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Low Voltage Distributed Generation Online Event

November 2020

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Agenda

Morning

- Overview of Generation Connections Process
- EREC G5-5 Policy Update
- ICE Update
- Questions

Afternoon

- Update on Transition to DSO
- RIIO ED2 Update
- Net Zero Update
- Questions

Meet the Team

Mark Williamson

Energy Solutions Director

Martin Edmundson

Head of Business Connections

Dominic Allen

Planning Engineer

Matt Savka

Business Connections Delivery Manager

Keith Evans

DSO Transition and Smart Grid Engineering Manager

Peter Twomey

Policy Manager

Lynn Tracey

Decarbonisation Officer

Meet the Team – ICE Team

Ami Mathieson

ICE Manager

Hannah Sharratt

Connections Stakeholder Engagement & Regulation Manager

Brian Hoy

Head of Market Regulation

We want to hear your feedback from today's session, please email ice@enwl.co.uk

End to end Generation Connection Process

Dominic Allen

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LV Generation End to End Process

Types of generation at LV

Application – G98, Integrated Micro-Generation, G99, Required Information

Study Process – LV, HV

Outcomes and Options – Ok to connect, Tap Change, Export limitation, Service upgrade

Commissioning

Opportunity for questions

Types of LV Generation

- Photovoltaic (PV)
- Battery Storage
- Combined Heat and Power (CHP)
- V2G chargers (Using an EV Car as a Battery)

Application

G98

Integrated Micro-Generation

G99

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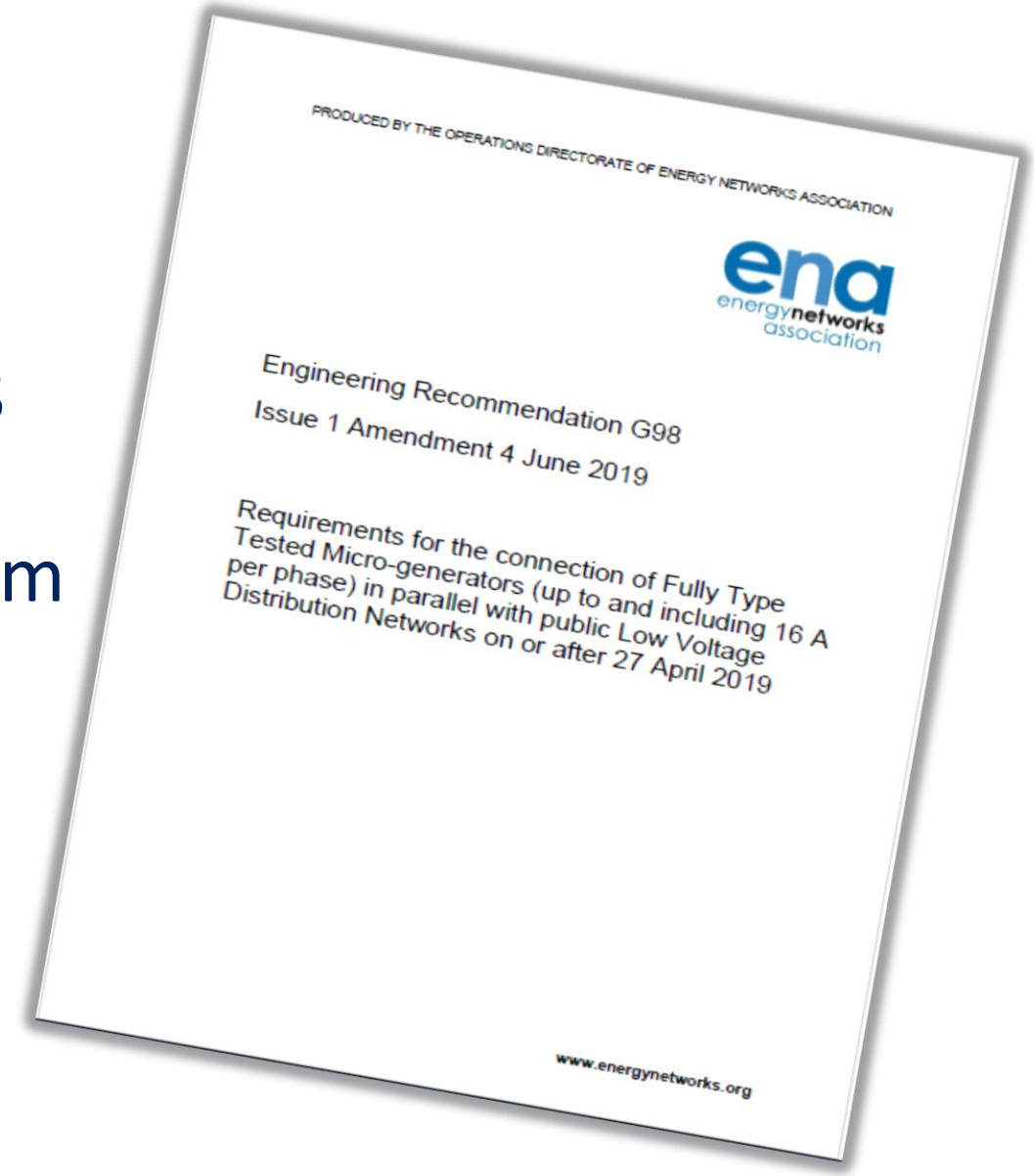
Application – G98

ENA Engineering Recommendation G98 (Formerly G83) is for the connection of generation to the network for any system up to and including 3.68kW (16A) per phase.



