

# *alpha-n infrastructure limited*

22<sup>nd</sup> April, 2018

Mike Middleton  
Strategy Manager  
Energy Technologies Institute  
Charnwood Building  
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Loughborough LE11 3AQ

Dear Mike,

## **Final review of Nuclear Cost Drivers Model Documents D7.1, D7.2, D7.3, D7.5 & D7.6**

This note documents the final independent review of the study into Nuclear Cost Drivers by CleanTech Catalyst and Lucid Strategies performed under our contract with CleanTech Catalyst ref CTC-ETI-NCD-2017-18 and refers to D7.4 of the overall work program.

1. I have reviewed documents D7.1, D7.2, D7.3, D7.5 and D7.6 provided in an email from Lucid Strategy dated 20<sup>th</sup> April 2018 at 22:19;
2. this note follows two earlier interim review notes covering earlier stages of work on this project;
3. the final outputs of the project which I have reviewed are:
  - D7.1 – Final Report on the Cost Model and Associated Database (V2 20/04/2018)
  - D7.2 – Final Cost Drivers' Analysis Report (V1 20/04/2018)
  - D7.3 – ETI NCD Summary Report (V1 20/04/2018)
  - D7.5 – ETI Nuclear Cost Drivers Model (20/04/2018)
  - D7.6 – ETI Final Cost Database (20/04/2018) – the version I have reviewed is the non-confidential version
4. from my examination of the model and cost database it is evident that the sources have been properly identified and recorded for data incorporated into the draft cost model and draft cost database; I have *not* performed a model audit but have inspected the model extensively;

5. I have reviewed and verified:
  - the appropriate treatment of costs within the cost model including calculation of LCOE;
  - the calculation of the dashboard metrics;
  - the recorded assumptions for the cost model and associated database and am satisfied with the validity of these assumptions;
  - the Cost Database.
6. from my examination of the model and cost database and discussions with the project team, it is evident that key assumptions utilised in the cost model and cost database have been recorded;
7. from my examination of the model and cost database and discussions with the project team, it is evident that key model assumptions have been appropriately verified;
8. I am satisfied that the analysis uses data collated in the database but must stress that the scope of the review does *not* include independent validation of data provided by third parties and used to populate the database;
9. it is essential to note that all the analyses related to SMRs and AMRs are based on data provided by their promoters and have not been subject to any practical verification through full regulatory clearance and actual construction; comparing existing reactor designs with SMRs and AMRs is therefore likely to be of limited general value;
10. I am further satisfied that:
  - the methodology for undertaking the cost driver analysis including the development of the list of cost drivers applied within this analysis has been sensible and appropriate given the quality of the data to which the team has had access; the data obtained and used by the survey is the highest quality of which I am currently aware;
  - having reviewed the cost driver report and summary report I am happy to confirm that the approach and analysis described within the report is consistent with the methodology undertaken; the findings and conclusions are based upon the model and associated evidence;
11. from my examination of the model and cost database it is evident that the model treats costs appropriately and, together with supporting assumptions, can be relied upon to create calculations of relative LCOE; it is not possible

to estimate the degree of precision of any particular LCOE calculation given the relative precision of the data;

12. provided that the capitalisation period remains set to 60 years, the LCOE calculations will be consistent with the industry norm as understood in the United Kingdom and consistent with the approach taken by BEIS as set out in [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/566567/BEIS\\_Electricity\\_Generation\\_Cost\\_Report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566567/BEIS_Electricity_Generation_Cost_Report.pdf); I have had very productive discussions with the CleanTech Catalyst and Lucid Strategy teams about this topic as there are different approaches used to LCOE calculation in North America and other parts of the world and in different approaches to various forms of electricity generation; the approach in this version is consistent with that used more generally by BEIS and should therefore be directly comparable;
13. the model has very sensibly avoided attempts at spurious accuracy which would, in any event, be pointless given that the nature of the study was to identify the cost drivers in civil nuclear power and not to provide a general-purpose project-finance style financing model;
14. it is important to recognise that the model and the reports provide very thorough estimates of LCOE which are capable of being compared and ranked; the model does *not* enable the precise calculation of accurate values in specific circumstances; comparisons will, however, be very useful and valid;
15. a range of second-order factors – such as the precise cost of treatment of spent fuel – are dealt with in a relatively broad-brush manner as the true values are unclear in some circumstances; similarly, the cost of decommissioning is treated consistently throughout the model as occurring after 40 years of operation – changing that to 60 years would have little to no effect on the calculation of the LCOE; this is an example of using external data consistently within itself but in a manner which is (pedantically) inconsistent with specific instances but equally would not affect any of the conclusions of the analysis or report in any meaningful way.

The authors are to be congratulated on a very high quality, ground-breaking piece of work which has shed a great deal of light into a murky, confusing and sometimes emotional debate. Their approach of combining thorough analysis of the best data yet collected together with enlightening discussions with dispassionate practitioners has produced a clear road-map for any country or company contemplating, or actually commissioning, new nuclear plants. This report should be required reading for every government official, electricity generating company,

investment professional and regulator who are, or may be, involved in making new nuclear happen. Furthermore, the Energy Technologies Institute deserves applause and thanks for having had the vision to commission this report.

Should you have any further questions please don't hesitate to let me know. Thank you for allowing me to support this extremely important project.

Yours sincerely,

A handwritten signature in red ink, appearing to read 'Stone', with a long horizontal flourish extending to the right and a small double-dot mark below it.

Dr. Timothy J. Stone CBE