



Prepared for: Energy Networks Association

WS3-Ph2 Addendum V2.0

Scenario data validation

Authors: Mark Sprawson / David Clements

Report No: 82530 (Addendum 2.0) PUBLIC

www.eatechnology.com

Delivering Innovation in Power Engineering

Project No: 82530 (Addendum 2.0) PUBLIC

CONFIDENTIAL - This document may not be disclosed to any person other than the addressee or any duly authorised person within the addressee's company or organisation and may only be disclosed so far as is strictly necessary for the proper purposes of the addressee which may be limited by contract. Any person to whom the document or any part of it is disclosed must comply with this notice. A failure to comply with it may result in loss or damage to EA Technology Ltd or to others with whom it may have contracted and the addressee will be held fully liable therefor.

Care has been taken in the preparation of this Report, but all advice, analysis, calculations, information, forecasts and recommendations are supplied for the assistance of the relevant client and are not to be relied on as authoritative or as in substitution for the exercise of judgement by that client or any other reader. EA Technology Ltd. nor any of its personnel engaged in the preparation of this Report shall have any liability whatsoever for any direct or consequential loss arising from use of this Report or its contents and give no warranty or representation (express or implied) as to the quality or fitness for the purpose of any process, material, product or system referred to in the report.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means electronic, mechanical, photocopied, recorded or otherwise, or stored in any retrieval system of any nature without the written permission of the copyright holder.

© EA Technology Ltd

EA Technology Limited, Capenhurst Technology Park, Capenhurst, Chester, CH1 6ES; Tel: 0151 339 4181 Fax: 0151 347 2404
<http://www.eatechnology.com>
Registered in England number 2566313

1 Introduction

The Transform™ model contains over 50,000 different input cells of data that can affect the output. As part of the regional model population by DNOs, an inaccuracy was brought to the attention of EA Technology in the application of certain scenarios.

Following its identification, all scenarios in both models have been reviewed, with analysis carried out by EA Technology on areas where errors were found. This Addendum describes the implications of the identified errors on the output of the GB and regional models.

The issues identified and resolved by this report are:

1. **GB model – Scenario 3 (Low electrification of both heat and transport) contained too high HP penetration.** The effect is a lower investment for scenario 3 in the GB model; and hence a larger spread between scenarios 0 and 3, i.e. high and low penetrations of LCTs
2. **Regional model – Scenario 0 (High electrification of both heat and transport) contained too low EV penetration.** The effect is a higher investment for scenario 0 for the regional model(s).
3. **Regional model – Scenarios 1 and 2 contained too low HP penetration.** The effect is a higher investment for scenarios 1 and 2 for the regional model(s).
4. **Regional model – A minor inaccuracy in the apportionment of LCTs to new build properties for all Scenarios.** The effect has been a minor increase in investment for all scenarios.

The majority of these issues lie in the regional model (as opposed to the GB model) and the reason that these errors have only been identified now is that the model was constructed under very tight timescales and, in the case of the regional model, there was insufficient time to robustly test all of the data entries. As part of this review, all data has now been corroborated to confirm that there are no further such errors.

Furthermore, as we move forward with Phase 3 of the Work Stream 3 activity, the relationship between the scenario inputs and the model will be algorithmic rather than manual; hence mitigating the risk of any issues such as those described here occurring again when scenario values are updated. It is also envisaged that the scenarios will align directly with the DECC scenarios (from Work Stream 1) rather than, in some cases, being composite scenarios. This will further eradicate the possibility of errors occurring when transferring data into the Transform™ model.

Change Log

Further to this addendum, EA Technology is issuing a new release of the Transform™ models to all licenced users:

- GB model: (v1.2.1)
- DNO model: (v1.2.1)

Issue	Date	Notes
1.0.0	July 2012	This is the original release of the model (referred to as the Workstream 3 model at time of release)
1.1.0	September 2012	The updated model following bug fix no. 1 (parsing and reconciliation of data). (Note that this release was prior to the adoption of the numbering convention outlined above.)
1.2.0	October 2012	Updated model following bug fix no. 2 (discount rate propagation). Note that this is the first release conforming to the numbering convention described above that will be used for all future releases.
1.2.1	October 2012	This is the release of the model corresponding to Addendum 2.0, which includes the updated scenario data to resolve the four errors identified (3 in the regional model and 1 in the GB model)

2 GB MODEL

The following issue only affects the GB model, as the regional scenarios are imported separately for this version of Transform™, with no algorithmic relationship in the dataset, there is no knock-on implications on the regional dataset or results.

Issue 1

GB model – Scenario 3 (Low heat and low transport electrification): contained the ‘medium’ HP penetration, rather than the ‘low’ dataset provided by DECC. Implications: As HPs can have a strong impact on distribution networks the effect is a lower investment for scenario 3 in the GB model.