Application - G98

Background

- ENA Engineering Recommendation G98 (formerly known as G83) is for the connection of generation systems up to an including 3.68kW (16A) per phase.
- A G98 system does not require a study as is it deemed that the impact on the network is negligible.
- A single phase G98 system will consist of one type of generation with a maximum capacity of 3.68kW.
- A three phase G98 system can either be 3 x single phase 3.68kW, each connected per phase or up to 11.04kW as a single, three phase system.

In the case of a G98 application, the customer may <u>connect and notify</u>

Application – G98

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- Form C	If fully type tested but not registered with the ENA- Form C	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested- Form A2-2 synchronous Form A2-3 inverter connected gen	PGMD** Form B2-1	PGMD** Form C2-1	
Site Compliance and Commissioning Checks					Form A2-4 if the Interface Protection is not Type Tested or for other site compliance tests	Form B2-2 if the Interface Protection is not Type Tested or for other site compliance tests	Form C2-2 if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						Form B3	Form C3	

*Standard Application Form

**Power Generating Module Document

A G98 notification should be made by submitting the G98 'Form B' to Electricity North West

Application – G98 Required Information

Form B: Installation Document for connection under G98	
Please complete and provide this document for each premises, once **Micro-generator** installation is complete.	
To ABC electricity distribution **DNO**	
99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com	
Customer Details:	
Customer (name)	
Address	
Post Code	
Contact person (if different from **Customer**)	
Telephone number	
E-mail address	
Customer signature	
Installer Details:	
Installer	
Accreditation / Qualification	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	
Installer signature	
Installation details	
Address	
Post Code	
MPAN(s)	
Location within **Customer's Installation**	

Location of Lockable Isolation Switch	

Details of Micro-generators. Use a separate line for new and existing installations and for different technology type. Use PH 1 column for single phase supply.

Manufacturer	Date of Installation	Technology Type / Primary Energy Source please enter code from table below	Manufacturer's Ref No (this number should be registered on the ENA **Type Test Verification Report** Register as Product ID)	**Micro-generator Registered Capacity** in kW				
				3-Phase Units	Single Phase Units			Power Factor
					PH1	PH2	PH3	

Declaration – to be completed by Installer for Micro-generators Tested to EREC G98

I declare that the relevant **Micro-generators** and the installation which together form a **Micro-generating Plant** within the scope of EREC G98 at the above address, conform to the requirements of EREC G98. This declaration of compliance is confined to **Micro-generating Plant** tested to EREC G98 or EREC G83 as applicable at the time of commissioning.

Signature:	Date:

Primary Energy Source	Code	Primary Energy Source	Code
Solar PV	1	Wind	2
Hydro (run of river)	3	Hydro (reservoir)	4
Biomass	5	Other Renewable	6
Fossil gas	7	Waste	8
Fossil coal gas	9	Fossil oil	10
Fossil oil shale	11	Fossil peat	12
Geothermal	13	Fossil brown coal/lignite	14
Fossil hard coal	15	Hydro pumped storage	16

Marine	17	Nuclear	18
Offshore wind	19	Other	20
Other – battery storage	21	Other – storage - not battery	22

Application - G98

As a study is not required, the G98 notification can be sent to the below mailbox. This will be checked by the team and added onto our network records.

G98notifications@enwl.co.uk

Application – Integrated Micro-Generation

Background

- Integrated Micro-Generation, formerly known as ‘Fast track’ is a part of the ENA G99 Engineering Recommendation.
- It covers systems up to a maximum installation capacity of 7.36kW (32 Amps) limited via a G100 export limitation scheme (ELS) to 3.68kW (16 Amps) of export.
- The main way this is utilised is by installing a 3.68kW PV system, alongside a 3.68kW battery storage unit. The full system is then limited to a maximum export capacity of 3.68kW (16 Amps).

