

SSEPD LCNF Tier 1 Close Down Report

SSET1005 Low Voltage Network Modelling and Analysis Environment

Appendix I

Data Migration Specification Report



GE Digital Energy

Data Migration Specification

Low Carbon Network Fund First Tier Project

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Version: 1.3



Document Approval

Checked:	<u>John Mitchell</u>	Date:	<u>19/11/2011</u>
Approved:	<u>John Mitchell</u>	Date:	<u>19/11/2011</u>

Change History

Date	Author	Version	Section	Change Description
07/11/2011	Mark Ryall	0.1		Initial draft
15/11/2011	Mark Ryall	1.0		Revised to include section on Placar data.
18/11/2011	Mark Ryall	1.1		Revised to include Pole Towers
19/11/2011	John Mitchell	1.2	All	Reviewed
05/01/2012	Mark Ryall	1.3		

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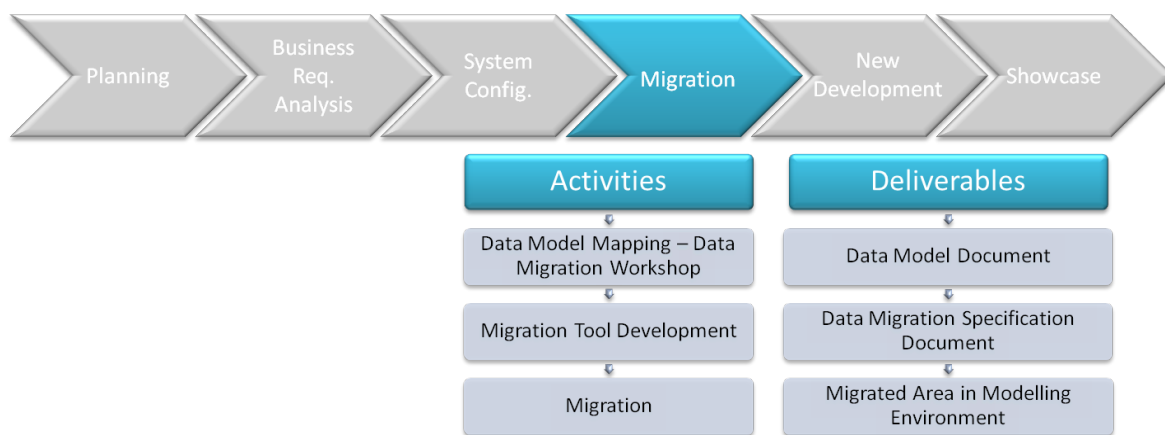
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1. Introduction

1.1 Purpose of Document

This specification document is one of the deliverables of Work Package 4 of the Low Carbon Network Fund First Tier Project. The purpose of the document is to define how data will be migrated from SSE’s existing Smallworld Version 3.1 SP2 GIS, and from the Placar system, into Smallworld Electric Office 4.2 which will act as the LV Network Modelling Environment. The context of the migration work package in the overall workflow of the project is indicated in the diagram below.



The specification document has 2 key purposes:

- It will be used as an input to design the software tools required to perform the data migration.
- It ensures a common understanding between SSE and GE of what data is required from Placar and the GIS for the LV network modelling exercise.

1.2 Scope

The document covers the following aspects of the migration exercise:

- It describes how the study area for the project is defined.
- It describes the overall approach of the migration exercise.
- It defines the mapping of data from Placar and SSE’s existing GIS into Smallworld Electric Office.
- It details any data model changes necessary in Smallworld Electric Office to accommodate the data from the existing GIS and from Placar

The field and value mappings are specified in detail in the associated spreadsheet ‘SSE EO Migration Spec.xls’

2. Project Study Area

For the purposes of the LCNF First Tier Project an area in Bracknell has been mutually agreed with SSE as providing a representative sample of the LV network. The area is defined as being fed by the following 21 Substations:

Site Code	Name	Network Reference Number
BRKN	BRACKNELL	2203
1626331	PRIESTWOOD	2203001020
1626216	MERRYHILL	2203001140
1626294	RACAL No1	2203002020
33722	THE ARENA BLOCK A	2203003020
33725	THE ARENA BLOCK B	2203003040
1636505	HORSNEILE LANE	2203004100
1626272	WOKINGHAM ROAD	2203008020
1640467	BOYD COURT	2203010020
37328	ONE THAMES VALLEY	2203013010
33763	TRINITY COURT No1	2203013020
1644236	MILBANKE WAY	2203013060
1626320	BROOK GREEN	2203017020
1626319	KINGSMERE ROAD	2203017040
1626135	MOORDALE AVENUE	2203017080
1626146	WINDLESHAM ROAD	2203017100
1626227	COPPICE GREEN	2203017120
1626238	PRIESTWOOD SCHOOL	2203017140
1626191	SHEPHERDS LANE	2203017260
1626249	STONEY ROAD	2203001120A
1626674	BULL LANE	Unknown

The area comprises approximately 28km of LV network, not including service cables, and around 1800 supply points.

3. Data Migration

3.1 SSE GIS to Electric Office Migration

3.1.1 GIS to EO Migration Approach

In order to identify the extent of the LV network which needs to be migrated to Electric Office, a series of network traces have been run in SSE's existing GIS from the 21 substations in the study area. The network traces have been used to define a polygon representing the boundary of the area to be migrated. When the actual data migration is performed, a copy of the SSE GIS database will be opened by the migration software in Electric Office, and all the LV network data inside the polygon will be copied directly into the Electric Office database.

All LV network objects in the area will be migrated, including substation internals. In addition the 11kV network between the Bracknell primary substation and the distribution substations will be included.

Schematics are excluded from the scope of the migration.

For the purposes of the LCNF First Tier Project the migration will be undertaken as a one off exercise. If the project is extended to the second tier phase the migration software will need to be enhanced to allow the data in Electric Office to be periodically refreshed from the source data in SSE's GIS. This will require that the internal ids of network objects in SSE's GIS are stored in Electric Office to enable EO records to be updated from the GIS source records. However, this is not within the scope of the current project.

3.1.2 GIS to EO Migration Mappings

The table below lists the objects in the SSE GIS which will be migrated and their corresponding objects in Electric Office.

SSE GIS Object	Electric Office Object
LV Cable and Service	Cable Segment Cable Existing Phase Cable Spec
LV Oh Line	Wire Segment Wire Existing Phase Wire Wire Spec
HV Cable	Cable Segment Cable Existing Phase Cable Cable Spec
HV Oh Line	Wire Segment Wire Existing Phase Wire Wire Spec
Joint	Connector Point Installation Connector Point Existing Phase Connector Point Connector Point Spec
Link Box	Composite Switch Composite Switch Spec
Pole Tower	Composite Switch Composite Switch Spec
Schematic Connector	Network Hypernode
Sub Station	Substation
Supply Location	Energy Consumer
Busbar	Connector Segment Installation Connector Segment Existing Phase Connector Segment Connector Segment Spec
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Internal Cable	Connector Segment Installation Connector Segment Existing Phase Connector Segment Connector Segment Spec
Power Transformer	Power Transformer Installation Power Transformer Existing Phase Power Transformer Power Transformer Spec
Switching Device	Isolating Equipment Installation Isolating Equipment Phase Isolating Equipment Isolating Equipment Spec

For details of the field and value mappings for each of these tables, see the associated 'SSE EO Migration Spec.xls' spreadsheet.

3.2 Placar to Electric Office Migration

3.2.1 Placar to EO Migration Approach

Data from Placar for the 21 substations in the study area will be supplied as an Excel spreadsheet which will be converted to CSV format and loaded into the Electric Office database.

For the tier 2 LV network modelling project it is expected that the capture of data from Placar into Electric Office could be streamlined using a direct ODBC connection between EO and the Placar database. However, this is not within the scope of the current LCNF First Tier Project .

3.2.2 Placar to EO Migration Mappings

The records from Placar will be matched with substations in EO using the the Loc ID (NRN) , Substation Code, and Substation Names fields. The rating in kVA will then be set for each substation transformer in EO from the Placar data.

For further detail, see the associated 'SSE EO Migration Spec.xls' spreadsheet.

4. Data Model Specification

Almost all data from Placar and the GIS required for the LV network modelling exercise can be migrated to Electric Office using the standard EO 4.2 datamodel and enumerator values. However, a small number of changes to the EO datamodel will be necessary. These are detailed in the table below. In accordance with EO customisation guidelines, and to ensure compatibility with future EO product releases, the internal names of new fields will be prefixed with 'sse_'.

EO Object	EO Field	Description
Cable Spec	Number of Main Cores	New enumerated field in EO with values: 1,2,3,4,5,6,7 & Unknown.
Wire Spec	Number of Conductors	Create new enumerated field in EO with values: 1,2,3,4,5,6,7 & Unknown.
Substation	Type	Change to sub_substation_type enumerator. New enumerator values: primary, ground mounted distribution, pole mounted distribution, buried distribution, kiosk distribution, pillar distribution, site only, & consumers.
Energy Consumer	Consumer Type	Change to energy_consumer_type enumerator. New enumerator values: Property & Street Furniture.

