Supporting Information for

Prevented mortality and greenhouse gas emissions from historical and projected nuclear power

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6 pages
3 figures
Additional discussion and references

Comparison with avoided GHG emissions in projection periods of prior studies

As discussed in the main text, our results for avoided GHG emissions for the projection period differ significantly from previous studies[1, 2], due primarily to differences in assumed nuclear power trajectories, and secondarily to assumed GHG emission factors.

Lenzen et al.[1] start with electricity demand projections from the Intergovernmental Panel on Climate Change and assume that a certain energy supply mix will fill that demand. They also assume dynamic emission factors (see their Table 7). Their global nuclear power production trajectory is similar to our low-end case until 2030 but by 2050 it slightly exceeds our high-end case (compare our Figure S2 with their Table 11). Consequently, the mean avoided emissions in our All Coal case are roughly 20% higher (low-end case) to 91% higher (high-end case) than theirs, while for our All Gas case avoided emissions are 34% lower (low-end case) to 5% higher (high-end case). By contrast, Coleman et al.[2] use nuclear power projections from an earlier version of the IAEA report we used[3]. The projected mean global avoided emissions in our All Coal case are 36% higher (low-end case) and 40% higher (high-end case) than theirs. In our All Gas case, mean avoided emissions are 23% lower (low-end case) and 21% lower (high-end case).

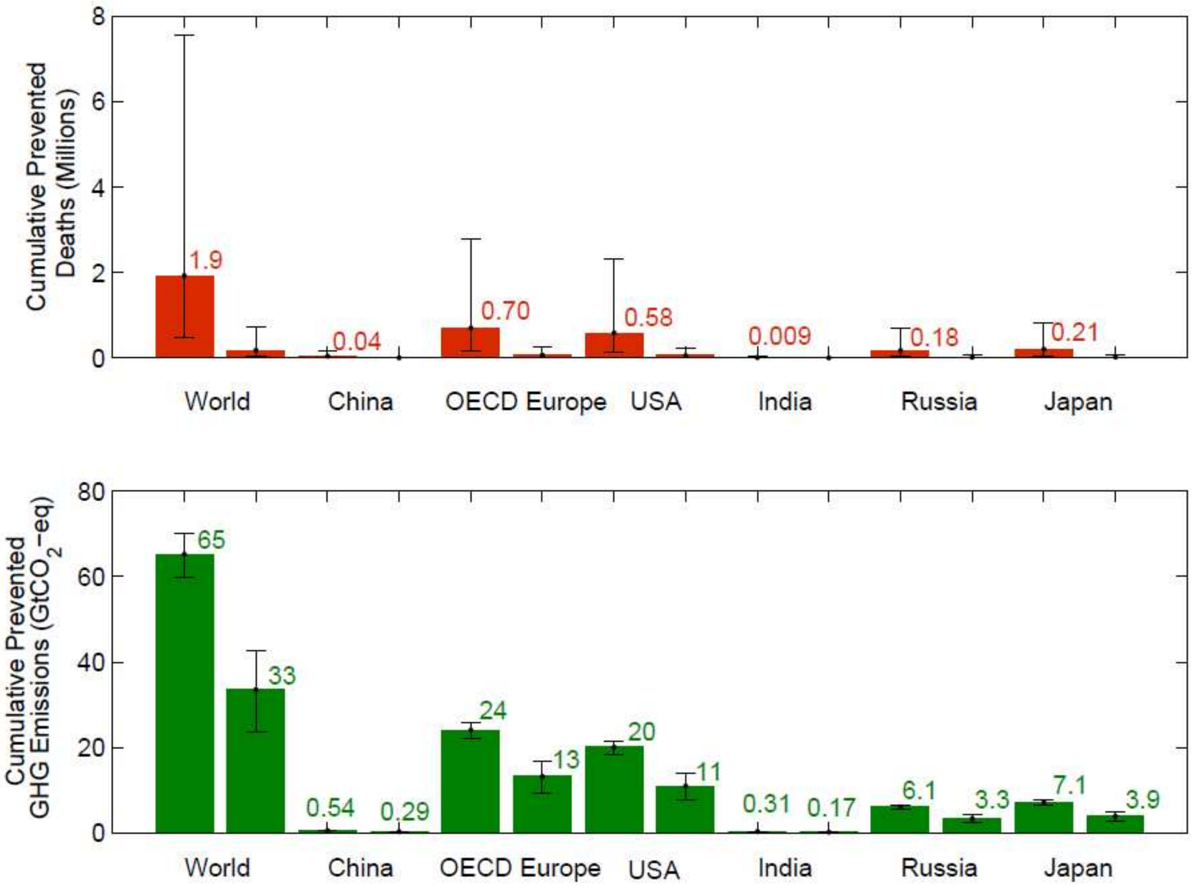

Figure S1. Upper and lower bounds for prevented deaths (top panel) and GHG emissions (bottom panel) assuming nuclear power replaces fossil fuels for the historical period in our study (1971-2009). Each panel shows results for two cases in each region that bound the baseline replacement scenario presented in the main text. The larger column in each region denotes the All Coal case, while the smaller column denotes the All Gas case, in which *all* historical nuclear power is replaced by coal and gas, respectively. The labels reflect the mean values for each region. In the top panel, only the values for the All Coal cases are labeled, simply because the values for the All Gas cases are a factor of ~10 lower (except for China), as a direct result of the ~10-fold difference between the mortality factors for coal and gas in Table 1 of the main text. (For China the difference is a factor of ~30 because of that country's relatively large mortality factor for coal – again, see Table 1.) Although there are many uncertainties involved in determining the specific substitution, our baseline historical scenario (95% replacement by coal and 5% by gas) is much more realistic than the All Gas case, for the reasons discussed in the main text.

