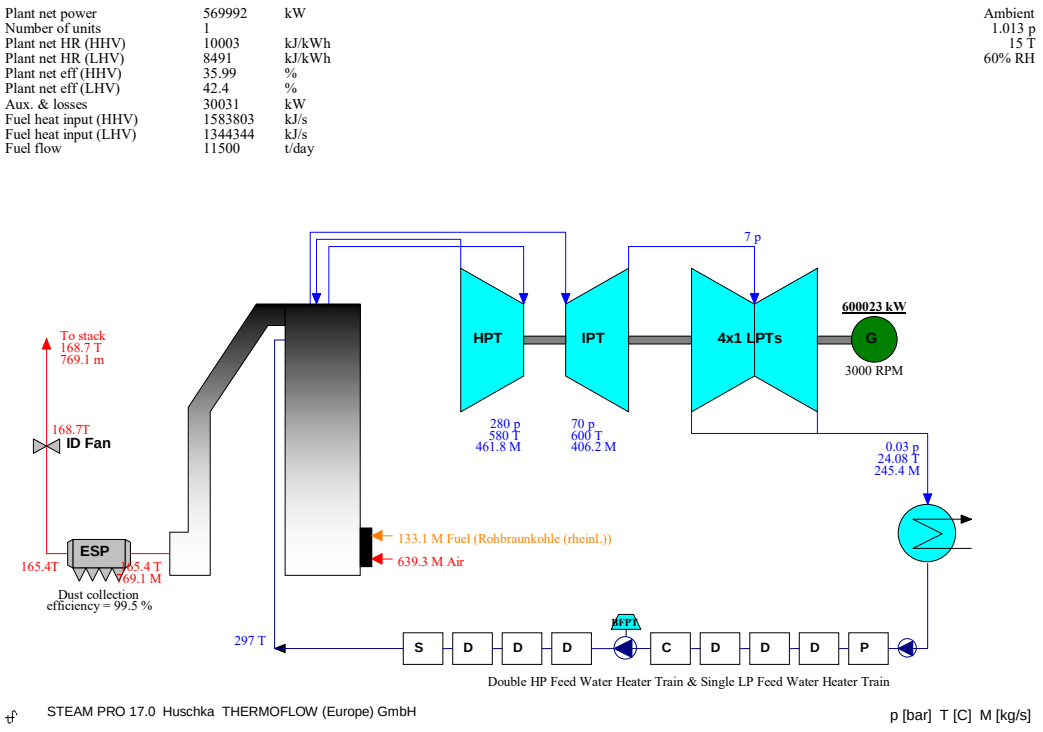
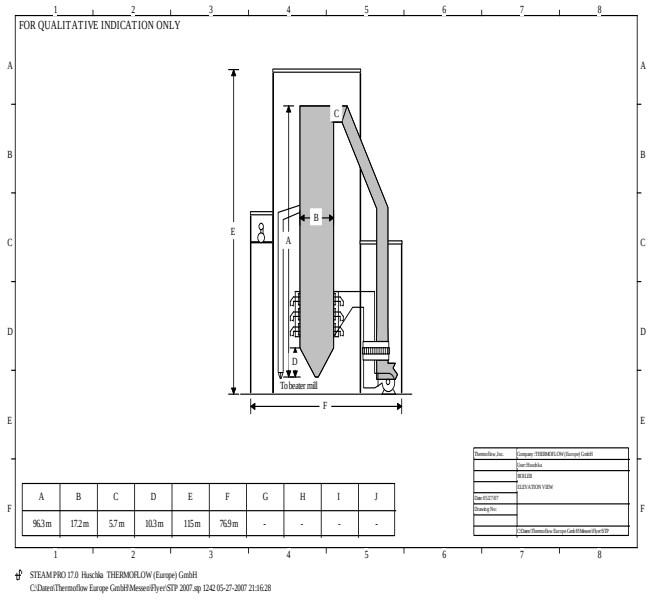
Conventional Cycle Design, Simulation, and Cost Estimation