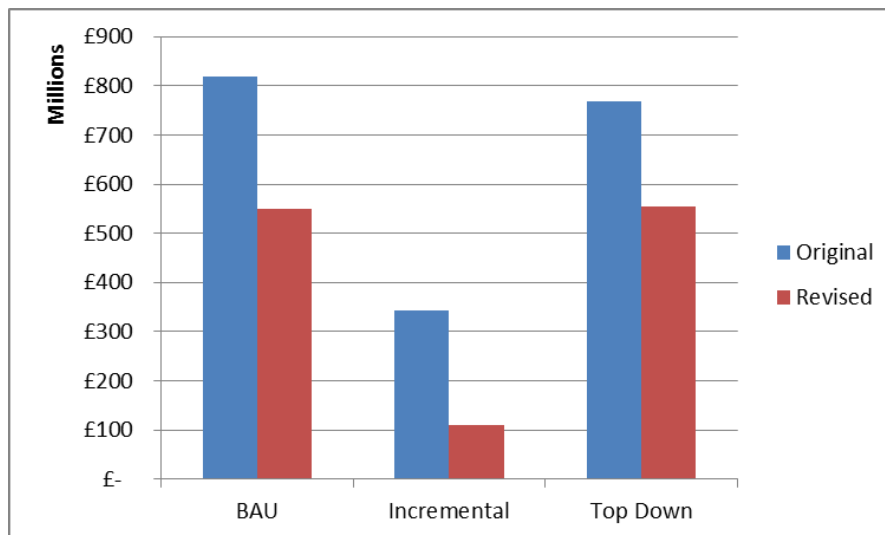


Figure 1 Comparison of Discounted Investment for the three investment strategies for Original and Revised Scenario 3 dataset (2022 figures)

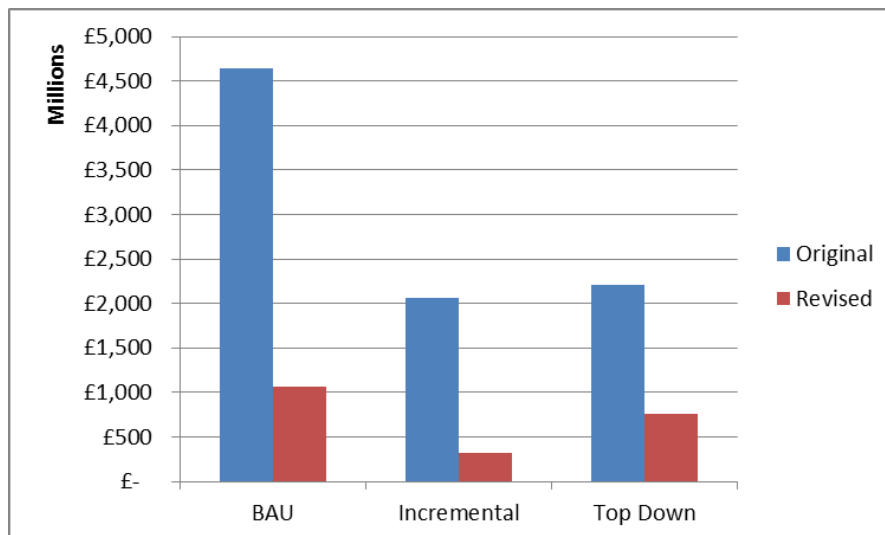


Figure 2 Comparison of Discounted Investment for the three investment strategies for Original and Revised Scenario 3 dataset (2012-2030 figures)

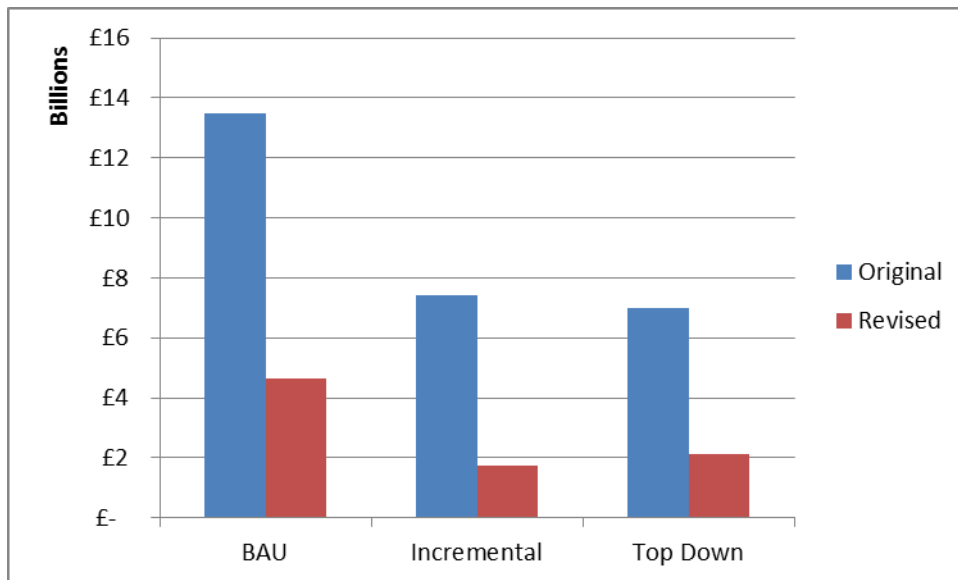


Figure 3 Comparison of Discounted Investment for the three investment strategies for Original and Revised Scenario 3 dataset (2012-2050 figures)

This leads to a larger spread between scenarios 0 and 3, i.e. high and low penetrations of LCTs as shown in the Figures below. It is noted that the upper figures have not moved, as this change only affects the lower limit(s).

