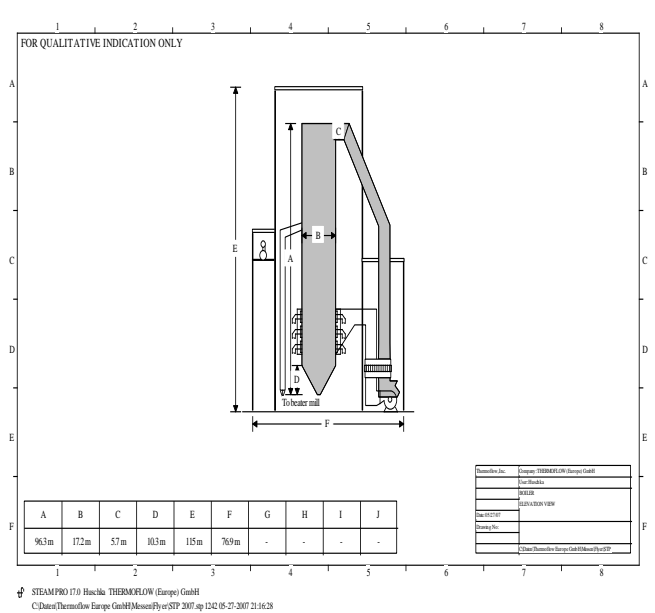
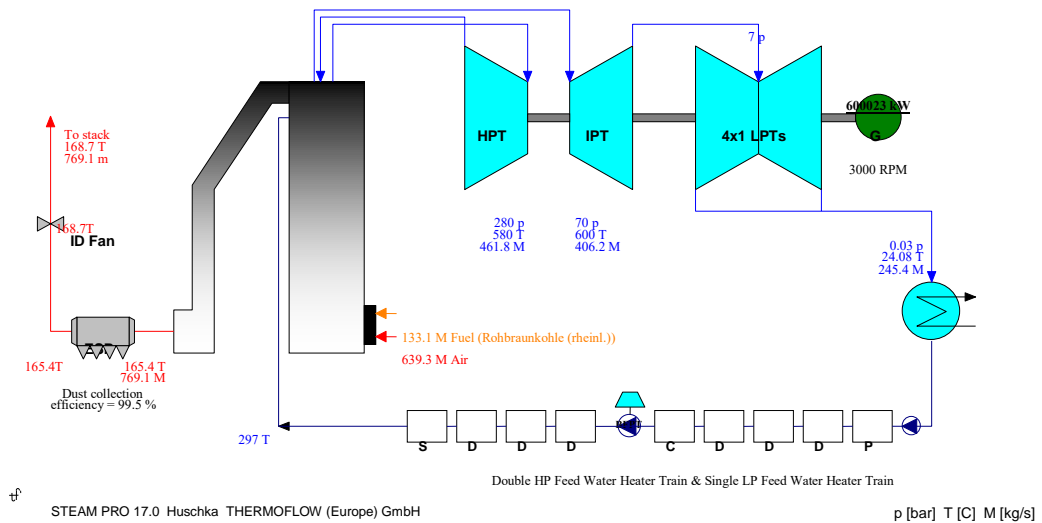


