

Lecture Notes #7A

Fuel Cost Calculations

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KINDS OF FUEL COSTS

DIRECT COSTS:

WHAT YOU PAY TO BUY IT

**(INCLUDES ALL LEASE
CHARGES)**

INDIRECT COSTS:

CARRYING CHARGES

PRE-IRRADIATION

AFUDC = AFN

IN-CORE

**ONLY SHOWS UP UNDER
FUEL IN LEASE CASE**

BATCH FUEL COST

$$\text{DIRECT MILLS/KWH} = \frac{41.67 \times X \text{ (\$/kgU)}}{\text{EFFIC} \times \text{DISCH BURNUP (MWD/MTU)}}$$

$$\text{CARRYING CHG MILLS} = \frac{41.67 \times X \text{ (\$/kgU)} \times \text{Int_Rate}}{2 \times \text{EFFIC} \times \text{SPEC_POW} \times \text{CAP_FAC}}$$

MATERIAL REQUIREMENTS FOR A BATCH OF FUEL

$$M_b = N_b * M_a$$

M_b = mass of uranium in batch

N_b = number of assemblies in batch

M_a = mass of uranium per assembly

$$M_p = M_b * L_f$$

M_p = mass of enriched uranium product (EUP)
delivered to fabricator

L_f = fabrication loss factor (1.009)

$$M_f = M_p * (X_p - X_t) / (X_f - X_t)$$

M_f = mass of uranium delivered to enricher

X_p = U-235 w/o in batch

X_f = U-235 w/o in feed (0.711)

X_t = U-235 w/o in tails (0.2 to 0.3)

$$M_t = M_f - M_p$$

M_t = mass of uranium in tails stream

$$M_u = M_f * L_c$$

M_u = mass of uranium delivered to convertor

L_c = conversion loss factor (1.005)

$$M(U_3O_8) = M_u * (3 * 238 + 8 * 16) / (3 * 238)$$

$M(U_3O_8)$ = mass of uranium ore

ENRICHMENT PROCESSES

- GASEOUS DIFFUSION
 - CENTRIFUGE
 - LASER ISOTOPE SEPARATION (LIS)
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- SEPARATIVE WORK UNIT (SWU)

$$S = M_p * V(X_p) + M_t * V(X_t) - M_f * V(X_f)$$

$$V(X_i) = (X_i/50 - 1) * \ln[X_i/(100 - X_i)]$$

S has units of kg SWU and is a measure of the work needed to perform a specified separation job.

HOW TO REDUCE FUEL COST

MAKE BURNUP GO UP FASTER
THAN \$/KGU

COMMERCIAL:

REDUCE \$/KGU FOR
SAME DISCHARGE BURNUP

TECHNICAL:

INCREASE DISCHARGE BURNUP
FOR SAME \$/KGU