This sample file first appeared in Thermoflow 29 (2020)

This heat-balance-only model includes the Steam Methane Reformer (SMR) component, introduced in Version 29, and available on the [Other Fluids] tab on the icon bar.

This model reproduces a flowsheet (Figure 2-1) in the publicly available report: "Equipment Design and Cost Estimation for Small Modular Biomass Systems, Synthesis Gas Cleanup, and Oxygen Separation Equipment - Task 1: Cost Estimates of Small Modular Systems", Subcontract Report NREL/SR-510-39943, May 2006. It was prepared by Nexant Inc. for the USDOE/NREL. This report is freely available.

Approximately 95% of worldwide hydrogen production is by steam reforming of natural gas. There are a wide variety of proprietary plant configurations in use, often tailored to handle constituents in the feedstock natural gas, and designed to efficiently produce hydrogen on the scale dictated by the consumer. This simple model is not typical of these large scale plants, which usually have more heat recovery to improve efficiency, and include more gas processing steps to ensure a high quality product stream. However, in contrast to all the proprietary system configurations, this simple configuration was published in a US government-funded report including sufficient detail that could easily be reproduced by THERMOFLEX using the SMR component introduced in Version 29.

The natural gas definition was adopted from the report. The ratio of steam/fuel entering the reformer is set by the fuel mixer, on a molar basis using a newly introduced feature. The SMR is configured to define mass flowrate of reformed product, and this value was entered directly from the report. SMR flue gas exit temperature was assumed. Various gas heaters and coolers were modeled using the simple, but useful, General Heat Exchanger. You'll notice this configuration could be made more efficient by recovering more energy from the flue gas and product gas streams.

Table 2-2 in the report shows some, but not all, the streams that are included in the published flowsheet. Those not included were established by assumptions in this model. The stream table atop the model, on the adjacent tab, uses the same numbering scheme as in the report. The THERMOFLEX-computed results match those from the report.

A script is used to compute the LHV ratio of the exported H2 gas compared to the incoming natural gas. This is reported as the 'LHV Hydrogen Production Efficiency'.

Stream numbers in this table match those in Figure 2-1 of the reference report. (See 'Description' page for details)

		1	2	3	4	5	6	7	8	9	10	11
p	psia	300,9	300,9	300,9	300,9	295	290	287,5	285	275	261,9	25
T	F	850	850	850	833,6	1472	840	480	130	130	142	105,3
m	kpph	0,0421	0,0421	0,1322	0,1743	0,1743	0,1743	0,1743	0,1743	0,1061	0,011	0,0734