SP Energy Networks 2015–2023 Business Plan

Updated March 2014

Annex

Asset Management Health Index Reporting Assurance

PA Consulting

June 2013

SP ENERGY NETWORKS

PA Consulting Group

SP ENERGY NETWORKS

Asset Management Health Index Reporting Assurance

June 2013

Corporate Headquarters:
PA Consulting Group
123 Buckingham Palace Road
London SW1W 9SR
UK
Tel: +44 20 7730 9000
Fax: +44 20 7333 5050
www.paconsulting.com

Version no: 1.6

Prepared by: K Smarzo, D Porter & I Wallace

Document reference: P009511

EXECUTIVE SUMMARY

SP Energy Networks (SPEN) owns and operates electricity distribution networks in Central and Southern Scotland and also Cheshire, Merseyside, North Shropshire and North Wales.

SPEN has a regulatory obligation to report the health of specific assets employed within its distribution networks. Ofgem requires all DNOs to provide information regarding movements of asset Health Indices (HIs) in order to monitor progress towards the delivery of investment plans, particularly regarding Non-Load Related Expenditure (NLRE).

In order to consistently report HI information according to an agreed calculation methodology and to accurately capture network investments, SPEN established an internal project in late 2012 to improve the quality of the data contained within its asset information systems, which provide the basis for HI reporting.

Scope of this assurance review

PA Consulting Group was engaged to undertake an independent assessment of the process recently undertaken by SPEN to update the volume of asset movements eligible for HI reporting purposes and the associated processes for reporting HI profiles and scoring.

PA was required to assess whether the processes adopted to amend the volumes of asset movements were robust, effectively implemented, and thus provide an accurate representation of HI profiles and capital plan delivery. In particular, SPEN sought confirmation that asset volume movements linked to capital plan delivery are now being captured accurately and that the revised HI achievement scores against DPCR5 targets are valid for inclusion in the 2012/2013 RRP submission to Ofgem.

Conclusions

Causes of inaccurate HI reporting

PA can confirm that SPEN's initial RRP submission to Ofgem in October 2012 contained inaccurate information, which impacted HI reporting in the first two years of DPCR5. Data inaccuracies applied to plant (switchgear & transformers) and pole assets in both SPD & SPM and were largely attributable to incomplete and inaccurate information relating to asset additions & disposals. These data issues were compounded by the application of SPEN's original HI scoring methodology, which was subsequently updated following clarification discussions with Ofgem for consistency purposes[1]. The combined impact of these issues resulted in an understatement of HI achievement when calculated according to the revised scoring methodology, which prompted SPEN to undertake a major data validation project to improve the accuracy of future regulatory submissions.

For plant equipment, the two dominant causes of data discrepancies were misallocated work undertaken on both networks and work that was not recorded at all and therefore invisible for reporting purposes. The issues impacting overhead line supports were biased towards missing pole disposals. The situation for poles was also compounded by incorrect HI rankings of pole disposals in the initial years of DPCR5.

Resolution of reporting inaccuracies

SPEN has now completed an intensive 7-month programme to validate DPCR5 asset interventions and has recalculated HI achievement scores accordingly. PA can confirm that the procedures have been robustly implemented and that the revised HI achievement scores are significantly more reliable than those submitted in 2012. The programme has also highlighted where there is scope to implement business-as-usual process improvements which should reduce requirements for such validation exercises to be undertaken future[2].

PA has some concerns regarding the manual and paper-based aspects of SPEN's HI reporting and the associated risks of data errors. PA believes that the robustness of asset delivery reporting and data input arrangements could be improved through further IT enablement on central systems and for field work.

PA also believes that more robust enduring solutions should be evaluated for the reporting of refurbishments, especially if refurbishment volumes are set to rise in future. The current 'manual workaround' to capture the benefits of such interventions may not be scalable.

Impact of data validation and revised reporting processes

PA has confirmed that SPEN's revised HI achievement scores to be submitted in the 2012/2013 RRP, have been based on NLRE and include asset volume movements arising from asset replacements, refurbishments and the replacement of faulted/defective equipment. PA can confirm that the HI achievement statistics presented in Table E1 below exclude all asset interventions initiated by other investment drivers such as reinforcement and connection activities.

---

[1] SPEN Management indicated that the revised scoring methodology was not finalised until May 2012 (following the 2011/2012 reporting year) and represented a material change to the way that SPEN had previously calculated HI outputs for DPCR5.

[2] SPEN is evaluating various IT proposals for enhancing system capability, new reporting requirements for Programme Managers and revised internal reporting.

The restatement of cumulative HI achievement scores for 2011/2012, based on the revised input data and scoring approach has resulted in a 7% and 8% improvement to the reported achievement scores for SPD and SPM respectively. Although the cumulative delivery figures at the end of 2011/2012 appear relatively low (23% & 19% for SPD & SPM respectively), projections indicate that delivery rates significantly increased in 2012/2013. The situation in SPM has been impacted by low levels of activity on 132 kV assets so far that could contribute significantly towards the delivery of overall targets.

Table E1: Comparison of SPEN's initial and recalculated HI achievement scores

	Initial 2010 - 2012 score based on Ofgem guidance	Restated 2010 - 2012 scores using revised data & new methodology	Projected cumulative 2012/2013 HI score	Incremental Score increase in 2012/2013
SPD	16%	23%	47.5%	+24.5%
SPM	11%	19%	41%	+22%

SPEN is not planning to restate pole related HI achievement scores for the first two years of DPCR5 in the 2012/2013 RRP submission. This decision slightly understates HI achievement scores for poles by approximately 3% in SPD and 2.5% in SPM in the early years of DPCR5. PA believes it will be beneficial for SPEN to restate HI achievement regarding poles in future RRP submissions.

Overall, PA believes that the reported amendments and step changes to the cumulative HI achievements scores are reliable and significantly more robust than those reported in October 2012. Given that the revised processes implemented to correct 2010 - 2012 reporting have also been applied to 2012/2013 data, PA is confident that the cumulative achievement figures in the July 2013 RRP tables will provide a reliable statement of SPEN's progress towards the delivery of overall DPCR5 targets.

Recommendations

Further to the completion of this review, and in the light of the conclusions reached, PA makes the following recommendations for future business process and organisational refinements:

- Improve training and introduce incentives on field staff (internal and contractors) to promptly and accurately submit details of all asset interventions implemented on SPEN networks.
- Increase levels of input data validation undertaken by the Data Management function prior to information updates in central IT system - embed as part of business as usual activities.
- Reduce the reliance on paper-based systems and consider making more data fields mandatory for valid information submissions to the Data Management function.
- Accelerate roll-out of mobile technology to increase levels of IT enablement so field staff can automatically access and populate accurate data on central IT systems.
- Consider inclusion of Health Index data fields in future releases of asset register software applications.
- Devise new business processes to remove requirements for 'manual workarounds' regarding the reporting of refurbishments and disconnected switchgear.

- Conduct a thorough end-to-end business process review to identify further opportunities to streamline and improve the efficiency and accuracy of both asset and regulatory reporting.

CONTENTS

FIGURES AND TABLES

FIGURES

TABLES

1 PROJECT SCOPE AND APPROACH

SP Energy Networks (SPEN) owns and operates electricity distribution networks in Central and Southern Scotland (Scottish Power Distribution – SPD) and also Cheshire, Merseyside, North Shropshire and North Wales (Scottish Power Manweb – SPM).

Throughout the current regulatory period (DPCR5), SPEN has a regulatory obligation to report the health of specific assets employed within each distribution network. This requirement was implemented from the end of the 2nd year of DPCR5 period with Ofgem requiring all DNOs to provide information regarding movements of asset Health Indices (HIs) in order to monitor progress towards the delivery of investment plans, particularly Non-Load Related Expenditure (NLRE).

In order to consistently report HI information according to an agreed calculation methodology and to accurately capture network investment activity, SPEN established an internal project in October 2012 to improve the quality of the data contained within its asset information systems, which also provide the basis for HI reporting.

PA Consulting Group has been engaged to undertake an independent assessment of the process recently undertaken by SPEN to update the volume of asset movements eligible for HI reporting purposes and the associated processes for reporting HI profiles and scoring.

In this section we provide the context and background information relating to this assignment. We also set out the scope of the work undertaken by PA Consulting Group in reviewing the process used by SPEN to improve asset data.

1.1 Background and context

As part of DPCR5, Ofgem introduced a new reporting requirement to monitor changes in selected asset HIs for all electricity Distribution Network Operators (DNO), particularly regarding the changes driven by asset replacement and refurbishment activities.

HIs are a Tier 2 network output measure related to asset condition. Its purpose is to collate and track changes in the health (or condition) of distribution assets during the price review period and will be used by Ofgem to assess the efficacy of a DNO's asset management and investment decisions over the price control period. Under the HI framework, each relevant asset is assigned a ranking between HI1 and HI5 by the DNO based on the DNO"s assessment of its overall health or condition, and for the forecast period based on the DNO"s views about future degradation, the options for Intervention and their impacts.

- HI1 - New or as New
- HI2 - Good or serviceable condition
- HI3 - Deterioration requires assessment and monitoring
- HI4 - Material deterioration, intervention requires consideration
- HI5 - End of serviceable life, intervention required

Each asset category (e.g. EHV Transformers) tracks the volume of new additions to the asset register, and importantly also captures details of those assets which have been decommissioned, referred to as disposals.

SPEN has an obligation to report HI ranking and volume movements for each relevant asset category as part of the annual Regulatory Reporting Pack (RRP) and provide insights regarding delivery of the NLRE capital plan for each network area. Plan delivery is monitored according to movements in annual HI scores relative to a forecast derived for the entire DPCR5 period. At the end of the 2nd year of DPCR5, Ofgem required all DNOs to submit Health Index reporting worksheets, for the period April 1st 2010 – March 31st 2012).

Upon completing an initial review of SPEN's Health Index worksheets, Ofgem noted that SPEN's reporting of HI progress differed from internal Ofgem analysis. The net impact of recalculating SPEN's HI scores according to Ofgem's clarified methodology was a significant reduction in reported levels of capital plan delivery. Further analysis by SPEN confirmed that the SPD & SPM achievement scores based primarily on asset disposals were indeed lower than those based on additions. This prompted SPEN to question the completeness of the asset data contained within their systems. As a result, SPEN established an internal project to collect, review, and revise the asset information relating to all network investments from the start of DPCR5 in order to recalculate HI scores for submission in July 2013.

Table 1 shows the discrepancies between SPEN's initial HI achievement scores for the first two years of DPCR5 compared with Ofgem's clarified approach and highlights the significant reduction in overall delivery as measured by the revised calculation methodology.

Table 1: Comparison of SPEN's initial (2010 – 2012) HI achievement scores

	SPEN initial achievement score	Revised score based on Ofgem guidance
SPD	20%	16%
SPM	24%	11%

1.2 Scope of the assignment

Following SPEN's completion of its asset data improvement project for the SPD and SPM networks, PA Consulting Group (PA) was appointed to conduct an independent assessment of whether the processes adopted to amend the volumes of asset additions and disposals were robust, effectively implemented, and thus provide an accurate representation of HI profiles and capital plan achievement outputs for all relevant assets. In particular, SPEN sought confirmation that asset volume movements linked to capital plan delivery are now being captured accurately and that the revised HI achievement scores against DPCR5 targets are valid for inclusion in the 2012/2013 RRP submission to Ofgem.[3]

PA's review only considered the asset categories required for reporting HIs, as set by Ofgem and described in the relevant Regulatory Instructions and Guidance (RIGs) documents. PA's review excluded transmission assets owned by Scottish Power Transmission Limited (SPTL) under its role as a Scottish Transmission Owner (TO).

The review undertaken by PA has been a desk-top exercise aimed at validating the processes employed. PA has not undertaken any operational site visits or inspected physical infrastructure as part of the review. The on-site time has been spent reviewing material produced by SPEN staff, interrogating reports, investigating calculations based on revised data, and validating decision-making processes.

1.3 Our approach

In this section of the report we set out the approach adopted by PA in its review. PA's approach to the audit can be described as having the following two distinct areas of focus:

- a review of the high-level approach adopted by SPEN to provide a revised set of delivery outputs eligible for health index reporting (a review of process); and
- a more focused examination of specific asset categories which had the greatest impact on the overall aggregate HI score for 2013.

1.3.1 Review of process

The process and approach adopted by SPEN to review and revise its capital plan asset delivery information has been fundamental to the validation exercise undertaken by PA. Our high-level assessment of the SPEN revision process has included the following:

[3] The next RRP is due to be submitted to Ofgem by 1 July 2013.

- an explanation of the aims and objectives of the data revision activities initiated by SPEN management;
- the overall approach and philosophy adopted by the SPEN team in its drive to improve the accuracy and quality of its asset reporting – both internal (management) reporting and reporting to external parties, such as Ofgem;
- an understanding of the causes of unreported additions and disposals in the first reporting periods;
- identity of short-term and long-term process or system improvements designed to maintain the validity of asset data in future reporting; and
- SPEN data tables showing 'before' and 'after' asset volumes of additions and disposals for affected asset categories;

As part of this high-level process review, PA has sought to validate the following:

- that asset replacement activity is now being recorded more accurately;
- the robustness of reporting arrangements to Ofgem;
- the delta between original RRP HI scores and those after data revisions to ensure the underlying data is accurate and the process robust enough to provide greater assurance that future reporting will also reflect actual work completed;

These initial, high-level assessments also informed selection of the asset categories for focused review referred to as 'Deep Dives'.