Appendix II

Distributed Generation

SIMS 10 - Main Menu

eXit Print Edit Options Help Window

Distribution Generation Reports

Distribution Generation Reports

From To

Date Field To Search

- QUOTED
- ACCEPTED
- COMMISSIONED
- DECOMMISSIONED

SGSP

GSP

Primary

Hv Feeder

Transformer

Lv Feeder

Installer

POC MTR

Class

Type

Fuel

Supplier

Email Address

Reports

- HIGH LEVEL
- LOW LEVEL
- RIGS

Export Exit

Figure 1 - Screenshot from SIMS to illustrate how Distributed Generation data is stored / accessed

FUEL	TYPE	DATE OF ENTRY	QUOTED DATE	ACCEPTED DATE	COMM DATE	GEN CAP	EXPORT CAP	PRIMARY	LOCATION	HV FEEDER	TX	LV FEEDER		POSTCODE	MTR	
h	Export	29/08/2011			12/08/2011	3.68	3.68	2203	Bracknell	11	90	Arkwright Drive	2	BERKSHIRE	xxx	LV
PHOTO	Export	27/01/2012			01/12/2011	3.68	3.68	2203	Bracknell	14	580	Dartmouth Close	1	BERKSHIRE	xxx	LV
PHOTO	Export	01/02/2012			23/01/2012	3.68	3.68	2203	Bracknell	17	200	Kennel Lane	3	BERKSHIRE	xxx	LV
PHOTO	Export	30/12/2011			21/11/2011	3.25	3.25	2203	Bracknell	17	260	Shephers Lane	3	BERKSHIRE	xxx	LV
PHOTO	Export	01/02/2012			25/01/2012	3.68	3.68	2203	Bracknell	1	180	Lakeside	2	BERKSHIRE	xxx	LV
PHOTO	Export	30/12/2011			21/11/2011	2.52	2.52	2203	Bracknell	14	560	Romney Hse	5	BERKSHIRE	xxx	LV
PHOTO	Export	16/11/2011			15/11/2011	3.68	3.68	2203	Bracknell	7	480	Firlands	1	BERKSHIRE	xxx	LV
PHOTO	Export	10/02/2012			27/01/2012	3.68	3.68	2203	Bracknell	14	230	Bagshot Road	2	BERKSHIRE	xxx	LV
PHOTO	Export	18/08/2011			16/08/2011	3.68	3.68	2203	Bracknell	1	20	Preistwood	1	BERKSHIRE	xxx	LV
PHOTO	Export	11/01/2012			26/09/2011	3.68	3.68	2203	Bracknell	1	270	Feilden Springs	2	BERKSHIRE	xxx	LV
PHOTO	Export	19/01/2012			19/01/2012	3.68	3.68	2203	Bracknell	17	60	Longmoors	3	BERKSHIRE	xxx	LV
PHOTO	Export	11/01/2012			08/11/2011	3.68	3.68	2203	Bracknell	1	270	Feilden Springs	2	BERKSHIRE	xxx	LV

Figure 2 – Sample of report run from SIMS on distributed generation within trial area

Appendix III

Data Migration Specification Spreadsheet

Table 1 - Integration data for SSEPD's GIS

SSE Object	EO Object	Comments
LV Cable and Service	Cable Segment	
	Cable Existing Phase	
	Cable	
	Cable Spec	
LV OH Line	Wire Segment	
	Wire Existing Phase	
	Wire	
	Wire Spec	
HV Cable	Cable Segment	11kV HV cables and lines in the study area will be migrated for context only with minimal attributes.
	Cable Existing Phase	
	Cable	
	Cable Spec	
OH Line	Wire Segment	
	Wire Existing Phase	
	Wire	
	Wire Spec	
Joint	Connector Point Installation	
	Connector Point Existing Phase	
	Connector Point	
Link Box	Composite Switch	
	Composite Switch Spec	
Pole Tower	Composite Switch	Only pole towers containing LV switches will be migrated
	Composite Switch Spec	
Schematic Connector	Network Hypernode	
Sub Station	Substation	
Supply Location (supply_point)	Energy Consumer	
Busbar	Connector Segment Installation	
	Connector Segment Existing Phase	
	Connector Segment	
	Connector Segment Spec	
Internal Cable	Connector Segment Installation	
	Connector Segment Existing Phase	
	Connector Segment	
	Connector Segment Spec	
Power Transformer	Power Transformer Installation	
	Power Transformer Existing Phase	
	Power Transformer	
	Power Transformer Spec	
Switching Device	Isolating Equipment Installation	
	Isolating Equipment Phase	
	Isolating Equipment	
	Isolating Equipment Spec	

Table 2 - Integration data for GE Smallworld Electric Office

EO Object	EO Field	EO Default Value	Value Mapping	Comments
Cable Segment	Usage		mains & major services -> Secondary; service (minor) -> Service	
	Lifecycle Status (status)		decommissioned -> Abandoned; in use -> Existing; in use PRIVATE -> Existing (& set Usage to Private Light)	
	Route			
	Annotations			Both multi geom fields
	Leader Line			
	Owner Type	Company Owned		
	Mounting	Underground		
	Reverse Flow (reverse_flow_ind)	maybe		
	Network Type	LV		
	Cable Existing Phase	Phase		Service Phase Colour is "Not Applicable" for all non-service LV cables in the study area - default these to Phase Unknown. Field is "Unknown" for all service cables -> Unknown
Phase Context		Unknown		
Cable	Remarks			
Cable Spec	Size			
	Material			
	Manufacturer			
	NEW FIELD			Create new enumerated field in EO with values: 1,2,3,4,5,6,7 & Unknown
	Spec Name		Create spec name from concatenation of Main Core Size, Number of Main Cores, Material & Construction	
	LV	true		
	Real Spec	false		
	Obsolete	false		
				Set to Not Applicable for all but a handful of records in the study area - do not migrate. Revisit for Tier 2.
Wire Segment	Usage		As LV Cable	
	Lifecycle Status (status)		As LV Cable	
	Route			
	Annotations			
	Leader Line			
	Owner Type	Company Owned		
	Mounting	Overhead		
	Reverse Flow (reverse_flow_ind)	maybe		
Network Type	LV			
Wire Existing Phase	Phase	Unknown	Unknown or Not Applicable in study area	
	Phase Context	Unknown		
Wire	Remarks			
Wire Spec	Material			
	Size			Conductor size not visible on SSE editor
	Stranding			Stranding not visible on SSE editor
	NEW FIELD			Create new enumerated field in EO with values: 1,2,3,4,5,6 & Unknown
	Spec Name		Create from concatenation of Conductor Material, size & stranding	
	LV	true		
Real Spec	false			
Obsolete	false			

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Cable Segment	Lifecycle Status (status)		As LV Cable	
	Route			
	Annotations			Both multi geom fields
	Owner Type	Company Owned		
	Mounting	Underground		
	Reverse Flow (reverse_flow_ind)	maybe		
	Network Type	HV		
Cable Existing Phase	Phase	ABC		
	Phase Context	Unknown		
Cable	Asset ID			
Cable Spec	Size			
	Material			
	Description			
	Spec Name		Create spec name from concatenation of Main Core Size, Number of Main Cores, Material & Construction	
	HV	true		
	Real Spec	false		
	Obsolete	false		
Wire Segment	Lifecycle Status (status)		As LV Cable	
	Route			
	Annotations			
	Owner Type	Company Owned		
	Mounting	Overhead		
	Reverse Flow (reverse_flow_ind)	maybe		
	Network Type	LV		
Wire Existing Phase	Phase	ABC		
	Phase Context	Unknown		
Wire	Asset ID			
Wire Spec	Material			
	Size			Conductor size not visible on SSE editor
	Stranding			Stranding not visible on SSE editor
	Description			
	Spec Name		Create from concatenation of Conductor Material, size & stranding	
	HV	true		
	Real Spec	false		
	Obsolete	false		
Connector Point Installation	Usage		As LV Cable	
	Lifecycle Status		As LV Cable	
	Location			Joint annotation and leader lines unpopulated in study area
	Owner Type	Company Owned		
	Mounting	Unknown		
	Network Type		Usage = 'HV' -> HV; otherwise LV	
Connector Point Existing Phase	Phase	Unknown		
	Phase Context	Unknown		
Connector Point				

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Connector Point Spec	Device Type		straight -> Splice, back to back -> Splice, joint casting (straight) -> Splice, tee -> Splice, trifurcating -> Splice, pot-end -> Termination, capped-end -> Termination, pole termination -> Termination, sealing-end -> Termination, service connector -> Splice, O/H connector -> Splice, wall box -> Splice	
	Spec Name			
	LV		Usage not = HV -> true	
	HV		Usage not 'HV' -> true	
	Real Spec	false		
	Obsolete	false		
Composite Switch	Location Description			
	Lifecycle Status (status)		decommissioned -> Abandoned, in use -> Existing, in use PRIVATE -> Existing	
	Network Type	LV		Operating Voltage set to 'LV' for all link boxes in study area Not populated in study area
	Location			Not populated in study area
	Device Type	Link Box		
	Owner Type	Company Owned		
	Phasing	Unknown		Note no separate Existing Phase table for Composite Switch in EO
	Mounting	Unknown		
Composite Switch Spec	Spec Name			
	Description			
	Device Type	Link Box		
	LV	true		
	Real Spec	false		
	Obsolete	false		
	Location Description			
Composite Switch	Lifecycle Status (status)		decommissioned -> Abandoned, in use -> Existing, in use PRIVATE -> Existing	
	Network Type	LV		
	Location			
	Device Type	Unknown		
	Owner Type	Company Owned		
	Phasing	Unknown		
	Mounting	Unknown		

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	Composite Switch Spec	Spec Name	Pole Tower		
		Description	Pole Tower		
		Device Type	Unknown		
		LV	true		
		Real Spec	false		
		Obsolete	false		
	Network Hypernode	Network Type		Derive from network type of connected objects	
		Lifecycle Status (status)	Existing		
Network Connection		Pin2			GIS World
Schematic Connection		Pin1			Internals World
Site Code (of reference)	Substation (sub_substation)	Number			
Site Name (name)		Name			
Locality		Operating Area			
		Class		Type = primary -> Transmission/Distribution; all other types -> Distribution/Distribution	
Type		Type			Requires change to sub_substation_type enumerator. No affect on style mappings
		Type	Distribution		
		Electric Fence Type	Unknown		
		Owner Type	Company Owned		
Boundary		Extent			
Site Name Text		Annotation			
Abbreviated Site Name (name_10000)		Asset ID			Contains network reference number (NRN)
Location Type	Energy Consumer	Consumer Type			Requires change to energy_consumer_type enumerator for values 'Property' and 'Street Furniture'. No affect on style mappings
Location		Location			
		Network Type	LV		
		Lifecycle Status (status)	Existing		
		Phasing	Unknown		
		Owner Type	Company Owned		
Equipment Code	Connector Segment Installation				Not populated in study area
Target Voltage					Not populated in study area
Operating Voltage		Nominal Voltage			
Status		Lifecycle Status (status)		redundant -> Abandoned; in use -> Existing; proposed -> Proposed Install	
Internal Location (ssi_location)		Location			
		Owner Type	Company Owned		
		Mounting	Unknown		
		Reverse Flow (reverse_flow_ind)	maybe		
		Network Type	LV		
	Connector Segment Existing Phase	Phase	Unknown		
		Phase Context	Unknown		
	Connector Segment				
Type	Connector Segment Spec	Spec Name			
Section Type		Spec Name		Create from concatenation of Type and Section Type	
		Device Type	Busbar		
		LV	true		
		Real Spec	false		
		Obsolete	false		

