A QUICK OVERVIEW OF SOME ISSUES TRANSPORTING HYDROGEN

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PIPELINE DIAMETER

$V := 1 \cdot ft^3$

$P := 5000 \cdot psi$

$T_{gas} := 510 \cdot R$

$m_{gas} = P \cdot V \cdot \frac{f_w}{R_{global} \cdot T_{gas}}$

$f_{wGas} := 16 \cdot \frac{gm}{mole}$

$f_{wH} := 2 \cdot \frac{gm}{mole}$

$R_{global} := 8.314 \cdot \frac{J}{mole \cdot K}$

$m_{gasH2} := P \cdot V \cdot \frac{f_{wH}}{R_{global} \cdot T_{gas}}$

$m_{gasH2} = 0.829\ kg$

$m_{Natgas} := P \cdot V \cdot \frac{f_{wGas}}{R_{global} \cdot T_{gas}} = 6.63\ kg$

$mass_{ratio} := \frac{m_{gasH2}}{m_{Natgas}} = 0.125$

$LHV_{NatGas} := \frac{50 \cdot 10^6 \cdot J}{kg}$

$LHV_{H2} := \frac{120 \cdot 10^6 \cdot J}{kg}$

Calculating power ratio:

$RatioPower_{suppliedPerCuFt} := \frac{m_{gasH2} \cdot LHV_{H2}}{m_{Natgas} \cdot LHV_{NatGas}} = 0.3$

Calculating required flow ID for equivalent velocities :

$ID := 24 \cdot in$

$area := \frac{\pi \cdot ID^2}{4} = 3.142\ ft^2$

$area := area \cdot 3.3333$

$ID_{new} := \sqrt{\frac{area \cdot 4}{\pi}} = 43.818\ in$ Pipeline ID to transport Hydrogen

$\rho_{hydrogen@5000psi} := 25 \cdot \frac{kg}{m^3}$

$\mu_{NatGas} := 2.688 \cdot 10^{-4} \cdot \frac{lb}{ft \cdot s}$

$\mu_{hydrogen} := 5 \cdot 10^{-6} \cdot \frac{lb}{ft \cdot s}$

$\rho_{natGas@5000psi} := 252 \cdot \frac{kg}{m^3}$

$RE_{hydrogen} = \frac{25 \cdot V \cdot ID_{new}}{\mu_{hydrogen}}$

$RE_{NatGas} = \frac{252 \cdot V \cdot 24 \cdot in}{\mu_{NatGas}}$