Application – Integrated Micro-Generation Required Information

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- **Form C**	If fully type tested but not registered with the ENA- **Form C**	If not type tested – **Form A2-1** synchronous <50kW, **Form A2-2** synchronous >50kW or **Form A2-3** inverter connected gen	If not type tested – **Form A2-1** synchronous <50kW, **Form A2-2** synchronous >50kW or **Form A2-3** inverter connected gen	If not type tested- **Form A2-2** synchronous **Form A2-3** inverter connected gen	**PGMD**** **Form B2-1**	**PGMD**** **Form C2-1**	
Site Compliance and Commissioning Checks					**Form A2-4** if the Interface Protection is not Type Tested or for other site compliance tests	**Form B2-2** if the Interface Protection is not Type Tested or for other site compliance tests	**Form C2-2** if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						**Form B3**	**Form C3**	

*Standard Application Form

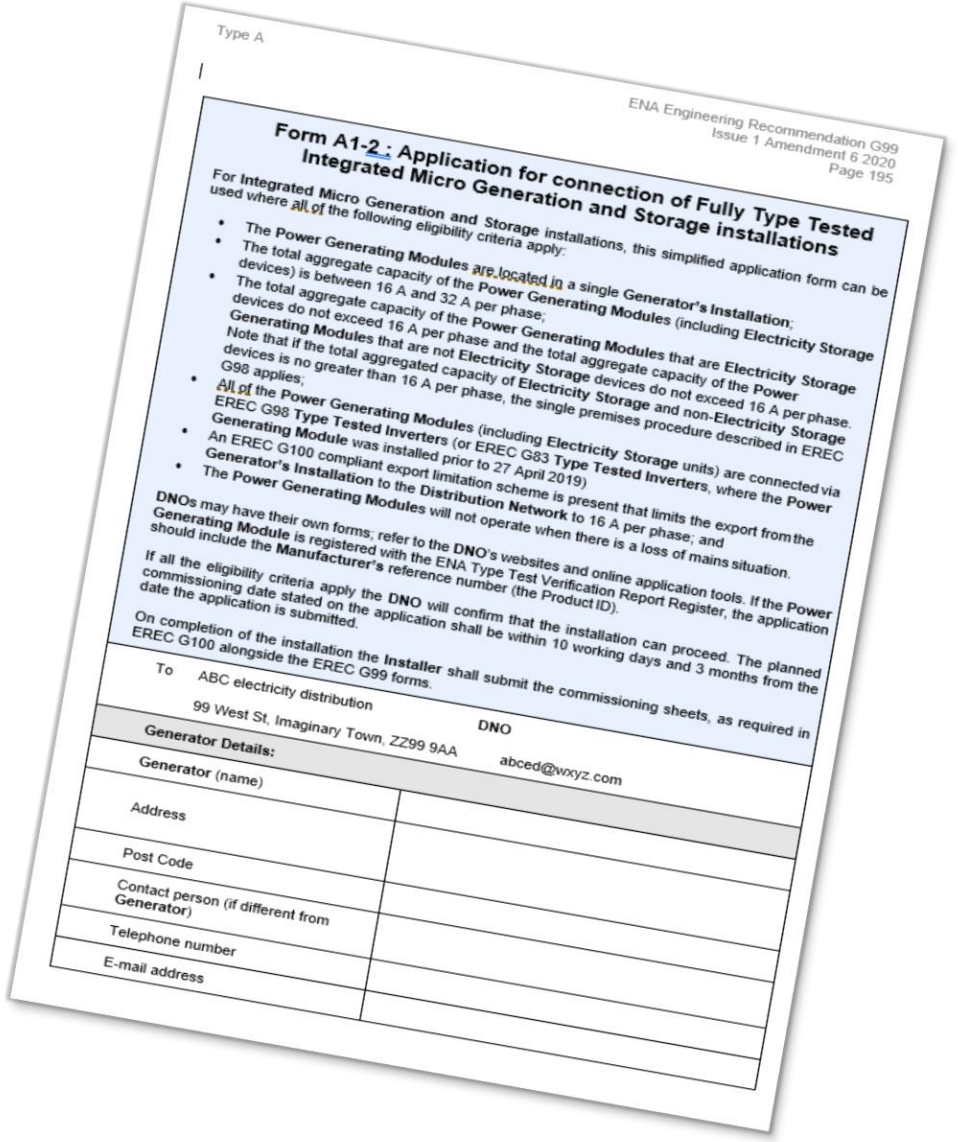
**Power Generating Module Document

A G99 Integrated Micro-Generation application should be made by submitting the G99 'Form A1-2' Electricity North West

Application – Integrated Micro-Generation Required Information

Required information for an Integrated Micro-Generation Application:

- G99 Form A1-2
- Site Plan
- MPAN number
- Inverter details (Data sheets)
- Inverter compliance certificates/type test reports
- Battery Storage details
- G100 Export Limitation Scheme (ELS) evidence/report
- A single line diagram of the full system including the G100 ELS



Type A

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Form A1-2 : Application for connection of Fully Type Tested Integrated Micro Generation and Storage installations

For **Integrated Micro Generation and Storage** installations, this simplified application form can be used where all of the following eligibility criteria apply:

