Supplementary Information for 'Risk of The Hydrogen Economy For Atmospheric Methane'

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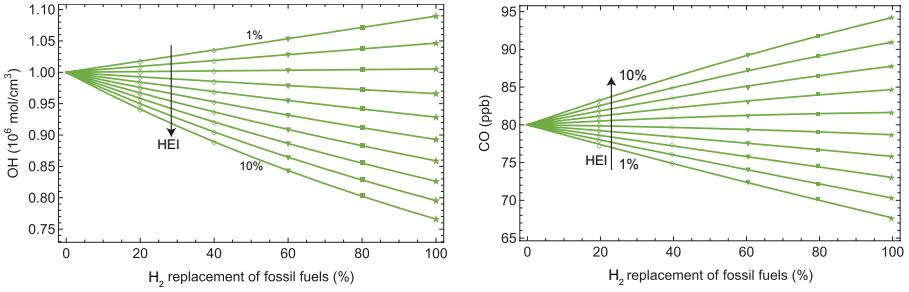
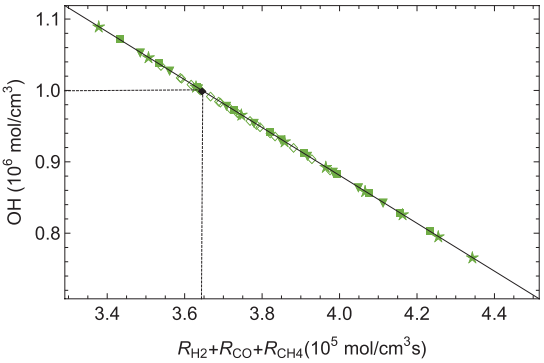
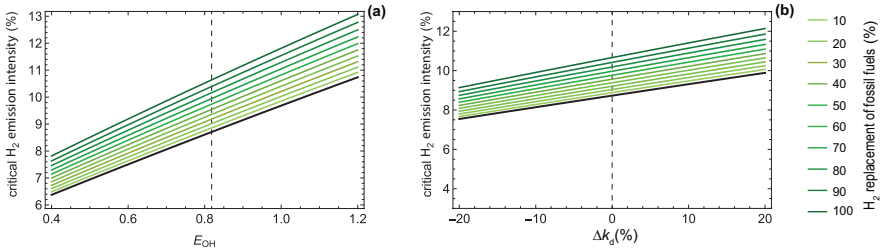


Supplementary Figure 1 Steady state concentrations of OH and CO. Equilibrium [OH] and [CO] vs the percentage of fossil fuel replacement by green H_2. Scenarios of Fig. 2 in the main text. HEI is the hydrogen emission intensity.



Supplementary Figure 2 Relationship between OH concentration and sinks. [OH] vs the sum of CH_4, CO and H_2 tropospheric sinks for the green H_2 scenarios of Fig. 2 in the main text. We find a linear relationship since $R_{CH_4} + R_{CO} + R_{H2} = S_{OH} - k_4[X][OH]$ from eq. (8) in the main text. More detailed atmospheric chemistry models sometimes find a nonlinear scaling with exponent -3/2, but with large inter and intramodel variability (see Ref. [39] in the main text).



Supplementary Figure 3 Critical H_2 emission intensity (HEI). Critical HEI of green H_2 for methane mitigation as a function of (a) the OH excess (E_{OH}) and (b) the rate of H_2 soil uptake. Black lines are HEI_{cr} from eq. (16) in the main text. Colored lines are obtained numerically for a finite replacement of fossil fuel energy with green H_2.