1.3.2 Focussed review of specific asset categories

Following completion of the process review, PA has undertaken a more focused review of the asset categories which had the largest impact on overall HI scores within each service territory. The purpose of this more detailed review of the asset data revision process was twofold:

- confirmation that the high-level process was implemented as intended; and
- confirmation that the latest reported outcomes associated with a sample of individual asset categories is reasonable.

In considering these criteria, the asset categories shown in Table 2 were selected for detailed examination. For each of the selected asset categories the following items were explored:

1. How did staff identify the data to examine – on what basis was the initial exception report generated?
2. What systems were used and what asset attributes were included as part of the revision process?
3. What business rules were applied to deal with the first pass set of exceptions?
4. How were the outstanding exceptions lacking sufficient data within the IT systems investigated?
5. How did the required asset data amendments impact HI scores and what process has been followed?
6. What measures have been identified to address the causes of misaligned or missed exception data in order to minimise the likelihood of inaccurate reports and data sets in the future?

Table 2 – Asset categories selected for detailed review

License area	Ofgem Asset Category	Asset Type
SPM	EHV Transformer	33kV Transformer
	LV OHL Support	LV Poles
	HV Switchgear (GM) - Primary	6.6/11kV HV RMUs. Switches
SPD	EHV Transformer	33kV Transformer
	HV Switchgear (GM) - Distribution	6.6/11kV HV Circuit Breakers
	HV OHL Support - Poles	6.6/11kV Poles

PA's approach has been to work with selected members of the SPEN's team based in Prenton, Llandudno and Glasgow and to 'walk-through' the chronology of the data revision process - discussing the issues, anomalies and business decisions addressed by the project teams. Separate reviews were undertaken for 'Plant' items (transformers and switchgear) and overhead line 'Supports' (largely poles), as different processes were employed due to differences in the numbers of asset concerned.

As part of the 'Deep Dive' reviews, PA sought to validate that changes have been accurately recorded so that an audit trail is accessible for any data revisions or 'fixes' implemented. PA also requested and reviewed additional supporting information and assessed its reasonableness - from both a process and a data management perspective.

1.3.3 Key assumptions

The following assumptions have been made in undertaking the review:

- the health condition of assets are as recorded in source systems; PA has undertaken no physical check of assets;
- that the reporting tools used by SPEN to capture asset information are an accurate reflection of the information contained within the asset systems;
- data files used to validate changes in volumes or scores reflect the best available at the time and may be subject to further revisions which would be reflected in the official Ofgem reporting packs; and
- that the information used to justify revisions to asset movements are valid; PA has not undertaken a review of contractor data or reviewed materials documenting condition based asset data or missing delivery outputs.

2 HEALTH INDEX REPORTING BACKGROUND

During DPCR5, Ofgem has introduced a new reporting requirement to monitor NLRE capital plan delivery within each DNO's service territory and HIs are used by Ofgem to assess the efficacy of a DNO's asset management decisions over the price control period.

This section outlines PA's understanding of the process for capturing HI related asset volume movements and the appropriate methodology for reporting HI delivery scores per asset category and aggregate achievement against an overall target for the DPCR5 period.

2.1 Background

During the 2011/2012 financial year, a new regulatory reporting requirement was introduced for all British electricity DNOs to report on annual delivery of asset replacement volumes. Ideally, there should be reasonable correlation between the asset volumes delivered and forecasts established as part of the DPCR5 settlement when considered over the full 5-year regulatory cycle.

Rather than reporting NLRE asset volumes in absolute terms, disaggregated by voltage and asset type, the new regulatory monitoring framework applies weighting factors for different asset interventions according to asset health and cost. These weighting factors incentivise replacement of assets nearing the 'End of Serviceable Life' and simultaneously reduce any incentives to disproportionately target low-cost asset replacements.

By applying the new reporting framework to actual and forecast DPCR5 asset replacement volumes, it is possible to determine a target score for the 5-year regulatory period against which actual asset replacement activity can be monitored in each DNO area on an annual basis. It is therefore possible to gain insights regarding the extent to which each DNO's asset replacement programme has been delivered annually.

For this monitoring framework to provide reliable insights regarding asset replacement achievement and meaningful comparisons, it is important for all DNOs to accurately record all asset replacement work delivered each year and to apply the weighted scoring methodology in a consistent manner. In late 2012 it became apparent that some DNOs had interpreted the new reporting requirements differently, resulting in inconsistent regulatory submissions for the first two years of the DR5 period.

In order to improve the accuracy of asset replacement reporting Ofgem has clarified the scoring methodology to be applied by all DNOs, which has resulted in material changes to the levels of asset replacement reported by SPEN at the end of the second and third years of the DPCR5 regulatory period.

2.2 Reporting Asset Condition as a Health Index

Under the HI framework, each relevant asset is assigned an HI ranking between HI1 and HI5 by the DNO based on the DNO's assessment of its overall health or condition, and for the forecast period based on the DNO"s views about future degradation, the options for Intervention and their impacts.

- HI1 - New or as New
- HI2 - Good or serviceable condition
- HI3 - Deterioration requires assessment and monitoring
- HI4 - Material deterioration, intervention requires consideration
- HI5 - End of serviceable life, intervention required

In each asset category (e.g. EHV transformers) the volume of new additions to the asset register is tracked, as well as those assets which have been decommissioned and removed from the network, referred to as disposals. SPEN reports on both HI rankings and volume movements for each asset category as part of each RRP submission.

The HI data is found within the Network Asset Data and Performance Reporting (NADPR) pack. A new reporting workbook titled "Network Outputs Reporting" was added to the NADPR component of the DPCR5 Regulatory Instructions and Guidance (RIGs) package (the set of instructions for the annual submission that enables Ofgem to collect data in a consistent format).

The Network Outputs pack is intended to determine whether a DNO has delivered the change in the level of network risk funded by customers as part of the DPCR5 settlement, and to help establish whether any cost savings achieved by a DNO are due to efficiencies achieved during the price control period. Part of this included reporting on asset health.

As part of the DPCR5 Business Plan submitted in 2008, a baseline of asset condition was determined, called the Agreed Network Outputs. In September 2011, the DNOs provided a profile of the health of the assets in those categories in respect to which the company maintains a HI, as of 31 March 2011.This included total volumes across each asset category at the start of DPCR5 (Year 0) Table 3, the resulting profile if no investment were to take place and only deterioration occurred, and then what forecasts of asset volumes and health profiles would look like with planned investment over the DPCR5 period, Table 4. Below is SPENs original Agreed Network Outputs.

Table 2: Agreed Network Outputs for SPM and SPD – Starting Position

	ASSET CATEGORIES	Ofgem Unit Cost (£k, 07/08 prices)	ASSET REGISTER as at 31st March 2010	ASSET REGISTER as at 31st March 2015	HEALTH INDEX - YEAR 0 (STARTING POSITION) HI 1	HI 2	HI 3	HI 4	HI 5	Total Volume
SPD	**LV Network**									
	LV OHL Support	1.32	64733	61179	6103	0	17195	37530	3905	64733
	HV Network									
	HV Switchgear (GM) - Primary	31.62	4320	4320	447	2222	716	569	366	4320
	HV Switchgear (GM) - Distribution	12.02	25727	25727	9751	6743	3587	3807	1839	25727
	HV Transformer (GM)	12.12	16283	16283	2543	3446	5793	4401	100	16283
	HV OHL Support - Poles	1.57	187941	187263	36773	24400	97484	26251	3033	187941
	EHV Network									
	EHV Switchgear (GM)	60.19	1183	1183	202	286	46	431	218	1183
	EHV Transformer	519.60	782	782	280	295	54	54	99	782
	EHV UG Cable (Oil)	276.14	30	30	0	0	5	25	0	30
	EHV OHL Support - Poles	2.71	36184	36029	9348	4835	6172	10332	5497	36184
	TOTAL		**337,183**	**332,796**	**65,447**	**42,227**	**131,052**	**83,400**	**15,057**	**337,183**

	ASSET CATEGORIES	Ofgem Unit Cost (£k, 07/08 prices)	ASSET REGISTER as at 31st March 2010	ASSET REGISTER as at 31st March 2015	HEALTH INDEX - YEAR 0 (STARTING POSITION) HI 1	HI 2	HI 3	HI 4	HI 5	Total Volume
SPM	**LV Network**									
	LV OHL Support	1.32	125002	117448	51036	16992	53495	1864	1615	125002
	HV Network									
	HV Switchgear (GM) - Primary	31.62	5214	5214	652	2567	1152	374	469	5214
	HV Switchgear (GM) - Distribution	12.57	15216	15216	5794	1920	1973	1860	3669	15216
	HV Transformer (GM)	12.12	11154	11154	2729	1858	3031	3505	31	11154
	HV OHL Support - Poles	1.57	167014	166407	12563	21817	118266	11281	3087	167014
	EHV Network									
	EHV Switchgear (GM)	60.19	3240	3240	145	617	211	720	300	1993
	EHV Transformer	519.60	743	743	160	207	105	121	150	743
	EHV UG Cable (Oil)	276.14	0	0	0	0	1	0	0	1
	EHV OHL Support - Poles	2.71	21408	21318	4385	1603	12752	524	2144	21408
	132kV Network									
	132kV CBs	694.00	212	212	58	42	4	46	62	212
	132kV Transformer	1200.68	132	132	50	31	21	16	14	132
	132kV UG Cable (Gas)	1031.00	34	25	0	15	0	0	19	34
	132kV UG Cable (Oil)	1031.00	161	156	45	69	25	15	7	161
	132kV OHL Support - Tower	108.85	2177	2177	254	298	887	460	278	2177
	132kV OHL Fittings and Conductors	4.48	1224	1224	383	108	216	224	294	1224
	TOTAL		**352,931**	**344,666**	**78,254**	**48,144**	**192,138**	**21,010**	**12,138**	**351,685**

These planned investment forecasts were subjected to the HI Scoring Methodology to determine Overall HI Achievement Targets, which a DNO is measured against in each RRP submission.

Table 3: Agreed Network Output Target Volume, HI Profiles & Achievement Scores - SPM & SPD

	ASSET CATEGORIES	Ofgem Unit Cost (£k, 07/08 prices)	ASSET REGISTER as at 31st March 2010	ASSET REGISTER as at 31st March 2015	HEALTH INDEX - YEAR 5 (WITH INVESTMENT) HI 1	HI 2	HI 3	HI 4	HI 5	Total Volume	Total Pts	Overall Pts	DPCR5 Agreed Output Targets Total Pts	Overall Pts	HI5 Equiv
SPD	**LV Network**														
	LV OHL Support	1.32	64733	61507	11014	0	9735	37277	3481	61507	3260554	4314895	532949	705285	5383
	HV Network														
	HV Switchgear (GM) - Primary	31.62	4320	4320	595	1739	816	483	687	4320	144975	4584110	24552	776334	248
	HV Switchgear (GM) - Distribution	12.02	25727	25727	8733	7662	2131	2364	4838	25727	798513	9594990	157087	1887569	1587
	HV Transformer (GM)	12.12	16283	16283	1734	3572	4559	6157	261	16283	631314	7649395	9405	113957	95
	HV OHL Support - Poles	1.57	187941	187263	35765	26549	68951	50141	5857	187263	6465355	10176506	415514	654021	4197
	EHV Network														
	EHV Switchgear (GM)	60.19	1183	1183	264	241	108	20	550	1183	62314	3750680	9801	589922	99
	EHV Transformer	519.60	782	782	277	291	91	35	88	782	17167	8919938	6769	3517159	68
	EHV UG Cable (Oil)	276.14	30	30	0	0	0	26	4	30	2220	613031	0	0	0
	EHV OHL Support - Poles	2.71	36184	36029	10622	5899	4012	10193	5303	36029	1433782	3884581	226862	614643	2292
	TOTAL		**337,183**	**332,796**	**69,004**	**45,953**	**90,403**	**106,696**	**21,069**	**333,124**	**12,816,194**	**53,488,126**		**8,858,890**	**-**

