**User Guider**

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# 1. Operating system and hardware requirements

Microsoft Windows 7 or 10

Microsoft .NET Framework 4.5

RAM: 4.0GB

Hard disk: 2.0GB

Monitor: 1920×1200

# 2. Introduction of files

HTR-GAS.exe: Execution file

User guider.docx: This file

The components of the names of input and output files have following meanings:

|  |  |
| --- | --- |
| **Name before the first “-”** | **Meanings** |
| Fuel | Configuration file of fuel |
| Work | Configuration file of working condition |
| GarTar | Configuration file of contents of gas, tar and BTX under the working conditions of GoBiGas plant |
| LHV | Configuration file of LHV of different substances |
| Enthalpy1, Enthalpy2, Enthalpy3 | Configuration files of enthalpy of different substances |
| in | Inlet stream of different equipment |
| out | Outlet stream of different equipment |
| Mass | Calculation results of mass balance |
| EnergyM | Middle calculation results of energy balance |
| Energy | Calculation results of energy balance |

|  |  |
| --- | --- |
| **Name after the first “-”** | **Meanings** |
| P-D | Default input and output files |
| 8% | Biomass with a moisture content of 8.1% |
| 40% | Biomass with a moisture content of 40% |
| 20 | 20MWth of power of final product gas |
| 200 | 200MWth of power of final product gas |
| G | Work conditions of GoBiGas plant |
| E | Electric auxiliary heating |
| R | Increasing recirculated product gas |
| HTR | heating inlet steam by HTR |
| HTR-BiGas | high-temperature gas-cooled reactor biomass gasification |