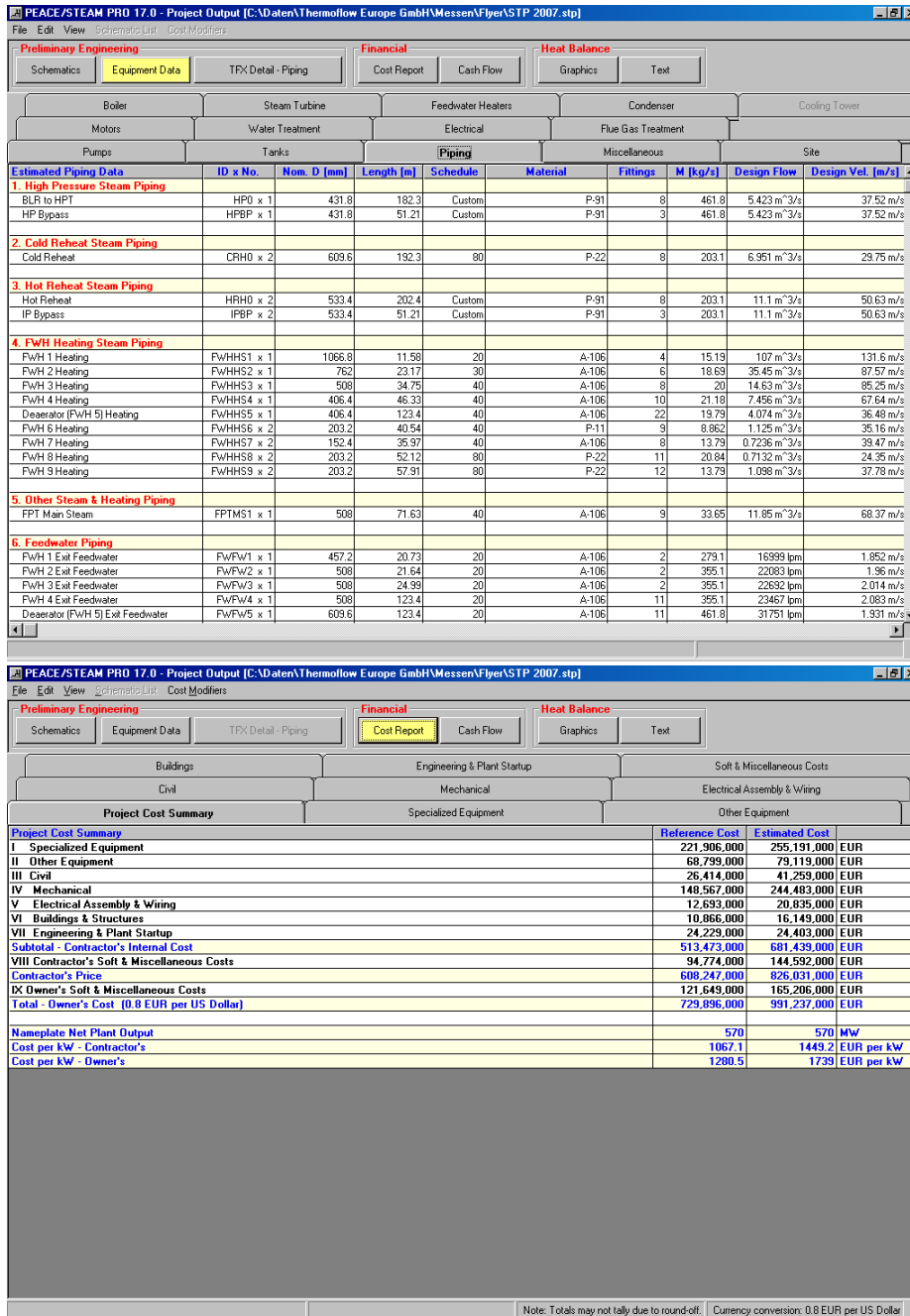
Conventional Cycle Design, Simulation, and Cost Estimation

STEAM PRO® is an **Expert Program** that 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**).

Plant net power	569992	kW	Ambient
Number of units	1		1.013 p
Plant net HR (HHV)	10003	kJ/kWh	15 T
Plant net HR (LHV)	8491	kJ/kWh	60% RH
Plant net eff (HHV)	35.99	%	
Plant net eff (LHV)	42.4	%	
Aux. & losses	30031	kW	
Fuel heat input (HHV)	1583803	kJ/s	
Fuel heat input (LHV)	1344344	kJ/s	
Fuel flow	11500	t/day	



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 latest version has over 3,500 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.



The screenshot displays the STEAM PRO software interface. The top window shows the 'Piping' data table, and the bottom window shows the 'Project Cost Summary' table.

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	356.1	22083 lpm	1.96 m/s
FWH 3 Exit Feedwater	FwFW3 x 1	508	24.99	20	A-106	2	356.1	22632 lpm	2.014 m/s
FWH 4 Exit Feedwater	FwFW4 x 1	508	123.4	20	A-106	11	356.1	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

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	681,435,000 EUR
VIII Contractor's Soft & Miscellaneous Costs	94,774,000	144,592,000 EUR
Contractor's Price	608,247,000	826,027,000 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	991,233,000 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

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®** (Plant Engineering And Cost Estimator) module, the programs provide extensive engineering and cost estimation details.

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**.

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 **CO₂ 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.