	ASSET CATEGORIES	Ofgem Unit Cost (£k, 07/08 prices)	ASSET REGISTER as at 31st March 2010	ASSET REGISTER as at 31st March 2015	HEALTH INDEX - YEAR 5 (WITH INVESTMENT) HI 1	HI 2	HI 3	HI 4	HI 5	Total Volume	Total Pts	Overall Pts	DPCR5 Agreed Output Targets Total Pts	Overall Pts	HI5 Equiv
SPM	**LV Network**														
	LV OHL Support	1.32	125002	117448	32595	47459	23531	13064	799	117448	2207495	2921316	828669	1096629	8370
	HV Network														
	HV Switchgear (GM) - Primary	31.62	5214	5214	1324	2023	765	883	219	5214	128214	4054127	66779	2111552	675
	HV Switchgear (GM) - Distribution	12.57	15216	15216	6142	3018	537	1423	4096	15216	561642	7059840	181725	2284283	1836
	HV Transformer (GM)	12.12	11154	11154	2010	2295	1986	4789	74	11154	427170	5175859	10593	128351	107
	HV OHL Support - Poles	1.57	167014	166407	19112	19049	105083	20128	3035	166407	5074552	7987374	439821	692281	4443
	EHV Network														
	EHV Switchgear (GM)	60.19	3240	3240	198	466	240	153	936	1993	116368	7004190	8316	500540	84
	EHV Transformer	519.60	743	743	198	192	64	90	199	743	30238	15711603	7491	3892308	76
	EHV UG Cable (Oil)	276.14	0	0	0	0	0	1	0	1	40	11115	0	0	0
	EHV OHL Support - Poles	2.71	21408	21318	5600	1669	9907	2069	2073	21318	671630	1819664	101323	274517	1023
	132kV Network														
	132kV CBs	694.00	212	212	66	49	12	2	83	212	9356	6493064	2475	1717650	25
	132kV Transformer	1200.68	132	132	47	36	13	15	21	132	3947	4739095	891	1069808	9
	132kV UG Cable (Gas)	1031.00	34	25	0	15	0	0	11	26	1270	1309762	760	783560	8
	132kV UG Cable (Oil)	1031.00	161	156	22	62	48	16	8	156	4003	4126802	500	515500	5
	132kV OHL Support - Tower	108.85	2177	2177	429	233	217	704	594	2177	117949	12838749	29421	3202476	297
	132kV OHL Fittings and Conductors	4.48	1224	1224	379	221	147	194	283	1224	48884	219000	15593	69857	158
	TOTAL		**352,931**	**344,666**	**68,122**	**76,787**	**142,550**	**43,531**	**12,431**	**343,421**	**9,402,758**	**81,471,558**	**1,694,357**	**18,339,313**	**17,115**

2.3 Calculation of Overall HI Target Scores

Under the HI framework, each relevant asset is assigned a ranking between HI1 and HI5 by the DNO based on the DNO's assessment of its overall health or condition, and for the forecast period based on the DNO's prediction of future degradation, the options for intervention and their impacts. To provide an incentive scheme which encourages DNOs to remove assets at the end of life, Ofgem introduced a scoring methodology to both set the Agreed Network Output Targets and which to measure progress in subsequent RRP submissions.

Step 1: Determine total number of additions and disposals made within the reporting year

Assets are counted against volume movements when they are being added or removed due to non-load related work. This includes planned and unplanned asset replacements, replacement of faulted equipment, and asset refurbishments. Asset replacement prioritisation is also influenced by asset criticality and SPEN uses four criteria to determine when to replace or refurbish an asset:[4]

- Safety – based on the exposure and proximity to the public and personnel
- Environment – based on the environmental exposure from the asset and the sensitivity of the geographic area local to the asset (undergrounding).
- System – based on the impact of the transmission system not delivering services to stakeholders or the smooth operation of the UK services and economy (modernisation).
- Financial – costs attributable to return on asset or system to service (replacing a pole that is not HI5 during a rebuild).

Asset additions and disposal data is contained in Table CV3 in the NADPR reporting pack. Below is an example of total volume data for additions and disposals across multiple asset types.

[4] These are documented by SPEN in "Asset Health, Criticality & Outputs Methodology" guidance document, ASSET-01-019, Issue No. 2, pg. 6.

Table 4: Example of Total Additions and Disposals by asset type

Asset Movement	Asset Type	Total Volume
ADDITION	6.6/11kV CB (GM) Primary	440
	6.6/11kV CB (GM) Secondary	194
	6.6/11kV Switch (GM)	40
	6.6/11kV RMU	683
	6.6/11kV X-type RMU	516
	6.6/11kV Transformer (GM)	737
	33kV CB (Air Insulated Busbars)(ID) (GM)	26
	33kV CB (Air Insulated Busbars)(OD) (GM)	8
	33kV CB (Gas Insulated Busbars)(ID) (GM)	71
	33kV RMU	1
	33kV Transformer (GM)	70
	132kV CB (Gas Insulated Busbars)(ID) (GM)	1
	132kV Transformer	7
ADDITION Total		**2794**
DISPOSAL	6.6/11kV CB (GM) Primary	419
	6.6/11kV CB (GM) Secondary	136
	6.6/11kV Switch (GM)	13
	6.6/11kV RMU	625
	6.6/11kV X-type RMU	549
	6.6/11kV Transformer (GM)	696
	33kV CB (Air Insulated Busbars)(ID) (GM)	41
	33kV CB (Air Insulated Busbars)(OD) (GM)	11
	33kV RMU	6
	33kV Transformer (GM)	61
	132kV CB (Gas Insulated Busbars)(ID) (GM)	10
	132kV Transformer	6
DISPOSAL Total		**2573**

Step 2: Determine HI rank and develop profile for reporting period

As previously mentioned, a subset of distribution network assets are assigned a HI ranking of 1 – 5 linked to asset health. For the majority NLRE asset additions, where an 'end of life' asset is replaced by a new asset, the HI ranking will move from HI5 – HI1. There may be instances where a used asset is commissioned into the system at a higher rank. As asset degradation occurs over time, so asset volumes in each HI category change accordingly. SPEN assigns HI rankings to particular assets based on a range of inputs which are described in SPEN's policy document 'Asset Health, Criticality and Outputs Methodology – ASSET-01-019 Issue 2'. Depending on the type of asset, these HI inputs include:

- Asset age;
- Asset type and known defect history; and
- Asset condition information from routine and targeted inspections; and
- Fault rates.

In the case of refurbishments, the situation is complicated in that assets are usually removed from the system as a HI4 and subsequently reinstated with an HI ranking of HI2 or HI3. Refurbishments have proved more difficult for SPEN to monitor as a consequence of the refurbished asset not being

withdrawn from the system as a disposal, necessitating manual monitoring refurbishment programmes.

It should be noted that SPEN has a policy of not refurbishing any HI5 ranked assets, deeming such equipment to have reached 'End of Serviceable Life' and therefore not suitable for refurbishment. This strict policy definition regarding HI5 assets may be inconsistent with the approaches adopted by other DNOs where refurbishment of HI5 equipment is possible. .

It should also be noted that all DNOs have flexibility to determine the criteria for mapping asset condition to particular HI rankings for each asset type to the extent that comparisons of HI profiles and network risk across DNOs becomes less meaningful.

Table 5: Example of assigning HI rank to additions and disposals by asset type

Asset Movement	Asset Type	HI1	HI2	HI3	HI4	HI5	Total Volume
ADDITION	6.6/11kV CB (GM) Primary	419	11	7	3		440
	6.6/11kV CB (GM) Secondary	178	14	2			194
	6.6/11kV Switch (GM)	40					40
	6.6/11kV RMU	681		2			683
	6.6/11kV X-type RMU	516					516
	6.6/11kV Transformer (GM)	599	111	15	12		737
	33kV CB (Air Insulated Busbars)(ID) (GM)	26					26
	33kV CB (Air Insulated Busbars)(OD) (GM)	7		1			8
	33kV CB (Gas Insulated Busbars)(ID) (GM)	68	3				71
	33kV RMU				1		1
	33kV Transformer (GM)	70					70
	132kV CB (Gas Insulated Busbars)(ID) (GM)		1				1
	132kV Transformer	7					7
ADDITION Total		**2611**	**140**	**27**	**16**		**2794**
DISPOSAL	6.6/11kV CB (GM) Primary	1	46	45	26	295	419
	6.6/11kV CB (GM) Secondary	14	58	28	4	32	136
	6.6/11kV Switch (GM)	8				1	13
	6.6/11kV RMU	42	13	42	51	472	625
	6.6/11kV X-type RMU	9		30	22	481	549
	6.6/11kV Transformer (GM)	53	116	126	354	45	696
	33kV CB (Air Insulated Busbars)(ID) (GM)		1	13	18	9	41
	33kV CB (Air Insulated Busbars)(OD) (GM)	1			10		11
	33kV RMU				5	1	6
	33kV Transformer (GM)	2	1	6	7	38	61
	132kV CB (Gas Insulated Busbars)(ID) (GM)					10	10
	132kV Transformer					6	6
DISPOSAL Total		**130**	**235**	**290**	**497**	**1390**	**2573**

Step 3: Determine asset volume movements across each asset category

Assets are grouped according to type as detailed in Ofgem's predefined asset categories. With the rare exception of adding used assets to the system or refurbishing existing assets, most additions will show up as positive numbers to HI1 and disposals will show as negative numbers across the remaining HI ranks, biased towards HI5 assets. Note that the volume changes represent net additions and disposals within that specific HI rank. For example, the refurbishment of four HI3 transformers would initially increase the HI3 count by +4 units. However, the removal of 6 faulted units would yield a net movement of -2 transformers in this HI3 category.

Table 6: Example of asset category movements by HI rank

HI Reporting Asset Category	HI1	HI2	HI3	HI4	HI5	Net Total
HV Switchgear (GM) - Primary	84	-1	-22	-19	0	42
HV Switchgear (GM) - Distribution	342	0	-6	-10	-120	206
HV Transformer (GM)	71	0	0	-44	-4	23
EHV Switchgear (GM)	22	0	0	-7	0	15
EHV Transformer (GM)	10	0	0	-2	-3	5
132kV CBs	0	0	0	0	0	0
Total	**729**	**-44**	**-88**	**-185**	**-364**	**48**

Step 4: Apply Weighting Factors to Determine Raw HI Scores

The HI ratings are weighted to reflect the relative significance of these five categories. For example, the removal of an asset classified as HI5 has significantly more impact than the removal of an equivalent asset of the same type classified as HI1.

HI1	HI2	HI3	HI4	HI5
1	10	30	70	100

This incentivises DNOs to prioritise the removal of end of life assets before those in serviceable condition. The higher weighting on HI5 results in a higher overall HI score, which enables a DNO to reach their Achievement Targets faster than they would if they replaced lower HI rank assets. Each volume is multiplied against the weighting to determine raw HI scores by rank and asset category.

Table 7: Example of weighting volumes to determine raw HI scores by rank and asset category

HI Reporting Asset Category	HI1	HI2	HI3	HI4	HI5	Net Total
HV Switchgear (GM) - Distribution	342	0	-6	-10	-120	42
Weighting Factors	*1*	*10*	*30*	*70*	*100*	
Total HI Points	**342**	**0**	**-180**	**-700**	**-12000**	**-12538**

Step 5: Apply Unit Cost to Determine Overall HI Scores

Having weighted asset replacement volumes according to the relevant HI rankings as described above, a further weighting factor is applied based on industry assumed units costs for each asset type. The effect of weighting NLRE asset interventions by unit costs is to equalise incentives such that DNOs are encouraged to pursue a range of asset replacement initiatives across the entire asset base and to avoid the selection of low cost interventions as a means of achieving the desired HI scores.

Table 8: Example of applying unit cost to determine overall HI score by rank and asset category

HI Reporting Asset Category	Ofgem Unit Cost	HI1	HI2	HI3	HI4	HI5	Net Total
HV Switchgear (GM) - Primary	£k 31.62	2,656	-316	-20,869	-42,055	0	-60,584
HV Switchgear (GM) - Distribution	£k 12.02	4,109	0	-2,163	-8,411	-144,193	-150,658
HV Transformer (GM)	£k 12.12	860	0	0	-37,319	-4,847	-41,306
EHV Switchgear (GM)	£k 60.19	1,324	0	0	-29,493	0	-28,169
EHV Transformer (GM)	£k 519.60	5,196	0	0	-72,744	-155,879	-223,427
Overall Total HI Points		**14,146**	**-316**	**-23,032**	**-190,022**	**-304,919**	**-504,143**

Step 6: Calculate Achievement against Overall Target HI Score and Investment 'Delta'

At the time of the price control, each DNO provided HI profile forecasts for each network at the end of the DPCR5 period, which were used to define Agreed Network Outputs.

The sum of the difference between the forecasts with and without investment for each asset category weighted by both HI rank and by unit cost is the total volumetric value of the HI delta which is then used to determine progress against targets. This figure is calculated as a proportion of the total DPCR5 delta (as a %) and can be used to monitor NLRE progress throughout the regulatory period relative to agreed network output targets.

Table 9: Example Achievement Score by Asset Category

ASSET CATEGORIES	DPCR5 Agreed Output Targets Overall Pts		RRP Specific Progress Values Overall Pts		RRP Progress % Overall Pts
HV Network					
HV Switchgear (GM) - Primary	2111552		-280153		-13.27%
HV Switchgear (GM) - Distribution	2284283		-349836		-15.31%
HV Transformer (GM)	128351		-70252		-54.73%
HV OHL Support - Poles	692281		-55259		-7.98%
EHV Network					
EHV Switchgear (GM)	500540		-19261		-3.85%
EHV Transformer	3892308		-425031		-10.92%
EHV UG Cable (Oil)	0		0		0.00%
EHV OHL Support - Poles	274517		-1325		-0.48%
TOTAL	**18,339,313**		**(1,309,995)**		**-7.14%**

SPEN's 2011/2012 RRP submission highlighted that the scoring methodology adopted by SPEN was inconsistent with those adopted by some other DNOs as a consequence of largely focusing on asset additions. Recalculation of HI achievement using asset disposal data revealed substantially lower achievement scores for both SPD and SPM and therefore provided strong incentives for SPEN to initiate a data improvement project to validate all asset addition and disposal data from the start of DPCR5.

