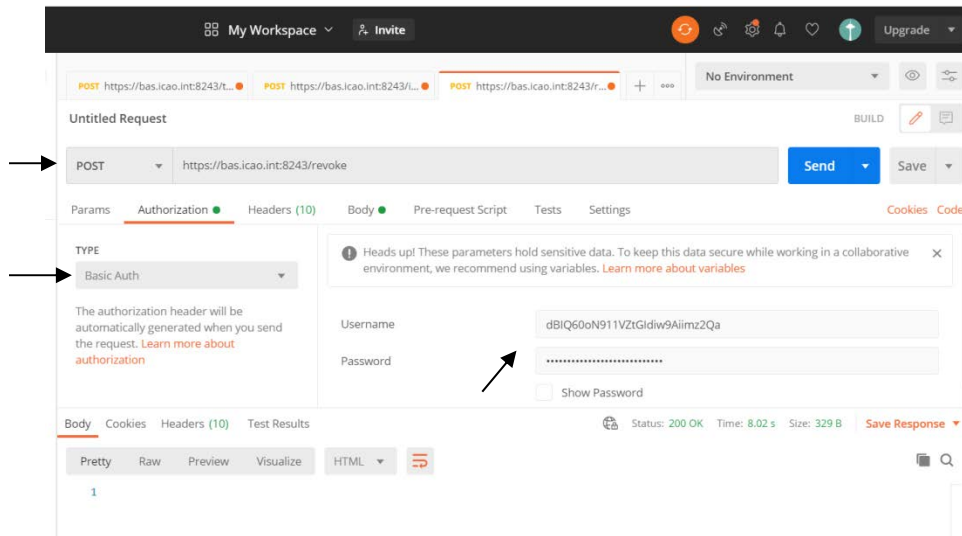
Example with using Postman

1. Select the Method POST
2. Type the url <https://bas.icao.int:8243/ revoke>

In the Authorizationtab:

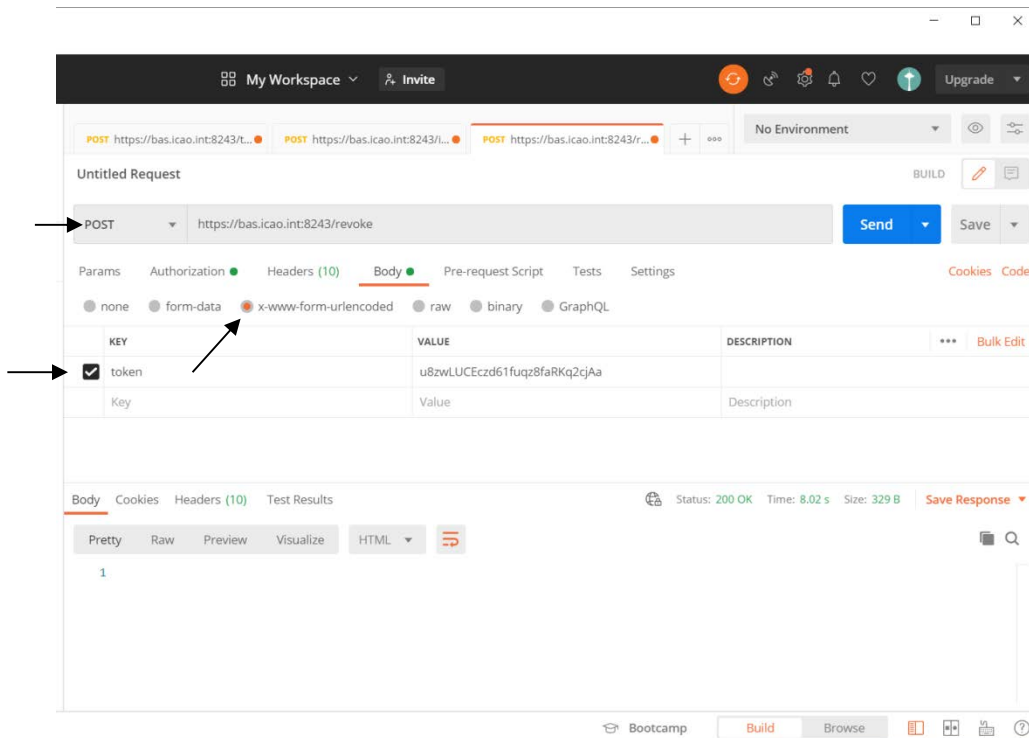
1. Select the type Basic Auth
 2. Fill the username field with your Consumer Key
 3. Fill the Password field with your Consumer Secret
- (to get your consumer key and secret, click on Subscriptions on the left menu, click on Prod Keys)





In the Body tab:

1. Select the option: x-www.form-urlencoded
2. Fill the key and value as following:
Token = the token to be revoked
3. Click on Send



Request the output of Carbon Emissions

Request the Carbon Emissions resources must contain the authentication token in the header
To do this, specify a HTTP header in the following format:

Component	Specifies
Authorization	Bearer <authentication token>

Allow the third-party software to connect with ICAO Carbon Emission Calculator application.