- The **Power Generating Modules** are located in a single **Generator's Installation**;
- The total aggregate capacity of the **Power Generating Modules** (including **Electricity Storage** devices) is between 16 A and 32 A per phase;
- The total aggregate capacity of the **Power Generating Modules** that are **Electricity Storage** devices do not exceed 16 A per phase and the total aggregate capacity of the **Power Generating Modules** that are not **Electricity Storage** devices do not exceed 16 A per phase. Note that if the total aggregated capacity of **Electricity Storage** and non-**Electricity Storage** devices is no greater than 16 A per phase, the single premises procedure described in EREC G98 applies;
- All of the **Power Generating Modules** (including **Electricity Storage** units) are connected via EREC G98 **Type Tested Inverters** (or EREC G83 **Type Tested Inverters**, where the **Power Generating Module** was installed prior to 27 April 2019)
- An EREC G100 compliant export limitation scheme is present that limits the export from the **Generator's Installation** to the **Distribution Network** to 16 A per phase; and
- The **Power Generating Modules** will not operate when there is a loss of mains situation.

DNOs may have their own forms; refer to the **DNO**'s websites and online application tools. If the **Power Generating Module** is registered with the ENA Type Test Verification Report Register, the application should include the **Manufacturer's** reference number (the Product ID).

If all the eligibility criteria apply the **DNO** will confirm that the installation can proceed. The planned commissioning date stated on the application shall be within 10 working days and 3 months from the date the application is submitted.

On completion of the installation the **Installer** shall submit the commissioning sheets, as required in EREC G100 alongside the EREC G99 forms.

To ABC electricity distribution
99 West St, Imaginary Town, ZZ99 9AA

DNO
abced@wxyz.com

Generator Details:	
Generator (name)	
Address	
Post Code	
Contact person (if different from **Generator**)	
Telephone number	
E-mail address	

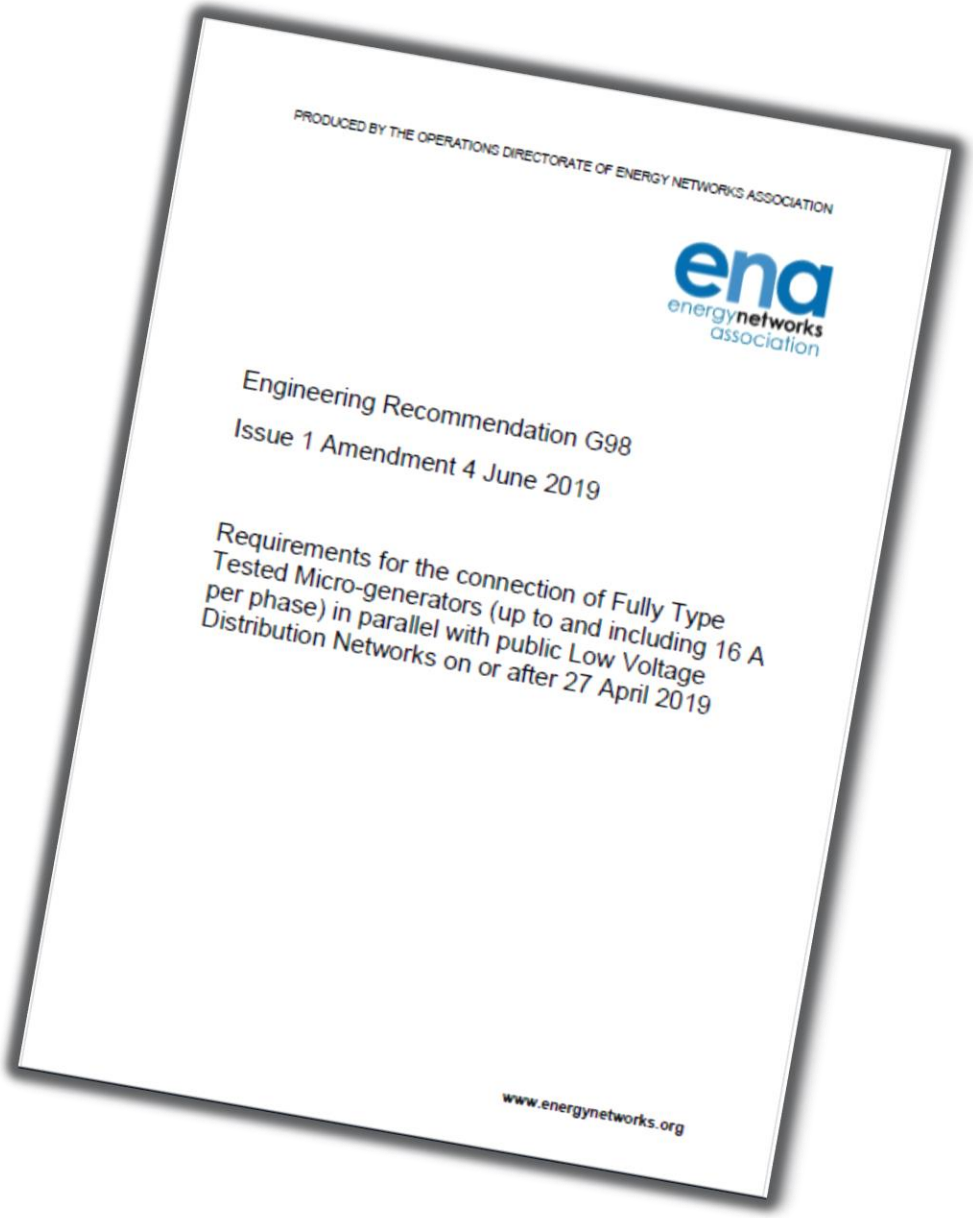
Application – Integrated Micro-Generation

