Learning Curve: Cost Reduction with Cumulative Production

Unit cost after cumulative production grows, by an experience (learning) rate per doubling, and the cumulative volume needed to reach a target cost.

Method: Wright's learning (experience) curve

Input parameters

Unit system: SI

Parameter	Value	Unit
Current unit cost	1,000.0	
Current cumulative production	100.00	
Learning rate (cost fall per doubling)	20.000	%
Future cumulative production	800.00	
Target unit cost	500.00	

Calculated results

Parameter	Value	Unit
Experience exponent $-\log_2(1 - LR)$	0.32193	
Unit cost at Q	512.00	
Doublings	3.0000	
Cumulative production for the target cost	861.16	

Notes for this case

• Wright's law C = $C_0(Q/Q_0)^{(-b)}$, b = $-\log_2(1 - LR)$. Solar PV modules have shown learning rates near 20 %, wind turbines about 10–15 %, batteries about 18–20 %.

Formula and method

$$C = C_0 \left(\frac{Q}{Q_0}\right)^{-b}, \quad b = -\log_2(1 - LR)$$

Variables

C_0	Current unit cost	-
Q_0	Current cumulative production	-
LR	Learning rate (cost fall per doubling)	-
Q	Future cumulative production	-
C_t	Target unit cost	-
b	Experience exponent $-\log_2(1 - LR)$	-
C	Unit cost at Q	-
$\log_2(Q/Q_0)$	Doublings	-
Q_t	Cumulative production for the target cost	-

Method and standards

Learning curve.

Assumptions and limits

- Constant learning rate.

References

Wright's learning (experience) curve

Report details

Report reference	FCC-98Q6-M77W (the same inputs always give the same reference)
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Calculator	Learning Curve: Cost Reduction with Cumulative Production
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 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/general/economics/learning-curve-experience-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.