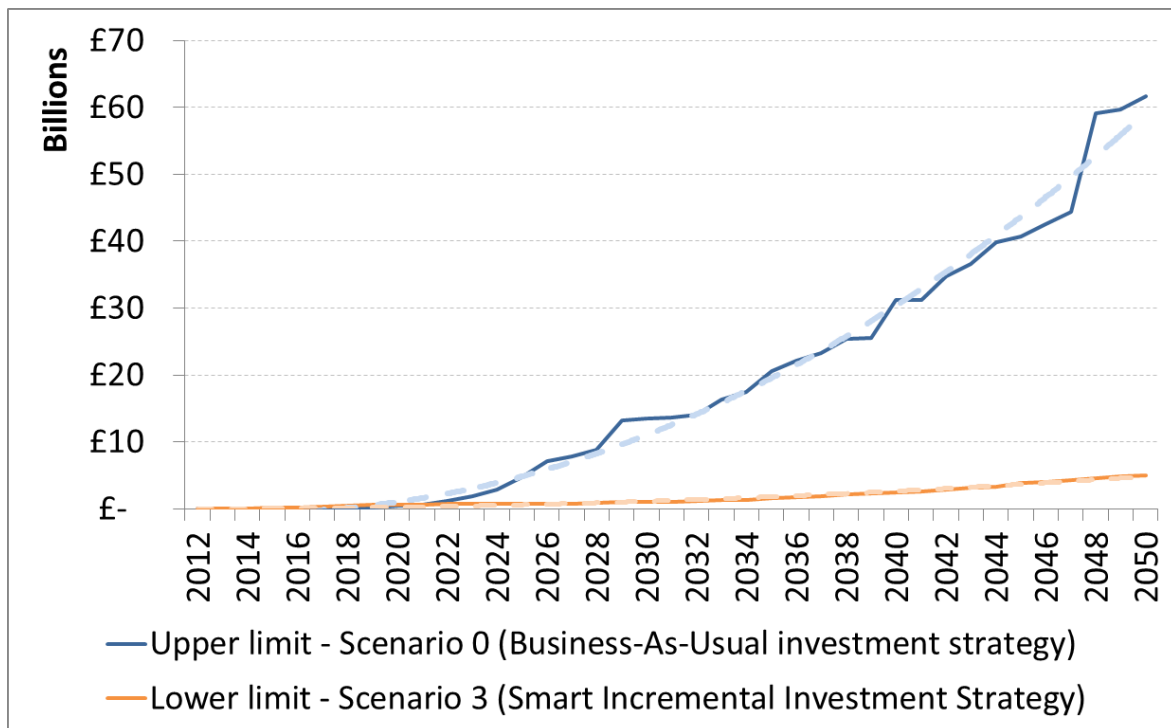


Figure 4(revised Figure 0.1 from the main report) Spread of GB network related investment (non-discounted cumulative totex showing the two most extreme scenarios) to accommodate projections in Low Carbon Technologies connecting to the electricity distribution network

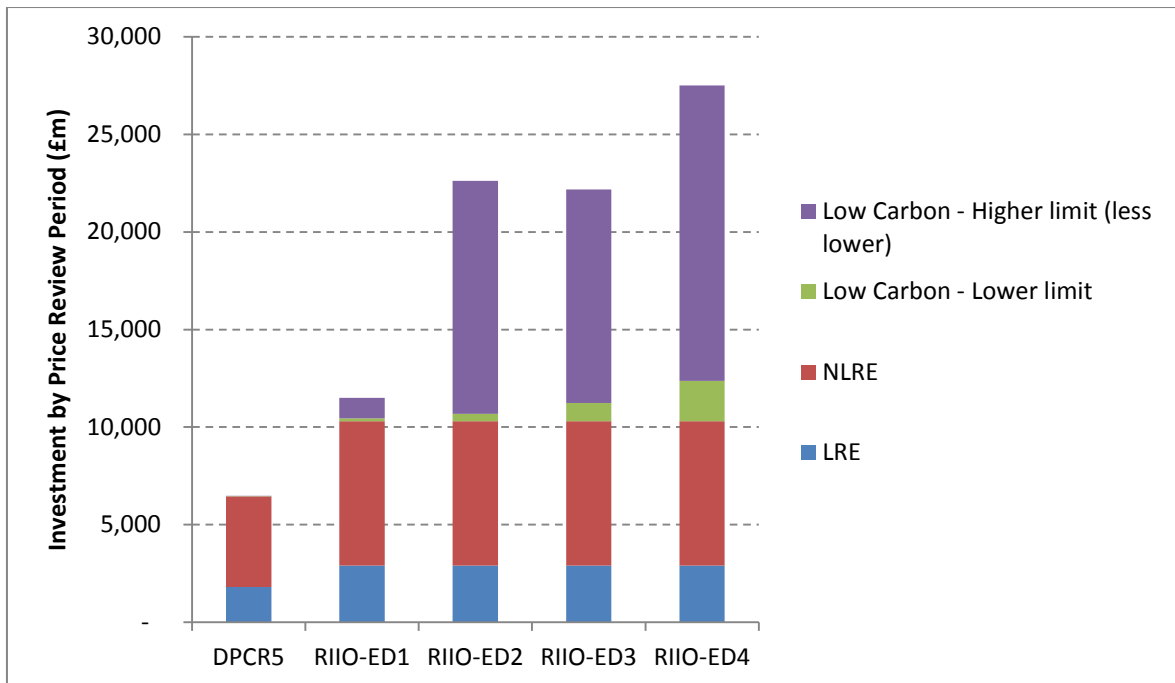


Figure 5(revised Figure 0.2 from the main report) Gross GB network related investment for the next four RIIO periods

It is noted that:

- Investment is likely to fall between the two limits (the top of the green blocks and the top of the purple block).
- The green trajectory, whilst plausible, would mean a fundamental shift in the policy around EVs, HPs and PV.
- The ‘blocky’ investment pattern remains for more aggressive uptake scenarios of EVs, HPs, and PV as shown in Figure 6 below
- For the low LCT uptake of Scenario 3 (using the corrected figures), the ‘Top-down’ smart strategy is now less efficient than ‘incremental’ smart strategy as shown in Figure 7 (however the effect is marginal and in the uncertainty range of the model)