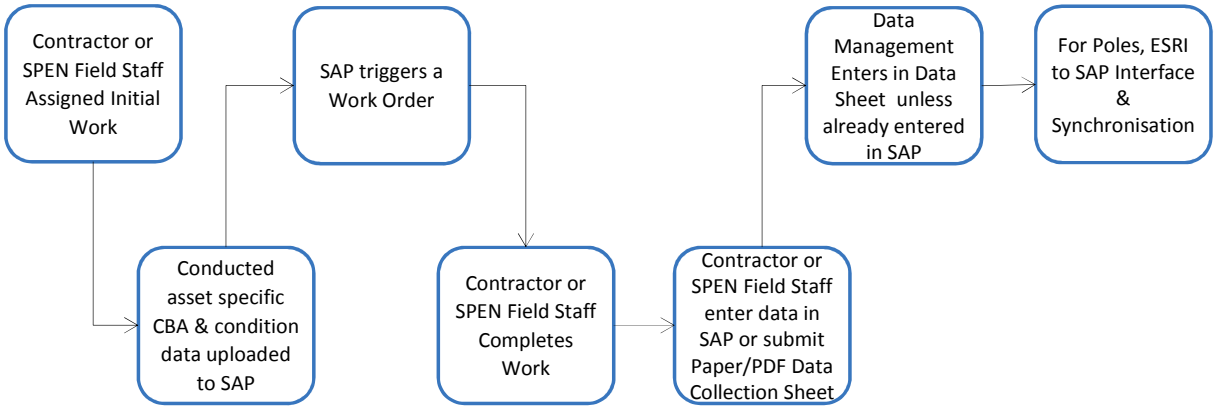
3 SPEN: ASSET HEALTH RECORDING PROCESS

This section describes the high-level approach adopted by SPEN to collect and reconcile the asset addition and disposal volumes in the SPD and SPM network areas for both plant equipment and overhead line supports. It also explains the underlying causes of the data discrepancies in the reported asset movements and the mitigations being implemented in the short and longer terms to avoid recurrence.

3.1 General Overview of SPEN Data Capture Processes and Systems

While differences exist between the detailed processes for collecting and reconciling asset volume movements across the various asset types, there is a common high-level process for capturing new additions and disposals within SPEN's IT systems, as well as common data fields and systems for processing such information. The process involves multiple information exchanges between central asset management functions and field engineers using various IT systems, as outlined below.

Figure 1: General Data Collection Process for Pole and Plant Assets



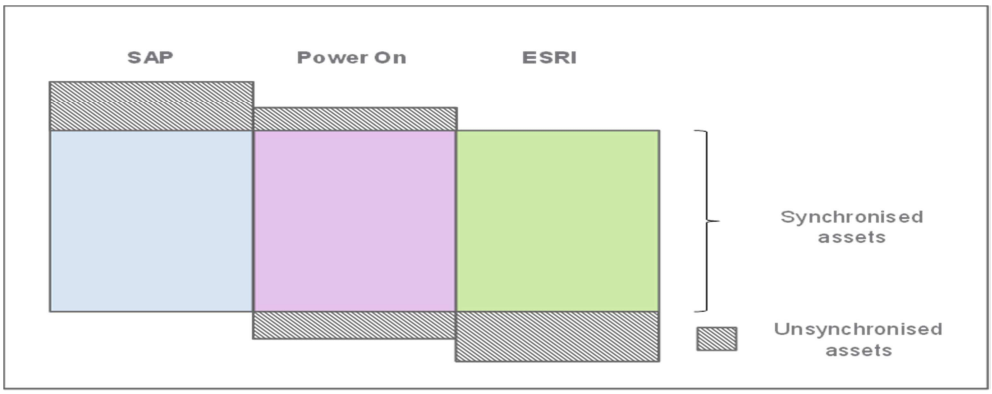
SPEN utilises three main databases for recording the type, location, condition and operational status of network assets: GE's PowerOn Distribution Management System, ESRI, and SAP. PowerOn is a combined SCADA and DMS application which is used to monitor and control the operational status of individual network component but contains a limited amount of HI related data. PowerOn is now

SPEN's standardised system for the operation and control of the SPD and SPM networks and therefore provides detailed information regarding the operational status of network assets.

For overhead line supports, the master database and asset register is ESRI. ESRI is a Geographic Information System (GIS) software and geodatabase application. ESRI asset information is synchronised with SAP in order to provide maintenance and inspection programmes, as well as recording pole condition information and defects. Plant assets are recorded directly in SAP which therefore provides the master database and asset register for switchgear and transformers.

As a result, when extracting asset volume data, pole related data is extracted from ESRI and plant data from SAP. However, data is synchronized across all three databases, but is limited to only select data depending on the asset. Consequently, common data exists across all three systems depending on the data field.

Figure 2: Asset data synchronization across major IT systems



3.2 Asset Data Discrepancies

This section explains the main reasons for the discrepancies in the number of reported asset additions and disposals that have arisen across SPEN's networks and have resulted in significant divergence between actual and reported work volumes delivered in the first two years of DPCR5. For reporting purposes, each asset group has been segregated into the following areas: Data collection, systems and processes.

The analysis was conducted separately for overhead line and plant assets mainly as a consequence of the primary data residing in different databases as described in Section 3.1, differences in the criteria for asset interventions and HI categorisation, and variations in the processes adopted to correct NLRE asset intervention volumes and associated HI ranking inaccuracies.

During the course of SPEN's investigations, a number of common reasons became apparent as to why asset addition and disposal information had been inaccurately recorded in the initial RRP submission. However, the main causes of the inaccurate reporting are summarised in Table 10.

.

Table 10: High-level summary of reasons for incorrect recording of additions & disposals

Asset grouping	Main reasons for asset addition/disposal inaccuracies
Plant – Switchgear and transformers	Disposals not fully captured due to misallocation of new asset information
	Disposals missing from SAP
Overhead line supports	Pole data missing from SAP & ESRI
	Incorrect assignment of pole HI upon replacement

These broad asset groupings contain a number of specific asset categories as summarised in Table 11.

Table 11: Specific asset categories contained within plant and pole asset groupings

Plant Assets	Pole Assets
HV Switchgear (GM) - Primary	LV OHL Support
HV Switchgear (GM) - Distribution	HV OHL Support - Poles
HV Transformer (GM)	EHV OHL Support - Poles
EHV Switchgear (GM)	
EHV Transformer	
132 kV Transformers (SPM only)	

3.2.1 Plant assets – switchgear and transformers

The two dominant causes of data discrepancies for plant assets relate to the inaccurate capturing of work undertaken on SPEN's networks which was either work relating to assets input to SAP but classified under an incorrect asset activity (misallocations) or work not entered in SAP ('missing').

Misallocations

SAP Input Data Sheets Allow Asset Activity Misclassification

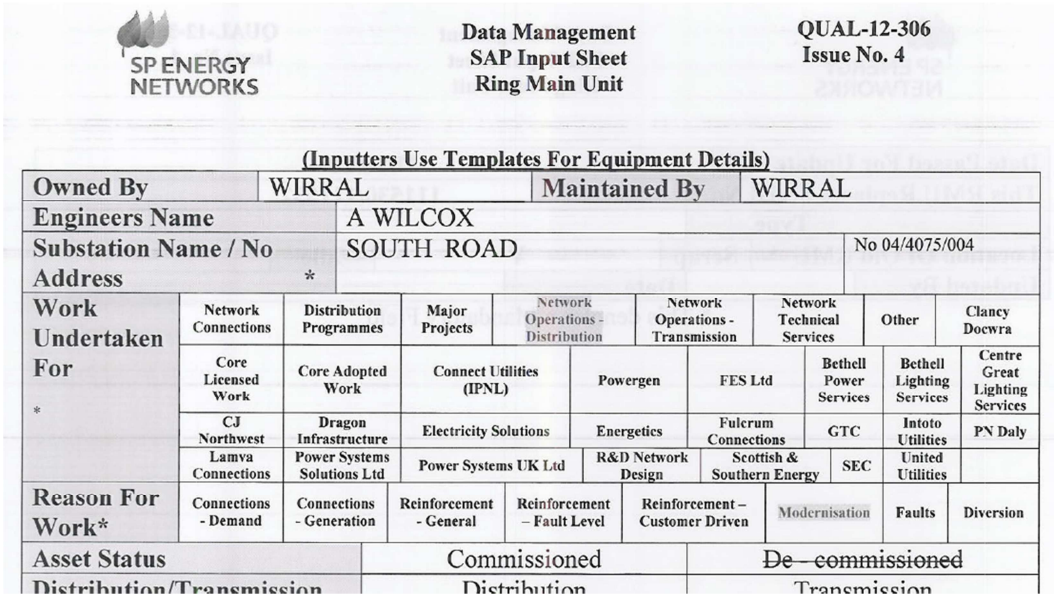
All work done on SPEN assets are assigned an Asset Activity, which confirms the reasons for work undertaken. This data field classifies the driver behind asset register movements. For example the cause of the work may have been faults or customer connections. For HI output reporting, Ofgem has narrowed the definition to primarily focus on Asset Replacements movements, however, other movements are relevant when identifying additions and disposals including refurbishments and assets removed from the system due to faults.

Table 12: SPEN Asset Activity types

Asset Activity in SAP	Description
Asset Replacement	• Driven by asset degradation, • Criticality: stakeholder impact of a failure based on safety, environmental sensitivity, economic and financial costs
Data Cleanse	• Identifies a legacy asset not included in the overall asset register.
Demand Connections	• Activity driven by load related new connections
Diversions	• Reconfiguration of network infrastructure and circuit in response to external locational factors
General Reinforcement	• Work to increase network capacity in response to changing customer demand or generation requirements
Generation Connections	• Activity from new connections driven by new generation being added to the system
Other (Faults)	• Faults
Unknown	• Default when asset lacks a 'Reason for Work' value, which is normally captured by the field in SAP data sheets.

The Asset Activity field is populated by field staff on data sheets when work is complete. This is then provided to Data Management to be entered into SAP. As it is a paper based data sheet, field staff have been able to select conflicting values for fields that are eventually entered into SAP. For example, a project engineer could be replacing an end of life asset, which should fall under 'Modernisation' as the 'Reason for Work.' The paper-based tool, however, allows for any field to be selected in the 'Work Undertaken For' category, such as 'New Connections'. This invalid combination may then be incorrectly entered into SAP and can only be reconciled through subsequent data validation later in the process. The figure below is an example of the data sheets used in the period 2010 – 2012.

Figure 3: Data sheet for Plant SAP data input



SP ENERGY NETWORKS

Data Management
SAP Input Sheet
Ring Main Unit

QUAL-12-306
Issue No. 4

(Inputters Use Templates For Equipment Details)

Owned By	WIRRAL			**Maintained By**	WIRRAL			
Engineers Name	A WILCOX							
Substation Name / No Address *	SOUTH ROAD							No 04/4075/004
Work Undertaken For *	Network Connections	Distribution Programmes	Major Projects	Network Operations - Distribution	Network Operations - Transmission	Network Technical Services	Other	Clancy Docwra
	Core Licensed Work	Core Adopted Work	Connect Utilities (IPNL)	Powergen	FES Ltd	Bethell Power Services	Bethell Lighting Services	Centre Great Lighting Services
	CJ Northwest	Dragon Infrastructure	Electricity Solutions	Energetics	Fulcrum Connections	GTC	Intoto Utilities	PN Daly
	Lamva Connections	Power Systems Solutions Ltd	Power Systems UK Ltd	R&D Network Design	Scottish & Southern Energy	SEC	United Utilities	
Reason For Work*	Connections - Demand	Connections - Generation	Reinforcement - General	Reinforcement – Fault Level	Reinforcement – Customer Driven	Modernisation	Faults	Diversion
Asset Status	Commissioned			~~De - commissioned~~				
Distribution/Transmission	Distribution			Transmission				

Another significant issue which has complicated the accurate recording of asset additions and disposals is that the work sheets have not historically included SPEN's unique asset identification number or 'ENID'. This has necessitated the manual interrogation of asset data for equipment changes in order to match additions with disposals (and vice versa). Such matching of additions and disposals has been based on SAP data extracts and achieved through retrospective validation of historic work undertaken by both contractors and SPEN staff.

Data Capture Processes

The Data Management team entering data into SAP has not been responsible for validating the information provided by field staff. This can sometimes result in two different issues. The first is that incorrectly filled out data sheets are entered into the system with errors remaining, and less frequently, some data sheets can be omitted from SAP entirely. A further complication has been that different staff within the data Management function were entering the additions and disposals into SAP for the same asset. This has led to timing issues for assets being added without corresponding disposals, and an increased number of data entry errors.

Missing Data

In addition to the misallocation of asset data described above and the omission of a relatively small number of work sheets from SAP with associated time lags, there have been other factors which have also incorrectly reduced the number of asset disposals reported by SPEN. These are discussed below.

