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CORRECTION

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Correction: Conceptual design and analysis of ITM oxy-combustion power cycles

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Correction for 'Conceptual design and analysis of ITM oxy-combustion power cycles' by N. D. Mancini *et al.*, *Phys. Chem. Chem. Phys.*, 2011, **13**, 21351–21361.

In ref. 1 Mancini and Mitsos simulated a variety of ion transport membrane (ITM) power cycles. The authors discussed the benefits of partial emissions cycles over a combination of zero-emissions cycles and conventional combined cycles using a linear combination metric.

Ref. 1 presented the linear combination of the zero-emissions cycle and conventional combined cycle as a line in a graph, *i.e.*, Fig. 8 of ref. 1 with First Law Efficiency and CO_2 emissions as evaluation criteria. Ref. 1 thus implied that the First Law Efficiency of a linear combination of non-hybrid plants can be determined by simple linear interpolation of the efficiencies of each non-hybrid plant, *i.e.*,

$$\eta_{\text{lincom,incorrect}} = \sum_i \lambda_i \cdot \eta_i = \sum_i \frac{\dot{W}_{\text{out},i}}{\dot{W}_{\text{out,overall}}} \cdot \left(\frac{\dot{W}_{\text{out},i}}{\text{LHV} \cdot \dot{n}_{\text{fuel},i}}\right), \tag{1}$$

with λ being the plant split fraction, which is based on the output of each cycle type, i,

$$\lambda_i = \frac{\dot{W}_{\text{out},i}}{\dot{W}_{\text{out,overall}}}. \tag{2}$$

It can be seen that $\eta_{\text{lincom,incorrect}}$ is not equivalent to the overall First Law Efficiency, $\eta_{\text{overall}} = \frac{\dot{W}_{\text{out,overall}}}{\dot{n}_{\text{fuel,overall}} \cdot \text{LHV}}$. Instead, one should use a reverse linear interpolation. Then $\dot{W}_{\text{out},i}$ is canceled out, such that the overall First Law Efficiency of the linear combination is correctly determined,

$$\begin{aligned}\eta_{\text{lincom,correct}} &= \frac{1}{\sum_i \lambda_i \cdot \frac{1}{\eta_i}} = \frac{1}{\sum_i \frac{\dot{W}_{\text{out},i}}{\dot{W}_{\text{out,overall}}} \cdot \frac{\dot{n}_{\text{fuel,i}} \cdot \text{LHV}}{\dot{W}_{\text{out,i}}}} \\ &= \frac{\dot{W}_{\text{out,overall}}}{\sum_i \dot{n}_{\text{fuel,i}} \cdot \text{LHV}} = \frac{\dot{W}_{\text{out,overall}}}{\dot{n}_{\text{fuel,overall}} \cdot \text{LHV}} = \eta_{\text{overall}}.\end{aligned} \tag{3}$$

Ref. 1 correctly used a linear interpolation for the second performance criterion, *i.e.*, CO_2 emissions. This leads to an inverse relationship of the two performance criteria, *i.e.*,

$$(\text{CO}_2\ \text{emissions})_i \propto \lambda_i \propto \frac{1}{\eta_i}. \tag{4}$$

Based on this insight, Fig. 1 shows how the performance line of Fig. 8 in ref. 1 has to be amended.

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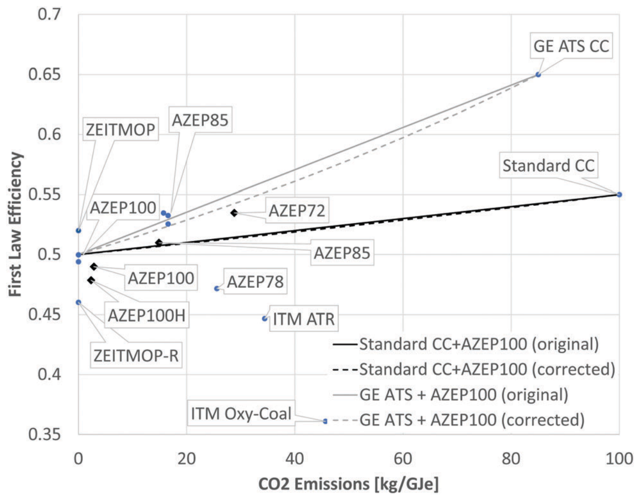

Fig. 1 Corrected linear combination originally from ref. 1.

When comparing the corrected function to the line originally illustrated in ref. 1 it becomes clear that the actual performance of a linear combination is slightly worse than previously indicated. Thus, from a relative perspective, partial emission cycles perform slightly better than previously thought.

In conclusion, the application of the linear combination in ref. 1 is incorrect but results in very small numerical errors.

The Royal Society of Chemistry apologises for these errors and any consequent inconvenience to authors and readers.

References

1 N. D. Mancini and A. Mitsos, *Phys. Chem. Chem. Phys.*, 2011, **13**, 21351–21361.