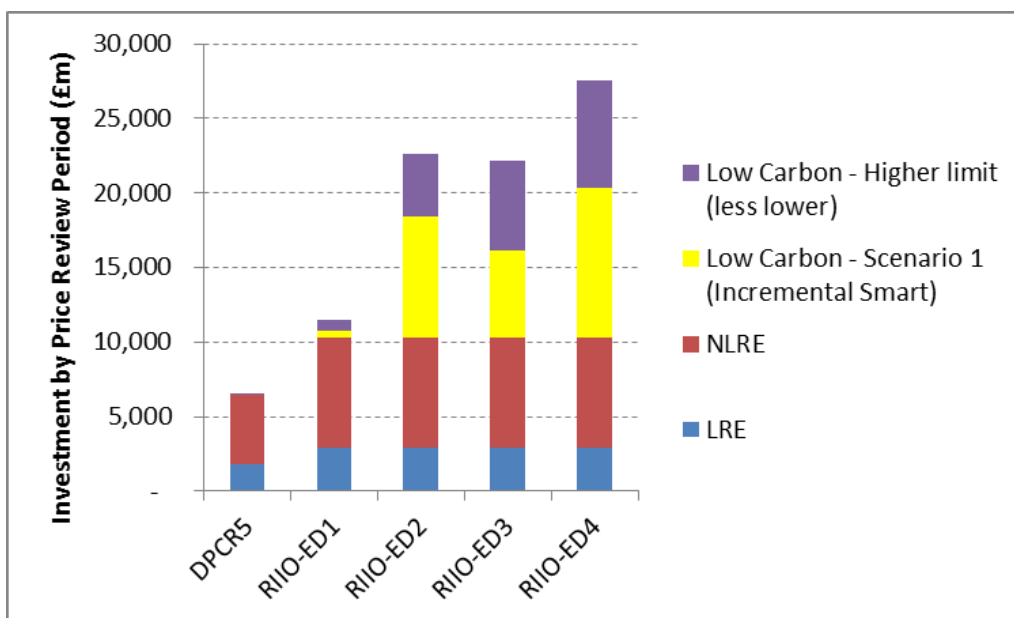


Figure 6 Gross GB network related investment for the next four RIIO periods – showing the investment profiles resulting from Scenarios 1 (Medium Transport, High Heat) and 0 (All High)

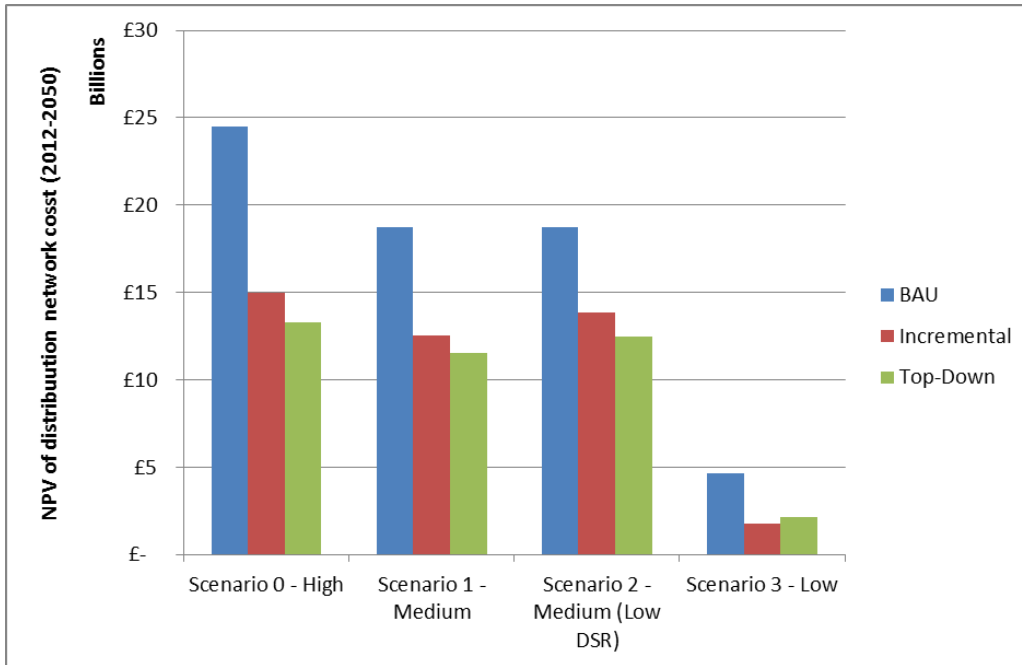


Figure 7 (revised Figure 0.3 from the main report) Summary of present value of gross totex of distribution network investment (2012-2050)