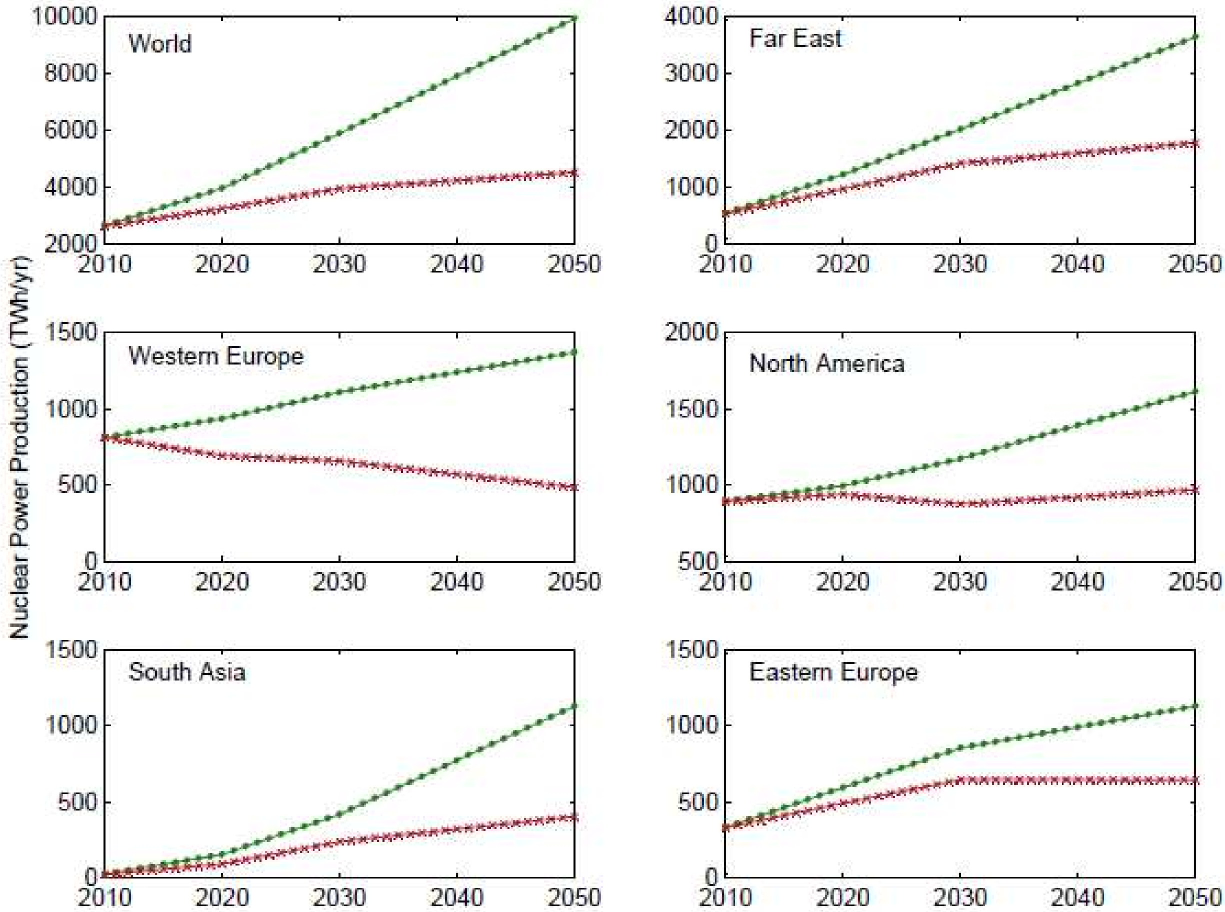

Figure S2. Projections of nuclear power production by region (linearly interpolated to annual values based on Table 4 of ref *3*). Upper and lower curves in each panel are used for our high-end and low-end projections, respectively. As discussed in IAEA[3], the high-end projections assume aggressive climate change mitigation policies. Western Europe is the only region in which the low-end curve shows a downward trend. In the global projections (top left panel), cumulative nuclear power generated in the high-end trajectory is 60% greater than in the low-end trajectory. South Asia (bottom left panel) shows the highest disparity in cumulative power – the high-end is more than double the low-end.