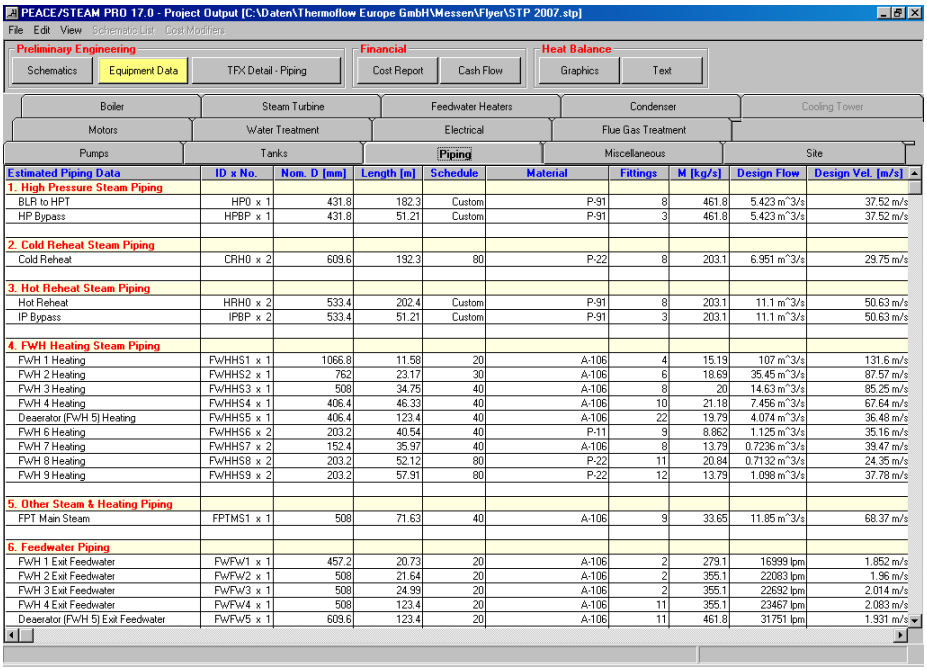
STEAM PRO automates the process of designing a conventional (Rankine Cycle) steam power plant. It is particularly effective for creating new plant designs and finding their optimal configuration and design parameters considering the plant performance and total plant cost **(techno-economic optimization).**





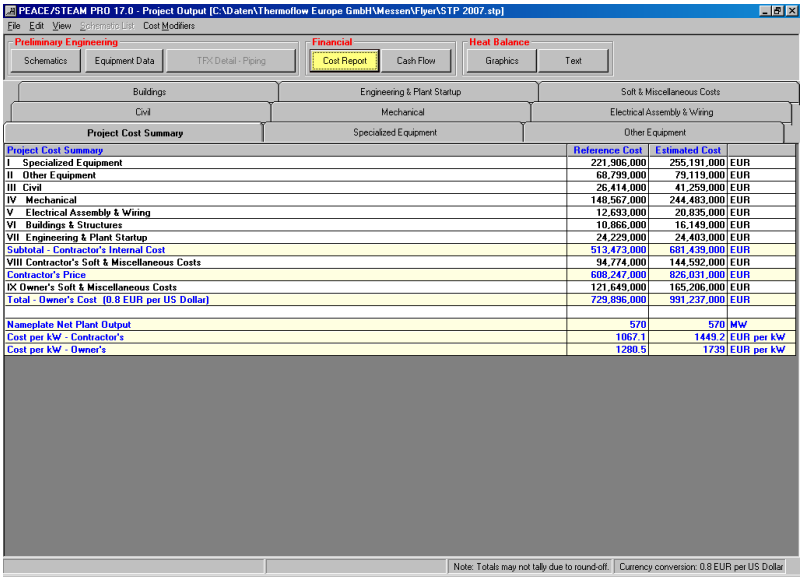
The user inputs design criteria and assumptions and the program computes heat and mass balance, system performance, and component sizing. The scope and level of detail in STEAM PRO has been continuously growing since 1990, to the point that the 2016 Version has over 2100 user-adjustable inputs. Most key inputs are automatically created by intelligent design procedures that help the user identify the best design with minimal time and effort, while preserving the flexibility to make any changes or adjustments.

STEAM PRO is truly easy to use, typically requiring only a few minutes to create a new plant design. It normally computes a heat balance and simultaneously designs the required equipment in under fifteen seconds. When run in conjunction with the optional ***PEACE*** (**P**lant **E**ngineering **A**nd **C**ost **E**stimator) module, the programs provide extensive engineering and cost estimation details.