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Operating Voltage	Connector Segment Installation	Nominal Voltage			
Status		Lifecycle Status (status)		in use -> Existing; in use PRIVATE -> Existing	
Location		Location			
		Owner Type	Company Owned		All other Internal Cable fields unpopulated in study area
		Mounting	Unknown		
		Reverse Flow (reverse_flow_ind)	maybe		
		Network Type	LV		
	Connector Segment Existing Phase	Phase	Unknown		
		Phase Context	Unknown		
	Connector Segment				
	Connector Segment Spec	Spec Name	Internal Cable		
		Device Type	Unknown		
		LV	true		
		Real Spec	false		
		Obsolete	false		
Target Voltage	Power Transformer Installation				Not populated in study area
Status		Lifecycle Status (status)		in use -> Existing	SSE enumerator has only 1 option 'in use'
T Number		Name			
Known As		Name		Create from concatenation of Known As & T Number e.g. Local Transformer T1 (ignore T Number if = not applicable)	
Equipment Code		Remarks			Equipment code maps to both Remarks and Asset Id so can be used in Remarks Annotation in EO.
Location		Location			Use midpoint of SSE location chain geom for EO point geom
Pin 1		Source Location			
Pin 2		Load Location			
Equipment Code Text		Remarks Text			
		Owner Type	Company Owned		
		Mounting	Unknown		
		Network Type		Secondary Operating Voltage = LV -> LV, otherwise HV	
Number of Phases	Power Transformer Existing Phase	Phase		unknown -> Unknown; 1 -> A; 2 -> AB; 3 -> ABC	unknown or 3 for all Transformers in study area
		Phase Context	Unknown		
Equipment Code	Power Transformer	Asset ID			
		Device Type	Substation		
Type	Power Transformer Spec	Description			
		Spec Name		Create from concatenation of Type, Primary Operating Voltage & Secondary Operating Voltage	
Primary Operating Voltage		Rated Source Voltage			
Secondary Operating Voltage		Rated Load Voltage		Map enumerated values as number, except 'LV' -> Unknown	
		Device Type	Substation		
		LV		Secondary Operating Voltage = LV -> true	
		HV		Secondary Operating Voltage not = LV -> true	
		Real Spec	false		
		Obsolete	false		

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Target Voltage	Isolating Equipment Installation				Not populated in study area
Status		Lifecycle Status (status)		in use -> Existing	SSE enumerator has only 1 option 'in use'
Known As		Name			
Equipment Code		Remarks			Equipment code maps to both Remarks and Asset Id so can be used in Remarks Annotation in EO
Location		Location			
Pin 1		Pin 1			Switches have 2 pins in SSE GIS; Isolating Equipment has only 1 Pin in EO
Equipment Code Text		Remarks Text			
		Owner Type	Company Owned		
		Mounting	Unknown		
		Network Type	LV	Operating Voltage = 'LV' -> LV; otherwise HV	
Normal Op State	Isolating Equipment Phase	Normal Status		closed -> Closed; open -> Open	
Temporary Op State					In all cases the same as Normal Op State in study area - do not migrate
		Phase	ABC		Must be set defaulted to ABC rather than Unknown or EO network tracing will never stop at open points.
		Phase Context	Unknown		
Equipment Code	Isolating Equipment	Asset ID			
Abbreviated Name (name_10000)		Remarks			For switches of type 'Circuit Breaker' in the primary sub this contains the NRN
Type	Isolating Equipment Spec	Device Type		Links -> Link; Switch Disconnecter -> Switch; Substation Connection -> Link; Circuit Breaker -> Circuit Breaker; Fuses -> Fuse; Metal Clad Switch Disconnecter -> Switch; Fault Thrower -> Switch; Earth Switch -> Switch; Isolating Contacts -> Switch	
Type		Spec Name			
Operating Voltage					Set to simply 'LV' for all switches in distribution substations. Do not migrate.
		LV		Operating Voltage = 'LV' -> true	
		HV		Operating Voltage not = 'LV' -> true	
		Real Spec	false		
		Obsolete	false		

Table 3 - Integration data for SSEPD's plant information system (PLACAR)

Placar Field	EO Object	EO Field	Comments
LOC_ID	Substation	Asset ID	Contains the network reference number (NRN)
NAME	Substation	Name	
STATUS			
OS_GRID_REFERENCE			
SUBSTATION_CODE	Substation	Number	
ED3_NAME			
TRANSFORMER_TYPE	Power Transformer	Total Apparent Power (kVA)	Placar records will be matched with substations in EO using combination of the Loc ID (NRN), Substation Code and Substation Name fields. KVA rating will then be set on each transformer.

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Appendix IV

Power Analysis Tool Evaluation document



GE Digital Energy

Power Analysis Tool - Evaluation

Low Carbon Network Fund First Tier Project

Date: 22/12/2011

Version: 1.0



Document Approval

Reviewed	John Mitchell	Date	22/12/2011
Approved	John Mitchell	Date	22/12/2011

Referenced Documents

Ref	Title	Version	Author
[1]	Ofgem registration proforma for the project SSET1005 http://www.ofgem.gov.uk/Networks/ElecDist/lcnf/ftp/Documents1/Tier120Proforma20SSET1005.pdf	1	N Copeland

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1. Introduction

1.1 Purpose

This Power Analysis Tool evaluation document is one of the deliverables of Work Package2 of the Low Carbon Network Fund First Tier Project with the Ofgem designation SSET1005 - LV Network Modelling and Analysis Environment (for more details see reference document #1).

1.2 Scope

This document describes the evaluation of power analysis tools for the First Tier Low Carbon Network Fund Project SSET1005 - LV Network Modelling and Analysis Environment.

SSE are working with GE Energy to create a Network Modelling Environment (NME) which integrates a Geographical Information System (GIS) with a Power Analysis Tool (PAT) to identify network reinforcement requirements around the emergence of a move towards a low carbon economy.

Three PAT vendors were selected for participation in the evaluation through discussion between SSE and GE Energy at the project inception stage. The companies and their respective products are listed below.

Company	Product
CYME	CYMDIST
Vendor X	Software X
Vendor Y	Software Y

1.3 Structure

The evaluation process requires each of the equipment vendors to successfully demonstrate their products suitability to meet the requirements of the SSE vision of the NME.

The evaluation was carried out in three distinct phases as detailed below and described fully within the main body of this document:

Phase 1 – Questionnaire

Phase 2 – Demonstration

Phase 3 – Practical Test

2. Evaluated Power Analysis Tools

CYMDIST, Software X and Software Y were selected for evaluation as three of the most well established products in the European market for electrical network analysis software. GE has previous experience of working with both CYME and Vendor X and has considerable in house knowledge of both suppliers' products. Vendor Y's Software Y product was included at the request of SSE as the package is already in limited use within SSE. Each of the three products was considered to be likely to be able to meet SSE's operational requirements for LV network analysis, and to offer a high probability of being successfully combined with Smallworld Electric Office to provide an integrated Network Modelling Environment.

2.1 CYMDIST

CYME International is a Canadian software company and is part of the Cooper Power Systems group. Its CYMDIST package is one of a suite of applications aimed specifically at distribution systems planning and analysis. The packages comprise of a number of different modules which together offer the following features and capabilities:

- Power flow and voltage drop analysis.
- Fault flow analysis.
- Optimal capacitor placement and sizing.
- Load balancing and load allocation/estimation.
- Harmonic analysis.
- Switching optimisation.
- Network planning.
- Distributed generation modelling.
- Reliability analysis.
- Contingency analysis.
- Analysis of balanced or unbalanced networks built with any combination of phases or configurations.

2.2 Software X

Vendor X GmbH is a German consulting and software company providing engineering services in the field of electrical power systems for generation, transmission and distribution. As with CYMDIST, Vendor X's Software X product includes a number of different modules offering the following functionality:

- Power flow analysis.
- Contingency analysis.
- Fault analysis.
- Time domain simulation and small signal analysis.
- Harmonic analysis.
- Reliability analysis.
- Capacitor, switch, and cable reinforcement optimisation.
- Voltage drop and cable loading analysis.

- Load balancing and analysis.

2.3 Software Y

Vendor Y is a UK company which originally evolved from the publically-owned UK Electricity Council's Research and Development Centre. Its Software Y product is the only one of the three power analysis tools under consideration which is currently in use in SSE, although it is believed to be used by only one engineer.

Vendor Y provided only very limited information on the functionality of the product as detailed below:

- Full facilities for LV network design.
- Support for embedded generation.
- Support for demand side management
- Intuitive user interface which can be used with little training.

3. Phase 1 - Questionnaire

This phase of the evaluation was based on exploring each equipment vendors' ability to meet the general project requirements by answering a number of foundation questions relating to the specific objectives of the project.

Phase 1 of the evaluation was based on the vendors' responses to a series of technical and commercial requirements as detailed in the following sections:

3.1 Evaluation Criteria

The evaluation questions asked of the suppliers are listed in the following sections.

3.1.1 Load Profiles

Project Requirement:

Effective modelling of current and future load profiles is a key requirement of the project in order to be able to identify sections of network which may be subject to excessive load. It is expected that load profile data from the University of Reading for the TVV area will be provided as an array of 48 half hour values, so it is essential that the product can handle data in this format. In addition the Power Analysis Tool must be able to handle many different load profiles associated with different classes of domestic and commercial energy consumer on a single circuit.

LP1 - Describe the product's capabilities for analysis using load profiles in it power analysis.

LP2 - Could a profile of 48 values for a 24 hour period be handled?

LP3 - How would multiple load profiles on the same circuit be handled?

