Credible Joint Chance-Constrained Low-Carbon Energy Management for Multi-energy Microgrids

This document is intended to help you understand our codes, and we will describe each file on the following section.

1. **The MATLAB code "main_MEMG.m"**

This file **defines most of the parameters** that appear in the manuscript. Detailed information can be found in the program comments, such as **the range of values for the parameters and the choice of methods**:

```
%EM of MEMG: scripted by Zehao Cao
clear all; rehash toolboxcache;yalmip('clear');
%% Initialization
n_T = 24; % dispactch periods
dt = 1;% dispactch interval
B = 10;% number of K-means
Method = 4;% 1:DO   2:RO   3:W-DRO   4:C-DRO
choice = 1;% 1:data set from Elia&DSO  0:data set from GMM
for_extr = 0;% 0:clean samples 1:samples with outliers
T_pruning = 0.1;%percentage of sample-pruning: [0,1]
%% Parameters of DRO
N_Omega_normal = 2000; %number of Trainning samples
N_extreme = 200;%number of extreme samples
N_Beta_normal = 2000; %number of Test samples
N_Sub = 200;%size of representative sub-set
rho = 1e-3;% radius of Wasserstein sphere
u_max = 0.1;% confidence interval of first-order moment: [0,1]
s_max = 4;% Max forecast errors
risk_factor = 0.05; %risk coefficient: [0,1]
```

2. **The MATLAB code "initialize_parameter.m"**

This file introduces the **operation parameters of the MEMG**, such as the power limit of the CHP units and so on. Detailed information can be found in the code comments.

3. **The MATLAB code "LDPF_parameter.m"**

This file is forced to **generated the power network parameters of the MEMG**, such as the Resistance matrix $\boldsymbol{X}$ and connectivity matrix $\boldsymbol{B}$, etc. Detailed information can be found in the code comments.

4. **The MATLAB code "case33mg.m"**

This file introduces **the modified IEEE 33-bus distribution system**. Detailed information can be found in the code comments.

5. **The MATLAB code "DERs_org_data.m"**

This file introduces **the original forecast power output of the DERs within MEMG**. Detailed information can be found in the code comments.

6. **The MATLAB code "data_treat_clean.m"**

This file introduces **the uncertain forecast error samples belonging to two different sample sets**. Notably, "clean" means these two sets do not contain extreme samples. Detailed information can be found in the code comments.

7. **The MATLAB code "data_treat_dirty.m"**

This file introduces **the uncertain forecast error samples belonging to a sample set that contains about 10% extreme samples**. Detailed information can be found in the code comments.

8. **The MATLAB code "out_sample_Test.m"**

This file is used for **out-of-sample test of the optimal decisions**, including testing for DRJCC

violation and calculating out-of-sample operation costs. Detailed information can be found in the code comments.

9. The MATLAB code "Model_C_DRObased_MEMG.m"

This file introduces **the energy management model based on C-DRO**, which proposed in our paper. Detailed information can be found in the code comments.

10. The MATLAB code "Model_W_DRObased_MEMG.m"

This file introduces **the energy management model based on W-DRO**, which is used in the comparisons. Detailed information can be found in the code comments.

The MATLAB code "Model_RObased_MEMG.m"

This file introduces **the energy management model based on RO**, which is used in the comparisons. Detailed information can be found in the code comments.

11. The MATLAB code "Model_NoUncertain_MEMG"

This file introduces **the energy management model based on DO**, which is used in the comparisons. Detailed information can be found in the code comments.

12. The MATLAB code "sample_pruning.m"

This file introduces **the sample-pruning algorithm proposed in our paper**. Detailed information can be found in the code comments.

13. The Excel document "Elia&DSO_DERs_data.xlsx"

This file introduces **the dataset used in the case study**, which is obtained from Elia. The relevant source is attached below:

https://www.elia.be/en/grid-data/power-generation/wind-power-generation