SAP Input Data Sheet – initial submissions predominantly focused on asset additions

Programme Managers are tasked with implementing investment plans by commissioning new assets (additions) on SPEN's networks. Historically, Programme Managers have been focussed and incentivised on the physical delivery of SPEN's capital programme and less on the accurate reporting of disposals with IT systems. This training and cultural issue applies to both internal staff and contractors and has resulted in many plant related disposals being omitted from HI reporting in the first two years of DPCR5. However, more recently exception reporting and frequent meetings with Programme Managers has proven a successful, if manual, method of matching missing disposals with reported asset additions. SPEN internal reporting has been enhanced to show the difference between physical work claimed and whether such activity has been registered in SAP/ESRI. These measures have improved field staff behaviours as Programme Managers must ensure all asset data is input within IT systems to meet personal objectives.

Inclusion of asset replacements caused by faults

In the first two years of DPCR5, not all asset replacements associated with faulted network components were accurately recorded in SPEN's HI achievement statistics. Measures have now been implement to ensure that disposals (and additions) associated with faults now contribute to HI delivery scores as reported in 2012/2013. This issue was compounded by failures to update the HI of faulted equipment (to HI5) in order to correctly report the contribution of such replacements to the overall HI score.

Tracking of asset refurbishments

SPEN has undertaken relatively few asset refurbishments in the initial years of DPCR5. However, there has been a refurbishment programme for 11 kV transformers in SPM. SPEN's asset information systems have not been able to effectively track disposals associated with asset refurbishments. This is

because SPEN's systems rely on an asset's unique identifier (ENID) to be recorded as decommissioned in order to log a disposal. Clearly in the case of refurbishments, where each asset is subsequently reinstated on SPEN's networks (perhaps in a different location) with an extended asset life but the same ENID, no disposal is automatically recorded even though NLRE investment has been committed and asset health has improved. Consequently, SPEN has recently implemented a manual process to capture HI benefits arising from refurbishments which are now included in 2012/2013 HI achievement scores. As previously mentioned, SPEN has a robust policy for asset refurbishment which targets the refurbishment of HI4 assets rather than HI5 assets (deemed 'end of life' and therefore not suitable for refurbishment).

Delayed decommissioning of disconnected circuit breakers

When decommissioning circuit breakers within a switchboard, situations can arise where the circuit breakers are disconnected incrementally over time but remain in the switchboard until the entire panel can be removed and decommissioned. A disposal data sheet is not filled out for these assets until the last breaker is removed from the board and the ENID logged as decommissioned. As these disconnected breakers are not actually removed, they are not given a decommission date and are therefore not captured in SAP as disposals until there entire panel is decommissioned. This leads to disposals being omitted from the SAP database and not associated with any corresponding additions. Furthermore, this results in a temporary mismatch between PowerOn data and SAP data. For the 2012/2013 submission, manual processes have been implemented to capture these assets which have been removed from service order to avoid a potentially extended reporting time lag.

Lost Data Sheets Resulted in Completely Missing Register Movements

As the data sheets are paper-based, these sheets are occasionally not submitted, lost or accidentally damaged. This means that some work has not been captured in SPEN's IT systems and therefore does not get included in the initial SAP or ESRI data extract. This is different from the work being captured, but misallocated to the incorrect 'Asset Activity' code.

Organisational changes and SAP Rollout in 2010

The start of DPCR5 in 2010 coincided with major organisational changes and major IT system transitions at SPEN, particularly in relation to the implementation of the new SAP based asset register. Data migration issues resulted in missing asset information which compounded both work scheduling activities and the accurate monitoring and reporting of HI related achievements scores.

3.2.2 Overhead Line Supports

The main issues identified impacting HI achievement scores in the overhead line support category (predominantly poles) relate to capturing multiple missing pole disposal records, which was compounded by incorrect HI rankings of pole disposals recorded on SPEN systems during the first two years of DPCR5. Both factors had the effect of depressing the reported HI score attributable to overhead line supports.

However, similar reporting issues to those impacting plant items also apply to pole data including; asset additions without corresponding asset disposal records, inaccurate capturing of investment drivers etc. The following sections discuss the factors impacting poles in more detail.

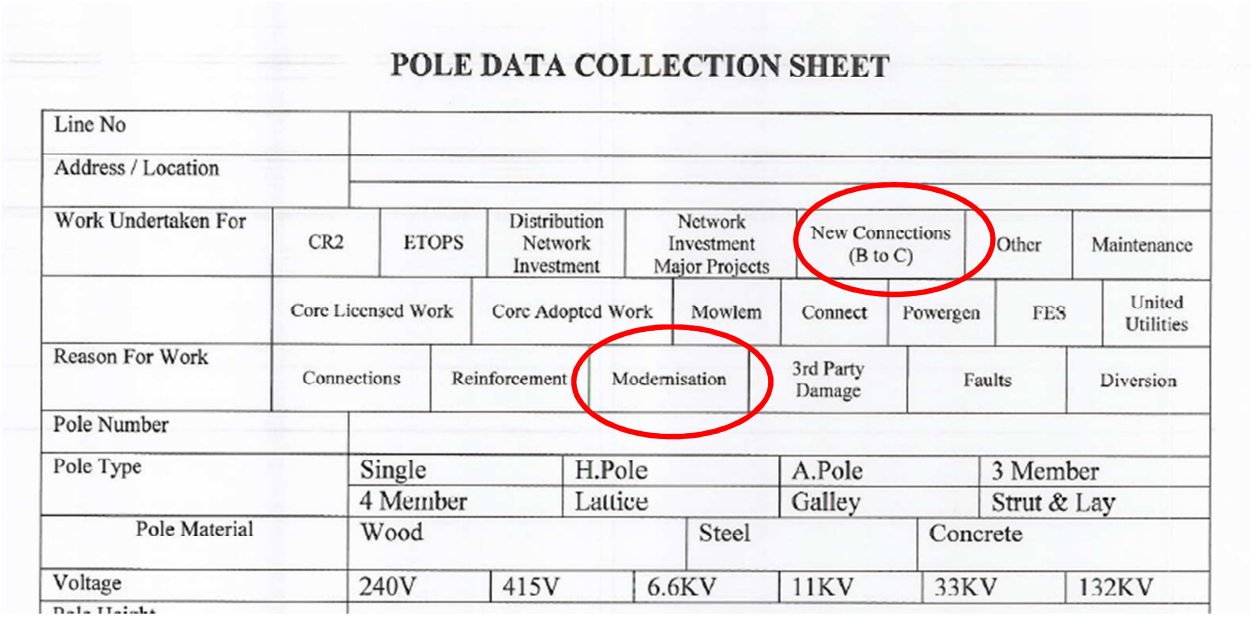
Capturing Correct Volumes

Pole Data Collection Sheets

In the Pole Data Collection Sheets, Asset Activity is again related to the 'Reason for Work'. This paper based information is submitted to the Data Management function for input within SAP. As the system relies on written paper based information, field staff are able to choose conflicting values for fields that result in the 'misallocations' of disposals to the wrong Asset Activity, e.g. misallocation of asset replacement work to reinforcement and connection activities.

To illustrate this point, it is possible for a rotten pole replacement, which should fall under 'Modernisation' as the 'Reason for Work', to be inadvertently recorded as a 'New Connection'. This then is incorrectly entered into SAP and can only be reconciled through data validation later in the process. Asset Management are currently in the process of producing a new guidance document, along with a revised input form to assist more accurate data entry from field staff.

Figure 4: Pole Data Collection Sheet for Reporting Period 2010 - 1013



POLE DATA COLLECTION SHEET

Line No								
Address / Location								
Work Undertaken For	CR2	ETOPS	Distribution Network Investment	Network Investment Major Projects	New Connections (B to C)	Other	Maintenance	
	Core Licensed Work	Core Adopted Work	Mowlem	Connect	Powergen	FES	United Utilities	
Reason For Work	Connections	Reinforcement	Modernisation	3rd Party Damage	Faults	Diversion		
Pole Number								
Pole Type	Single	H.Pole	A.Pole	3 Member				
	4 Member	Lattice	Galley	Strut & Lay				
Pole Material	Wood	Steel	Concrete					
Voltage	240V	415V	6.6KV	11KV	33KV	132KV		

SAP Data Extract for 2010/11

As highlighted in the plant section, SPEN implemented SAP as the asset register for both networks in 2010. While ESRI is regarded as the master database for poles and other linear assets, data is synchronised with SAP in order to provide maintenance and inspection programmes, as well as recording pole condition information, including defects. For the 2010/11 RRP submission, it was believed that SAP and ESRI would provide the same information, as all poles in ESRI were supposed to be replicated in SAP.

However, in 2010/2011 SPEN was at an early stage of aligning SAP and ESRI pole information. Since SAP held the condition information, SPEN decided to use SAP as the basis for HI reporting in 2010/11, without robust linkages to ESRI data. This was in part due to a time constraint preventing the ESRI and SAP databases being fully synchronised. The 2010/11 RRP submission was based on a data extract from SAP and therefore did not contain all relevant ESRI data for that period. Therefore, identifying genuine pole asset disposals has proved to be challenging during this period with multiple replacement records being missed.

SAP Data Linkages to ESRI

There was an additional issue with SAP data linkages to ESRI. Asset activity information (e.g. asset replacement, modernisation etc.) was lost because information from the Pole Collection Datasheet was not linking to SAP during database synchronisations. This ultimately affected approximately 30,000 poles in the 2010 – 2012 periods by leaving asset activity blank. The Asset Activity field 'Asset Replacement' is used to determine asset register movements for additions and disposals for Health Index calculations. These additions and disposals were not captured in the original SAP extract in 2010/11 and instead fell into an 'Unknown' category, lacking the reason for the work undertaken, the date work was completed and any corresponding addition and/or disposal information. This was not identified and corrected until 2012.

AIS to SAP Data Migration

A further asset information data migration problem resulted in approximately 24,000 pole defect records in the SPD and SPM network areas not being transferred into the SAP defect reporting system during the migration of data from AIS to SAP.

These poles had previously been flagged with one of the defect codes listed below. However this information was recorded as 'Unknown' in ESRI and SAP. Consequently, an estimation methodology was required to categorise these unrecorded poles as described below.

- I = Immediate defect
- E = Early
- P = Programmed

The original dataset was subsequently used to validate the 2010/11 data.

Assigning HI Ranking to Poles

Toughbook Rollout to Contractors and SPEN Field Staff

In 2012, SPEN rolled out the deployment of Toughbook hand-held mobile computers to capture asset Condition Based Assessment (CBA) data. This deployment happened gradually, resulting in CBA data being electronically transferred or input from paper-based sources. In addition, 'As-Needed' work done on the spot would not have been entered into the Toughbook, resulting in CBA data not being fed into the SAP before work was completed.

Given the phased introduction of Toughbooks, situations arose where work was completed, but not captured in the Toughbooks. To capture this work retrospectively following Toughbook deployment, contractors raised defects for poles to ensure the work fed into SAP. This resulted in some instances of incorrect assignment of HI codes with some new assets being assigned the previous asset's disposal code of HI5 (rather than HI1).

Pole Anomaly Codes for Rotten & Corroded assets

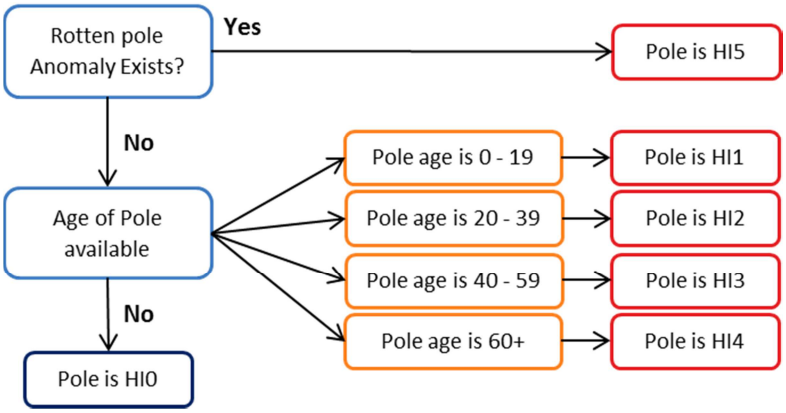
For the first two years of DPCR5, field staff did not routinely collect HI pole condition related data unless requirements for unplanned replacements emerged during regular inspections or due to faults. To identify poles needing immediate removal, however, 'Rotten/Corroded' would be entered into the description field of the CBA. This would trigger work to replace the pole, thus enabling the HI value to be automatically assigned to a 5. However, not all disposals received this code unless it went through

this process of prior inspection. Consequently, many poles removed for other reasons did not have the HI ranking updated and therefore SPEN could not be certain whether the asset removed was a genuine HI5 or not.

Previous HI Assignment Policy/Methodology

The methodology of assigning a Health Index value in 2010/11 and 2011/12 was based predominantly on whether the pole had a 'Rotten Pole Anomaly Code' assigned to the asset and then the pole's age. A field for Health Index does not currently exist within SAP or ESRI. As such, SQL code has been applied to the ESRI data which assigns values of HI0 – HI5 to pole assets according to the business rules in Figure 5 below.

Figure 5: Health Index Assignment Methodology for RRP 2010 - 12[5]



Note that this methodology assigns some assets a value of HI0. This indicated that existing ESRI data was insufficient to assign a value. When revising this HI data, a process was developed to assign the HI0 poles to a valid rank in order to create the most complete data set possible based on specific asset data.