3.1.2 Embedded Generation

Project Requirement:

A key requirement of the project is to be able to model extra demand placed on the LV network by a range of embedded generation technologies, including solar, wind, heat pumps and micro combined heat and power. For accurate LV modelling it is essential that the Power Analysis Tool can model generation profiles from embedded generation devices as well as load profiles for energy consumers, and that load and generation profiles can be modelled simultaneously on the same circuit.

EG1 - Describe the product's capabilities for analysis using embedded generation:

EG2 - What types of embedded generation can your product analyse?

EG3 - Can you analyse embedded generation profiles?

EG4 - It is possible to do analysis using both embedded generation and load profiles at the same time?

3.1.3 Batch Mode

Project Requirement:

At this stage of the project it was expected that the Geographical Information System (GIS) would be the main data gathering / network editing / visualisation platform for the Network Modelling Environment (NME) users. It was therefore a requirement to be able to run the power analysis directly from the GIS rather than have users undergo the necessity of learning the user-interfaces of more than one software product. Being able to run the power analysis tool in a non-interactive way was therefore a requirement.

BM1 - Describe the non-interactive ways that your product's analysis functions can be driven.

3.1.4 Data Input

Project Requirement:

Using a power analysis tool in conjunction with a GIS meant that data would need to be exchanged between the two systems. Questions were therefore asked around what input formats the power analysis tools could accept and specifically the Common Interface Model (CIM) that is gaining acceptance as a standard within the electricity industry. Even if CIM was not eventually used in this project the answer to this question gives an indication of whether the development of the different power analysis tools is taking into account such advances within the industry.

DI1 - List the data input formats that your product can handle, along with any limitations to any specific formats

DI2 - Please state if your product can accept CIM format inputs. If it can then we would like to know which version of CIM is used and what constraints there are on the CIM profiles your product can use.

3.1.5 Data Output

Project Requirement:

We investigated the ability of the PATs to be driven non-interactively. This was done to establish whether the results could be reported to a file and subsequently imported into the Electric office for visualisation and reporting purposes. This would provide SSE with the ability to visualise analysis results within the Electric Office as opposed to the power analysis tool if required

DO1 - Describe the reporting capabilities of your product

DO2 - Can lists of out of tolerance components be generated and exported?

DO3 - Can the reporting be done non-interactively?

3.1.6 Performance

Project Requirement:

To get a feel for the performance of the competing products questions were asked around the particular factors that influence how quickly the power analysis could be expected to run. Performance was also examined in Phase 2 of the evaluation process, see Demonstration Objective 2.

P1 - What are the factors that affect the performance of your analysis tool?

P2 - Please indicate whether a typical low voltage circuit analysis involving load profiles and embedded generation takes in the order of seconds or minutes

3.1.7 GIS Linkages

Project Requirement:

As the project design envisages the linking of a GIS with the chosen power analysis tool, questions were asked about experiences with linking to GIS products and Smallworld in particular.

G1 - Please indicate any experience you have with using your product in conjunction with GIS software

G2 - Does any of this experience involve the Smallworld GIS product?

3.1.8 Commercial Issues

Project Requirement:

A number of questions concerning the Licensing model and more general commercial issues were added to the questionnaire in order to identify any potential commercial showstoppers at this stage, and also the level of likely engagement the project team could expect from each of the equipment vendors.

CI1 - Describe the licencing model and pricing structure for your product

CI2 - Would you be willing to provide a free evaluation licence during the proof of concept (October 2011- June 2012)?

CI3 - What levels of support would be provided for this project?

3.2 Responses

The full questionnaire was issued to each of the potential vendors by email, after initial contact had been made describing the high-level project scope and aims in order to establish their interest in participating in the project. Invitations to participate were made by email on Wednesday, 21 September 2011, with responses being requested by end of business Friday, 14 October.

CYME: The response from CYME concerning the suitability of CYMDIST was received on Wednesday, 12 October 2011. This response is attached to this document as reference.

Vendor X: The response from Vendor X relating to their product, Software X, was not received by the deadline date. An email was sent to Vendor X on the morning of Monday, 17 October requesting clarification of their intentions. Vendor X were insistent that they had responded on Friday, 14 October and did not understand why GE had not received it. Vendor X immediately resent their response. It later transpired that the original email response somehow got stuck in their mail server and did eventually turn up on Tuesday, 18 October. This response is attached to this document as reference.

Vendor Y: Vendor Y's response did not arrive by close of business on Friday, 14 October. The project team finally received their submission on Friday, 21 October after several email exchanges encouraging them to respond. This response is attached to this document as reference.

3.3 Evaluation Process

The evaluation results are shown in section 3.6 of this document and are derived as a result of executing the following process:

3.3.1 Weighting

The principle consultant gave each question a weighting according to the importance of that particular question in relation to the other questions contained within the questionnaire. An "essential" question was given a weighting of 10 whilst a question about a non-essential requirement was given a significantly lower weighting.

3.3.2 Scoring

Each question was then marked out of 10, with a 0 mark representing a totally unsuitable response and a mark of 10 representing an exact fit to the requirement.

3.3.3 Total Score

The scores were then multiplied by the weightings to establish a total score for a particular question. The scoring for each of the questions within the evaluation was then totalled to give a final score against each of the vendors' responses.

3.3.4 Validation

The principle consultant would mark each of the vendors' responses against their own weighting and scoring and enter the results in an evaluation table (actual results detailed in section 2.6). Once this initial scoring was complete, two further consultants would independently apply their own weightings and scoring against each of the questions, the objective being to establish whether the relative positions of each of the vendors' products would change when marked by 2 further consultants working in isolation. Should either of these consultants results indicate a change in the position of the three evaluated vendors' products then the intention would be to further investigate the reasons behind this disparity.

This validation exercise was conducted as stated. All 3 consultants marked the relative positions of the three products in the same order as described in section 3.5 and detailed in section 3.6.

3.4 Phase 1 - General Observations

3.4.1 Vendor Engagement

It has been very apparent during both the pre-evaluation and throughout the phase 1 evaluation that CYMDIST's level of engagement has been significantly higher than both Vendor X and Vendor Y. They are pro-active in everything they do and when asked to provide specific information are able to do so expediently.

It must equally be noted that Vendor Y's level of engagement has been far lower than the level we would expect from a supplier committed to supporting this project through to completion.

3.4.2 Voice of the Customer

It was documented as an assumption of the project that the necessary SSE subject matter experts would be made available to GE during the project execution. It was our expectation that these SSE subject matter experts would act as the empowered voice of the customer driving SSE direction at workshops and through consultation and active participation in project meetings, document reviews and general project activities. Unfortunately this has not been the case and the evaluation has therefore been carried out without the required level of proactive and fully engaged detailed electrical network knowledge. The GE project team, supported by the SSE project manager have therefore taken the decision to drive forward assuming that the PATs included in the evaluation all meet the level of power analysis functionality required by SSE and that this evaluation should focus wholly on the requirements needed to create the integrated NME. Please note that this assumption was based on the fact that all three PAT's are well established products in the European market for electrical network analysis software.

3.5 Phase 1 Conclusions

The outcome of this process shows that CYMDIST consistently came out as the preferred power analysis tool, followed by Software X with Software Y trailing significantly behind. A brief summary of the responses is given below, with the full response of each vendor attached at the end of this document.

3.5.1 CYMDIST

- Satisfactory answers provided to all questions fully meeting the project requirements.
- Most thorough answers to questions on load profiles, embedded generation, analysis capabilities and batch mode requirements.
- Product supports the CIM format, as well as Oracle, MS SQL Server & MS Access.
- Thorough responses received around the GIS interfaces. The product has been used extensively with Smallworld.
- Demonstrated a willingness to provide in depth support throughout the project.

3.5.2 Software X

- Satisfactory answers to all questions although some responses considerably less detailed than CYME's for CYMDIST.
- Good answers to questions on load profiles, embedded generation, analysis capabilities and batch mode requirements.
- Product supports the CIM format and ODBC database connections.

- Good response on GIS interfaces.
- Willing to provide support for the project.

3.5.3 Software Y

- A number of questions not answered at all.
- Satisfactory answers on load profiles, embedded generation & analysis capabilities.
- Response on batch mode suggested further development may be required.
- No information provided on input formats, other than that the product does not handle the CIM format.
- Unconvincing responses on interfaces to Smallworld.
- Support for the project would not be provided without further commercial negotiations.

3.6 Phase 1 Evaluation Results

Req. ID	CTQ	CTQ Weight	CYMDIST		Software X		Software Y	
			Score	Total	Score	Total	Score	Total
LP1	Capabilities	10	10	100	10	100	10	100
LP2	48 Values	8	10	80	10	80	10	80
LP3	Multiple LPs	8	10	80	10	80	10	80
	DO Total			260		260		260
EG1	Capabilities	10	10	100	10	100	10	100
EG2	Types	8	10	80	10	80	10	80
EG3	Analysis	8	10	80	10	80	10	80
EG4	with Load Profiles	8	10	80	10	80	10	80
	DO Total			340		340		340
BM1	Capability	8	8	64	8	64	5	40
DI1	Formats	8	10	80	10	80	0	0
DI2	CIM	8	8	64	5	40	0	0
	DI Total			144		120		0
DO1	Capabilities	8	10	80	10	80	10	80
DO2	Equipment Lists	6	10	60	10	60	5	30
DO3	Non Interactive	6	10	60	10	60	5	30
	DO Total			200		200		140
P1	Factors	6	10	60	10	60	10	60
P2	Magnitude	6	10	60	10	60	10	60
	P Total			120		120		120
G1	GIS General	6	10	60	10	60	10	60
G2	Smallworld	6	7	42	8	48	5	30
	G Total			102		108		90
CI1	Licencing Model	6	10	60	10	60	10	60
CI2	Evaluation Licence	8	10	80	10	80	10	80
CI3	Support	8	10	80	8	64	5	40
	CI Total			220		204		180
TOTAL				1450		1416		1170
RANKING				CYMDIST 1st		Software X 2nd		Software Y 3rd

4. Phase Two - Demonstration

The second phase of the evaluation invited each vendor to demonstrate their products suitability to meet the requirements of the project via an on-line demo. All three companies were invited to provide demonstrations, but despite repeated attempts via both email and telephone, EA Technologies chose not to respond. EA Technologies were therefore removed from the evaluation at this stage.

