Equipment Cost Scaling: Six-Tenths Rule, Cost Index and Lang Factor

Equipment or plant cost at a new capacity and date by the capacity exponent (six-tenths rule), a cost index ratio and a Lang factor for installed cost.

Method: Perry's Chemical Engineers' Handbook; 9th ed. (McGraw-Hill, 2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Known cost (currency)	7.0000e+07	
Known capacity	100,000	
New capacity (same units)	150,000	
Capacity exponent	0.67000	
Cost index at the known cost's date	381.70	
Cost index now	457.40	
Lang factor (1 = equipment only) Perry's Table 9-10 lists Lang factors by plant type.	1.0000	

Calculated results

Parameter	Value	Unit
Scaled cost	1.1007e+08	
Installed (fixed capital) cost	1.1007e+08	
Cost ratio	1.5724	

Notes for this case

- Order-of-magnitude accuracy (−30 to +50 %); scale only within about tenfold of the known capacity.

Formula and method

$$C_2 = C_1 \left(\frac{S_2}{S_1}\right)^n \frac{I_2}{I_1}, \quad C_{FC} = f_L C_2$$

Variables

C_1	Known cost (currency)	-
S_1	Known capacity	-
S_2	New capacity (same units)	-
n	Capacity exponent	-
I_1	Cost index at the known cost's date	-
I_2	Cost index now	-
f_L	Lang factor (1 = equipment only)	-
C_2	Scaled cost	-
$f_L C_2$	Installed (fixed capital) cost	-
C_2/C_1	Cost ratio	-

Method and standards

Perry's Eq. (9-1) with a cost index ratio and Eq. (9-6).

Assumptions and limits

- Same technology and scope.

- A note appears when the new capacity is more than about ten times larger or smaller than the known one.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 9
- Eq. (9-1) (cost–capacity scaling) and Eq. (9-6) with Table 9-10 (Lang factors)

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/unit-operations/equipment-cost-scaling

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.