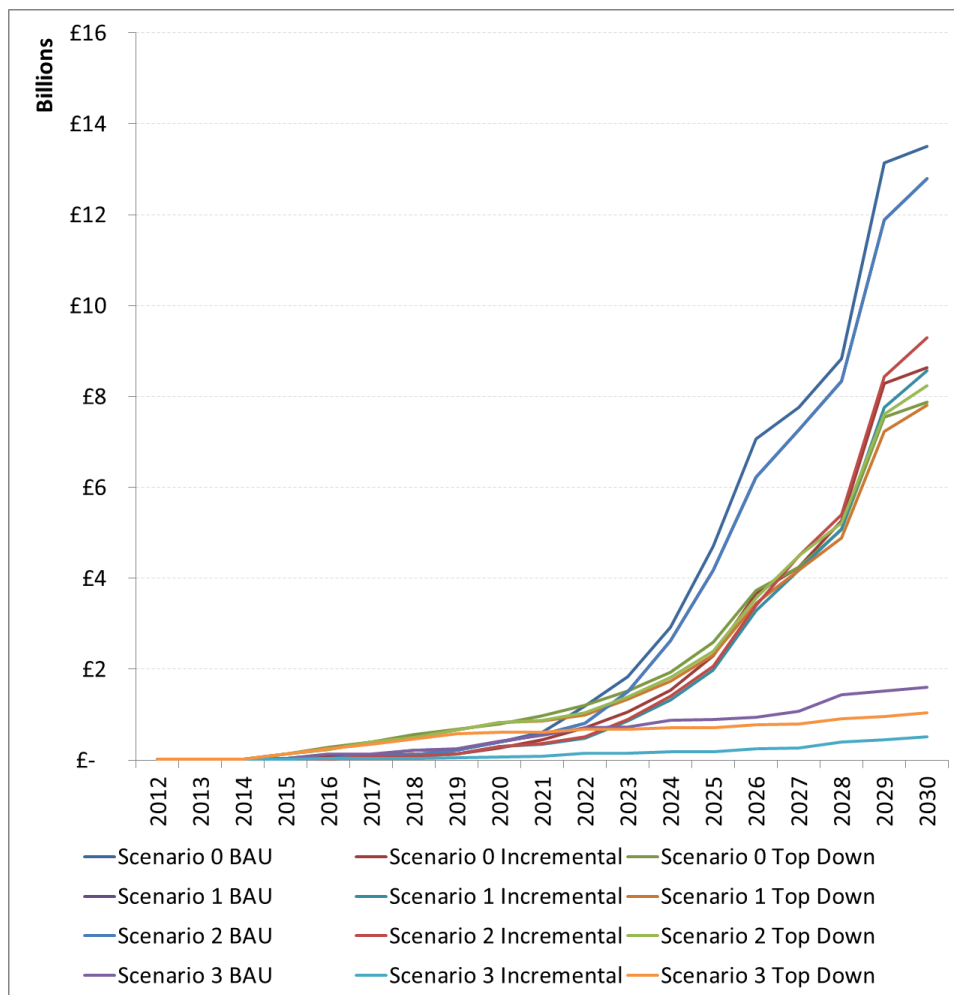


Figure 8 (revised Figure 0.8 from the main report) Totex investment (gross cumulative) of all scenarios until the end of the RIIO-ED2 period associated with facilitating the Low Carbon Technology uptake

3 REGIONAL MODEL

The following issues only affect the regional model, with no knock-on implications on the GB dataset or results:

- **Issue 2:** Scenario 0 (High heat and high transport electrification) contained too low EV penetration. Implications: The effect is a higher investment for scenario 0 for the regional model(s).
- **Issue 3:** Scenarios 1 and 2 contained too low HP penetration. Implications: The effect is a higher investment for scenarios 1-2 for the regional model(s).
- **Issue 4:** A minor inaccuracy in the apportionment of LCTs to new build properties for all Scenarios. Implications: The effect has been a minor increase in investment for all scenarios

The effects of these changes are shown across all four modelled scenarios are provided in the Appendix to this report.

It is of note that the materiality is based on the synthetic network developed by EA Technology for the WS3 Phase 2 work. It is not believed to be any more or less sensitive to these inputs than those created by the DNOs. Nonetheless it likely to indicate an average impact of changes, which may be more or less significant for certain licence areas.

The collated impact is shown in the Figures below¹:

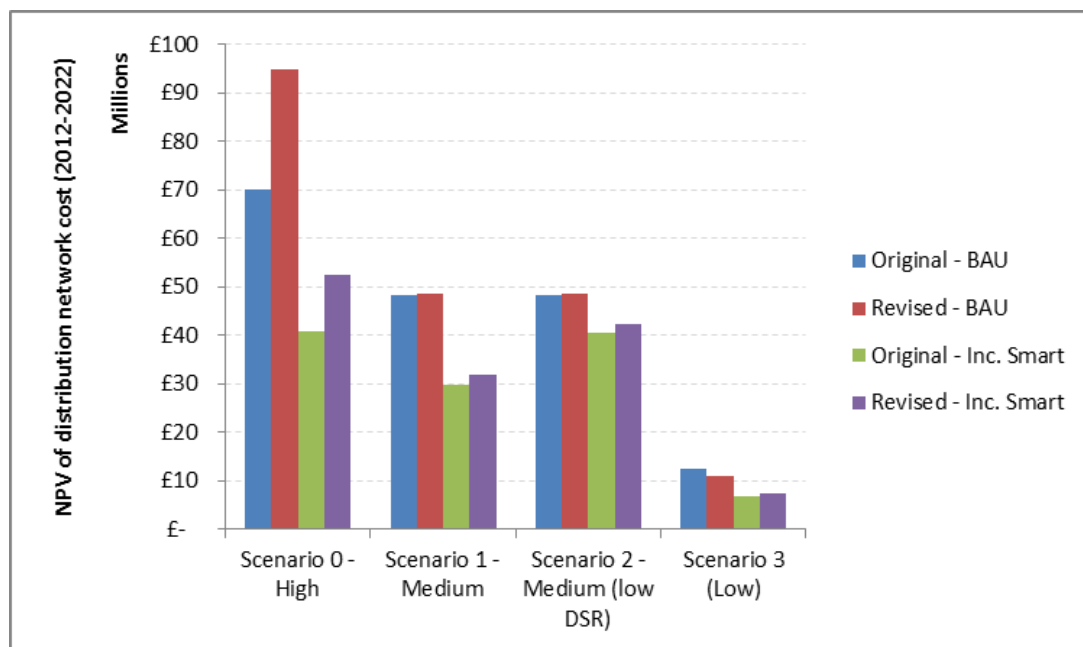


Figure 9 Discounted totex for all modelled scenarios (2012-2022) - Comparison between outputs between WS3 Ph2 and the revised dataset