4.1 Demonstration Objectives

A list of demonstration objectives were sent to each of the companies as detailed below:

- 1) Import of a circuit from an external file format.
- 2) Import of a 48 value load profile for supply points.
- 3) Import of a 48 value generation profile for an embedded generation location.
- 4) Demonstrate power analysis performance.
- 5) Demonstrate reporting of overloaded equipment, to an external file format.
- 6) Demonstrate an external way of driving all the above activities.

4.2 Evaluation Criteria

4.2.1 Import of a circuit from an external file format

Project requirement:

In order for the power analysis to be carried out, the chosen circuit information needs to be transferred from the GIS to the PAT.

4.2.2 Import of a 48 value load profile for supply points

Project requirement:

SSE use 48 values at half-hourly periods to model the changes in consumer load over a 24 hour period. This therefore requires multiple sets of 48 load values to be stored in the PAT in order to model the different types of consumers.

4.2.3 Import of a 48 value generation profile for an embedded generation location

Project requirement:

As with the Load Profile data mentioned above, SSE want to model embedded generation profiles as 48 values in a 24 hour period. The vendors must demonstrate this functionality.

4.2.4 Demonstrate power analysis performance

Project requirement:

The power analysis needs to be carried out within a time period acceptable to the user. It is expected that this analysis should take seconds rather than minutes in order to carry out an analysis with 48 data values for a day's half-hour load profiles for all the consumers on an SSE circuit.

4.2.5 Demonstrate reporting of overloaded equipment, to an external file format

Project requirement:

The aim of the NME is to enable network planners to establish whether the network configuration they are analysing is sufficient for the expected loads and embedded generation inputs. The identification and reporting of overloaded equipment is therefore an important requirement.

4.2.6 Demonstrate an external way of driving all the above activities

Project requirement:

For the flexibility of the NME the ability to drive all the PAT activities described above in sections 4.2.1 to 4.2.5 non-interactively was also explored.

4.3 CYMDIST Phase 2 Evaluation Results

CYMDIST is the product of CYME a Canadian power analysis tool company. The demonstration was delivered over the Internet via screen sharing software from Canada. The session began with a brief PowerPoint presentation describing the company and its products, before the product was demonstrated.

4.3.1 Demonstration Narrative

Demonstration Objective 1: Import of a circuit from an external file format

The initial data load into the CYMDIST PAT from an external source used three files, one each for the network itself, the equipment making up the network and the load profiles. The demonstration used CYMDIST's own demonstration data which consisted of approximately 6 kilometres of network. Later in the demonstration it was shown that it was possible to display geographic contextual data, in the example AutoCAD format, behind the network information if a non-schematic network representation is used.

Input from the CYMDIST ASCII data exchange format was demonstrated. This is extensively documented, and it would be possible to create data in this format from the Smallworld GIS.

CYMDIST fully meets the requirements of the NME. Score = 10/10.

Demonstration Objective 2: Import of a 48 value load profile for supply points

This objective was demonstrated at the same time as Object 1 (see above). The load profiles can be given text identifiers in order for the user to distinguish them and allocate them to consumers, and the same profile can be allocated to multiple consumers.

CYMDIST also has an add-on module, the Energy Profile Manager (EPM), which has its own user interface and wizard for the optimal viewing, editing and importing of load profiles. It is designed to store, process and visualise the large amounts of data collected from automated meter reading activities. It has the ability to load information from a CSV format file. Load Profiles can be stored at 15 minute levels of granularity, better than the 30 minutes required for the NME.

CYMDIST goes beyond the requirements of the NME. Score = 10/10.

Demonstration Objective 3: Import of a 48 value generation profile for an embedded generation location

The actual importing of generation profiles from an external file was not included in the demonstration, although working with them was shown. Generation profiles are handled in the same way as load profiles, they can be stored within the EPM along with metered loads, global demands, and customer profiles.

CYMDIST did not completely meet the requirements of the NME during the demonstration, but subsequent communication has established that the product does meet this requirement. Score = 8/10.

Demonstration Objective 4: Demonstrate power analysis performance

The power analysis functionality of CYMDIST covers a wide variety of power analysis scenarios including: Unbalanced load flow; Comprehensive fault analysis; Load balancing; Load allocation/estimation and Optimal capacitor placement. In terms of the time taken, when the analysis was carried out for a single point in time, or with 48 sets of load profiles, the results were near instantaneous. In the discussions at the end of the demonstration the example of analysing a whole year's worth of load profile information was investigated. The demonstrator expressed a qualified opinion that for the example network this would be in the region of thirty minutes processing time, but this obviously depends on the power of the machine running the analysis.

CYMDIST fully meets the requirements of the NME. Score = 10/10.

Demonstration Objective 5: Demonstrate reporting of overloaded equipment, to an external file format

Once an analysis has been run there is a wide variety of analysis values that can be reported on. This can be displayed to both screen and exported to a file, and can also be used as the basis for the thematic display of the network. Reports can be created by choosing which analysis values the user wishes to see.

CYMDIST goes beyond the requirements of the NME. Score = 10/10.

Demonstration Objective 6: Demonstrate an external way of driving all the above activities

CYMDIST can be driven by an external program using the COM (Component Object Model) module add-on. This allows the power analysis tool to be used as an engine, i.e. all the commands required to carry out the power analysis can be put into a file that can be executed non-interactively without the NME user needing to be exposed to the PAT user interface. The Smallworld GIS has native support for applications to invoke functionality exposed via COM.

CYMDIST fully meets the requirements of the NME. Score = 10/10.

4.3.2 Demonstration Summary

The Table below brings together GE's evaluation results against each of the Demonstration Objectives previously detailed:

Demonstration Objective	Observation	Score (10-Good 0-Bad)
1) Import of a circuit from an external file format	ASCII format network import observed.	10
2) Import of a 48 value load profile for supply points	ASCII format load profile import observed.	10
3) Import of a 48 value generation profile for an embedded generation location	Not demonstrated, but follow-up established that it can be done.	8
4) Demonstrate power analysis performance	Load Flow Analysis was demonstrated and other analysis types discussed.	10
5) Demonstrate reporting of overloaded equipment, to an external file format	Screen and file based reporting was demonstrated. Thematic visualisation of results on the network was also shown.	10
6) Demonstrate an external way of driving all the above activities	The running of CYMDIST as an engine via a script run by another software package was demonstrated.	10

In summary CYMDIST fully meets, or goes beyond, the requirements of the NME project.

Two of the three aspects of import functionality required for the project were satisfactorily demonstrated by the CYMDIST tool. The only gap in the presentation, the non-demonstration of the import of a generation profile was followed-up by telephone and email. Through extensive discussions we are satisfied that CYMDIST has this functionality and as such this does not present an issue.

Multiple load flow algorithms are available within CYMDIST for different types of analysis. This provides for reporting on overloaded and underloaded equipment which can then be exported to a file.

The external control of CYMDIST is achieved via the COM add-on module, which provides for automating all the required functionality. From a Smallworld perspective, external COM objects manifest themselves within Smallworld as native classes.

4.3.3 Additional Observations

Beyond the established requirements both the visualisation functionality and network editing functionality demonstrated went beyond the project team's expectations. The GIS had originally been envisaged as the network editing and results visualisation platform within the NME, but the functionality within CYMDIST established that these aspects of the project allowed the project team the flexibility to view the results within the PAT if required. The exact visualisation solution will be fully defined with SSE at a later date.

4.4 Software X Phase 2 Evaluation Results

Power Factory is the product of Vendor X, a German power analysis tool company. The demonstration was delivered over the Internet via screen sharing software from Germany. The session began with a brief PowerPoint presentation explaining the product and particularly its database structure before the power analysis tool was demonstrated.

4.4.1 Demonstration Narrative

Demonstration Objective 1: Import of a circuit from an external file format

The importing of data from an external file was demonstrated using Vendor X's own DGS ASCII format. The demonstration data was initially shown with a schematic representation of an electrical network, with a geographic representation used later.

Software X fully meets the requirements of the NME. Score = 10/10.

Demonstration Objective 2: Import of a 48 value load profile for supply points

The actual importing of load profiles from an external file was not included in the demonstration, although working with load profiles was shown, it was done via pasting data in from a spreadsheet.

Software X did not completely meet the requirements of the NME during the demonstration, but subsequent communication has established that the product does meet this requirement. Score = 8/10.

Demonstration Objective 3: Import of a 48 value generation profile for an embedded generation location

The actual importing of generation profiles from an external file was not included in the demonstration, although working with them was shown, and they are handled in a very similar way to load profiles.

Software X did not completely meet the requirements of the NME during the demonstration, but subsequent communication has established that the product does meet this requirement. Score = 8/10.

Demonstration Objective 4: Demonstrate power analysis performance

A load flow analysis was demonstrated. The network thematically displayed any overloading and underloading based on default tolerances that can be set by the user. Without any load profile information analyses are done with peak load values assigned to the network equipment. To carry out analysis for a 24 hour period with load profiles the use of a pre-defined script was needed which required the user to manually enter the start and stop times for the analysis.

Software X meets the requirements of the NME. Score = 8/10.

Demonstration Objective 5: Demonstrate reporting of overloaded equipment, to an external file format

Reporting can be created in a variety of ways. Initially the demonstration showed on screen reporting via pre-defined reports, but any report produced on screen can be directed to a file if required. Exception reporting was demonstrated, in this example just those pieces of equipment on the network that fell outside of their defined tolerances were listed.

Software X goes beyond the requirements of the NME. Score = 10/10.

Demonstration Objective 6: Demonstrate an external way of driving all the above activities

The engine mode of Vendor X was demonstrated via “API mode” using an executable with a DGS import file specified as the network data source and an output filename specified as the results. The executable was created from C++ code. The Smallworld GIS has the ability to run such external programmes with its Alien Co-Processor functionality.

Software X meets the requirements of the NME. Score = 8/10.