Verbs	Path	Description
POST	https://bas.icao.int:8243/ICECAPI/1/carbonemission	Perform Carbon Emission Calculate

Arguments

DATA TYPE	PARAMETER NAME	DESCRIPTION	FIELD REQUIREMENT
String	Indicator	(M)etric or (S)tandard	Required
String	Departure	Airport of Departure 3 letter IATA CODE	Required
String	Arrival	Airport of Arrival 3 letter IATA CODE	Required
String	TravelClass	Class of Travel: Economic classes: Y,S,B,H,K,L,M,N,Q,T,V,X Premium classes: F,A,P,R,C,J,D,I,Z,W,E	Required
String	Indicator	(M)etric or (S)tandard	Required

Request Code

JSON format of API request. The parameters should be included in the request body.

```
{
  Indicator: "M",
  Departure: "CDG",
  Arrival: "JFK",
  TravelClass: "E"
}
```

Response Code

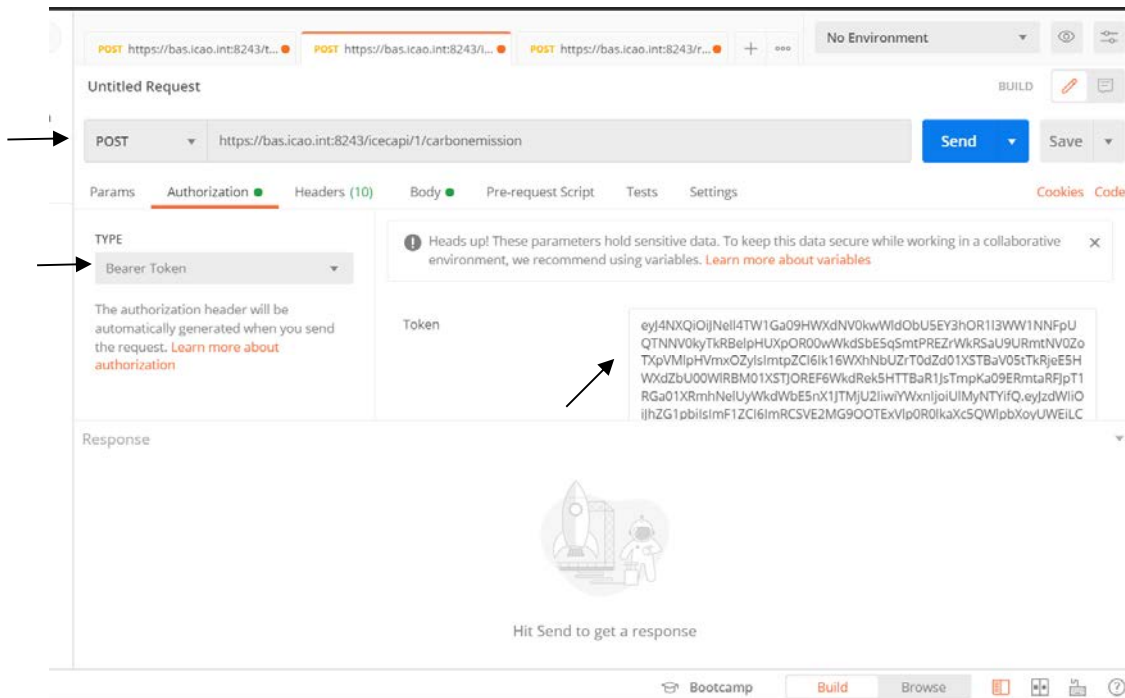
Code	DESCRIPTION
200	<p>Return a delimited string containing the ICAO data for each leg of the input flight itinerary, in the following format:</p> <p><An indicator that direct flights exist for that leg (Y)es or (N)o> / <The distance of each flight leg in Kilometers or Miles (Standard)> / <The aircraft fuel burn(in KG) for each flight leg> / <The CO2 emissions (in KG) for each flight leg></p> <p><u>Example :</u> Y/4340.0/56047.6/274.5</p>
404	Not found