¹ Only the incremental scenario is assessed in the Regional model. This is as Top-Down investments are currently made on a GB wide basis, and have not be segregated to consider a licence specific case

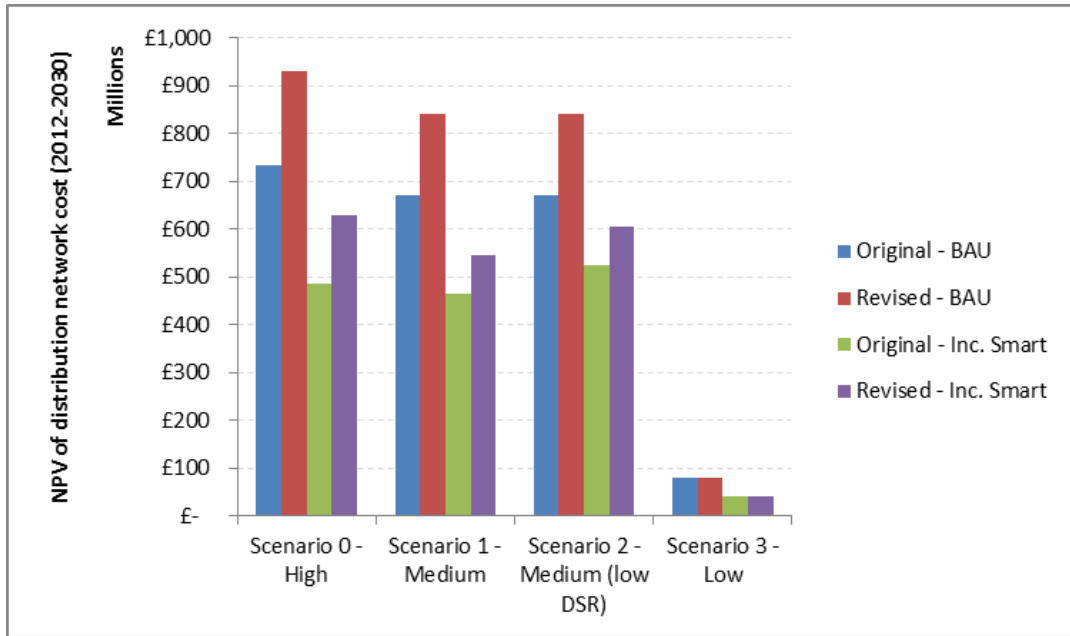


Figure 10 Discounted totex for all modelled scenarios (2012-2030) - Comparison between outputs between WS3 Ph2 and the revised dataset

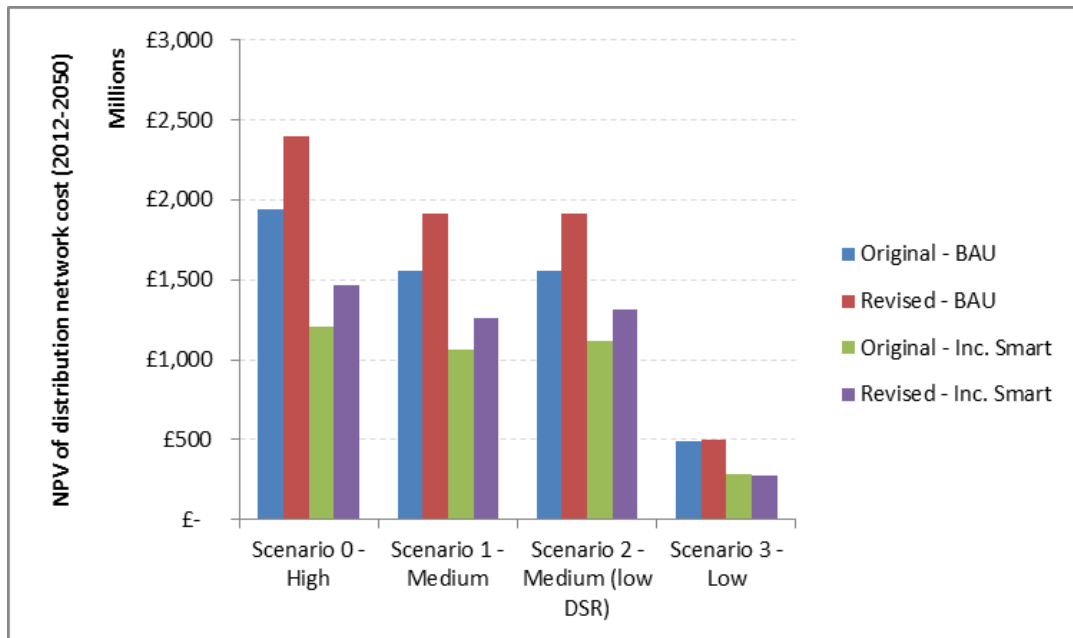


Figure 11 Discounted totex for all modelled scenarios (2012-2050) - Comparison between outputs between WS3 Ph2 and the revised dataset

4 Other improvements

Generic issues identified with managing data in the Transform™ model:

