1. Ideal gas law

\[ PV = NRT \]

one mole of ideal gas @ STP \((273 \text{ K}, 1 \text{ atm})\) has a volume of \(22.4 \text{ L}\).

\[ V \propto T \]

\[ \text{1 mole of } \text{H}_2 @ (298 \text{ K}, 1 \text{ atm}) \text{ has a volume of} \]
\[ 22.4 \text{ L} \times \frac{298}{273} = 24.45 \text{ L} \]

\[ 1 \text{ mole of } \text{H}_2 = 2 \text{ gram} \]

\[ \therefore \text{ Therefore, the volumetric density @ } 1 \text{ atm is} \]
\[ = \frac{0.002 \text{ kg}}{24.45} = 0.0000818 \text{ kg/litre} \]

\[ 3000 \text{ psi} = 3000 / 14.696 = 204.1 \text{ Atmospheres} \]

\[ \text{Vol. density} = 0.0000818 \times 204.1 = 0.0167 \text{ kg/litre} \]

\[ 5000 \text{ psi} : \]

\[ \text{Vol. den.} = 0.0278 \text{ kg/litre} \]

\[ 7000 \text{ psi} : \]

\[ \text{Vol. den.} = 0.03896 \text{ kg/litre} \]

\[ 10000 \text{ psi} : \]

\[ \text{Vol. den.} = 0.0557 \text{ kg/litre} \]

All are smaller than liquefied \(\text{H}_2\) density.
2. Total energy for 500 M @ 60 MPH and 5 kW

\[ E = 5\, \text{KW} \times 3600 \times 500/60 \]
\[ = 150,000,000 \text{ Joules} = 150\, \text{MJ} \]

\[ 2\, \text{H}_2 + \text{O}_2 \rightarrow 2\, \text{H}_2\text{O} \] (suppose in liquid form)
\[ \Delta G = -237.1 \text{ KJ/mol} \]

@ 50% efficiency. 2 mole of \( \text{H}_2 \) generate 237.1 KJ

Hence we need \( \frac{1500\, \text{MJ}}{237.1\, \text{KJ/mol}} = 1265.2 \) mole of \( \text{H}_2 \)

which is \( 25.3 \) kg.

\[ \text{NaBH}_4 + 2\, \text{H}_2\text{O} \rightarrow \text{NaBO}_2 + 4\, \text{H}_2 \]

1 mol (37.83) \( \rightarrow \) 4 mol

In order to make 1265.2 mole of \( \text{H}_2 \) we need

\[ 1265.2 \times \frac{1}{4} = 316.3 \] mole of \( \text{NaBH}_4 \)

which is \( 316.3 \times 37.83 = 119664 \) g = \( 11.966 \) kg

Now need to find out what a 6% - H-content solution is made of.

\[ + x \, \text{H}_2\text{O} \] (balance water)

\[ \text{NaBH}_4 + 2\, \text{H}_2\text{O} \rightarrow \text{NaBO}_2 + 4\, \text{H}_2 \]

37.83 + \( (x+2) \times 18 \)

\[ \text{total weight} \]
So need to find out what \( x \) will make
\[
\frac{8}{8 + 37.83 + 18(x+2)} = 6\% 
\]

Easily solvable:
\[
\frac{8}{18x + 81.83} = 6\% 
\]

\[18x + 81.83 = 133.33\]
\[18x = 51.50\]
\[x = 2.86\]

Hence \( 19x + 81.83 = 133.33 \).
or to make 8 grams of \( H_2 \) we need 133.33 gram of \( \text{NaBH}_4 \) solution.

Therefore, the total amount of \( \text{NaBH}_4 \) to drive the car is \( \frac{2.53}{8} \times 133.33 = \frac{42.167}{8} \) kg.

The fuel only energy density of the t.c. system is
\[4.1.667/42.167 \approx \frac{982 \text{ W/hr/kg}}{8}\]
so it's no one order of magnitude higher.

The End.