Example

- **Assume 1 fission = 200 MeV**

$$\left(200 \bullet 10^{6}\,\frac{eV}{fission}\right) \bullet \left(1.6 \bullet 10^{-19}\,\frac{watt-s}{eV}\right) \bullet \left(\frac{1day}{86,400\,s}\right)$$

$$= 3.7 \bullet 10^{-16}\,\frac{watt-d}{fission}$$

$$\frac{watt-d}{g_{fuel}} = 3.7 \bullet 10^{-16} \bullet \left(\frac{1}{\rho_{fuel}}\right) \bullet \left(\frac{fissions}{cm^{3}}\right)$$

or, $$\frac{MWd}{tonne-U} = 3.7 \bullet 10^{-16} \bullet \left(\frac{1}{\rho_{fuel}}\right) \bullet \left(\frac{fissions}{cm^{3}}\right) \bullet \frac{m'}{A}$$

where A = atomic wt. of U

What if not all of the energy released is captured by the fuel?

- **can only count on 169 MeV K.E. of FP's**
  Plus <u>12 MeV</u> Decay of FP's

$$\frac{MWd}{tonne-fuel} = 1.85 \bullet 10^{-18} \bullet \left(\frac{1}{\rho_{fuel}}\right) \bullet \left(\frac{fissions}{cm^{3}}\right) \bullet E_{f}$$

where E_f is the fission energy (MeV) deposited in the fuel

Another way to express this is:

$$\frac{MWd-in-fuel}{tonne-U} = 1.85 \bullet 10^{-18} \bullet \left(\frac{E_f}{\rho_{fuel}}\right) \bullet \left(\frac{fissions}{cm^3}\right) \bullet \frac{m'}{A}$$

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What Have We Forgotten?

1.) Conversion of fertile to fissile
(important at low enrichments and at high burn up)

2.) Fast fission
Few % in thermal reactors

3.) Absorption of gamma rays
From the parent fuel rod or from surrounding fuel rods