4.4.2 Demonstration Summary

The Table below brings together GE’s evaluation results against each of the Demonstration Objectives previously detailed:

Demonstration Objective	Observation	Score (10-Good 0-Bad)
1) Import of a circuit from an external file format	ASCII format network import observed.	10
2) Import of a 48 value load profile for supply points	Not demonstrated, but follow-up established that it can be done.	8
3) Import of a 48 value generation profile for an embedded generation location	Not demonstrated, but follow-up established that it can be done.	8
4) Demonstrate power analysis performance	Load Flow Analysis was demonstrated.	8
5) Demonstrate reporting of overloaded equipment, to an external file format	Screen and file based reporting was demonstrated. Thematic visualisation of results on the network was also shown.	10
6) Demonstrate an external way of driving all the above activities	The running of CYMDIST as an engine via a DOS script run was demonstrated.	8

In summary Software X fully meets the requirements of the NME project.

Although just one of the three aspects of import functionality required for the project was satisfactorily demonstrated by the Software X tool, it was later established that the two gaps in the demonstration, the importing of load and generation profiles from an external file, are possible with the software.

Like CYMDIST multiple types of load flow analysis are available, although the user interface appears more complex than that for the equivalent functionality within CYMDIST, with more menus and options available on each menu.

External control of Software X is via a C++ executable rather than the COM linking used by CYMDIST. A bespoke programme would need to be written in C++, which is beyond the skillset of the current project team.

4.4.3 Additional Observations

Software X like CYMDIST included more visualisation and network editing functionality than had originally been expected in the PATs, offering similar levels of functionality in these areas. CYMDIST stores the different network configurations in different study files, whilst Software X stores what it calls “variations” in its database. The Software X application allows the user to have large areas of network

visible on screen which are not included in the analysis; in CYMDIST only the network currently being analysed is displayed.

It is our opinion that the simpler network editing functionality available in CYMDIST is preferred to similar functionality available in Software X.

4.5 Phase 2 General Observations

4.5.1 Vendor Engagement

Our suspicions concerning the level of commercial engagement raised during the Phase 1 evaluations were confirmed during the second phase evaluation when Software Y failed to provide a demonstration of their product to the project team. As a result of this lack of engagement the team felt we had no choice but to remove Software Y from the process.

Again, through this phase CYME showed a significantly higher level of engagement than Vendor X proactively providing additional information and responding to queries without the need for follow up communications.

4.5.2 Product & Industry Knowledge

The two demonstrators from CYMDIST and Vendor X knew their products and the electricity power analysis domain well. They each coped well with any questions that were put to them. If an SSE network engineer had been available to participate in the demonstrations and ask more searching technical questions then a differential between the two companies may have been observed.

4.5.3 PAT User Interfaces – Visualisation / Network Editing

It was originally thought that the user would only interact with the NME via the Smallworld Electric Office GIS, with the PAT being run non-interactively in the background in an engine mode. The demonstrations of both the PATs showed us that these tools have the capacity for thematic visualisation, and also the capability for network editing. It had been expected that both these activities would be carried out within the GIS part of the NME, but it is possible to do them in the PAT without the need for any customisation. This has led to the possibility that the focus of user interaction within the NME could be the GIS or the PAT. The preferred visualisation platform will be defined during the Detailed Design phase in full consultation with SSE.

Overall the User Interface of CYMDIST is less complicated than that of Software X. The Data Management menu of Software X was frequently used appearing in a separate window over the top of the network. CYMDIST makes use of an embedded panel on the left of the screen to reduce window overlay issues, although pop-up windows are not completely eliminated. CYMDIST pop-up menus tended to be smaller and less cluttered than those in Software X.

4.6 Phase 2 Conclusion

The Table below brings together GE's evaluation results against each of the Demonstration Objectives for both CYMDIST and Software X.

Demonstration Objective	CYMDIST	Software X
1) Import of a circuit from an external file format	10	10
2) Import of a 48 value load profile for supply points	10	8
3) Import of a 48 value generation profile for an embedded generation location	8	8
4) Demonstrate power analysis performance	10	8

5) Demonstrate reporting of overloaded equipment, to an external file format	10	10
6) Demonstrate an external way of driving all the above activities	10	8
7) Vendor Engagement	9	5
8) Product & Industry Knowledge	10	10
9) PAT User Interfaces	8	5
TOTAL	85/90	72/90
RANKING	CYMDIST 1 st	Software X 2 nd

The outcome of the Phase 2 evaluation again shows that the CYMDIST was preferred to Software X. In the absence of any contribution from an SSE network engineer the evaluation was mainly carried out on criteria concerning the integration with the Smallworld GIS for the creation of the NME, rather than the technical power analysis criteria which we had to assume was fully met by each of the PAT's.

The main differentiators identified in this phase of the evaluation were the interoperability technology, CYMDIST using COM compared to Software X's C++, as well as the level of engagement that the respective companies demonstrated.

5. Phase Three – Practical Test

The integration of the GIS and the PAT is the requirement of the NME with the most risk attached. It was therefore decided that the final stage of the evaluation process would concentrate on the data exchange aspect of the project, and would attempt to use SSE's own data.

5.1 Evaluation Criteria

5.1.1 CIM Data Exchange Format

The Common Information Model (CIM) is a specialised data exchange format for the electricity industry that has been designed through the auspices of the International Electrotechnical Commission (IEC). It forms part of the IEC 61970 standard for energy management systems. The CIM format for use in distribution activities is still developing and so is the standard, but GE is developing a CIM exporter for its Smallworld Electric Office product, and this is expected to be out of the box functionality in the next version of the product (4.3) that is due for release in June 2012. Vendors of other software products in this domain are also adding import and export functionality using CIM to their products.

The CIM is becoming a de facto data exchange format within the electricity industry. It was therefore decided to investigate the CIM capabilities of the PATs under consideration as the ability to transfer between the GIS and the PAT using a standard format rather than a bespoke one would facilitate the further integration of the NME with other software expected in the Tier 2 project.

Both the power analysis vendors responded to the original phase 1 questionnaire by saying they either had a CIM importer or were developing one. The objective of this phase was therefore to establish whether network data could be transferred between Smallworld Electric Office and the PAT using a CIM format file, allowing for the fact that the Smallworld CIM software was only available in a 'pre-release' state, and that at this stage of the project SSE's network data had only been partially migrated into Electric Office and was missing certain important elements, most notably the internals of link boxes and substations.

5.2 Evaluation Results

5.2.1 CYMDIST

CYME already have a CIM loader for CYMDIST. A pre-release version of the CIM exporter currently in development for Smallworld Electric Office was used with an early test migration of data from SSE's existing GIS to produce a set of CIM files for a single circuit. An attempt was made to import this into CYMDIST and some success was achieved with the equipment information being read. However, the geographic portion of the CIM format was not correctly loaded and the cable segments were left disconnected. This meant that it was not possible to perform any LV analysis on the network, so overall the test was only a partial success.

The failure may be the result of the Smallworld CIM exporter software being unfinished, the example data lacking in internal structure, issues with the CYMDIST CIM loader, or a combination of all three. It would have been an unexpected bonus if the exchange of data via the CIM format had completely worked at this stage. However, subsequent discussions with CYME suggested that their CIM software has been successfully used by several customers, and given that there is a significant proportion of the development phase of the project set aside for this integration, the project team is confident that it will be possible to successfully exchange data between Smallworld Electric Office and CYMDIST using the CIM format.

CYMDIST partly meets the requirements of the NME. Score = 4/10

5.2.2 Software X

Vendor X had responded that they had a CIM importer under development but when pressed were somewhat reticent about their CIM handling capabilities. They referred us to a project where they said that they were already working with GE and a customer on CIM, but were unable to provide any contact names. Our own internal enquires could not identify anybody within GE working on such a project.

Software X did not demonstrate any part of the CIM requirement of the NME. Score = 0/10.

5.3 Phase 3 - General Observations

5.3.1 Vendor Engagement

CYME were very helpful in taking the CIM format produced and attempting to load it into CYMDIST and returning the results to us to view in a trial version of their product.

Vendor X were less than helpful with this stage of the evaluation.

5.3.2 Other ASCII Data Exchange Formats

It had originally been envisaged that the third phase of the evaluation would be carried out by creating test data from SSE's own network extracted into a generic ASCII format, e.g. AutoCAD's DXF, and loading this into each of the power analysis tools. This would have then allowed a demonstration of the power analysis tools on part of the SSE network. Although both products do have the facility to import DXF format this is not used for the creation of their connected network data, only for background geographical data that gives the network context. Each product does have its own ASCII data exchange format for connected network data. However, it was beyond the scope of the evaluation process to write exporters from the GIS for each of these formats. It was therefore not possible to test the loading of SSE's own data in such a format.

5.4 Phase 3 Conclusions

The CIM format is the preferred data exchange format for the project as it will provide for greater flexibility of integration of the NME in the Tier 2 project. The CYMDIST product has demonstrated the ability to partially load SSE network data via the CIM format. Software X could not demonstrate this.

Demonstration Objective	CYMDIST	Software X
1) Import of a circuit in CIM format	4	0
RANKING	CYMDIST 1st	Software X 2nd

6. Evaluation Conclusion

The outcome of the evaluation process is that the CYMDIST product supplied by CYME International is the power analysis tool recommended by GE for the LCNF project.

As shown in the summary table below it scored highest out of the three PATs in each of the three phases of the evaluation process.

Evaluation Phase	CYMDIST	Software X	Software Y	Phase leading PAT
1 – Questionnaire	1450	1416	1170	CYMDIST
2 – Demonstration	85	72	NA	CYMDIST
3 – Practical Test	4	0	NA	CYMDIST
FINAL RANKING	1	2	3	CYMDIST

Phase 1 - Questionnaire: CYME provided the most thorough response to the questionnaire, providing satisfactory answers to all the evaluation questions.

Phase 2 – Demonstration: CYME provided the best product demonstration, in which the CYMDIST application was shown to meet or exceed all the pre-defined project requirements.

Phase 3 – Practical Test: CYME were the only supplier to demonstrate any of the data exchange functionality specified in the practical test.