Where insufficient data exists to reliably assign an appropriate HI value to an asset, the remaining HI0 asset disposals were divided across the HI rankings1 – 4 in the same proportion as the existing profile as shown in Table 13. This was a last resort mechanism for assets which could not be validated against known sources. HI0 asset for new additions were assigned a ranking of HI1. The problem was that a large number of asset movements were assigned as HI0 and had to be investigated further to determine the correct rank.

[5] Note that this is referenced within the internal document, "Regulatory Reporting Pack – Wooden Poles: Guidance Document", dated June 2013, version 1.5.

Table 13: Example of apportionment of HI0 assets across existing HI profile

Asset Activity	HI0	HI1	HI2	HI3	HI4	HI5	Total
Existing Profile	**750**	0	50	200	500	750	**2250**
Percent Contribution	-	0%	7%	27%	67%	-	
New Profile After Spread	**0**	**0**	**100**	**400**	**1000**	**740**	**2250**

3.3 Steps to correct source data

One of the primary reasons for the significant volume gap between additions and disposals was due to data collection process shortcomings from the field. These data issues spanned the first 3 years of DPCR5, as the realisation that data was incorrect only became apparent in Q4 of 2012. As a result, data cleansing began in mid-November 2012.

Data revision activities focused on capturing the correct volumes of additions and disposals to close the volume gap, and to correctly assign HI values to those assets. The ultimate objective being to accurately capture the amount of work completed against plan and report the correct HI Achievement Score.

3.3.1 Methodology for Revising Plant Source Data

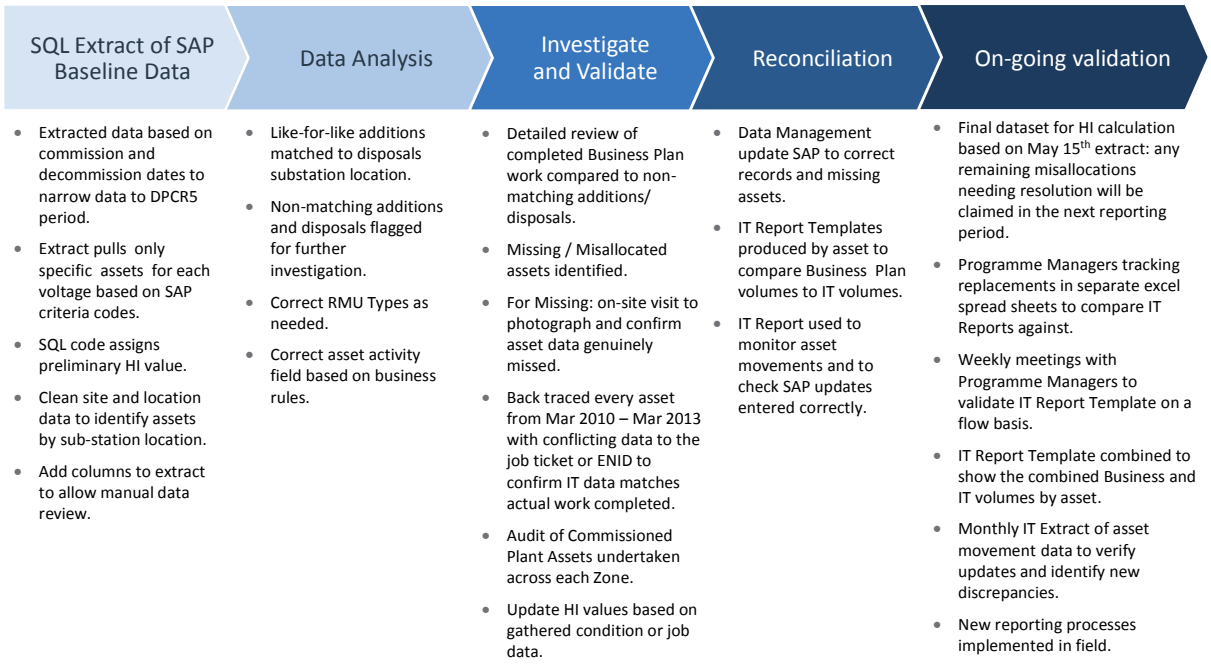
An initial data extract was first conducted from SAP on November 3rd, 2012. This became the baseline from which future updates and validation were to be based on. Mismatches of additions and disposals were first sought within the Asset Replacement activity within the extract.

A report was created, called the IT Report Template, which lists each plant by site, sourced from SAP. The reason the list was by site, is because this was then used during weekly meetings or to query the programme managers. Each report was assigned to a programme manager. When the number of additions and disposals did not match, the programme manager was asked to explain the delta. This report was a view of what work was actually entered into SAP by the Data Management function. This was the primary method for identifying missing disposals and additions not entered into the IT system.

The IT Report Template is run to identify discrepancies between volume movements in SAP with work actually completed by Program Managers in the field. If managers are unable to determine the type of asset intervention, they investigate the asset further either with the field engineer who conducted the work, site surveys, and/or reviewing the original data sheet submitted.

Revised data was then uploaded into SAP and the IT Report run monthly to verify data is correct. Figure 6 below describes in greater detail the activities done at each stage. PA believes the methodology adopted for validating and revising plant related asset additions and disposals to have been comprehensive and robust. However PA also recognises that implementation has been a highly manual, labour intensive and iterative process. Consequently, it will be imperative to maintain accurate data records to avoid repetition of this process in future. PA also recognises that whilst a number of business process improvements have been implemented, many of the processes for maintaining data alignment remain paper based and reliant on accurate initial data population.

Figure 6: High-level process for revising plant data



3.3.2 Methodology for Revising Pole Source Data

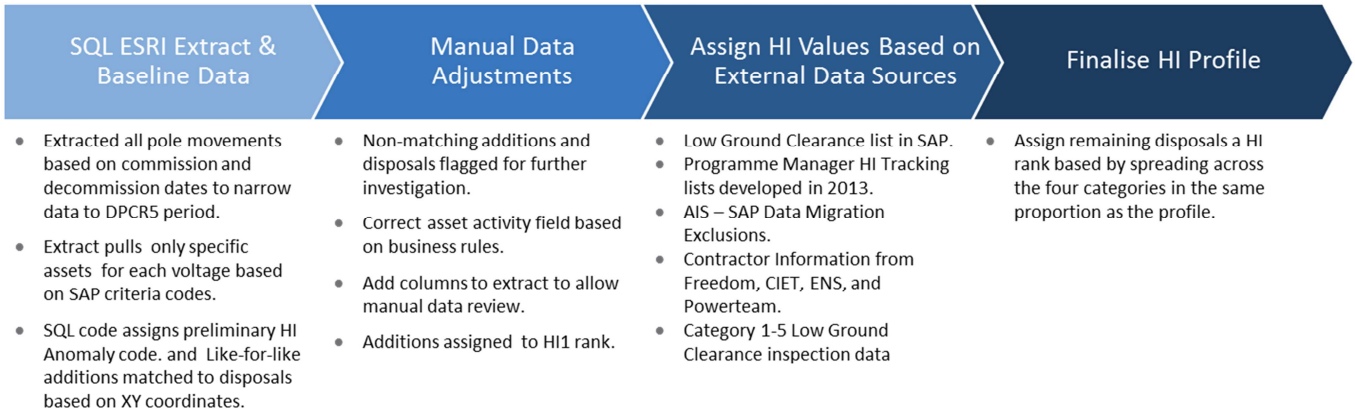
Unlike the process for revising plant data which updated SAP directly, overhead support revisions were developed in an Access database where all revisions were made. In addition, all input and output datasets can be found within this 'Pole Database.' Given the large number of physical assets, validation in the field or by checking against submitted data sheets would be time consuming. SPEN instead developed a series of data revision rules which were applied within the Pole Database. The figure below outlines the high level process which took place to perform data revisions.[6]

PA believes the methodology adopted for validating and revising pole related data has been comprehensive and robust. Similar to comments made for plant items, PA recognises that implementation has been a highly manual and iterative process which was complicated by large asset populations and significant quantities of uncertain asset information. Again, it will be imperative to maintain accurate data records to avoid repetition of this process in future. PA believes that there could be significant scope to improve the robustness of 'business as usual' processes in future through the use of mobile technology linked to asset information systems to accurately record asset information directly with SPEN databases.

It should also be noted that whilst the number of asset interventions on poles substantially exceeds those in other asset categories, unit cost considerations mean that the relative impact of individual pole changes is significantly less material than for some of higher cost asset types.

[6] This process can be found in further detail within an internal document titled, "Regulatory Reporting Pack – Wooden Poles – Guidance Document"

Figure 7: High-level process for revising pole data



3.4 Process changes made to prevent repetition of data source errors

From 2010 to 2012, SPEN has focused on capturing additions correctly in the belief that this was the foundation for calculating HI scores. When informed by Ofgem in the fourth quarter of 2012 that their methodology was in fact incorrect, SPEN became aware that this focus on additions hid the fact that disposals were not being captured correctly. In an effort to ensure data for both ED1 as well as the 2012/13 RRP submission reflected both the correct methodology and volumes of additions and disposals, SPEN undertook an immediate data revision exercise. Whilst this addressed immediate short-term needs, enhanced procedures have also been established to ensure the revised rigour in asset reporting is maintained in the long term.

3.4.1 Immediate Improvements

Given the urgency to reconcile a significant number of asset data anomalies, SPEN developed a set of *ad hoc* data validation processes and tools over the succeeding six months. This report concentrates upon the revisions and process improvements that have been implemented as short-term fixes. However, further process improvements to formalise/automate these interim solutions for data revisions need to be evaluated in the longer-term[7].

Greater Role for Programme Managers

In January of 2013, SP Programme Managers in charge of delivery began to track and record additions and disposals manually along with any asset condition information used to determine HI values. This allowed SPEN to improve monitoring of contractor delivery, as well as compare the data held within IT systems. The separate tracking sheet is being used to justify any revisions to HI values that are not reflected within IT systems due to the data collection issues mentioned above or due to a

[7] SPEN is evaluating various IT proposals for enhancing system capability, new reporting requirements for Programme Managers and revised internal reporting (manual vs. IT). In addition, 2 process experts "Black belts" have commenced work on formal improvements to processes. SPEN is also conducting random sample audits of completed work.

time lag between reporting the work and recording it within IT systems. Managers now submit on a monthly basis the number of units planned to be replaced during the month by Asset type.

Improved Data to Field Engineers

A new template has been issued containing site, volumes, work completed and equipment type fields. Rather than requiring contractors to 'complete 8 CBs', work orders now specify the asset by ENID number (plant) or XY coordinates (pole). In addition, data sheet information requirements have been rationalised to reduce the amount of inaccurate data collecting. For example, data sheets used within SPM have removed Business Unit and Reason for Work options so that each form only states the work undertaken as 'Distribution Programmes' and the reason for work as 'Modernisation'

Weekly Meetings with Programme Managers to Validate Data

In addition, the Planning and Delivery teams now have weekly follow up meetings to ensure data sheets are sent from field staff and populated accurately. Managers now compare the amount of completed work to IT reports. In addition, they also review individual data sheets from the field to reinforce requirements to following these enhanced procedures and to review conflicting data.

3.4.2 Summary of process and system changes

Table 14 and Table 15 summarise the process and system improvements that SPEN has implemented, or is planning, to further improve and maintain the rigour of asset addition and disposal reporting, hence ensuring the accuracy of future HI achievement scores and regulatory submissions.

Table 14: Summary of Plant Issues and Resolutions

PLANT	Issue	Sub-issues	Immediate Process Changes implemented	Planned Long Term Process Improvements and System Updates
Misallocation	**SAP Input Data Sheets**	Data Sheet Guidance documentation	Providing guidance to Project Engineers on the relevance of Data Sheets and how to populate. Reinforcing this with regular review, where incorrect data sheets are reviewed and corrected with the Engineers.	Electronically collecting this data to implement data selection rules.
		Misallocation of disposals to the wrong Asset Activity	Asset data sheets revised to improve accuracy of completed Asset Replacement work by removing the Business Unit and Reason for Work fields. Work instructions now focus on 'Distribution Programmes' where the reason for work is classified as 'Modernisation'	Electronically collecting this data to implement data selection rules.
		Lacked ENID	An ENID needs to be captured for all asset interventions, which is then checked if an update occurred in SAP by checking against the following month's IT Report.	Electronically collecting this data to implement data selection rules.
Missing	**Data Validation Processes**		11kV Plant Data Sheets are now collected and passed through to Data Management via a single PDG on a monthly basis and represents the full programme of work completed for the month.	Greater role for Programme Managers to proactively capture HI data correctly.
	Tracking of refurbishments		A manual process has been implemented to accurately record all refurbishment activities for inclusion in HI achievement score. This currently resides outside the reporting framework for asset replacements	Under consideration
	Delayed decommissioning of disconnected circuit breakers		A manual process has been implemented to log all disconnected assets removed from the networks so that such disposals can be included in HI achievement scores.	Under Consideration

	Incorrectly capturing commission and decommission dates	Cross checks of commissioning & decommissioning dates according to contractor or Programme Manager to determine when assets were physically removed or added.	SAP Change Request to make Commission and Decommission Data mandatory fields for disposals.