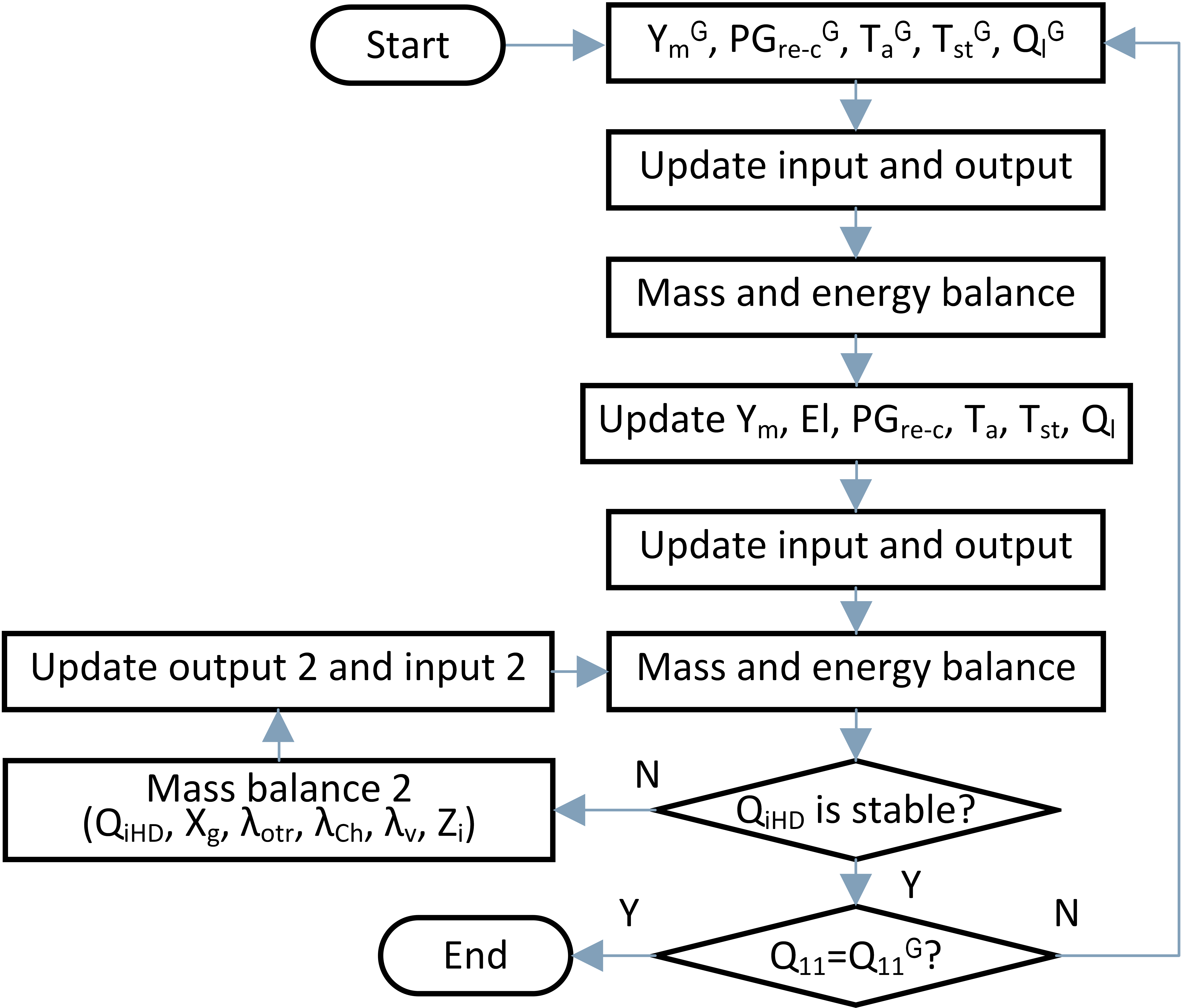
# 3. Running the software

When ruining the software, all default input and output files (12 files) should be put in the same folder of the execution file.

It will take around several minutes for the start of the software which depends on the computer.

|  |  |
| --- | --- |
| **Command or option** | **Meanings** |
| Set | Set the configuration |
| Load | Load the related configuration file |
| Save | Save the related file |
| Save as | Save the related file by setting the name of the file |
| Save as default | Save the related file as the default file |
| Cal | Calculate the mass or energy balance |
| Cal2 | Calculate the mass balance, input and output streams according to the calculation results of the energy balance |
| HTR | Heating inlet steam by HTR (production gas, 200 MWth) |
| SHTR | Heating inlet steam by HTR (production gas, 20 MWth) |

When calculating the energy and mass balance, the flow chart of the operations is shown as follows:



At present, the software uses a manual process for iterative calculation.

Follows is an example to calculate the mass and energy balances of HTR-BiGas:

(1) Start the software;

(2) Load Fuel-8%.xlsx; (in the input.zip)

(3) Load Work-8%-200-G.xlsx; (in the input.zip)

(4) Click “Cal” button in “Cal Input and others”;

(5) Click “Cal” button in “Cal Output”;

(6) Click “Cal” button in “Cal Mass”;

(7) Click “Cal” button in “Cal Energy middle”;

(8) Click “Cal” button in “Cal Energy”;

(9) Load Fuel-40%.xlsx; (in the input.zip)

(10) Load Work-40%-200-HTR-BiGas.xlsx; (in the input.zip)

(11) Check the option box of “HTR” in “Cal Energy middle”

(12) Click “Cal” button in “Cal Input and others”;

(13) Click “Cal” button in “Cal Output”;

(14) Click “Cal” button in “Cal Mass”;

(15) Click “Cal” button in “Cal Energy middle”;

(16) Click “Cal” button in “Cal Energy”;

(17) Compare the values of “QiHD” (Item 32) in the last two steps, and continue the next step if they are not close. If they are close, go to (22).

(18) Click “Cal2” button in “Cal Mass”;

(19) Click “Cal2” button in “Cal Output”;

(20) Click “Cal2” button in “Cal Input and others”;

(21) Go to step (14)

(22) Check the value of “Q11-Q11G=-QE” (Item 27). If it is not a case related to “E” (Electric auxiliary heating), the absolute value of it should be less than 1 when the calculation is finished. For the cases of “E” (Electric auxiliary heating), it should be a value less than 0. If it is a case related to “E” (Electric auxiliary heating) and the value of “Q11-Q11G=-QE” is bigger than 0, then go to (2). Otherwise, the calculation ends.

Here, since the case is for “HTR-BiGas” not for “E”, if the absolute value of “Q11-Q11G=-QE” (Item 27) is bigger than 1, we will go to (2). Otherwise, the calculation ends.

In addition, we should modify the value of “Flow rate-P4-Raw gas” (Item 15) in Work-40%-200-HTR-BiGas.xlsx which is loaded at step (10) according to the value of “Q11-Q11G=-QE”. If the value of “Q11-Q11G=-QE” is too big, we will increase the value of “Flow rate-P4-Raw gas”, and vice versa.

After finishing the calculation, we can get the related results at the following location:

(a) Flow rates of final product gas in P16 for SNG production from “Flow rate” (Item 161-172) in “Cal Output”.

(b) Flow rates of final product gas in P17 for hydrogen production from “Flow rate” (Item 173) in “Cal Output”.

(c) Other values related to mass balance, such as Xg, λotr, λch, λv, ZH2, ZCO, ZCH4, ZC2H2, ZC2H4, ZC2H6, ZC3H6, Ztar, Zbtx, etc., of each step in “Cal Mass”.

(d) Results of energy balance of each step, Q11-Q11G (Item 27), QE (El, Item 28), QiHD (Item 32), EPG,rec (Item 34) and various efficiencies (Item 38-40, 41-45) in “Cal Energy”.