This Addendum has identified some areas for improvement in the way data can be managed and taken into the Transform model. In particular:

- The manual process used to create composite scenarios from multiple data sources (1 for each LCT), using data in different formats
- The challenge in spotting errors in data when that data is contained in a tabular format consisting of large numbers of rows and columns

Immediate Solutions:

In order to address this, and give confidence to users, EA Technology has:

- Reviewed all scenario data within model and identified any issues associated with the uptake scenario data
- Quantified the materiality of each data change through the production of this addendum
- Added in a new screen to Transform to provide users with visibility of the figures being used in the model

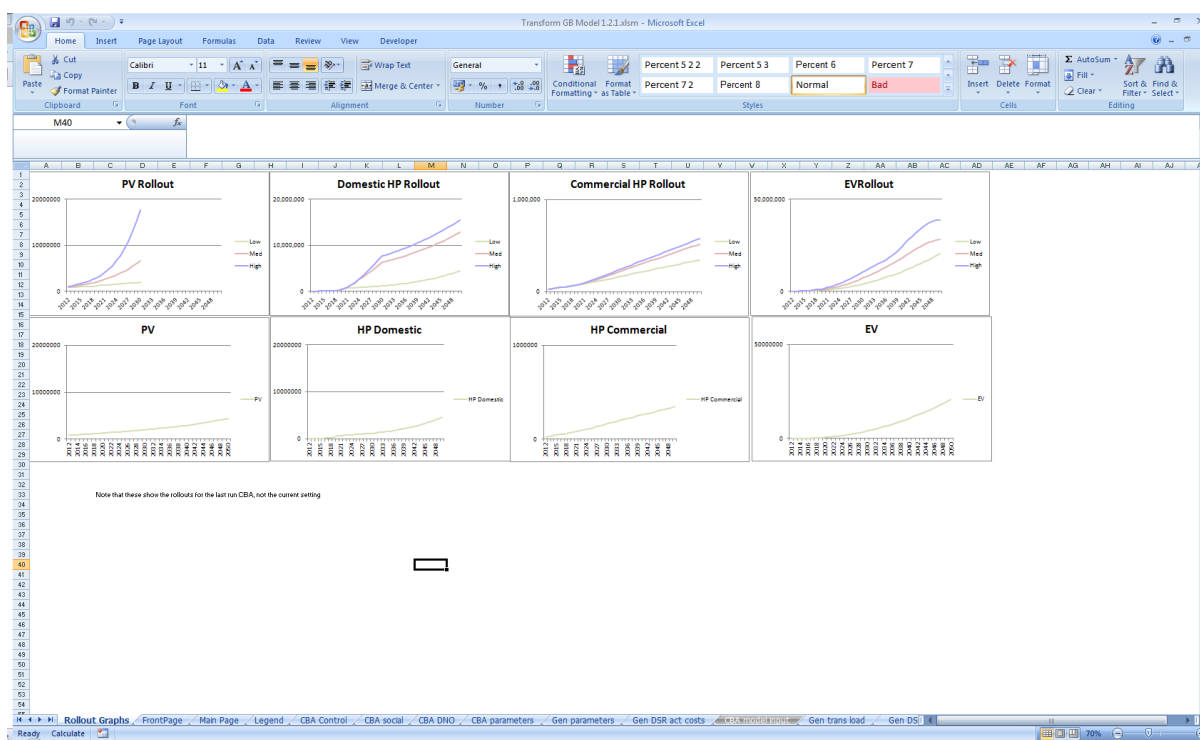


Figure 12 Screen shot of the latest version of the Transform™ model showing the input scenarios (top) and an overview of the selected dataset used in the last run of the CBA (bottom)

Ongoing activity:

In addition to the above, EA Technology will:

- Continue to identify and refine modelling inputs through the documented governance process
- Continue dialogue with WS1 and DECC on the collation of scenario data to align with Carbon Plan containing the correct mix of high, medium, low uptake levels of EVs, PV, HPs and DG. This will ultimately simplify the update of scenarios in the future

- Continue to develop the algorithmic relationship for apportionment of LCTs from GB-wide to each of the 14 licence areas being developed under WS3 Phase 3 Task 3.2 to automate the parsing of data from one model to another

END

5 Appendix: Materiality of the changes in the regional model

Note: This output is based on the synthetic DNO model – not a real DNO licence area.

Table 1 Scenario 0 (High Heat, High Transport Case [All High]) – Results showing the materiality of changes made to the DNO licence model dataset

Discounted Totex							Percentage Change					
BAU	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	BAU	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 1,763,485,749	£ 2,179,937,073	£ 1,763,485,749	£ 1,764,632,177	£ 1,763,485,749	£ 2,176,811,977	2050	123.6%	100.0%	100.1%	100.0%	123%
2030	£ 735,723,226	£ 930,151,694	£ 735,723,226	£ 740,477,750	£ 735,723,226	£ 930,011,166	2030	126.4%	100.0%	100.6%	100.0%	126%
2022	£ 70,142,515	£ 94,965,874	£ 70,142,515	£ 70,208,457	£ 70,142,515	£ 94,965,874	2022	135.4%	100.0%	100.1%	100.0%	135%
Discounted Totex							Percentage Change					
Smart-Incremental	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	Smart-Incremental	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 1,188,882,388	£ 1,477,791,731	£ 1,188,882,388	£ 1,188,878,485	£ 1,188,882,388	£ 1,477,076,403	2050	124.3%	100.0%	100.0%	100.0%	124%
2030	£ 488,689,347	£ 627,562,658	£ 488,689,347	£ 489,123,140	£ 488,689,347	£ 627,714,786	2030	128.4%	100.0%	100.1%	100.0%	128%
2022	£ 40,843,154	£ 51,894,403	£ 40,843,154	£ 41,548,174	£ 40,843,154	£ 51,894,403	2022	127.1%	100.0%	101.7%	100.0%	127%

