1. $E_{avg} = 310$ kWh/day energy density crude oil = 46 MJ/kg

$\sim 331.89 \times 10^6$ People in USA 365 day = 1 year

E_{avg}/day · # of ppl · days in yr = $\frac{E_{avg}}{year}$

$310 \cdot 331.89 \times 10^6 \cdot 365 = 3.755 E13 \frac{kWh}{year}$ → for USA

$3.755E13 \cdot 3.6 = 1.352E14 \frac{MJ}{yr}$

$\frac{1.352 E14 \ MJ/yr}{46 \ MJ/kg} = \boxed{2.939E12 \ kg/yr}$

2. 200 W = .002 MJ/s 24 MJ/kg

$\eta = 30\%$

loss = 10% → $\eta_{coal} = 40\%$

$$= \frac{6307.2 \text{ MJ/yr}}{(24 \cdot .4) \text{ MJ/kg}}$$

$$= \boxed{657 \text{ kg/yr}}$$

3. m = 1 kg 60% carbon

CO_2 is 3.67 x heavier than carbon

$$600 \text{ g C} \times 3.67 = \boxed{2.2 \text{ kg } CO_2}$$

4. 24 MJ/kg $\eta = 30\%$ 60% carbon

$24 \cdot .3 = 7.2$ $1/7.2 = .134$ kg/MJ

$$.134 \cdot .6 = .0833 \frac{\text{kg}}{\text{MJ}} \text{ C} \qquad .08 \times 3.67 = \boxed{.3058 \frac{\text{kg}}{\text{MJ}} CO_2}$$

5. a) $V = 112500\ cm^3 = 112.5\ kg$ $T_L = 10°C$ $T_H = 50°C$

$\Delta T = 40°C$ $1\ kcal = 4.184\ kJ$

$112.5 \cdot 40 \cdot 4.184 = 18828\ kJ = 5.23\ \frac{kWh}{day}$

b) ~ 215 s to optimum toast
1000 W

$2 \times 215{,}000\ J = 430{,}000\ J = .119\ \frac{kWh}{day}$

c) ~ 1200 W

$2400\ W \cdot 3600 = 8.64\ MJ/hr = .6\ \frac{kWh}{day}$

d) 5 kW

$3000 \cdot 7200 = 36\ \frac{MJ}{hr} \cdot 2 = 5\ \frac{kWh}{day}$

f) typical washer ~2.25 kWh
~30 minute cycle

.321 kWh/day

g) assuming family of 2
-30 days in a month

1 kW · 24 = 24 kWh/day · 2 = 48 kWh/day

7.84
~ ~~24.48~~ kWh/day per person on AC throughout the year

h) 2600 cal × 4,184 J = 10.878 MJ

= 3.022 kWh/day

i) 5 kg milk per person
~ 22.56 kWh/day / 16 Liters = 1.4098 kWh/day / Liter

5 Liters · 1.4098 kWh/day / Liter = 7.049 kWh/day per person