Nuclear Fuel Cost per MWh from the Front-End Cycle

Front-end fuel cost of enriched uranium per kg and per MWh of electricity from uranium, conversion, enrichment (SWU) and fabrication prices, burn-up and efficiency.

Method: Front-end fuel cycle cost with the separative work value function

Input parameters

Unit system: SI

Parameter	Value	Unit
Product enrichment	4.5000	%
Tails assay	0.25000	%
Natural uranium price per kg U (as U_3O_8 content)	150.00	
Conversion price per kg U	25.000	
Enrichment price per SWU	160.00	
Fabrication price per kg of enriched U	400.00	
Discharge burn-up	50.000	GWd/t
Net plant efficiency	33.000	%

Calculated results

Parameter	Value	Unit
Natural uranium feed per kg of product	9.2191	
Separative work per kg of product	6.8711	
Cost per kg of enriched uranium in fuel	3,112.7	
Electricity per kg of uranium in fuel	396.00	MWh
Front-end fuel cost per MWh of electricity	7.8604	
Share of uranium purchase in the cost	44.426	%

Notes for this case

• Per kg of enriched uranium: F/P(c_U + c_conv) + (SWU/P)c_SWU + c_fab, with feed at natural assay 0.711 % and the ideal-cascade value function. Electricity per kg = BU·η. Back-end costs (storage, disposal, interest on inventory) are excluded; they typically add 1–3 per MWh.

Formula and method

$$c_{kg} = \frac{F}{P}(c_U + c_{conv}) + \frac{SWU}{P}c_{SWU} + c_{fab}, \quad c_{MWh} = \frac{c_{kg}}{BU \cdot \eta}$$

Variables

x_p	Product enrichment	-
x_t	Tails assay	-
c_U	Natural uranium price per kg U (as U_3O_8 content)	-
c_{conv}	Conversion price per kg U	-
c_{SWU}	Enrichment price per SWU	-
c_{fab}	Fabrication price per kg of enriched U	-
BU	Discharge burn-up	J/kg
η	Net plant efficiency	-
F/P	Natural uranium feed per kg of product	-
SWU/P	Separative work per kg of product	-

c_{kg}	Cost per kg of enriched uranium in fuel	-
E_e	Electricity per kg of uranium in fuel	J
c_{MWh}	Front-end fuel cost per MWh of electricity	-
$c_U F / c_{kg}$	Share of uranium purchase in the cost	-

Method and standards

Front-end fuel cost.

Assumptions and limits

- Front end only; no carrying charges or back-end costs.

References

Front-end fuel cycle cost with the separative work value function

Report details

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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/nuclear-fuel-cycle-cost

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Reopens the calculator with the inputs of this report.