Table 15: Summary of Overhead Support Issues and Resolutions

POLES	Issue	Description	Immediate Process Changes implemented	Planned Long Term Process Improvements and System Updates
Capturing Correct Volumes	**Pole Data Collection Sheets**	Misallocation of additions & disposals across different asset activities, resulting in disposals not being assigned to Asset Replacement.	Provided additional training to Field Engineers	Asset Management are currently in the process of producing a new guidance document, along with a revised form.
		Misallocation of disposals to the wrong Asset Activity	Applied a series of Data Revision Rules to determine the correct asset activity type.	
	Data Validation Processes		Provided additional training to Data Management staff and Field Engineers	Black Belt Six Sigma process review underway
	ToughBook Rollout	Timing	Applied a Data Revision Rule: If an addition has an HI5 and the HI anomaly code was set after the Addition date of the pole, the matching disposal should be the HI5 and the addition given an HI1.	Only applies to 2010/12 data

POLES	Issue	Description	Immediate Process Changes implemented	Planned Long Term Process Improvements and System Updates
		Raising Defects	Have instructed field staff to no longer do this.	Only applies to 2010/12 data
	SAP Related	Data Extract from SAP Instead of ESRI for 2010/11 data validation	Corrected the overnight update in 2012.	Only applies to 2010/12 data
		SAP Data Linkages to ESRI	~30,000 poles that fell into the 'Unknown' category, lacked the reason for work, date completed, and any corresponding additions or disposals information. Additions and disposals were not picked up in the original SAP extract in 2010/11.	Only applies to 2010/12 data
		AIS Data Migration: 24,000 rotten poles spread across both SPD and SPM were not transferred into the SAP	In April 2013, the missing data was matched against the system and approximately 11,600 were transferred over to any remaining poles not already removed. Those already removed, however, were included in a separate Source Information data file which was used to cross check data against to match any disposals in the first three years of DPCR5 and also set the HI value.	Only apply to 2010/12 data
HI Rank Assignment	**Previous HI Rank Assignment Methodology**	Dependent on rotten pole anomalies, but not all disposals receive the Rotten Pole Anomaly code	Separate Pole Database created in Access for each DNO to assign HI values independently from the IT systems. Created a series of queries based on business rules found within document ASSET-01-019 ("Asset Health, Criticality & Outputs Methodology") are run to manually change HI scores. Leverage multiple data sources to justify the HI value of a pole and which Asset Activity it should be assigned to.	Create a Health Index database table within SAP or ESRI to both record HI scores and also track historical changes to the score as the asset deteriorates, reaches end of life, or faults.

POLES	Issue	Description	Immediate Process Changes implemented	Planned Long Term Process Improvements and System Updates
		Dependent on pole age	Approximate 800,000 records lack a commissioning date, which prevents automatic HI code assignment from happening based on asset age. However, age is gradually being updated via inspection data	Pole age banding updated based on a UK study that looked at the lifecycle of a pole and how it deteriorates. Reflects a more accurate HI profile for wooden poles.
		Low amounts of condition based assessment (CBA) data	Beginning in 2012, poles assigned a condition based HI value of 1-5 during inspections.	Will continue for all inspections going forward.

4 IMPACTS ON HEALTH INDEX REPORTING

Having analysed the reasons for significant changes to the numbers of asset additions and disposals recorded for plant equipment and overhead line supports in 2011/2012 and 2012/2013, PA has evaluated the impact on HI achievement scores as a result of these changes.

4.1 Validation of Health Index calculation methodology

PA has reviewed the application of SPEN's HI achievement scoring methodology to confirm that individual point scores and associated percentage achievement statistics have now been calculated correctly. PA can confirm that HI achievement scores have been based on the detailed methodology described in Section 2.3.

SPEN's HI achievement scores have been based on asset interventions relating to NLRE activities including asset replacement, refurbishments and equipment replaced due to faults, i.e. the latest achievement scores do not include asset volume changes attributable to reinforcement or connection activities. PA can also confirm that the HI scores have been calculated on the basis of HI movements arising only from SPEN's asset interventions.

PA has reviewed SPEN's HI achievement scoring methodology to confirm that scores are now correctly based on weighted asset disposals calculated net of weighted additions and multiplied by the correct unit cost factors in each asset category.

Overall PA can confirm that SPEN has correctly applied Ofgem's preferred HI achievement score calculation methodology for the reporting of NLRE related asset movements in the 2012/2013 RRP.

The adoption of the calculation methodology described above combined with significant changes to reported asset additions and particularly disposals has had a marked impact on the cumulative level of reported HI achievement at the end of 2012/2013 for the first 3 years of DPCR5 in both SPD and SPM.

The following sections provide insights regarding the scale of the changes observed and the impact on resultant scores.

4.1.1 Delta between revised and previously reported HI scores

Table 16 and Table 17 below show the original HI scores for SPD and SPM respectively as calculated for the 2011/12 RRP submission. These original cumulative figures for 2010/2012 (2 year period) were based on incorrect numbers of asset movements and the incorrect application of Ofgem's HI calculation methodology. These figures have been compared with the corrected cumulative data for 2012/2013 (3 year period) based on the revised calculation methodology. These figures highlight the extent of under reporting in HI achievement for plant items and overhead line support structures (poles) in both SPD & SPM in the 2011/2012 RRP submission.

Table 16: Comparison of total HI Score across relevant asset categories in SPD

SPD - Total HI Score by asset	Original 2010/12 RRP Values	Predicted 2012/13 Revised Cumulative Values	Difference in Score
LV OHL Support	- 68,921	- 420,903	- 351,983
HV Switchgear (GM) - Primary	- 4,194	- 368,594	- 364,400
HV Switchgear (GM) - Distribution	- 831,284	- 1,212,878	- 381,594
HV Transformer (GM)	- 61,086	- 137,778	- 76,692
HV OHL Support - Poles	- 68,333	- 542,687	- 474,355
EHV Switchgear (GM)	- 7,799	- 230,106	- 222,307
EHV Transformer	- 235,555	- 1,303,671	- 1,068,116
EHV OHL Support - Poles	- 36,270	- 117,812	- 81,542
TOTAL HI SCORE	**- 1,313,442**	**- 4,334,431**	**- 3,020,990**

As can be seen, significant movements in scores have been achieved (disproportionate to an additional year of delivery) in SPD for EHV transformers, HV switchgear and pole supports (both LV & HV). PA is satisfied that these changes to the achievement score reported previously are valid, based on the significant movements in numbers of additions and disposals which have been identified through the extensive data cleansing and validation process.

For SPM, significant movements in HI scores have been achieved for a similar range of asset types, i.e. EHV transformers, HV switchgear and pole supports (again LV & HV). This is to be expected given the common monitoring approaches adopted (with associated shortcomings) in both areas. PA is satisfied that the changes to the SPM achievement scores are also valid based on the significant movements in numbers of asset additions and disposals.

Table 17: Comparison of total HI Score across relevant asset categories in SPM

SPD - Total HI Score by asset	Original 2010/12 RRP Values	Predicted 2012/13 Revised Cumulative Values	Difference in Score
LV OHL Support	- 113,835	- 738,056	- 624,222
HV Switchgear (GM) - Primary	- 513,607	- 1,010,069	- 496,462
HV Switchgear (GM) - Distribution	- 766,000	- 972,742	- 206,742
HV Transformer (GM)	- 163,327	- 309,313	- 145,986
HV OHL Support – Poles	- 51,499	- 497,792	- 446,293
EHV Switchgear (GM)	- 118,428	- 170,278	- 51,849
EHV Transformer	- 432,240	- 2,095,019	- 1,662,779
EHV OHL Support – Poles	- 1,799	- 49,323	- 47,524
TOTAL HI SCORE	**- 2,160,735**	**- 7,476,907**	**- 5,316,172**

4.2 Analysis of assets with high impact on HI score to asset information source data

This section provides further insights regarding the main reasons for the discrepancies in asset addition and disposal volume data. The following tables and charts clearly illustrate the absolute and net changes to source data in the first 2 years of DPCR5 impacting achievement scores. This analysis has focussed on Distribution HV Switchgear, EHV Transformers, and Primary HV Switchgear.

As reported previously, the dominant causes of data discrepancies for plant assets relate to the inaccurate capturing of work undertaken on SPEN's networks either relating to assets input to SAP but classified under an incorrect asset activity (misallocations) or work not entered in SAP ('missing'). Table 18 and Table 19 (and the charts) show that the main cause of plant related data inaccuracies to be missing asset disposals.

Table 18: Breakdown of causes for misreported asset additions and disposals in SPD

Type	Reason Code	Description	Reasons for Disposal Discrepancies	EHV Transformers		HV Switch Gear (Primary)	
				2010/11	2011/12	2010/11	2011/12
Disposal	A	Misallocated Disposal	Incorrectly categorised as a Fault, Connection, Unknown or Data Cleanse when it should have been asset replacement or vice versa	1	2	40	70
	B	Misallocated Disposal	Incorrectly categorised as asset replacement	-7		-21	-8
Addition	C	Misallocated Addition	Incorrectly categorised as Demand Connection or a Reinforcement and should have been asset replacement		4	5	20
	D	Misallocated Addition	Incorrectly categorised as asset replacement			-8	-6
Disposal	E	Missing Disposal	Not entered into SAP before revision activities			2	2
Additions	F	Missing Addition	Not entered into SAP before revision activities				
Disposals	G	Other Disposal	Wrong Year		-1	4	-2
Additions	H	Other Addition	Wrong Year				

Figure 8: Changes to SPD Asset Additions & Disposals for EHV Transformers

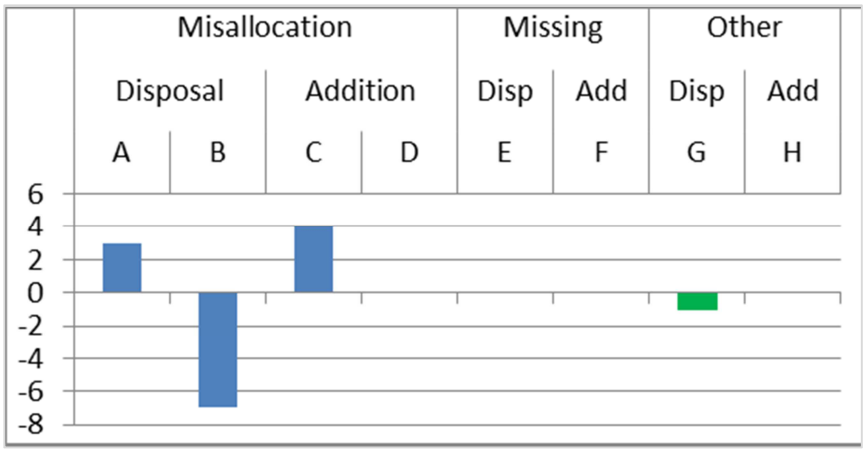


Figure 9: Changes to SPD Asset Additions & Disposals for HV Switchgear (Primary)

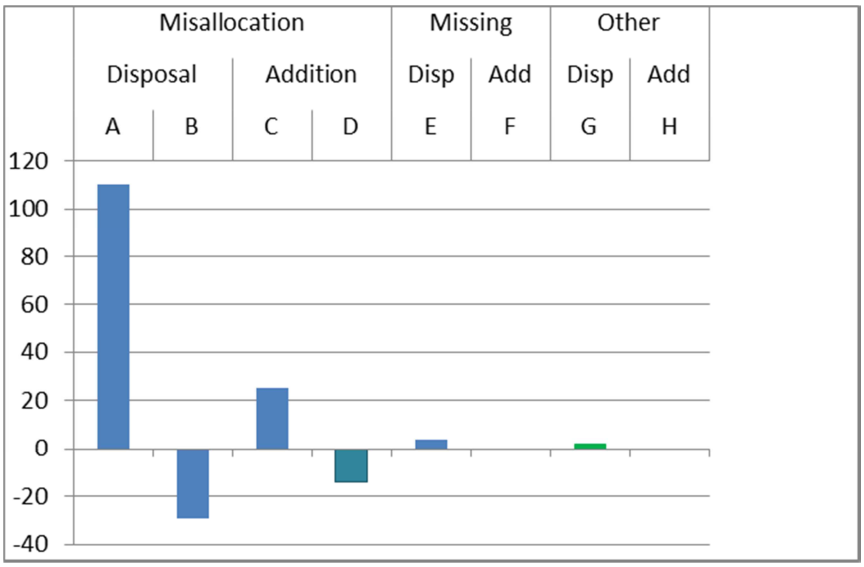


Table 19: Breakdown of causes for misreported asset additions and disposals in SPD

Type	Reason Code	Description	Reasons for Disposal Discrepancies	EHV Transformers		HV Switch Gear	
				2010/11	2011/12	2010/11	2011/12
Disposal	A	Misallocated Disposal	Incorrectly categorised as a Fault, Connection, Uknown or Data Cleanse when it should have been asset replacement or vice versa	4	3	23	28
	B	Misallocated Disposal	Incorrectly categorised as asset replacement		-4	-3	-9
Addition	C	Misallocated Addition	Incorrectly categorised as Demand Connection or a Reinforcement and should have been asset replacement	-3	-3	8	
	D	Misallocated Addition	Incorrectly categorised as asset replacement		-2	-5	-40
Disposal	E	Missing Disposal	Not entered into SAP before revision activities		6	1	1
Additions	F	Missing Addition	Not entered into SAP before revision activities	1	1	8	
Disposals	G	Other Disposal	Wrong Year			7	-1
Additions	H	Other Addition	Wrong Year	-1		-3	

