Re: H2 burner

Source: http://sci.tech−archive.net/Archive/sci.energy.hydrogen/2008−06/msg00045.html

- *From*: "Spaceman" <spaceman@xxxxxxxxxxxxxxxxxxxxxxxxxxx>
- *Date*: Thu, 12 Jun 2008 10:13:16 −0400

"Williamknowsbest" <William.Mook@xxxxxxxxx> wrote in message
news:87d56cdd−196b−4806−afcf−0ce1e18f425c@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

> Internal combustion engines are limited by thermodynamics. The ratio of hottest temperatures versus lowest temperatures limits the efficiencies of these sorts of engines.
>
> http://en.wikipedia.org/wiki/Carnot_efficiency#Efficiency
>
> Maximum efficiency = 1 − Tc/Th
>
> Where Th=hot temperature (absolute terms Kelvin or Rankine)
> Tc= cold temperature (again absolute terms Kelvin or Rankine)
>
> Hydrogen fuel can burn hotter than hydro−carbon fuels, but metallurgical considerations limit temperatures anyway to about 1,000C − or 1,273K. If the exhaust temperature is say 500K then efficiency cannot exceed 60% or so. Exhaust temps of 300K increases efficiency to 76% − at the great expense of decreasing specific power and reducing power to weight due to increased air handling and heat transfer area. (higher temps transfer more energy per unit area − and per unit weight − than lower temps − large areas not only mean more material, but more costs as well)
>
> Generally speaking lowest cost and lowest mass per unit weight is favored − at the expense of efficiency
>
> Here is a partial list of the heat engines that have been developed over the years. Due to materials limitations as well as power and cost limitations, they are limited to 20% to 60% efficiency − with the higher efficiencies going to the stationary applications where weight and cost are higher. Higher power lower mass lower cost systems tend to have higher exhaust temps and lower peak temps and pressures (which are related in most cases) − which reduce efficiency. Also, variable loading and speeds take their toll in applications. This is why hybrids get better mileage than direct drive engines. Hybrids can be

tuned to run very efficiently at one speed, and be switched on when batteries need recharging, and switched off when batteries are full − while the electrical management system takes the place of the transmission. A continuously variable mechanical transmission with flywheel can have much the same impact as a hybrid, at potentially lower costs.

http://en.wikipedia.org/wiki/Otto_cycle#The_Otto_cycle
http://en.wikipedia.org/wiki/Diesel_cycle
http://en.wikipedia.org/wiki/Brayton_cycle
http://en.wikipedia.org/wiki/Rankine_cycle
http://en.wikipedia.org/wiki/Ericsson_Cycle
http://en.wikipedia.org/wiki/Atkinson_Cycle
http://en.wikipedia.org/wiki/Lenoir_cycle
http://en.wikipedia.org/wiki/Miller_cycle
http://en.wikipedia.org/wiki/Thermoacoustic_refrigeration
http://en.wikipedia.org/wiki/Peltier−Seebeck_effect
http://en.wikipedia.org/wiki/Pyroelectricity
http://en.wikipedia.org/wiki/Thermionic_emission

http://en.wikipedia.org/wiki/Continuously_variable_transmission
http://en.wikipedia.org/wiki/Flywheel_energy_storage

Another possibility for using heat is TPV − thermophotovoltaics. This is the same as a solar cell, but uses heat energy

http://en.wikipedia.org/wiki/Thermophotovoltaic

Even though the mechanism is quite different than in the systems described above, TPV is still a heat engine − similar to many of the thermo−electric engines described above.

One way efficiencies might be improved, without dramatically increasing costs and maintaining or improving power to weight, is to make engines smaller and run them in parallel. When the size of an engine changes, the surface area changes as the square of the dimension, and the volume changes as the cube of the dimension. So, reducing an engine to 1/2 the size of a similar engine, decreases its surface area by 1/4 and its volume by 1/8th − so its surface area per unit weight goes by by a factor of 2 − allowing us to operate at a different regiion of efficiency while maintaining the same amounts of materials even though surface areas are larger per unit volume.