The application is to be sent to the below mailbox. This will be raised by our registrations team and a quote letter will be provided to you by one of our engineers.

connectionapplications@enwl.co.uk

Application – G99

ENA Engineering Recommendation G99 (Formerly G59) is for the connection of generation to the network for any system above 3.68kW (16A) per phase.



Background

ENA Engineering Recommendation G99 (formerly known as G59) is for the connection of generation systems above 3.68kW (16A) per phase.

Above G98 and Integrated Micro-Generation, G99 can be split into two types of applications. This is dependant on the capacity and size of the proposed system:

- A G99 Form A1-1 Application – This is for single phase systems up to and including 17kW, and for three phase systems up to and including 50kW.
- A G99 Standard Application Form (SAF) – This is for single phase systems above 17kW, and for three phase systems above 50kW.

Application – G99 up to 17kW 1ph or 50kW 3ph

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- **Form C**	If fully type tested but not registered with the ENA- **Form C**	If not type tested – **Form A2-1** synchronous <50kW, **Form A2-2** synchronous >50kW or **Form A2-3** inverter connected gen	If not type tested – **Form A2-1** synchronous <50kW, **Form A2-2** synchronous >50kW or **Form A2-3** inverter connected gen	If not type tested- **Form A2-2** synchronous **Form A2-3** inverter connected gen	**PGMD**** **Form B2-1**	**PGMD**** **Form C2-1**	
Site Compliance and Commissioning Checks					**Form A2-4** if the Interface Protection is not Type Tested or for other site compliance tests	**Form B2-2** if the Interface Protection is not Type Tested or for other site compliance tests	**Form C2-2** if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						**Form B3**	**Form C3**	

