Energy Efficient Investments in Burners

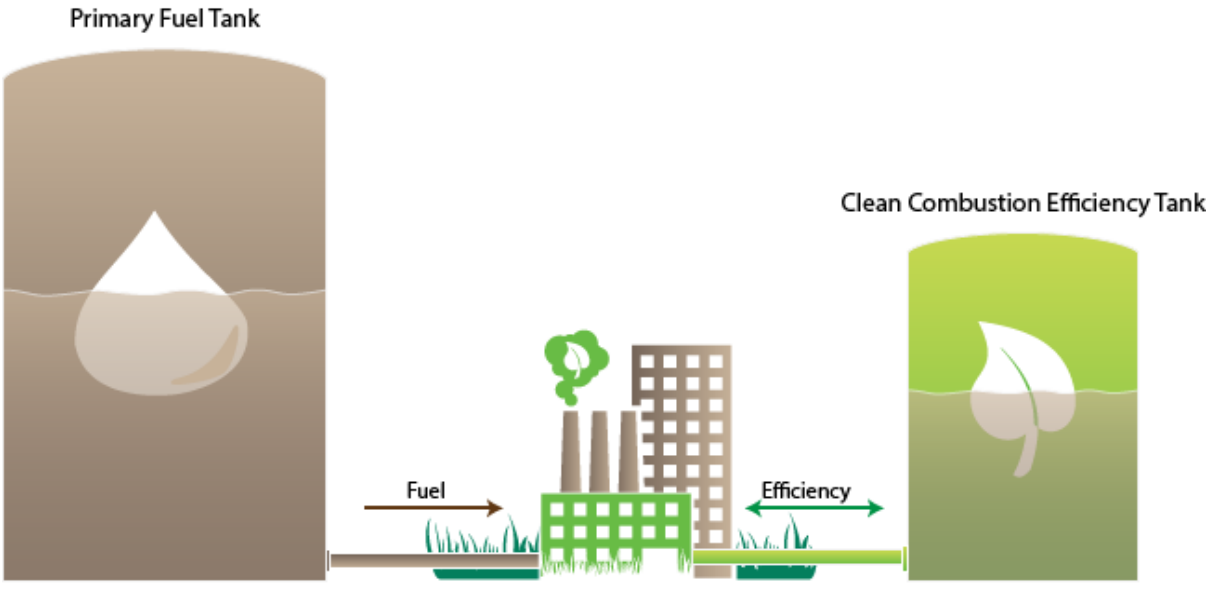
Closing the "Energy Efficient Gap" between efficient technology and inefficient investments

Energy Efficiency is difficult, sometimes confusing, to measure. A more efficient outcome can only be achieved when something is changed, and is therefore relative to its predecessor. At Clean Combustion we measure the efficiency relative to the good we are replacing. At Clean Combustion we recognize the efficiency as liberation of resources, and therefore a fuel.

An example: A pulp mill is operating a rotary kiln burner that is on annual average consuming oil at the rate of 800 kg/hr. They decide to replace the burner to a Clean Combustion make. The new burner generates the same result through the kiln consuming only 720 kg/hr. That is an efficiency increase by 10%. In order to quantify the actual liberation of resources we set the differing 80 kg of oil into a separate "efficiency tank" every hour. This makes the efficiency tangible.

Over a month (31 days) process the "efficiency tank", during a 24hr operation, will consist of 59,520 kilos. If we then decide to run the burner of the "efficiency tank", at 720 kg/hr we will get 82,6 hours of Free operations due to the plants own production. That is equal to 3,4 days.

This is as simple as it sounds.



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Let us then continue with this model, let's make a formula of this to compare if this is a healthy investment in comparison to the current good handling the operation. The good is to replace, and run on the same fuel, and same usage. The accounting department give the project of replacing the good the risk adjusted discount rate of 15%, medium risk. The old burner was bought 3 years ago for the price of $300,000 with a straight-line depreciation rate of 10% of net value over 10 years. The current burner is accounted as an asset of $210,000, resulting in opportunity cost of $210,000. The incremental upfront capital cost, in other terms the cost of the new burner is $250,000. The formula will look like this;

$$\frac{pm(e_0 - e_1)}{(1+r)} - \varepsilon > c$$

- The old good to be replaced is denoted by 0.
- The new "energy efficient" good is denoted by 1.
- e represents the energy intensity.
- $e_0 > e_1$ because it is the less efficient good.
- p represents the cost of energy.
- m represents the usage of the durable good.
- r represents the risk adjusted discount rate over the lap of one year.
- ε represents the opportunity cost (positive) or benefit (negative) by this choice.
- c represents the incremental upfront capital cost.

