Project Introduction

Firewood™

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1 Prologue

1.1 Customer Traits

It is reasonable to assume that, due to the inherent nature of the products offered by Firewood™, its customers must exhibit one common trait, namely **the need for a mobile, localised source of heat energy**. This definition, despite not being necessarily flawed, ignores a very important parameter of the energy source — the (average) thermal power output. There is, after all, a vast difference between a cigarette lighter, and an acetylene torch.

1.2 Power Calculations

To narrow down our customer base, let's run some primitive calculations to determine the power range we're striving to operate within. Consider a typical lighter from a competing company, *BIC*. Said lighter is equipped with $4.5g$ of butane fuel. This amount of butane allows the device to maintain a (more or less) constant power output throughout the duration of $30min$. Upon combustion, one mole of the butane fuel releases a fixed amount of energy into the environment. This energy is defined by the *enthalpy of combustion* ...

$$\Delta H_{c(mol)} = -2.88 \cdot 10^3 \; kJ \cdot mol^{-1}$$

Thus, the device is capable of outputting an average amount of thermal power equal to ...

$$\begin{aligned} M &= 58.124 \; g \cdot mol^{-1} \\ n &= \frac{4.5 \; g}{58.124 \; g \cdot mol^{-1}} \\ &= 7.74 \cdot 10^{-2} \; mol \\ \Delta H_c &= \Delta H_{c(mol)} \cdot n \\ &= -2.23 \cdot 10^2 \; kJ \\ \bar{P} = \frac{E}{t} &= \frac{2.23 \cdot 10^2 \; kJ \cdot 10^3}{30min \cdot 60s} \\ &= \frac{2.23 \cdot 10^5}{1.7 \cdot 10^3} \\ &= \underline{\underline{123.8 \; W}} \end{aligned}$$

1.2.1 Continuous Form

Assuming that the fuel consuption is not constant, the formulæ for the instantaneous and average power outputs shall be expressed in a continuous form:

$$\begin{aligned} P(t) &= \frac{dE}{dt} \\ \bar{P} &= \frac{1}{T} \cdot \int_0^T P(t) \, dt \end{aligned}$$