Example with using POSTMAN

1. Select the Method POST
2. Type the url **https://bas.icao.int:8243/ICECAPI/1/carbonemission**

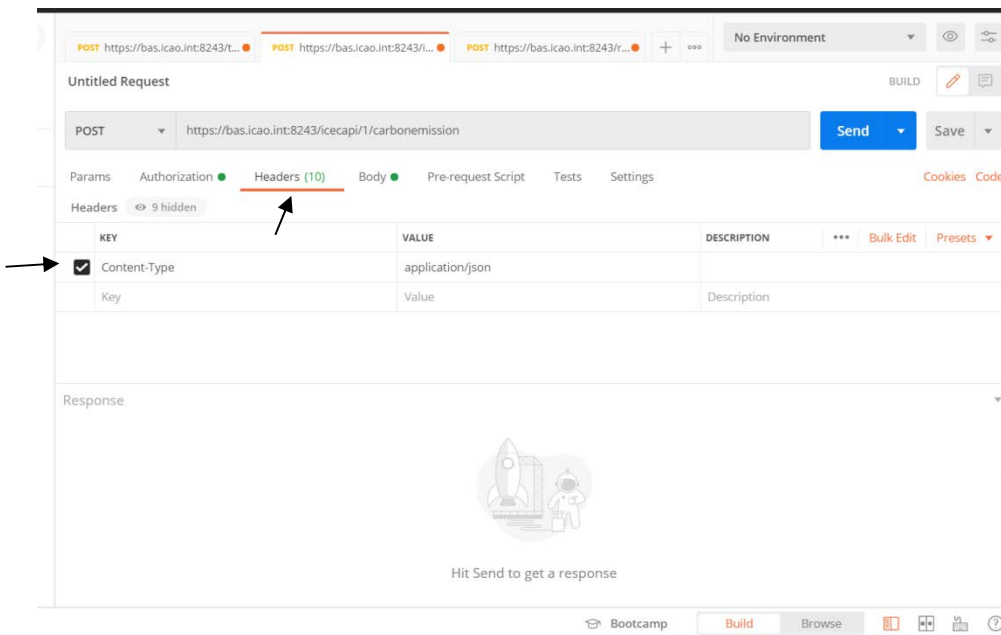
In the Authorizationtab:

1. Select the type Bearer Token
2. Fill the Token field with a valid token



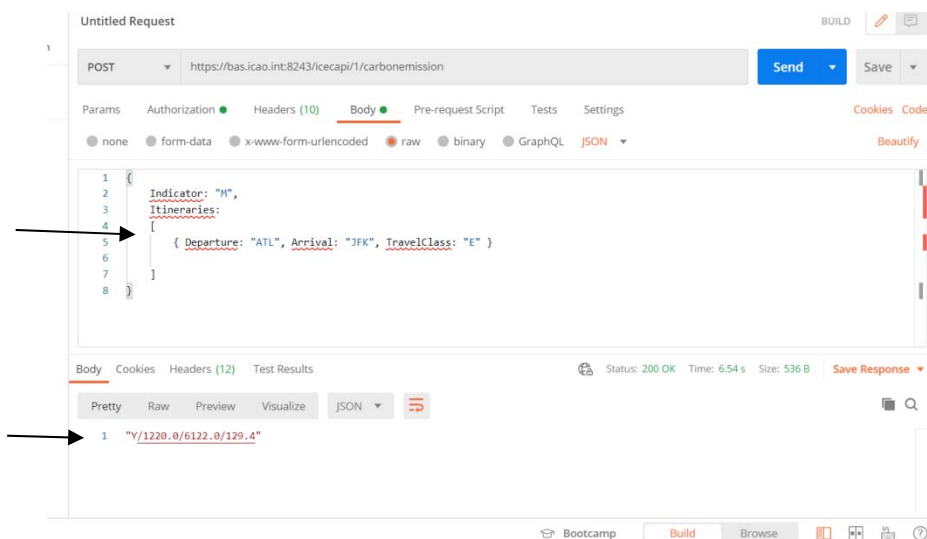
In the Headers tab:

1. Content_Type = application/json



In the Bodytab:

1. Select "raw" as a format
2. Type the parameters
3. Click on Send and get the result



UN methodology

Request the output of Carbon Emissions:

Verbs	Path	Description
POST	https://bas.icao.int:8243/ICECAPI/1/un/carbonemission	Perform Carbon Emission Calculate using UN methodology

Arguments

DATA TYPE	PARAMETER NAME	DESCRIPTION	FIELD REQUIREMENT
Integer	Year	Year of data (YYYY)	Required
String	Indicator	(M)etric or (S)tandard	Required
String	Departure	Airport of Departure 3 letter IATA CODE	Required
String	Arrival	Airport of Arrival 3 letter IATA CODE	Required
String	TravelClass	Class of Travel: Economy classes: Y,S,B,H,K,L,M,N,Q,T,V,X Premium classes: F,A,P,R,C,J,D,I,Z,W,E	Required

Request Code:

JSON format of UN API request. The parameters should be included in the request body.

```
{
  Departure: "FAO",
  Arrival: "JFK",
  TravelClass: "E",
  Year: 2015,
  Indicator: "M"
}
```

Response Code

JSON format of UN API response.

Code	DESCRIPTION
200	<p>Return a JSON containing the ICAO data for each leg of the input flight itinerary, in the following format:</p> <p><u>Example 1:</u></p> <pre>{ "route": "FAO-JFK", "class": "E", "cO2RemainingAfterOtherOffsetting": 437.01628712945296, "tripDistance": 8768, "additionalCO2UncertaintyLowKg": -78.407995690412633, "additionalCO2UncertaintyHighKg": 432.53846264509104, "cO2OffsetFromOtherSoucesKg": 60.965529546264975, "messages": "Average value computed due to a missing connecting airport between: FAO and JFK. There are 32 possible connecting airports for this route.", "indicator": "M" }</pre>
404	Not found