The key factors in differentiating CYMDIST from Software X, its closest rival in the evaluation process, are as follows:

- The application has a simpler and more intuitive user interface, which should reduce the training/learning overhead for SSE network engineers.
- It offers interoperability via COM (as opposed to C++), which will facilitate integration with Smallworld Electric Office
- The product handles the CIM data exchange format. This is becoming the industry standard format for electricity network data, is the preferred format for data exchange with Smallworld Electric Office, and will make the NME a more flexible platform for the integration with other systems envisaged for the Tier 2 LCNF project.
- CYME International have demonstrated a consistently high level of engagement throughout the evaluation process, giving confidence of the supplier's continued support in tackling any issues that may arise during the project and providing a timely resolution.

Appendix V

Power Analysis Tool Vendor Responses

SSEPD LCNF Tier 1 Close Down Report

SSET1005 Low Voltage Network Modelling and Analysis Environment

GE Energy UK – Power Analysis Tool

Response from CYME International T&D

CYMDIST Software



CYMDIST - Distribution System Analysis

CYMDIST performs several types of analysis on balanced or unbalanced three-phase, two-phase and single-phase systems that are operated in radial, looped or meshed configurations. CYMDIST includes a full network editor, as well as:

- Unbalanced load flow
- Comprehensive fault analysis
- Load balancing
- Load allocation/estimation
- Optimal capacitor placement

The CYME workspace is fully customizable. The graphical representation of network components, results and reports can be built and modified to supply the level of detail needed. Innovative engineering technologies, industry practices and standards are at the core of the CYME algorithms, flexible user interface and extensive libraries.

The CYMDIST Distribution Analysis software is a suite of applications composed of a network editor, analysis modules and user-customizable model libraries from which you can choose to get the most powerful solution. The program is designed for planning studies and simulating the behavior of electrical distribution networks under different operating conditions and scenarios. It includes several built-in functions that are required for distribution network planning, operation and analysis. The analysis functions such as load flow, short-circuit, and network optimizations, are performed on balanced or unbalanced distribution network that are built with any combination of phases and configurations.



Load Profiles

Describe the product's capabilities for analysis using load profiles in it power analysis

With the integration of automated meter reading (AMR) telemetry in distribution systems, short-term load forecast calibrated by AMR telemetry data and energy billing records, new tools are necessary to help the distribution utilities exploit this data. The Energy Profile Manager module is the CYME optional planning tool that assists users in performing accurate time range analysis based on AMR data and combination of historical consumption patterns and real-time monitoring.

The Energy Profile Manager module comes with its own user interface and wizard for the optimal viewing, editing and importing of load profiles and metering demands from various types of data sources.

The Energy Profile Manager includes a *Load Flow with Profiles* analysis functionality that utilizes the data organized with the module. When running a voltage drop simulation for a specified period, it produces significant information for the system planners about the network conditions. Using the Load Flow with Profiles analysis, the user can generate several reports and charts based on monitored device and summary networks results.¹

Could a profile of 48 values for a 24 hour period be handled?

Yes

.

How would multiple load profiles on the same circuit be handled?

Combinations of metered and non-metered profiles as well as load, generator, meter, customer and demand profiles are supported.

¹ Additional information is provided in the *Energy Profile Manager* brochure.



Embedded Generation (aka Distributed Generation)








Describe the product's capabilities for analysis using embedded generation

From the traditional diesel generators to the new low-carbon energy producers such as photovoltaic and wind turbines, distributed energy resources have changed tremendously the landscape of power utilities. The need to manage the interconnection appropriately, to understand the resulting technical issues and to prepare the network to meet the challenge of tomorrow can be satisfied with the use of CYME Power System Analysis software.

With its robust analytical and modeling capabilities, CYME is a powerful tool to help engineers study and understand the different issues coming from small-scale embedded generation and large distributed generation sources.²

What types of embedded generation can your product analyze?

CYMDIST can analyze the following type of

-  generators: Photovoltaic
-  Wind Energy Conversion System
-  Micro-Turbine
-  Solid Oxide Fuel Cell Induction
-  Generator Electronically-
-  Coupled Generator
-  Synchronous Generators

Can you analyze embedded generation profiles?

Yes

.

It is possible to do analysis using both embedded generation and load profiles at the same time?

Yes

.

² Additional information is provided in the CYME Distributed Generation brochure



Batch Mode

Describe the non-interactive ways that your product's analysis functions can be driven.

CYMDIST COM consist of a comprehensive collection of Power Engineering Analysis simulation components that can be easily and transparently launched within your preferred DMS, CAD, GIS, OMS, EMS, NMS or SCADA programs, as if they were an integral part of your own solution.

CYMDIST COM is built on top of the information technologies most recognized standard: the Component Object Model or COM. The COM-based components can be accessed by any computer program written in C, C++, Java, J++, Delphi or Visual Basic.

Additionally the CYMDIST Server can be deployed either as a client/server solution, as Web- based tools on your intranet, as an application service provider (ASP) or as Web services, since they provide support for browser standard HTML and XML formats.

Data Input

List the data input formats that your product can handle, along with any limitations to any specific formats

The CYMDIST import formats

- are: CYMDIST ASCII
- file
CIM
- Multispeak 1.1, 2.2 and
3

The data is imported into a database. CYMDIST supports the following 3 database

- formats: Microsoft Access
- Microsoft SQL Server: 2000, 2005, 2008
- Oracle: 9, 10 and
11



Please state if your product can accept CIM format inputs, and if it can which version of CIM you use and what constraints there are on the CIM profiles your product can use.

CYMDIST does support CIM format inputs. If a new CIM version is available, an update to the

CYMDIST software can be made to support the new CIM format.



Data Output

Describe the reporting capabilities of your product

CYMDIST reporting facilities allow to fully define the analyses results into web reports. CYMDIST includes a variety of report templates for all types of analyses. You can combine any reports, and create new ones, utilize any CYMDIST variable and created your own mathematical expressions using any of those variables, which further extends the reporting possible with CYMDIST. Available report formats are:

- CYME embedded reports
- Microsoft Excel
- spreadsheet XML format
- HTML format
- Microsoft Access database

Can lists of out of tolerance components be generated and exported?

The data validation engine validates all networks, equipment, and range of data currently loaded in memory, to ensure all data are with-in operating limits. A list of all errors and warnings is generated and can be exported to Microsoft Excel for editing and archiving.

Can the reporting be done non-interactively?

Yes reports can be generated using the CYMDIST-COM interface.

Performance

What are the factors that affect the performance of your analysis tool?

- Number of circuits/feeders loaded in memory
- Type of analysis run
- Computer memory and CPU

Please indicate whether a typical low voltage circuit analysis involving load profiles and embedded generation takes in the order of seconds or minutes

In the order of seconds for a few feeders/substations.



GIS Linkages

Please indicate any experience you have with using your product in conjunction with GIS

software

For the integration of CYMDIST with GIS system, CYME has developed a platform called the CYMDIST Gateway. This interface is used to connect transparently to your GIS system (ESRI, Intergraph, GE Smallworld, etc.) and to any other enterprise system (AMI, SCADA, OMS, CIS, etc.) to gather all information available to build the most complete network model possible for CYMDIST. The users can use the "Configuration Tool" of the Gateway to select the feeders and substations as well as complementary information they want to extract. Here are examples of options we also offer;

- Extraction of the low-voltage network; ■ Extraction of kWh consumption;
- Extraction of substations, grids, vaults, manholes and other sub-network; ■ Enhanced validation;
- Automatic simulations and reports;
- Etc.

The extraction takes seconds per feeder, and the CYMDIST database is ready for use right after; no need for additional import steps by the user.

We have delivered more than 50 CYMDIST Gateways currently used in production. We can provide many references for the projects we have delivered so far.

As for our regular off-the-shelf software, we offer a maintenance contract for the CYMDIST Gateway that covers timely email and telephone support, but also upgrades to new versions of CYMDIST and to new versions of the GIS system.

Does any of this experience involve the Smallworld GIS product?

Yes, multiple CYMDIST Gateway interfaces were developed to interface with GE Smallworld GIS systems. For example, CYMDIST Gateway interfaces for GE Smallworld have been provided to Baltimore Gas & Electric (BG&E), Commonwealth Edison

(Continued part of Exelon), Saskpower, etc. www.cyme.co



SSEPD LCNF Tier 1 Close Down Report

SSET1005 Low Voltage Network Modelling and Analysis Environment



Commercial Issues

Describe the licensing model and pricing structure for your product

Software licensing is available as stand-alone and network floating licenses. The price structure for multiple licenses is as follows:

- 1st license = full price
- 2nd and 3rd license = 25% discount
- 4th and 5th = 50% discount
- 6th and over = 75% discount

Would you be willing to provide a free evaluation license during the proof of concept (October 2011-June 2012)?

Yes we can provide a free evaluation license during the proof of concept period.

What levels of support would be provided for this project?

Depending on the level of customization required, we could be involved in the design, development and deployment phases. For developing a CYMDIST Gateway interface, we normally assign a Project Manager and the project process go through the following phases, all involving CYME experts; Design, Development, Factory Acceptance Test (FAT), Installation/Deployment, Site Acceptance Test (SAT), and then warranty and maintenance. We would propose the same approach for the development of the CYMDIST Gateway interface, and could propose a similar process for the entire project is custom development is required for the CYMDIST tool.



Vendor X Response to LCNF Power Analysis Tool Questionnaire from GE Digital Energy



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1 Introduction

Smallworld UK Services / GE Energy – Infrastructure, UK has invited Vendor X to provide a response to the Questionnaire “LV Network Modelling Power System Analysis Tool – Low Carbon Network Fund First Tier Project”.

Background of the questionnaire in reference is the engagement of GE Digital Energy by a UK DNO to provide a Proof of Concept demonstrating a Low Carbon Low Voltage Modelling Environment for a defined area of network in the South of England.

The solution proposed by Smallworld UK Services comprises the following three areas:

- ! Low Carbon Data Modelling, Recording and Reporting
- ! Management of Multiple Low Carbon Network Scenarios
- ! Power Analysis of Low Carbon LV Networks

Vendor X’s response to the questionnaire is making reference to Vendor X’s standard power system analysis software product Software X which is already widely in use in UK and Ireland, namely NG, UK Power Networks, ScottishPower, NEDL, ESB, etc.

The requirements indicated in the questionnaire are already covered to a very high extend by the actual release of the Software X software. However, Vendor X is open to implement certain extension according to specific project requirements.



