Greek boundary nodes user documentation

Introduction

This pdf is created to provide comprehensive instructions for users about the script named Boundary_diagrams.py in path I:\Konstantinos Sidiropoulos\Documentation\Greek Boundary Nodes.

Script loads 24 CGM's in UCTE format that correspond to the same day. Reads the boundary lines of the European network and keeps only the Greek boundary nodes with information about **Current (A**), **Active Power(MW)** and **Reactive Power (MVAr)** that flows through the boundary line to the Greek boundary Node. Creates a final file in .xlsx form with a new column that gives the **timestamps**. File is sorted by id and timestamp in order user to see for each Greek boundary node the Power flows from 0030 to 2330 (HH:MM) without making any changes to the file. Automatically 3 diagrams for each Greek boundary node are created. X-axis contains the timestamps and Y-axis the Current (A), active power (MW) or reactive power(MVar) depending on the diagram.

The code has been tested and works for CGM's in UCTE format.

It was used in computer 10.91.100.15 with the following installations:

- Python version 3.12.0
- Pypowsybl library: User can simply install released versions of pypowsybl from PyPI using pip:

```
pip install pypowsybl
```

- Visual Studio Code: VSCodeUserSetup-x64-1.91.0.exe

Note: File_type was always FO = Day Ahead (D-1) or 2D = Two Days Ahead (D-2)
Note: ALL UCTE'S had name structure ucte_filename = {Date}_{hour}_{File_type}_{country_code}{number}.{format}

1. How to use

User has to enter after **running** the script the following information to console:

- **Enter the path for UCTE folder:** Enters the path where his UCTE files are.
- **Enter the path for Excel output folder:** Enters the path where final excel is saved.
- **Enter the path for diagrams output folder:** Enters the path where plots are saved.
- **Enter the date in YYYYMMDD format:** Enters the date of UCTE files.
- **Enter the file type:** Enters the filetype
- **Enter the country code:** Enters the country code. For CGMs UCTE files is always UX.
- **Enter the file format:** Enters the file format. In the examples was always UCTE.
- **Enter the range of numbers:** Enters the number of versions of UCTE files.

Note: Code has been tested only in UCTE formats.

The default construct of the UCTE filename is (**line 47**):

```
1. ucte_filename = f'{Date}_{hour}_{File_type}_{country_code}{number}.{format}'
```

Figure 1: Dynamic filename construct

If UCTE file has different structure, an error in the terminal will occur (in **line 47** of the script) and user has to change the default construct of the **ucte_filename**.

2. AC loadflow execution

User has to define the parameters he needs for the loadFlow execution.

Replaces True/False instead of None values for all the parameters he needs except: **balance_type, countries_to_balance, connected_component_mode, dc_power_factor, provider_parameters.**

All parameters description for AC LoadFlow execution are available in:

https://powsybl.readthedocs.io/projects/pypowsybl/en/stable/reference/loadflow/parameters.html#pypowsybl.loadflow.Parameters

```
p = lf.Parameters(
                distributed_slack=False ,
                transformer_voltage_control_on=False ,
                phase_shifter_regulation_on=True ,
                shunt_compensator_voltage_control_on=True ,
                voltage_init_mode=None,
                use_reactive_limits=None,
                twt_split_shunt_admittance=None,
                read_slack_bus=None,
                write_slack_bus=None,
                balance_type=None,
                dc_use_transformer_ratio=None,
                countries_to_balance=None,
                connected_component_mode=None,
                dc_power_factor=None,
                provider_parameters={
               'maxOuterLoopIterations' : str(30) ,
               'lowImpedanceBranchMode': 'REPLACE_BY_MIN_IMPEDANCE_LINE'
               })
```

Figure 2: Parameters settings

Provider_parameters contain a list of parameters linked to the loadflow provider. All provider parameters available in the excel named **'provider_parameters.xlsx'** in I:\Konstantinos Sidiropoulos\Documentation\LoadFlow_reports.

User can add the follow orders to get anytime the provider parameters names and description:

```
It =lf.get_provider_parameters() # OPTIONAL --> GET A LIST OF AVAILABLE provider PARAMETERS TO EXECUTE AC LOADFLOW
It.to_excel('provider_parameters.xlsx')
```

Figure 3: Provider parameters

3. Results

An excel named **'GREEK_BOUNDARY_NODES_{Date}.xlsx'** (**line 65**) is created. Excel contains all Greek real boundary buses and the power flows (I, P, Q) of their boundary line side for every hour from 00:30 until 23:30. User can change anytime the output filename.

```
1. output_file = os.path.join(output_folder, f'GREEK_BOUNDARY_NODES_{Date}.xlsx')
```

Figure 4: Output filename

The diagrams of power flows for each Greek boundary bus are saved in **output_folder1**. The **ticks** variable is used to define the number of values that Y-axis will show in the final plots (**line 158**). User can change this variable, with attention to the step value change between the shown numbers.

NOTE: default value is 15.

```
1. ticks = 15
```

Figure 5:ticks

Demonstration example available in: **I:\Konstantinos Sidiropoulos\Documentation\Greek Boundary Nodes\RESULTS_DEMONSTRATION**.