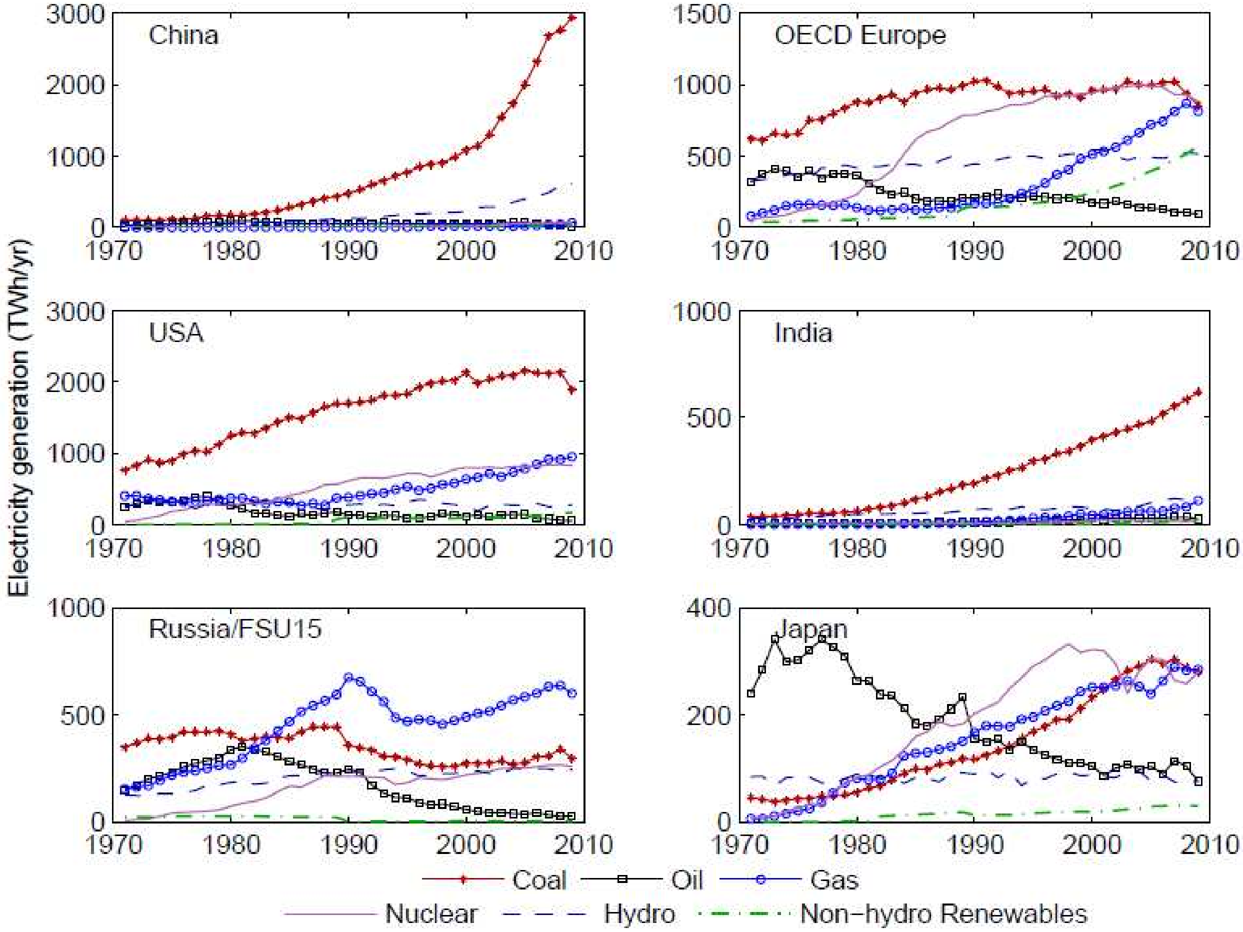

Figure S3. Total electricity production from 1971-2009 by fuel source for the top five CO_2-emitting countries and OECD Europe (data from ref *4*). Global data are shown in main text Figure 1. Note the dominance of coal in China, USA, and India, as well as Russia's heavy reliance on (domestically supplied) gas. Gas use has risen sharply in USA and OECD Europe since ~1990, and both gas and coal show upward trends in Japan. Oil use shows downward trends in each area and for the world overall (main text Figure 1). Non-hydro renewable use has risen significantly only in OECD Europe (mainly over the past decade), although gas use has risen faster there.

SI References

1. Lenzen, M.; Schaeffer, R. Historical and potential future contributions of power technologies to global warming. *Clim. Ch.* **2011**, doi 10.1007/s10584-011-0270-y.
2. Coleman, N. M.; Abramson, L. R.; Coleman, F. A. B. Estimated lag time in global carbon emissions and CO_2 concentrations produced by commercial nuclear power through 2009 with projections through 2030. *Health Physics* **2012**, *102*, 326-334.
3. *Energy, Electricity and Nuclear Power Estimates for the Period up to 2050: 2011 Edition*; International Atomic Energy Agency, 2011; http://www-pub.iaea.org/MTCD/Publications/PDF/RDS1_31.pdf (accessed January 2012)
4. *IEA World Energy Statistics and Balances* (database); International Energy Agency, 2010; doi: 10.1787/data-00512-en.