Figure 10: Changes to SPM Asset Additions & Disposals for EHV Transformers

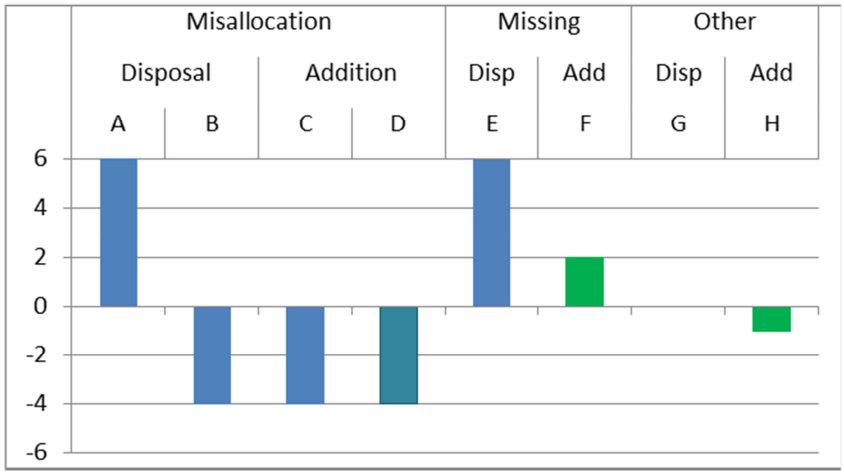
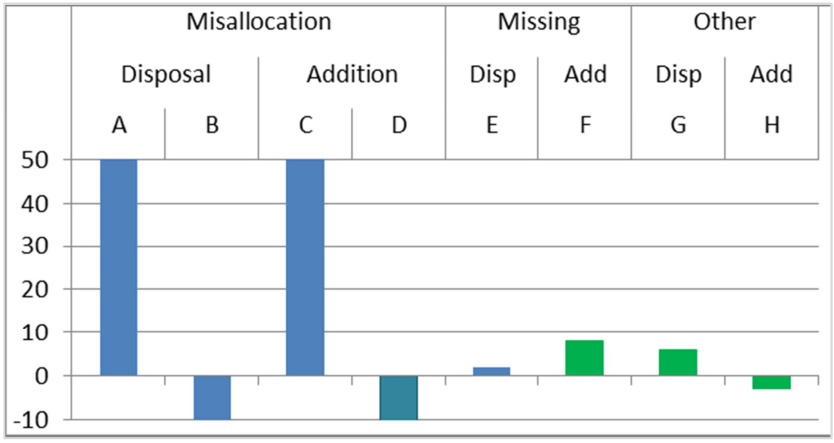


Figure 11: Changes to SPM Asset Additions & Disposals for HV Switchgear (Primary)



4.3 Resultant impact on reported HI delivery scores

Table 20 summarises the overall impact on SPEN's HI achievement scores for SPD & SPM following the amendments to the volumes of asset additions and disposals, combined with the alignment of SPEN's HI scoring mechanism with Ofgem's required methodology. The table also includes cumulative projections for the 2012/2013 regulatory year sourced at the time of the review in June 2013.

SPEN was able to replicate Ofgem's calculations of HI achievement relative to targets which initially highlighted low levels of HI delivery in the first two years of DPCR5. The restatement of cumulative HI achievement scores for 2011/2012, based on the revised input data and scoring approach, highlighted 7% and 8% improvements in reported delivery for SPD and SPM respectively.

Table 20: Comparison of SPEN's initial and recalculated HI achievement scores

	Initial 2010 - 2012 score based on Ofgem guidance	Restated 2010 - 2012 scores using revised data & new methodology	Projected cumulative 2012/2013 HI score	Incremental Score increase in 2012/2013
SPD	16%	23%	47.5%	+24.5%
SPM	11%	19%	41%	+22%

These cumulative delivery figures of 23% and 19% at the end of 2011/2012 are perhaps lower than might be expected at the end of the 2nd year of DPCR5 which may be explained by relatively low levels of programme delivery from the start of the period. However, projections obtained during the course of this review indicate that delivery rates in the 3rd year of DPCR5 have now substantially increase to beyond 20% per annum in both network areas.

During this analysis PA has noted that there has been relatively little movement in132 kV asset volumes in SPM which could contribute significantly towards the delivery of overall targets. Consequently, it will be beneficial for SPEN to ensure delivery of the 132 kV capital plan in the latter years of DPCR5.

A further scoring consideration noted during the course of this review has been SPEN's differential approach regarding the restatement of HI achievement for the first two years of DPCR5 (2010 – 2012) for plant and pole assets:

- There has been a full restatement of the HI score contributions for plant items on account of a high proportion of asset disposals having been missed and therefore absent from the initial submission.
- For poles, SPEN is not planning to restate pole related HI achievement scores for the first two years of DPCR5 in the 2012/2013 RRP submission.

The rationale for this decision is that some of the reported errors were attributable to incorrect allocation of HI rankings to recorded pole replacements rather than some replacements having been completely missed (as was the case for plant items). A review of the original dataset for pole additions and disposals has highlighted that many pole replacements were unexpectedly reported with a lower disposal HI than should have applied, which incorrectly reduced the number of HI5 pole replacements in the first two years of DPCR5 and therefore artificially under reported HI achievement scores for this period. PA understands that this pole related under reporting reduces total HI achievement score by approximately 3% in SPD and 2.5% in SPM over the DPCR5 period to date.

For the 2012/2013 year, SPEN has reported pole replacements according to the revised addition, disposal and HI dataset so the under reporting consideration described above does not apply to the 3rd year of DPCR5. For future RRP submissions, PA recommends that SPEN restates the 2010 – 2012 contributions for pole related asset replacements to reflect the most accurate data available (as identified by the data cleansing process) and thus captures the full benefit of the pole related work completed in the early years of DPCR5.

Overall PA believes that the reported amendments and step changes to the cumulative HI achievements scores for 2011/2012 to be reliable and are now much more robust than initially reported. Given that the revised processes implemented to correct the 2010 - 2012 reporting have now been applied to 2012/2013 data, PA is also confident that cumulative performance figures being

presented for the first 3 years of DPCR5 will also provide a reliable statement of SPEN's progress towards the delivery of overall DPCR5 targets.

5 CONCLUSIONS

PA has completed a detailed review of SPEN's monitoring and reporting processes for recording movements of Health Indices and the calculation of HI achievement scores in SPD & SPM. This section provides PA's conclusions and includes an opinion regarding the accuracy of the regulatory outputs to be provided to Ofgem in July 2013.

5.1.1 Causes of inaccurate HI reporting

PA can confirm that SPEN's initial RRP submission to Ofgem in October 2012 contained inaccurate information, which impacted HI reporting in the first two years of DPCR5. Data inaccuracies applied to plant (switchgear and transformers) and pole assets in both SPD & SPM and were largely attributable to incomplete and inaccurate information relating to asset additions & disposals. These data issues were compounded by the application of SPEN's original HI scoring methodology, which was subsequently updated following clarification discussions with Ofgem for consistency purposes[8]. The combined impact of these issues resulted in an understatement of HI achievement when calculated according to the revised scoring methodology and prompted SPEN to undertake a major data validation project to improve the accuracy of future regulatory submissions.

For plant equipment, the two dominant causes of data discrepancies were misallocated work undertaken on both networks which was then incorrectly classified in relevant IT systems and, to a lesser extent, work that was not recorded at all and therefore invisible for reporting purposes.

The issues impacting overhead line supports (mainly poles) were similar to those relating to plant items but were biased towards missing pole disposals. The situation for poles was also compounded by incorrect HI rankings of many pole disposals throughout the first two years of DPCR5.

[8] SPEN Management indicated that the revised scoring methodology was not finalised until May 2012 (following the 2011/2012 reporting year) and represented a material change to the way that SPEN had previously calculated HI outputs for DPCR5.

5.1.2 Resolution of reporting inaccuracies

SPEN has now completed an intensive 7-month programme to validate significant volumes of asset interventions undertaken in the initial 3 years of DPCR5 and has recalculated HI achievement scores for future regulatory reporting purposes. Whilst these resolution processes have been time-consuming and labour intensive (being based on manual interrogation of exception reports), PA can confirm that the procedures developed have been robustly implemented and that the revised HI achievement scores are significantly more reliable than those submitted in 2012. The programme has also highlighted where there is scope to implement business-as-usual process improvements which should reduce requirements for such validation exercises to be undertaken future.

PA has some concerns regarding the manual and paper-based aspects of SPEN's HI reporting and the associated risks of data errors. PA believes that the robustness of asset delivery reporting and data input arrangements could be improved through increased IT enablement both on central systems and for field work[9].

PA also believes that more robust enduring solutions should be evaluated for the reporting of refurbishments, especially if refurbishment volumes are set to rise in future. The current 'manual workaround' to capture the benefits of such interventions does not appear to be scalable. Similar observations apply to lesser extent regarding the treatment of de-energised and disconnected switchgear awaiting decommissioning.

5.1.3 Impact of data validation and revised reporting processes

PA has confirmed that SPEN's revised HI achievement scores to be submitted in the 2012/2013 RRP, have been based on NLRE and include only asset volume movements arising from asset replacements, refurbishments and the replacement of faulted/defective equipment. PA can confirm that the HI achievement statistics presented in Table 21 below exclude all asset interventions initiated by other investment drivers such as reinforcement and connection activity.

Table 21: Comparison of SPEN's initial and recalculated HI achievement scores

	Initial 2010 - 2012 score based on Ofgem guidance	Restated 2010 - 2012 scores using revised data & new methodology	Projected cumulative 2012/2013 HI score	Incremental Score increase in 2012/2013
SPD	16%	23%	47.5%	+24.5%
SPM	11%	19%	41%	+22%

The restatement of cumulative HI achievement scores for 2011/2012, based on the revised input data and scoring approach has resulted in a 7% and 8% improvement to the reported achievement scores for SPD and SPM respectively. Although the cumulative delivery figures at the end of 2011/2012

[9] It is acknowledged that SPEN is already evaluating various IT proposals for enhancing system capability, new reporting requirements for Programme Managers and revised internal reporting (manual vs. IT). In addition, 2 process experts "Black belts" have commenced work on formal improvements to processes.

appear quite low at 23% and 19% for SPD & SPM respectively, projections indicate that delivery rates in the 3rd year of DPCR5 have now significantly increased. The situation in SPM has been impacted by low levels of activity on 132 kV assets to date that could contribute significantly towards the delivery of overall targets in the remaining years of DPCR5.

SPEN is not planning to restate pole related HI achievement scores for the first two years of DPCR5 in the 2012/2013 RRP submission. This decision slightly understates HI achievement scores for poles by approximately 3% in SPD and 2.5% in SPM in the early years of DPCR5. PA believes it will be beneficial for SPEN to restate HI achievement regarding poles in future RRP submissions but can confirm that this issue only applies to 2010/2011 & 2011/2012 data and does not impact the latest delivery figures for 2012/2013.

Overall, PA believes that the reported amendments and step changes to the cumulative HI achievements scores are reliable and much more robust than those reported in October 2012. Given that the revised processes implemented to correct the 2010 - 2012 reporting have now been applied to 2012/2013 data, PA is also confident that cumulative achievement figures in the July 2013 RRP tables will provide a reliable statement of SPEN's progress towards the delivery of overall DPCR5 targets.

6 RECOMMENDATIONS

During the course of this review PA has become aware of a number of opportunities and initiatives that could be implemented to capture the enhanced accuracy and robustness of asset health reporting within business as usual and simultaneously reduce levels of administrative burden and rework for SPEN staff. The following recommendations should be considered in greater detail by relevant SPEN experts as potential business process improvements:

- Improve training and introduce incentives on field staff (internal and contractors) to promptly and accurately submit details of all asset interventions implemented on SPEN networks.
- Increase levels of input data validation undertaken by the Data Management function prior to information updates in central IT system - embed as part of business as usual activities.
- Reduce the reliance on paper-based systems and consider making more data fields mandatory for valid information submissions to the Data Management function.
- Accelerate roll-out of mobile technology to increase levels of IT enablement so field staff can automatically access and populate accurate data on central IT systems.
- Consider inclusion of Health Index data fields in future releases of asset register software applications.
- Devise new business processes to remove requirements for ‘manual workarounds’ regarding the reporting of refurbishments and disconnected switchgear.
- Conduct a thorough end-to-end business process review to identify further opportunities to streamline and improve the efficiency and accuracy of both asset and regulatory reporting.

We are an employee-owned firm of over 2,500 people, operating globally from offices across North America, Europe, the Nordics, the Gulf and Asia Pacific.

We are experts in energy, financial services, life sciences and healthcare, manufacturing, government and public services, defense and security, telecommunications, transport and logistics.

Our deep industry knowledge together with skills in management consulting, technology and innovation allows us to challenge conventional thinking and deliver exceptional results with lasting impact.

Corporate headquarters
123 Buckingham Palace Road
London SW1W 9SR
United Kingdom
Tel: +44 20 7730 9000

United States headquarters
45th Floor, Chrysler Building,
405 Lexington Avenue,
New York, NY 10174
Tel: +1 212 973 5900

paconsulting.com

For more information about
PA in the USA, please visit
paconsulting.com/us