

Re: Compressed air might blow the oil-gas-petrol profits

Source: <http://sci.tech-archive.net/Archive/sci.physics/2006-02/msg00639.html>

- *From:* Hero.van.Jindelt@xxxxxx
 - *Date:* 5 Feb 2006 12:38:11 -0800
-

The Ghost In The Machine wrote:

In sci.physics, Hero.van.Jindelt@xxxxxx
<Hero.van.Jindelt@xxxxxx>
wrote
on 2 Feb 2006 16:23:45 -0800
<1138926225.443661.260680@xx>:

<http://www.theaircar.com/aboutmdi.html>

Enjoy

Hero

I wouldn't bet on that. Compressed air is merely an energy conveyor; something has to pressurize the tank.

What is that something?

It turns out the link is referring to some sort of hybrid vehicle using compressed air, a small electric motor, and standard petrol/gasoline. The pistons are moved using an unusual camshaft arrangement, the details of which aren't available (trade secrets). It is not clear whether the air tank is prepressurized or whether it is used as some sort of buffer, compressed by the action of the engine during operation.

I have a scenario of my own. Living in East Frisia, here it's like the netherlands with lot's of windmills, one can make use of the electricity of these wind"mills" when there's abundant wind, to fill bottles with compressed air. These can be sold to wind-car owners (and used for generating electricty, when there's not much wind).

I also see no numeric claims of fuel consumption. How many mpg would this engine get, were it placed in a car and

Re: Compressed air might blow the oil-gas-petrol profits

compared against a standard reciprocating piston engine of equal power?

The FAQ suggests that the engine refills the tanks (by running in "compressor mode"), taking about 6 hours. That is a huge buffer, from an engineering standpoint. The pressurization is 300 bars (30 million Pascal). If we assume a 100 kW engine, dedicating 10 kW to pressurization, we might get a workable engine, for a small-to-midsize auto.

Assume an air reservoir of size V , initially at pressure P (with respect to vacuum). The engine does some work dW , and we then get V at pressure $P + dP$. In the usual setup we get V at pressure P and dV at pressure P_0 ; the work is then done by a piston pushing against the air. Therefore, $(P + dP)V = PV + P_0 dV$ unless temperature effects are considered -- and ideally they would be, as one discovers after pumping up a bicycle tire with (in my case) a unit standing on the floor; that pump's metal casing gets fairly warm. ...

One can recycle the warmth, when producing the bottles with compressed air.

...However, I don't know how to compute temperature issues in gas compression at this time.

If $(P + dP)V = PV + P_0 dV$ then $V dP = P_0 dV$.

If we assume a piston with area A , the pressure P yields a force on that piston of $F = (P - P_0)A$, and $dV = A dx$, or $dx = dV/A$. $dW = F dx = F/A dV = (P - P_0) dV = V(P - P_0)/P_0 dP$. Integrating from $P_0 = 10^5$ to $P_1 = 3 * 10^7$ Pa, we get

$$\begin{aligned} & (V/P_0) * ((P_1^2 - P_0^2)/2 - (P_1 - P_0)) \\ & = V * 1.4999832 * 10^7 \end{aligned}$$

6 hours = 21,600 seconds. Therefore, the amount of power (call it W_p) dedicated to tank pressurization is such that

$$\begin{aligned} W_p * 21600 &= V * 1.4999832 * 10^7 \\ V &= W_p / 694.44 \end{aligned}$$

Considering that a midsize auto might have a few cubic meters of cargo space this is highly unreasonable, and therefore I've overestimated the amount of power (W_p). Maybe 100 watts, yielding a 14.4 liter air tank. Of course it is still going to take about 2.16 megaJoules to fully pressurize that tank, no matter how one does it.

Re: Compressed air might blow the oil–gas–petrol profits

Which leads one to the 1.5 euros estimate. A liter of gas is about 35 megajoules or thereabouts, and may cost 3–4 euros.

It's about 1 euro for "Diesel" and a bit more for "Benzin"(=benzinum), but this is going to increase, as long as firms like shell want to stay at the top of profitmaking companies.

(It costs \$2.50 or so a gallon around here, but the US taxes are lower.) This indicates that 1.5 euros is a gross overestimate of the cost of that energy; a more realistic estimate would be 25 "eurocents", unless I assume a 86.4 liter tank — a possibility, but it will sap 600 watts of power.

There is some good news. 86.4 liters of 300 bar air would be such that;

$n = PV/(RT) = 3 \cdot 10^7 * (0.0864) / (8.314472 * 290) = 1075$ moles
or 31 kg.

86.4 liters of fuel, by contrast, would weigh maybe 73 kg.

--

Actually this car is runing, some people bought it already and i would really like to see one or better to sit inside.

One problem might be the acceleration. As You have good knowledge of physics, what acceleration one can get out of an "shot" of let's say one tenth of a liter of compressed air of a pressure of 300 bars with a car weighing 500 kilogramms in a rocket–like mode?

(And it would make a thrusting sound very interesting to young people, who let the engines of their motor bikes roar).

And what is also nice, there's no pollution – except for the construction, if they didn't use air or sunenergy. Actually,. who is throwing away litter is responsible for cleaning it up, the same with polluted water, one cannot release it into the rivers or sea, one has to pay for cleaning it. The only exception – nuclear waste, there they wouldn't earn money with it, if they had to care for the waste – so we/they leave this to future generations to pay for.

Enjoy

Hero

.