*Standard Application Form

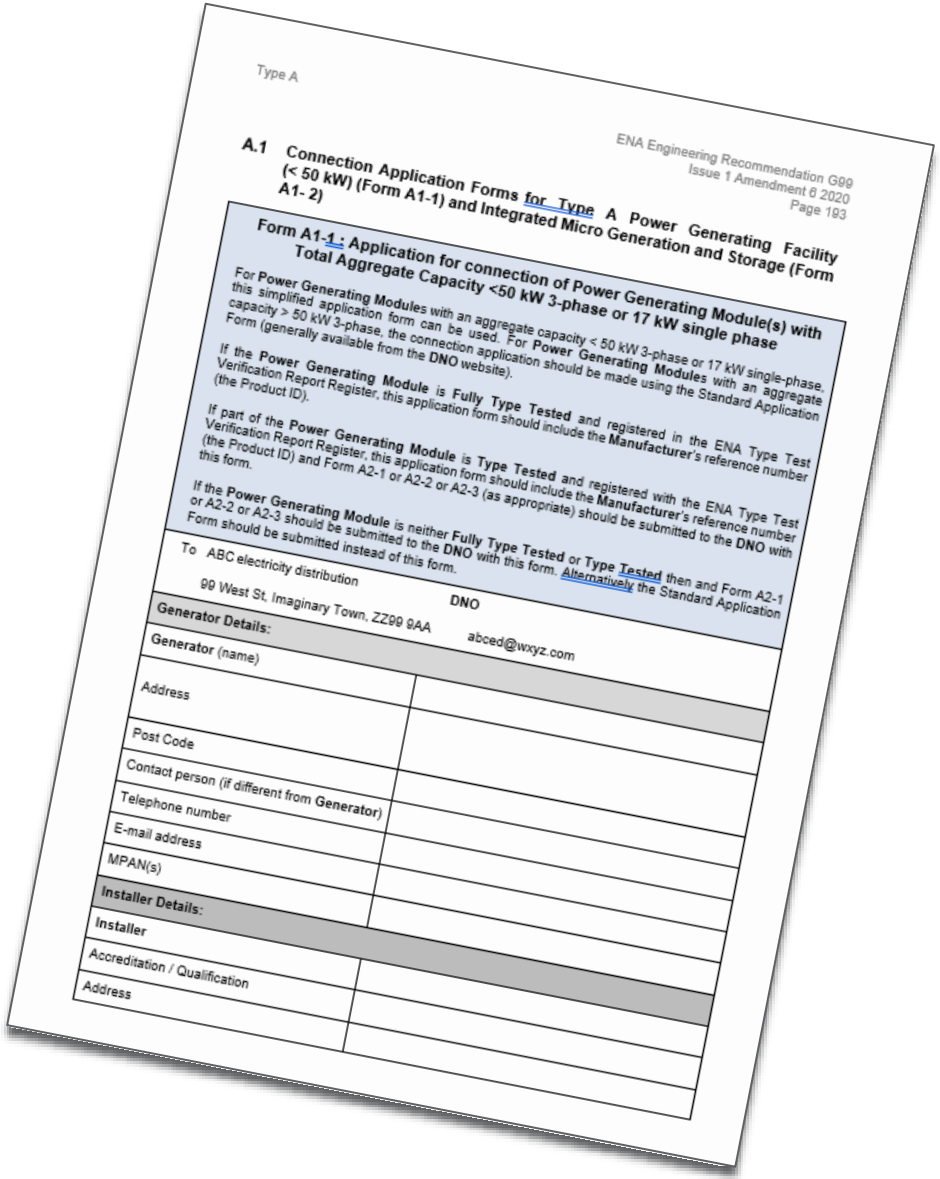
**Power Generating Module Document

A G99 application for systems up to 17kW on a single phase service, or up to 50kW on a three phase service should be made by submitting the G99 'Form A1-1' to Electricity North West

Application – G99 up to 17kW 1ph or 50kW 3ph

Required information for a G99 Form A1-1 Application:

- G99 Form A1-1
- Site Plan
- MPAN number
- Inverter/Relay details (Data sheets)
- Inverter/Relay compliance certificates/type test reports
- Battery Storage details (if required)
- G100 Export Limitation Scheme (ELS) evidence/report (if required)
- A single line diagram of the full system including the G100 ELS



Type A

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A.1 Connection Application Forms for Type A Power Generating Facility (< 50 kW) (Form A1-1) and Integrated Micro Generation and Storage (Form A1- 2)

Form A1-1 : Application for connection of Power Generating Module(s) with Total Aggregate Capacity <50 kW 3-phase or 17 kW single phase

For **Power Generating Modules** with an aggregate capacity < 50 kW 3-phase or 17 kW single-phase, this simplified application form can be used. For **Power Generating Modules** with an aggregate capacity > 50 kW 3-phase, the connection application should be made using the Standard Application Form (generally available from the **DNO** website).

If the **Power Generating Module** is **Fully Type Tested** and registered in the ENA Type Test Verification Report Register, this application form should include the **Manufacturer**'s reference number (the Product ID).

If part of the **Power Generating Module** is **Type Tested** and registered with the ENA Type Test Verification Report Register, this application form should include the **Manufacturer**'s reference number (the Product ID) and Form A2-1 or A2-2 or A2-3 (as appropriate) should be submitted to the **DNO** with this form.

If the **Power Generating Module** is neither **Fully Type Tested** or **Type Tested** then and Form A2-1 or A2-2 or A2-3 should be submitted to the **DNO** with this form. Alternatively the Standard Application Form should be submitted instead of this form.

To ABC electricity distribution **DNO**
99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com

Generator Details:	
Generator (name)	
Address	
Post Code	
Contact person (if different from Generator)	
Telephone number	
E-mail address	
MPAN(s)	
Installer Details:	
Installer	
Accreditation / Qualification	
Address	

Application – G99 above 17kW 1ph or 50kW 3ph

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- Form C	If fully type tested but not registered with the ENA- Form C	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested- Form A2-2 synchronous Form A2-3 inverter connected gen	PGMD** Form B2-1	PGMD** Form C2-1	
Site Compliance and Commissioning Checks					Form A2-4 if the Interface Protection is not Type Tested or for other site compliance tests	Form B2-2 if the Interface Protection is not Type Tested or for other site compliance tests	Form C2-2 if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						Form B3	Form C3	

