Reactor Annual Fuel, Natural Uranium and SWU Needs

Heavy metal loaded per year, natural uranium feed and separative work for a reactor from its electrical output, efficiency, capacity factor, burn-up and enrichment.

Method: Equilibrium-cycle fuel balance with enrichment

Input parameters

Unit system: SI

Parameter	Value	Unit
Net electrical output	1,000.0	MW
Net efficiency	33.000	%
Capacity factor	90.000	%
Discharge burn-up	50.000	GWd/t
Enrichment	4.5000	%
Tails assay	0.25000	%

Calculated results

Parameter	Value	Unit
Thermal energy per year	23,907	GWh
Heavy metal loaded per year	19.923	t
Natural uranium feed per year	183.67	t
Separative work per year (kg-SWU)	136,891	
U-235 in the fresh fuel	896.52	kg

Notes for this case

- Heavy metal = thermal energy/burn-up (equilibrium cycle); feed and SWU per kg product from the enrichment mass balance and value function at 0.711 % natural assay.

Formula and method

$$m_{HM} = \frac{P_e\, CF\, t}{\eta\, BU}, \quad m_F = m_{HM}\frac{x_p - x_t}{x_f - x_t}$$

Variables

P_e	Net electrical output	W
η	Net efficiency	-
CF	Capacity factor	-
BU	Discharge burn-up	J/kg
x_p	Enrichment	-
x_t	Tails assay	-
E_{th}	Thermal energy per year	J
m_{HM}	Heavy metal loaded per year	kg
m_F	Natural uranium feed per year	kg
SWU	Separative work per year (kg-SWU)	-
m_{235}	U-235 in the fresh fuel	kg

Method and standards

Annual fuel balance.

Assumptions and limits

- Equilibrium cycle; uranium fuel only.

References

Equilibrium-cycle fuel balance with enrichment

Report details

Report reference	FCC-11N2-YKGM (the same inputs always give the same reference)
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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/boilers-power-plant/nuclear-power/reactor-annual-fuel-requirement

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.