Estimated Piping Data	ID x No.	Nom. D [mm]	Length [m]	Schedule	Material	Fittings	M [kg/s]	Design Flow	Design Vel. [m/s]
1. High Pressure Steam Piping									
BLR to HPT	HP0 x 1	431.8	182.3	Custom	P-91	8	461.8	5.423 m^3/s	37.52 m/s
HP Bypass	HPBP x 1	431.8	51.21	Custom	P-91	3	461.8	5.423 m^3/s	37.52 m/s
2. Cold Reheat Steam Piping									
Cold Reheat	CRH0 x 2	609.6	192.3	80	P-22	8	203.1	6.951 m^3/s	29.75 m/s
3. Hot Reheat Steam Piping									
Hot Reheat	HRH0 x 2	533.4	202.4	Custom	P-91	8	203.1	11.1 m^3/s	50.63 m/s
IP Bypass	IPBP x 2	533.4	51.21	Custom	P-91	3	203.1	11.1 m^3/s	50.63 m/s
4. FWH Heating Steam Piping									
FWH 1 Heating	FWHHS1 x 1	1066.8	11.58	20	A-106	4	15.19	107 m^3/s	131.6 m/s
FWH 2 Heating	FWHHS2 x 1	762	23.17	30	A-106	6	18.69	35.45 m^3/s	87.57 m/s
FWH 3 Heating	FWHHS3 x 1	508	34.75	40	A-106	8	20	14.63 m^3/s	85.25 m/s
FWH 4 Heating	FWHHS4 x 1	406.4	46.33	40	A-106	10	21.18	7.456 m^3/s	67.64 m/s
Deaerator (FWH 5) Heating	FWHHS5 x 1	406.4	123.4	40	A-106	22	19.79	4.074 m^3/s	36.48 m/s
FWH 6 Heating	FWHHS6 x 2	203.2	40.54	40	P-11	9	8.862	1.125 m^3/s	35.16 m/s
FWH 7 Heating	FWHHS7 x 2	152.4	35.97	40	A-106	8	13.79	0.7236 m^3/s	39.47 m/s
FWH 8 Heating	FWHHS8 x 2	203.2	52.12	80	P-22	11	20.84	0.7132 m^3/s	24.35 m/s
FWH 9 Heating	FWHHS9 x 2	203.2	57.91	80	P-22	12	13.79	1.098 m^3/s	37.78 m/s
5. Other Steam & Heating Piping									
FPT Main Steam	FPTMS1 x 1	508	71.63	40	A-106	9	33.65	11.85 m^3/s	68.37 m/s
6. Feedwater Piping									
FWH 1 Exit Feedwater	FWFW1 x 1	457.2	20.73	20	A-106	2	279.1	16999 lpm	1.852 m/s
FWH 2 Exit Feedwater	FWFW2 x 1	508	21.64	20	A-106	2	355.1	22083 lpm	1.96 m/s
FWH 3 Exit Feedwater	FWFW3 x 1	508	24.99	20	A-106	2	355.1	22692 lpm	2.014 m/s
FWH 4 Exit Feedwater	FWFW4 x 1	508	123.4	20	A-106	11	355.1	23467 lpm	2.083 m/s
Deaerator (FWH 5) Exit Feedwater	FWFW5 x 1	609.6	123.4	20	A-106	11	461.8	31751 lpm	1.931 m/s

STEAM PRO allows you to quickly create steam plant design point heat balances, complete with outputs for plant hardware description, preliminary engineering and hardware details, and cost estimate with PEACE.



Project Cost Summary	Reference Cost	Estimated Cost	
I Specialized Equipment	221,906,000	255,191,000	EUR
II Other Equipment	68,799,000	79,119,000	EUR
III Civil	26,414,000	41,259,000	EUR
IV Mechanical	148,567,000	244,483,000	EUR
V Electrical Assembly & Wiring	12,693,000	20,835,000	EUR
VI Buildings & Structures	10,866,000	16,149,000	EUR
VII Engineering & Plant Startup	24,229,000	24,403,000	EUR
Subtotal - Contractor's Internal Cost	513,473,000	681,439,000	EUR
VIII Contractor's Soft & Miscellaneous Costs	94,774,000	144,592,000	EUR
Contractor's Price	608,247,000	826,031,000	EUR
IX Owner's Soft & Miscellaneous Costs	121,649,000	165,206,000	EUR
Total - Owner's Cost (0.8 EUR per US Dollar)	729,896,000	991,237,000	EUR
Nameplate Net Plant Output	570	570	MW
Cost per kW - Contractor's	1067.1	1449.2	EUR per kW
Cost per kW - Owner's	1280.5	1739	EUR per kW

The variety of steam plant configurations is virtually endless. From back pressure units with gas fired boilers feeding desalination plants, to oil-fired boilers feeding straight condensing turbines with a small number of heaters, to coal fired PC boilers, or CFBs feeding single reheat turbines with seven or eight heaters, to supercritical double-reheat plants of the largest variety, or even biomass plants and waste incineration plants using grate fired boilers or BFB, each with any sort of cooling system, are all easily accommodated in STEAM PRO.

STEAM PRO includes a fuel database with more than 180 pre-defined coals, biomass, waste materials, and other fuels. STEAM PRO, in conjunction with PEACE, has an option to automatically include/exclude FGD, ESP or baghouse filter, and SCR using current fuel characteristics and plant size for guidance. It also allows inclusion of a chemical/physical **CO_2 Capture Plant**.

STEAM MASTER is the companion to STEAM PRO and is used for Off-Design simulation. STEAM MASTER computes plant performance for varying ambient conditions, fuel characteristics and fuel blends, equipment loading, process steam/water flows, hardware degradation levels, etc.

THERMOFLOW Inc. – USA
+1 508-303-5033 - info@thermoflow.com

THERMOFLOW Europe GmbH – Germany
+49 6407 906991 - huschka@thermoflow.com