DOCUMENT

Plant / project	**Example Plant**
Equipment tag / system	**Steam turbine**
Calculation / document no.	**CALC-ST-001**
Revision	**0**
Prepared by	**Your name**
Checked by	**—**
Date	**07-Nov-2026**

Calculation basis

Condensing turbine · 60.0 bar a / 480 °C to 0.100 bar a · efficiency from measured power · IAPWS-IF97 steam properties · power at the generator terminals

Status	**✓ Inputs OK · ℹ️ 4 default value(s) in use: mechanical efficiency of the turbine, generator efficiency, reference isentropic efficiency, operating hours per year**

KEY INPUTS

Input	Unit	Value used
Inlet pressure (stop-valve inlet)	bar a	60.00
Inlet temperature	°C	480.0
Exhaust pressure	bar a	0.1000
Steam flow through the turbine	kg/h	48,000
Measured power	kW	12,000.0
Mechanical efficiency of the turbine	%	98.5
Generator efficiency	%	97.0
Reference isentropic efficiency (design or guarantee)	%	80.0
Operating hours per year	h/yr	8,000
Value of electricity	per MWh	80.00

RESULTS

Result	Unit	Value
Inlet enthalpy	kJ/kg	3,375.2
Inlet entropy	kJ/kg·K	6.8198
Isentropic exhaust enthalpy	kJ/kg	2,160.0
Isentropic enthalpy drop	kJ/kg	1,215.2

Actual enthalpy drop	kJ/kg	942.0
Isentropic efficiency (internal)	%	77.51
Actual exhaust enthalpy	kJ/kg	2,433.2
Exhaust dryness (steam quality)	%	93.70
Exhaust temperature	°C	45.8
Internal (blade) power	kW	12,559.5
Shaft (coupling) power	kW	12,371.1
Generator output	kW	12,000.0
Power at the chosen basis	kW	12,000.0
Steam rate (specific steam consumption)	kg/kWh	4.000
Heat rate	kJ/kWh	12,734
Thermal efficiency on that basis	%	28.27
Exhaust heat above saturated liquid	kW	29,886
Power at the reference efficiency (same steam)	kW	12,385.1
Power lost against the reference	kW	+385.1
Extra steam needed for the same power	kg/h	+1,493
Energy lost per year	MWh/yr	3,081
Value of the energy lost per year	per yr	246,490

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FINDINGS AND RECOMMENDATIONS

◆ **Opportunity**

A 10 % lower exhaust pressure would give about 125 kW more power at the same steam flow (999 MWh per year), about USD 79,958 per year.

ℹ️ **Note**

Sensitivity: 10 K lower inlet temperature changes the power by -136 kW and gives an exhaust dryness of 93.1 %.

ℹ️ **Note**

Steam rate 4.000 kg/kWh against a theoretical 2.962 kg/kWh: the difference is the turbine, mechanical and generator losses.

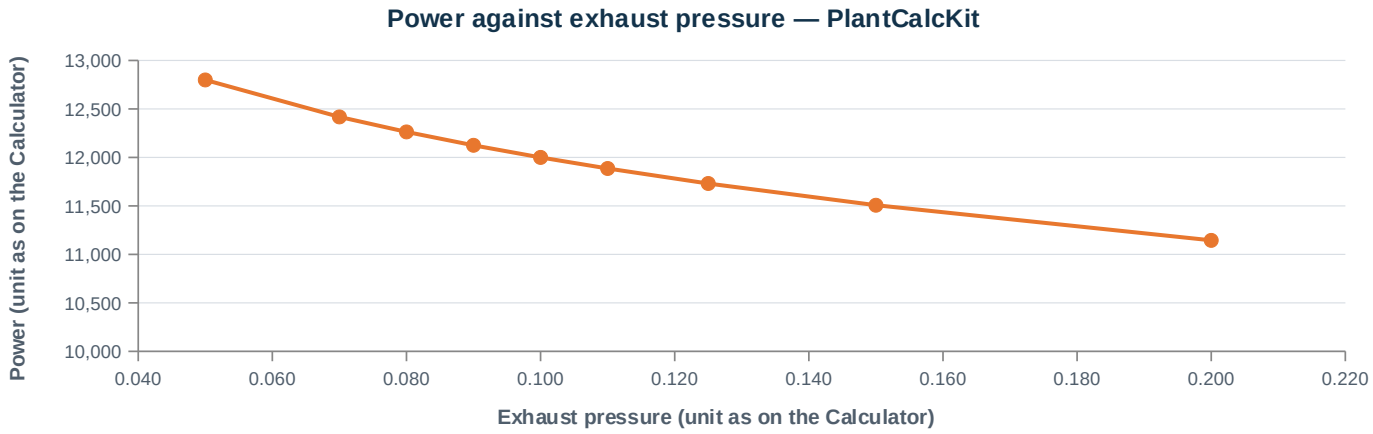
WHAT-IF — EXHAUST PRESSURE (same flow and efficiency)