*Standard Application Form

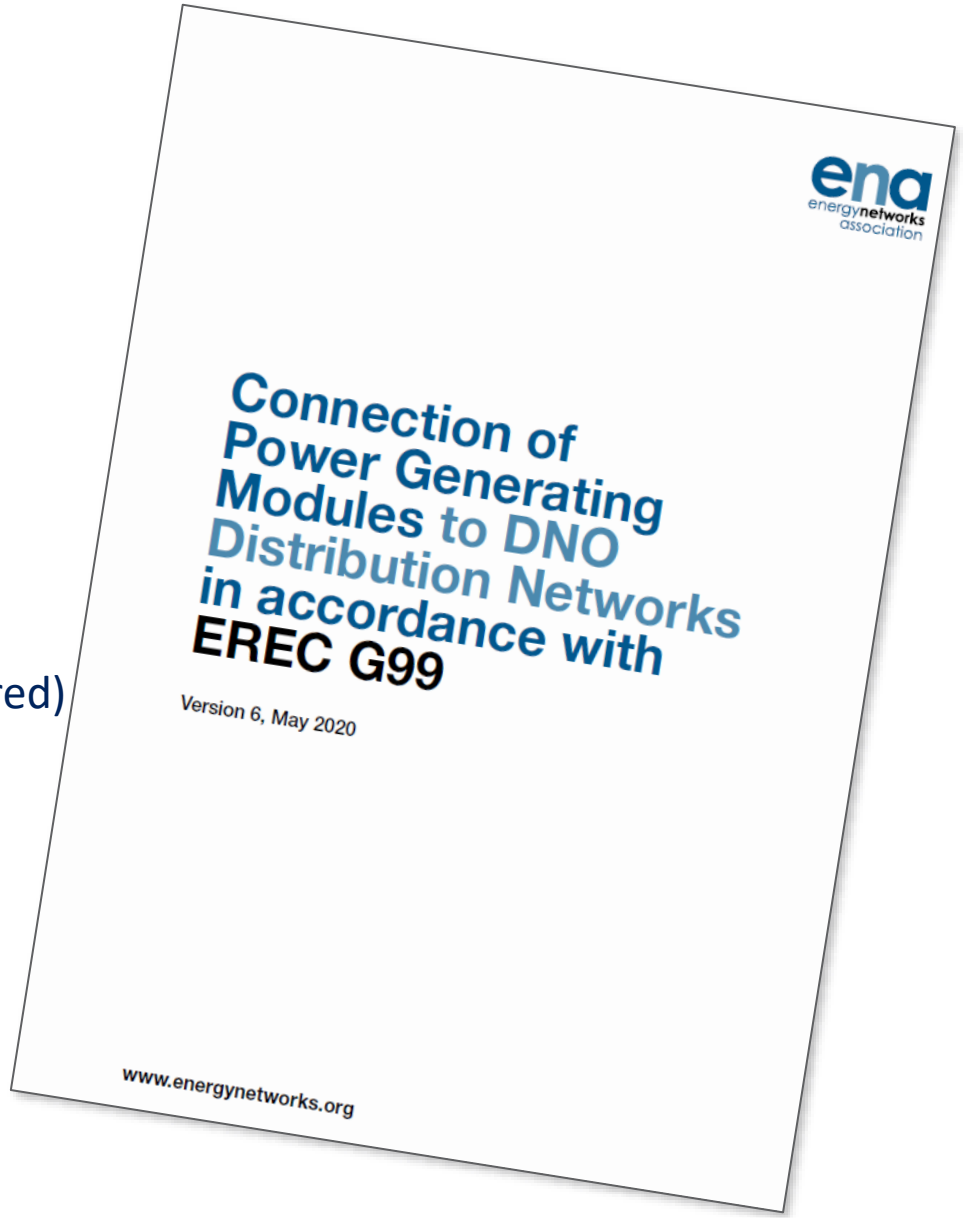
**Power Generating Module Document

A G99 application for systems above 17kW on a single phase service, or up to 50kW on a three phase service should be made by submitting the G99 'SAF (Standard Application Form)' to Electricity North West

Application – G99 above 17kW 1ph or 50kW 3ph

Required information for a G99 SAF Application:

- G99 SAF (Standard Application Form)
- Site Plan
- MPAN number
- Inverter/Relay details (Data sheets)
- Inverter/Relay compliance certificates/type test reports
- Battery Storage details (if required)
- G100 Export Limitation Scheme (ELS) evidence/report (if required)
- A single line diagram of the full system including the G100 ELS



Application – G99 above 17kW 1ph or 50kW 3ph

4 **Introduction**

The following section provides an overview of the information required to complete each part of the application form, which is divided into the following sections:

Part 1	Contact details, location and operational information	Initial submission
Part 1a	Supplementary contact details	Initial submission
Part 2	Power Generating Facility general data	Initial submission
Part 3	Power Generating Module model data	Initial submission
Part 3 Section 1a	Summary of the new Generating Units that comprise the Power Generating Module	Initial submission
Part 3 Section 1b	Summary of the existing Generating Units that comprise the Power Generating Module	Initial submission
Part 3 Section 2	Generating Unit data	Initial submission
Part 4a	Synchronous Power Generating Modules	Prior to synchronising
Part 4b	Power Park Module model data: Fixed speed induction Generating Units	Prior to synchronising
Part 4c	Power Park Module model data: Doubly fed induction Generating Units	Prior to synchronising
Part 4d	Power Park Module model data: Series inverter connected Generating Units	Prior to synchronising
Part 4e	Power Park Module model data: Electricity Storage plant	Prior to synchronising
Part 4f	Transformer information	Prior to synchronising
Part 5	Additional data which may be required by the DNO	Prior to synchronising

Main areas to fill in for a G99 SAF Application:

Application – G99

The application is to be sent to the below mailbox. This will be raised by our registrations team and a quote letter will be provided to you by one of our engineers.

connectionapplications@enwl.co.uk

Study Process

LV & HV

electricity north west
Bringing energy to your door

Study Process

Electricity North West, as the DNO, have a responsibility to ensure the network is safe. With regards to adding generation to the network, the network becomes stretched to the limits, and in cases becomes un-safe should there be no action taken.