Table 2 Scenario 1 (High Heat, Medium Transport Case [Central]) – Results showing the materiality of changes made to the DNO licence model dataset

Discounted Totex							Percentage Change					
BAU	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	BAU	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 1,564,212,122	£ 1,564,212,122	£ 1,916,074,976	£ 1,565,942,168	£ 1,564,212,122	£ 1,915,443,832	2050	100.0%	122.5%	100.1%	100.0%	122%
2030	£ 687,438,091	£ 687,438,091	£ 842,605,432	£ 686,543,531	£ 687,438,091	£ 842,156,978	2030	100.0%	122.6%	99.9%	100.0%	123%
2022	£ 48,564,763	£ 48,564,763	£ 48,464,042	£ 48,586,250	£ 48,564,763	£ 48,485,529	2022	100.0%	99.8%	100.0%	100.0%	100%
Discounted Totex							Percentage Change					
Smart-Incremental	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	Smart-Incremental	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 1,067,836,914	£ 1,067,836,914	£ 1,274,727,798	£ 1,071,487,029	£ 1,067,836,914	£ 1,264,378,623	2050	100.0%	119.4%	100.3%	100.0%	118%
2030	£ 463,264,994	£ 463,264,994	£ 565,213,154	£ 470,610,421	£ 463,264,994	£ 546,853,606	2030	100.0%	122.0%	101.6%	100.0%	118%
2022	£ 32,030,818	£ 32,030,818	£ 32,191,733	£ 31,864,830	£ 32,030,818	£ 31,845,624	2022	100.0%	100.5%	99.5%	100.0%	99%

Table 3 Scenario 2 (High Heat, Medium Transport Case with low consumer DSR uptake [Low DSR]) – Results showing the materiality of changes made to the DNO licence model dataset

Discounted Totex							Percentage Change					
BAU	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	BAU	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 1,562,748,954	£ 1,562,748,954	£ 1,913,666,910	£ 1,564,382,858	£ 1,562,748,954	£ 1,913,639,381	2050	100.0%	122.5%	100.1%	100.0%	122%
2030	£ 687,438,091	£ 687,438,091	£ 842,605,432	£ 686,543,531	£ 687,438,091	£ 842,156,978	2030	100.0%	122.6%	99.9%	100.0%	123%
2022	£ 48,564,763	£ 48,564,763	£ 48,464,042	£ 48,586,250	£ 48,564,763	£ 48,485,529	2022	100.0%	99.8%	100.0%	100.0%	100%
Discounted Totex							Percentage Change					
Smart-Incremental	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	Smart-Incremental	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 1,119,421,743	£ 1,119,421,743	£ 1,325,260,451	£ 1,121,334,404	£ 1,119,421,743	£ 1,315,142,594	2050	100.0%	118.4%	100.2%	100.0%	117%
2030	£ 524,006,162	£ 524,006,162	£ 623,662,986	£ 531,351,589	£ 524,006,162	£ 605,303,438	2030	100.0%	119.0%	101.4%	100.0%	116%
2022	£ 42,760,827	£ 42,760,827	£ 42,757,883	£ 42,594,840	£ 42,760,827	£ 42,411,775	2022	100.0%	100.0%	99.6%	100.0%	99%

Table 4 Scenario 3 (Low Heat, Low Transport Case [Low Elect]) – Results showing the materiality of changes made to the DNO licence model dataset

Discounted Totex							Percentage Change					
BAU	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	BAU	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 498,599,558	£ 498,599,558	£ 498,599,558	£ 502,901,413	£ 498,599,558	£ 502,901,413	2050	100.0%	100.0%	100.9%	100.0%	101%
2030	£ 80,177,753	£ 80,177,753	£ 80,177,753	£ 84,969,246	£ 80,177,753	£ 84,969,246	2030	100.0%	100.0%	106.0%	100.0%	106%
2022	£ 10,992,873	£ 10,992,873	£ 10,992,873	£ 10,992,873	£ 10,992,873	£ 10,992,873	2022	100.0%	100.0%	100.0%	100.0%	100%
Discounted Totex							Percentage Change					
Smart-Incremental	Base (as per WS3-Ph2 report)	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0	Smart-Incremental	Effect of EV figures only	Effect of HP figures only	Effects of Housing Change (inc new build electric heating) only	Effect of PV figures only	Effect of All changes as per Addeundum 2.0
2050	£ 280,747,420	£ 280,747,420	£ 280,747,420	£ 293,396,819	£ 280,747,420	£ 293,396,819	2050	100.0%	100.0%	104.5%	100.0%	105%
2030	£ 43,510,368	£ 43,510,368	£ 43,510,368	£ 45,019,366	£ 43,510,368	£ 45,019,366	2030	100.0%	100.0%	103.5%	100.0%	103%
2022	£ 6,791,882	£ 6,791,882	£ 6,791,882	£ 6,794,861	£ 6,791,882	£ 6,794,861	2022	100.0%	100.0%	100.0%	100.0%	100%

EA Technology Limited
Capenhurst Technology Park
Capenhurst, Chester UK
CH1 6ES

tel +44 (0) 151 339 4181
fax +44 (0) 151 347 2404
email sales@eatechnology.com
web www.eatechnology.com