Case	Value	Power	Change	Dryness, %	Exhaust T
Exhaust pressure × 0.50	0.0500	12,799.0	+799.0	92.1	32.9
Exhaust pressure × 0.70	0.0700	12,417.8	+417.8	92.9	39.0
Exhaust pressure × 0.80	0.0800	12,263.1	+263.1	93.2	41.5
Exhaust pressure × 0.90	0.0900	12,124.9	+124.9	93.5	43.8
Exhaust pressure × 1.00	0.1000	12,000.0	0.0	93.7	45.8
Exhaust pressure × 1.10	0.1100	11,885.9	-114.1	93.9	47.7
Exhaust pressure × 1.25	0.1250	11,731.1	-268.9	94.2	50.2
Exhaust pressure × 1.50	0.1500	11,506.8	-493.2	94.7	54.0
Exhaust pressure × 2.00	0.2000	11,144.5	-855.5	95.4	60.1

WHAT-IF — INLET TEMPERATURE (same flow and efficiency)

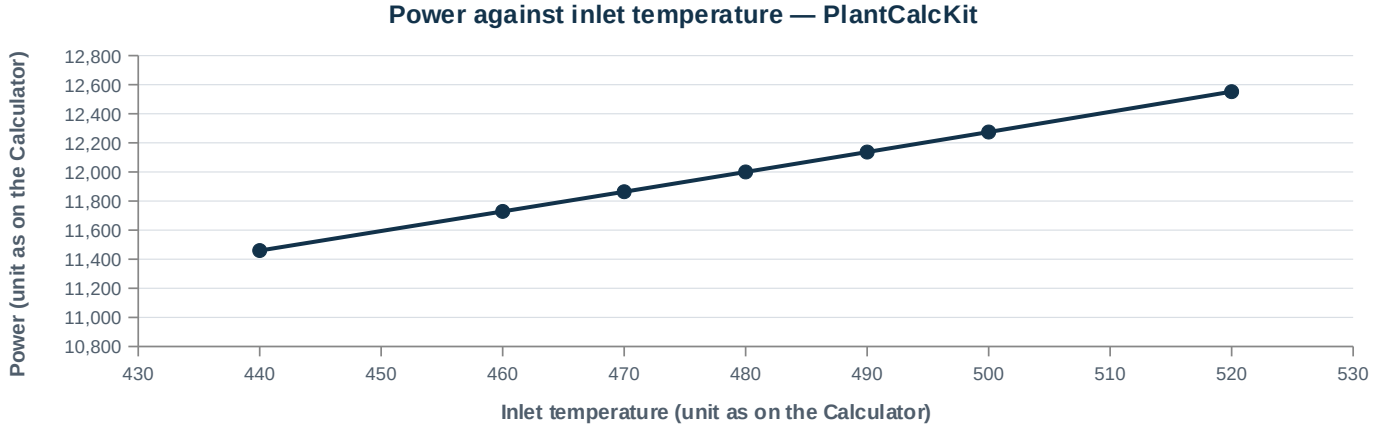
Case	Value	Power	Change	Dryness, %	Exhaust T
Inlet temperature -40 K	440.0	11,459.6	-540.4	91.4	45.8
Inlet temperature -20 K	460.0	11,728.6	-271.4	92.6	45.8
Inlet temperature -10 K	470.0	11,863.9	-136.1	93.1	45.8
Inlet temperature as entered	480.0	12,000.0	0.0	93.7	45.8
Inlet temperature +10 K	490.0	12,136.8	+136.8	94.3	45.8
Inlet temperature +20 K	500.0	12,274.4	+274.4	94.8	45.8
Inlet temperature +40 K	520.0	12,552.0	+552.0	95.9	45.8

CHARTS



Observations — exhaust pressure

[Write your observations here]



Observations — inlet temperature

[Write your observations here]

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