THERMOFLEX Version 29.0 Revision: February 25, 2020   thermoflow   Thermoflow, Inc.

bar | C
kg/s | kJ/kg

Sample file introduced in Thermoflow 29, 2020.

(1) Summary
This plant model consists of a six turbine windfarm and a comparably-sized electrolyser plant. It is configured to use electricity from the windfarm to produce hydrogen (H2), and export any surplus electricity to the grid. The model uses the Classic Macro to run 24 cases, one for each hour of a hypothetical summer day. The macro input is hourly wind speed.

A script is used to set the electrolyser power consumption input variable equal to the computed windfarm power output. The electrolyser model consumes the specified power, up to its capacity. It reports the actual power consumption as one if its output variables.

The script also computes 'excess' electricity that's exported to the grid, and it accumulates hourly results to display daily totals for the last hour of the day (Macro Case 24).

Click the [Macro Cases] menu to summon results from a particular hour. Click the [Graphics] output button, followed by 'Hourly Energy Flow' to review the percentage of windfarm output that is exported and the percentage consumed by hydrogen production.

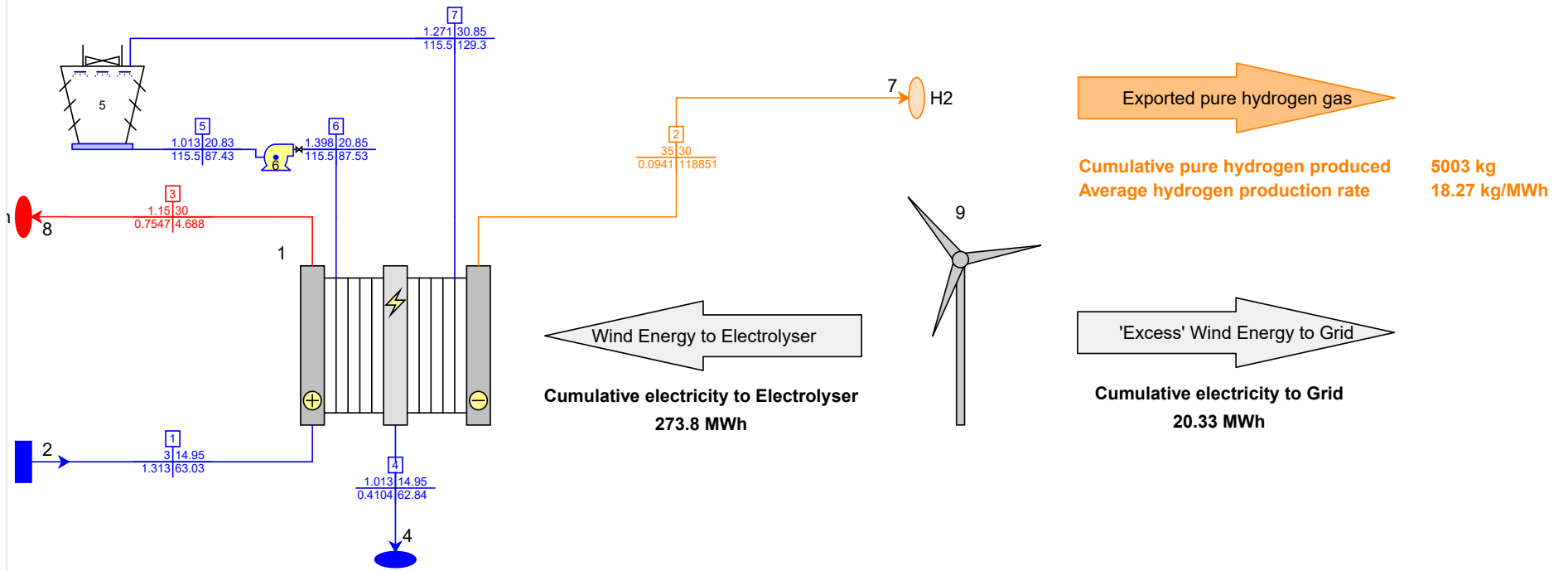You can view the script by clicking the [Define] -> [Scripts] menus.

(2) Overview of script calculation logic
At the end of every loop, the electrolyser power consumption input variable is set equal to the total windfarm power output. Once the model is completely converged for each macro hour, the actual amount of power consumed by the electrolyser will be available. The script computes the 'excess' electricity as the difference between windfarm output and electrolyser consumption. This will always be greater than or equal to zero, and is the energy available for export from the model to the grid.

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(3) Nitty-gritty Scripting Details
The following is information for scripting-gurus. A little known scripting feature, available only in THERMOFLEX models using the Classic Macro, is used to sum hourly results to create cumulative outputs. Public, non-local, variables are declared atop the script and initialized to zero. Since this code is placed outside the main script body, it is executed once when LUA begins. These public variables remain 'alive' for the duration of the THERMOFLEX calculation which includes the twenty-four macro cases. At the end of each macro case, the script is called a final time. During this call (CallOrigin==TFCO_END) these persistent variables are update by adding the current hour's results to the ongoing tally. These variables are then assigned to Custom Output variables so they're available for display. After the final run of the final macro case, hour 24 of the day, these custom outputs represent summations of what happened during the course of the day.

bar | C
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Results for Hour of Day:

24

7
1.271	30.85
115.5	129.3

5

| 5 |
| 1.013 | 20.83 |
| 115.5 | 87.43 |

| 6 |
| 1.398 | 20.85 |
| 115.5 | 87.53 |

| 3 |
| 1.15 | 30 |
| 0.7547 | 4.688 |

8

7 H2

| 2 |
| 35 | 30 |
| 0.0941 | 118851 |

Exported pure hydrogen gas

Cumulative pure hydrogen produced   5003 kg
Average hydrogen production rate   18.27 kg/MWh

1

9

Wind Energy to Electrolyser

Cumulative electricity to Electrolyser
273.8 MWh

'Excess' Wind Energy to Grid

Cumulative electricity to Grid
20.33 MWh

2

| 1 |
| 3 | 14.95 |
| 1.313 | 63.03 |

| 4 |
| 1.013 | 14.95 |
| 0.4104 | 62.84 |

4

Hourly Hydrogen Production

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File = 0 04-12-2021 15:04:35 file= C:\Program Files (x86)\Thermoflow 29\Samples\(S5-24b) Wind to Hydrogen (Daily Operation using Classic Macro + Script).tfx

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