The investment is only efficient if the new burners "efficiency tank" will repay the opportunity cost for the old burner and the initial investment for the new burner. The table will run over the lap of months, one month is defined to 30,41 days. The new burner requires downtime of 1 week every year, that is counted as 0,58 days per month. Resulting in 29,83 days usage per month. The energy intensity for the old good is 800 kg/hr (19,200 kg/day), and the new efficient good is 720 kg/hr (17,280 kg/day). The oil price is $89,50 per Barrel (WTI oil, 1 Barrel = 151kg) resulting in price $0,59 per kg.

- $e_0 = 19{,}200\ kg/day,$
- $e_1 = 17{,}280\ kg/day$
- $p = \$0.59\ per\ kg$
- $m = 29.83\ days\ per\ month$
- $r = 0.15$
- $\varepsilon = \$210{,}000$
- $c = \$250{,}000$
- $n = number\ of\ month$

$$n\left(\frac{\$0.59\ * 29.83(19{,}200 - 17{,}280)}{(1+0.15)}\right) - \$210{,}000 > \$250{,}000$$

$$n(\$29{,}384) - \$210{,}000 > \$250{,}000$$

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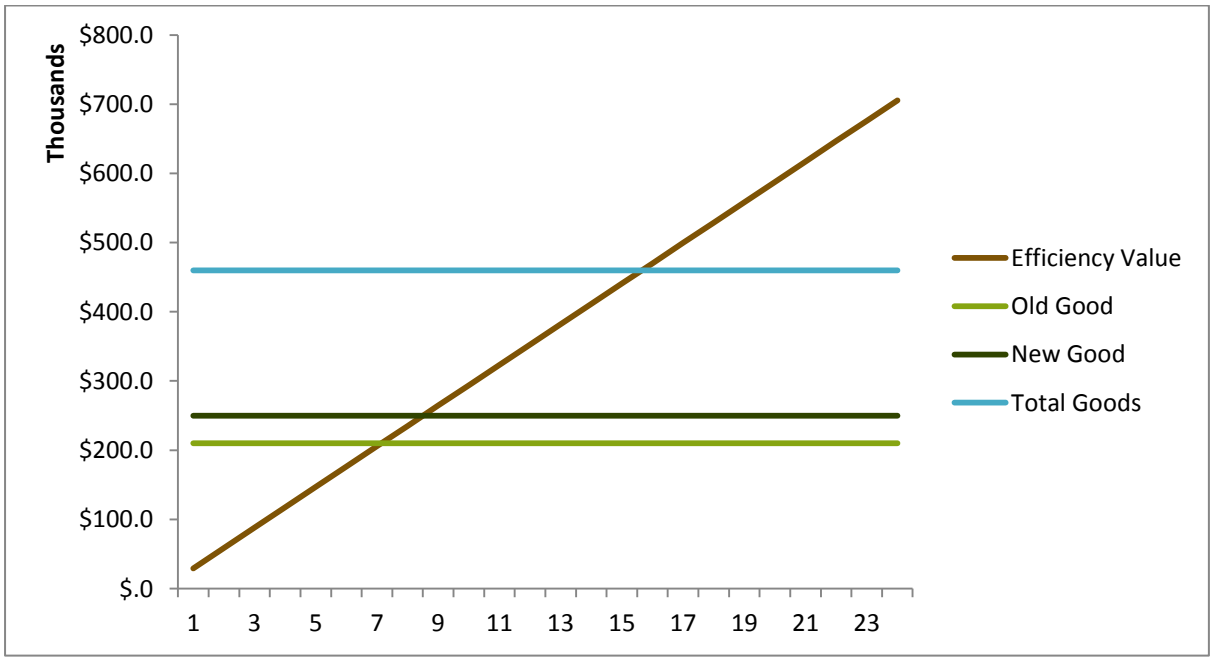
Month	Efficiency($)	e	c	Difference($)	ROI
1	29,384	210,000	250,000	-180,616	-1,72
2	58,768			-151,232	-1,60
3	88,152			-121,848	-1,49
4	117,536			-92,464	-1,37
5	146,920			-63,080	-1,25
6	176,304			-33,696	-1,13
7	205,688			-4,312	-1,02
8(1)	235,072			25,072	-0,90
9	264,456			54,456	-0,78
10	293,840			83,840	-0,66
11	323,224			113,224	-0,55
12	352,608			142,608	-0,43
13	381,992			171,992	-0,31
14	411,376			201,376	-0,19
15	440,760			230,760	-0,08
16(2)	470,144			260,144	0,04

(1) Point number 1 describes when the energy efficient investment has covered the opportunity cost of replacing the good.

(2) Describes when the energy efficient good has covered (1) and the investment for itself.

Figure 1, 24 Month Forecast of 10% efficiency rate.



This is why we at Clean Combustion encourage financially sound energy efficient investments.

"Although industry has become much more efficient over the past decades, still the potential for significant savings remains. For one thing, technology is not static, and technological change is always opening up new opportunities." – Daniel Yergin

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