2 Response to Questionnaire

The below sections are summarizing Vendor X's response to the GE Digital Energy questionnaire.

2.1 Load Profiles

Load profiles are either relevant for subsequent static analysis (e.g. load flow sweeps), as well as for dynamic stability calculations which are often used when control strategies in combination with storage systems are to be modelled and simulated.

2.1.1 Static Analysis Methods

Realisation of load profiles for static analysis methods is preferable based on parameter characteristics assigned to the individual load parameters (e.g. active power, power factor, etc.). In general, such characteristics can be assigned to any object parameter defined in the Software X program. Besides the definition of load profiles, cases with generation profiles related to wind or solar radiation, temperature depending cable parameter or the switch status of substation depending on time could be realized. The characteristic themselves can be defined as internal data or via the reference to external files (e.g. EXCEL pages and columns). In general, the flexibility of such definition is featuring the implementation of any kind parametric study. Such studies are typically implemented via DPL scripts under the variation of scenarios, triggers or any other parameter. Result display can make use of the Software X graphic library.

Various definitions of characteristics are supported such as scalars, vectors or matrices on basis of discrete or variable triggers (x-axis). This allows the definition of any kind of continuous scale as well as discrete scale. Various interpolation methods are available for smoothing gives values. Available methods easily provide the definition and handling of 48 values for a 24 hour period.

Handling of multiple profiles

Characteristics can be combined (multiplied) by just defining several characteristics for the same parameters and setting the appropriate trigger (e.g. Monday 11.25 hours, February, strong wind, low solar radiation).

Alternatively, or in combination, multiple profiles can be handled via the operational library.

The usage of "characteristics" is described in the attached section of the Software X manual named "profiles".

All data are stored in a multi-user database. Easy and fast access to the various selected and defined settings (trigger) is additionally provided via the definition of operational scenarios.

2.1.2 Dynamic Analysis Methods

In case of dynamic analysis methods (time domain) the user may assign to any object parameter a reference to a column of an external file (measurement file, text, COMTRADE, etc.). Interpolation of values is provided.

Usage of successive static calculations (e.g. load flow sweep) or alternatively the dynamic calculation on basis of the Software X long-term stability mode will typically depend on the complexity of storage simulation requirements as well as overall control modes associated with the dispatch and operation of distributed generation and storage systems. Calculation sweeps (e.g. load flow sweeps) are implemented on basis of the Vendor X script language DPL. In case of time domain simulations, the DSL modelling approach is applied.

2.2 Embedded Generation / Distributed Generation

All supported analysis methods such as load flow, fault analysis, transients, harmonics, reliability analysis, etc. are covering also Embedded Generation.

Software X is supporting all relevant types of distributed generation such as: synchronous machines, asynchronous machines, static generators (PV, wind turbines, Micro turbines, fuel cell, battery, etc.) as well as the doubly-fed induction generator.

Embedded Generation profiles are also handled via parameter characteristics.

As parameter characteristics are applicable for all available Software X objects, Embedded Generation and Load Profiles can be handled at the same time to any degree of complexity.

2.3 Batch Mode

The following non-interactive execution modes are available:

1. Execution of Software X DPL-scripts featuring access to any Software X objects and functions incl. the call to external DLLs.
2. Software X Engine mode allowing other programs to call Software X via API

Both methods allow the full access and automated execution of fix user defined or variable function execution (batch).

2.4 Data Input

External data which are not stored and handled within the Software X database can be imported via the DGS interface. DGS is a flexible object oriented format for bi-directional data exchange. Objects and their parameters to be included in the DGS import/export can be freely configured by user. DGS is supporting CSV and well ODBC data structures.

Foreign file format supported is PSS/E *.raw, *.seq and *dyn-files

CIM standards and profiles supported are:

CIM for transmission IEC 61970, ENTSO-E profile 2009

CIM for distribution IEC 61968, CDPSM profile (under development)

2.5 Data Output

The output of calculation results for load flow or any other function is available as follows:

1. Spread-sheet type Data Manager and Object Browser with comprehensive filter and multi-sorting sorting functions with user defined selection of result variables. Export functions (e.g EXCEL);
2. Numerous ASCII outputs designed for document printing;
3. DPL flexibility to generate individual reports;
4. Export of any set of object variables (DGS) supporting CSV and ODBC format for external reporting.

2.6 Performance

The performance of the execution functions is determined by the "grid size" (topology nodes) and the complexity of control functions. Typical execution times of distribution grid power flows of several 100 000 busbars are in the range of a couple of seconds. Such execution times for a profile type analysis (load flow sweeps) will have to be multiplied by the number of profiles to be considered. It is expected that for relevant distribution grid areas, the execution of 48x24 cases will perform within the order of seconds.

2.7 GIS Linkage

GIS data export via the DGS interface (non-integrated solution) has been realized for a number of different GIS systems. As the bi-directional DGS interface is fully transparent to the user, quite a number of GIS interfaces have been developed by the users themselves. Vendor X has executed projects or has been involved in projects with SmallWorld, ESRI/ArcGIS, Magnis GIS, COS Vega GIS, SICAD Open, GEOGRAT GIS.

2.8 Commercial Issues

The Software X installation options and licensing model is explained in detail in chapter 29 and 30 of the Software X product information (attached to this email). The Software X base package is most probably covering the initial project needs.

An free evaluation installation can be made available.

LV Network Modelling Power Analysis Tool Questionnaire Low Carbon Network Fund First Tier Project

Vendor Y response to LCNF Power Analysis Tool Questionnaire from GE Digital Energy

Software Y

Load Profiles

o Describe the product's capabilities for analysis using load profiles in its power analysis

Software Y allows two methods for using load profiles to model the LV network.

- Multiple point loads can be modeled on the network. Each point load can be associated with a load profile and then linked to a number of consumers i.e. 10 consumers can be modeled at a single point on the network all associated to a load profile. Point loads can be used to group loads together to simplify a network design or an individual point load can be used to represent each load on the network.
- Loads can be represented as distributed load along a cable. The load profile is selected and then a number of distributed loads selected. These loads are then modeled as evenly distributed loads along the cable. This is often used to build large network designs as it can be faster to set the network up than modeling individual point loads.

Widespread use by all UK DNOs at technician and engineer level has allowed us to refine the load profiles in use and the modeling techniques.

o Could a profile of 48 values for a 24 hour period be handled?

Software Y load profiles are defined as 48 half hour periods and so can handle this requirement.

o How would multiple load profiles on the same circuit be handled?

Each point load on a circuit can be given a different load profile and then a load flow analysis module analyses them to calculate results.

Embedded Generation (aka Distributed Generation)

o Describe the product's capabilities for analysis using embedded generation

At each point load on the network a set of generators can be modeled. The generation is included in the load flow analysis with the main aim for Software Y to assess the impact of the generation in terms of the impact of the maximum volt rise on any point of the network. For the 48 half hour period modeled a voltage and current graph can be displayed at any point on the network to view the impact of the generation against the load at that point.

Vendor Y response to LCNF Power Analysis Tool Questionnaire from GE Digital Energy

o **What types of embedded generation can your product analyse?**

Software Y allows the user to enter their own generation profiles. As current users are looking for worst case scenarios of volt rise PV curves are often used but other forms of generation are often modeled with constant generation to give the worst case scenario for volt rise. Software Y is though capable, as the use of PV curves demonstrates, of modeling any generation where a suitable profile can be supplied.

o **Can you analyse embedded generation profiles?**

The software allows the user the option to modify or create new generation profile based on half-hourly data.

o **It is possible to do analysis using both embedded generation and load profiles at the same time?**

Both generation and load profiles can be analysed at the same time. A load and generation can be modeled at the same point on the network.

Batch Mode

o **Describe the non-interactive ways that your product's analysis functions can be driven.**

Software Y is primarily driven through its user interface, but it does sit on top of a modeling engine that could be used in a batch mode. Software Y could be easily adapted to run in a full batch mode as an interface specification is available to load in networks from other systems.

Data Input

o **List the data input formats that your product can handle, along with any limitations to any specific formats**

o **Please state if you product can accept CIM format inputs, and if it can which version of CIM you use and what constraints there are on the CIM profiles your product can use.**

Software Y does not currently accept CIM formats

Data Output

o **Describe the reporting capabilities of your product**

Software Y outputs general results to the user interface for immediate use by the user. A more detailed 'text' based output file is also available that many clients store as their permanent record of results.

o **Can lists of out of tolerance components be generated and exported?**

Software Y flags up any out of tolerance components and they are clearly identified in the standard output files. A small adaption would allow specific lists of information to be output as required.

o **Can the reporting be done non-interactively?**

Currently the results output file is generated when ever a model is run. The user must then choose to save this results file. It would require a small adaption to store results of multiple runs non-interactively.

Performance

o What are the factors that affect the performance of your analysis tool?

The number of individual components to model is the main area that affects performance. The software though is relatively light on resource use and this has not been found to be an issue for any of our clients.

o Please indicate whether a typical low voltage circuit analysis involving load profiles and embedded generation takes in the order of seconds or minutes

A typical low voltage circuit analysis will take in the order of seconds.

GIS Linkages

o Please indicate any experience you have with using your product in conjunction with GIS software

Software Y has a public interface specification that is targeted at allowing networks from GIS to be imported into Software Y.

o Does any of this experience involve the Smallworld GIS product?

The Software Y public interface was developed with a company who used Smallworld and so was targeted at this technology. It has since been used to link to further GIS products.

Commercial Issues

o Describe the licencing model and pricing structure for your product

Licences are either sold per seat (1 user has an allocated licence) or as a concurrent licence (5 concurrent licences mean that as many users as required can have Software Y but only 5 can be actively using it at one time)

Pricing is on a sliding scale dependant on the number of licences purchased.

o Would you be willing to provide a free evaluation licence during the proof of concept (October 2011-June 2012)?

A free evaluation copy of Software Y can be supplied for the proof of concept.

o What levels of support would be provided for this project?

If selected for the proof of concept stage then we would need to enter a Commercial negotiation to understand how we can cover costs for this type of work.

If product development is required then we would expect to enter a further Commercial agreement with GE Digital Energy or GE Digital Energy's client.