Alright, this is taken to its extremes with MEMs based engines (micro−electro−mechanical systems)

http://en.wikipedia.org/wiki/MEMS
http://en.wikipedia.org/wiki/Micropower
http://berkeley.edu/news/berkeleyan/2001/04/10_cmbus.html

In the end, the real factor is the total cost of the engine for the given application over its life cycle. Blind pursuit of highest efficiency at any cost − typically does not achieve this − a cost−effective efficiency however varies with the cost of energy.

From the beginning of the industrial age in the 1840s thorugh 1960s− the cost of energy decreased consistently at about a 5% per annum rate. Oil produced at an inflation adjusted $200 per barrel in 1860 fell to $2 per barrel by 1960. Over that same period the use of energy by civilization increased exponentially, and with it, the benefits of industrial living increased living standards. Slavery was ended, the work week was shortened from 80 hours to 60 hours to 40 hours, civil rights were enacted, the middle class emerged, retirement at 65 was commonplace, all byproducts of lower energy costs.

From 1960 to the present day, energy costs have risen at an average 8% per annum. Oil now exceeds $100 per barrel − $20 per barrel when measuring in 1960s dollars. However, increased automation and efficiency improvements have resulted in a holding action against economic decline. We perceive this as limits to our industrial capacities and increasing costs of things today that were done more cheaply in the past. Despite this, families have two wage earners, reinstituting for many 80 hour work weeks, and many people hold two jobs, reinstituting 60 hour work weeks. Increasing conflicts over material shortages will lead to a reversal of civil rights, likely along wealth lines rather than race lines, and eventually with higher and higher energy costs − we will see slavery re−instituted in moder guise − as some sort of debt instrument that is carried from generation to generation.

Of course if we could reduce the cost of GENERATION of PRIMARY energy from nuclear and solar (which is also nuclear) sources we can usher in an age where energy is too cheap to meter.

In the 1960s people looked forward to the 2010s with enthusiasm. Why? They predicted that high temperature nuclear reactors made very cheaply − but safely and reliably − would make energy too cheap to meter. With high temperature nuclear power we'd have low cost hydrogen created thermolytically from water. So, expert opinion in the 1960s had every reason to believe that the 5% reduction in energy costs woudl continue for another 50 years − and today we'd be paying the equivalent of $0.15 per barrel (15 cents) − and this combined with increased automation and efficiencies obtained at low cost would transform life on Earth. Our average GDP in the USA would be about $1,000,000 per person per year − and we'd have universal health care, universal PhD, a 20 hour work week, and retirement at age 40.

None of this happened. The high temperature nuclear reactor was shelved with the election of Richard Nixon, and his appointment of major oil companies as advisors of energy policy for this nation. With the election of Jimmy Carter, a Navy nuclear engineer, who vowed to do something about the shortages brought about under Nixon, there was hope that the BNL studiy created by Johnson/Kennedy and ignored by Nixon would get some action − and by 1980s we'd have energy too cheap to meter. The week Congress acted on Carter's program Three Mile Island melted down, and Jane Fonda's movie China Syndrome hit the theaters. So, Congress passed legislation establishing huge programs for the DOE, but avoiding any major development of high temperature nuclear reactors called fo rin the BNL study as a pathway to energy that was too cheap to meter. Since that time, proponents of high temperature nuclear reactors have fought an uphill battle − which has resulted in the DOE Gen IV reactor proposal − which is slated for development around 2030 − about the time oil price increases no longer increase the value of oil reserves for those who own them since at the prices projected for that date, the marginal value of oil equals its marginal cost − and utilization goes down, reducing the value of reserves despite their high cost relative to cost of production.

http://en.wikipedia.org/wiki/Generation_IV_reactor

This technology was available as early as 1950 −it has merely been classified and sidestepped for 60 years−

http://en.wikipedia.org/wiki/Project_Pluto

Nobody knows why − some suspect a conspiracy. Similar to the conspiracy that ended street cars in the USA

http://en.wikipedia.org/wiki/National_City_Lines

Outside the USA, electric trains and streetcars, driven by nuclear power plants, move lots of people seamlessly in places like Switzerland, vastly reducing their use of oil natural gas and coal without reducing their standards of living

http://www.vbz.ch/vbz_opencms/opencms/vbz/english/index.html

Heat problem of the ICE is no problem at all.
The design I have reduces the heat by about 4:1 or better
from a 4 cylinder engine

:)
nice bunch of links too .
thanks.

−−
James M Driscoll Jr
Spaceman

.