Generation systems, when exporting, may increase the network voltage above the statutory limit of 253V. Should this be the case, Electricity North West are required to amend the network to ensure its safety.

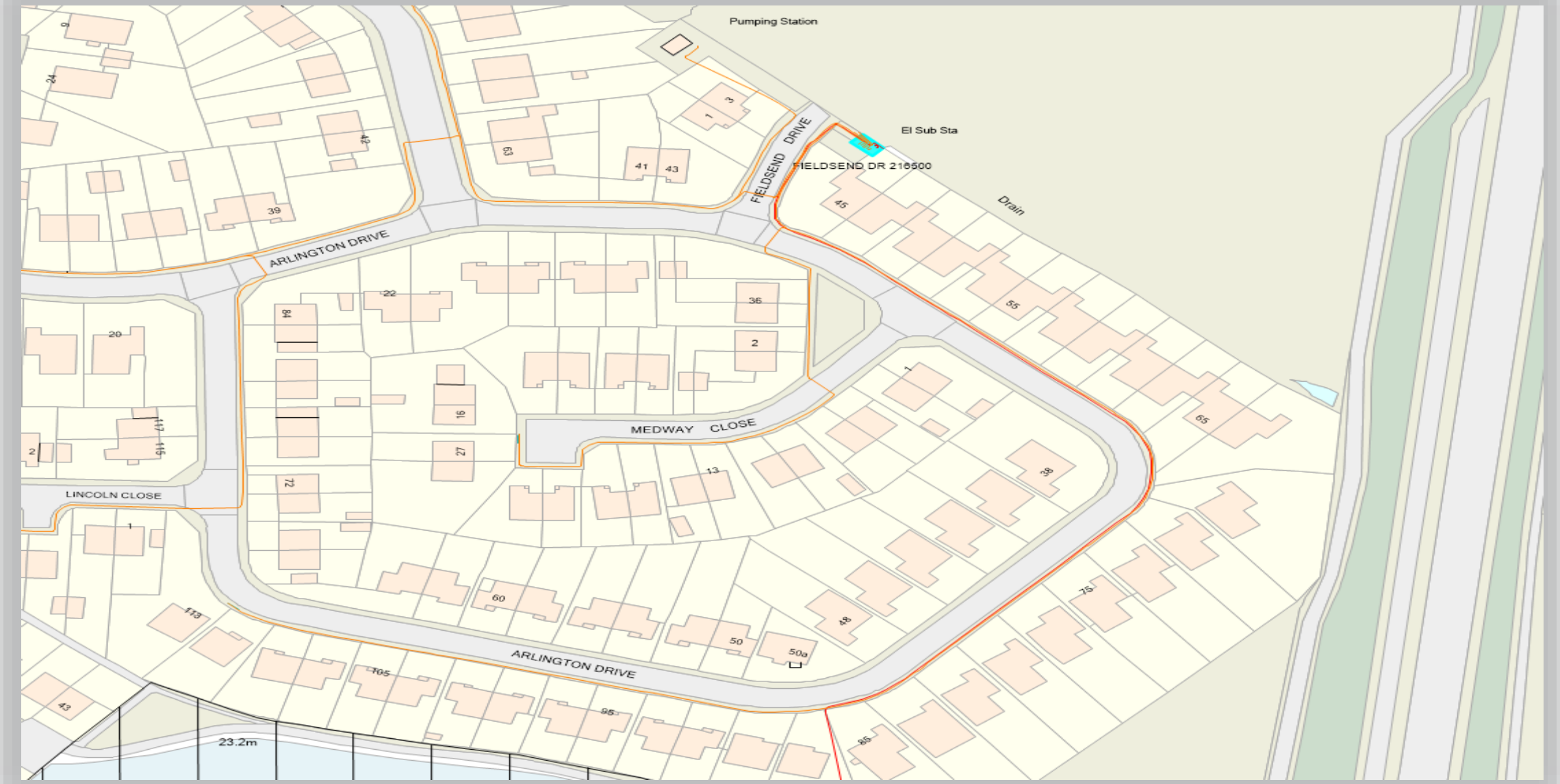
The statutory voltage limits as governed by OFGEM is to keep the network between 230V +10%, -6%.

Therefore this means the safe voltage values we can operate between is 253V (230V +10%) and 216.2V (230V -6%).

Study Process – LV

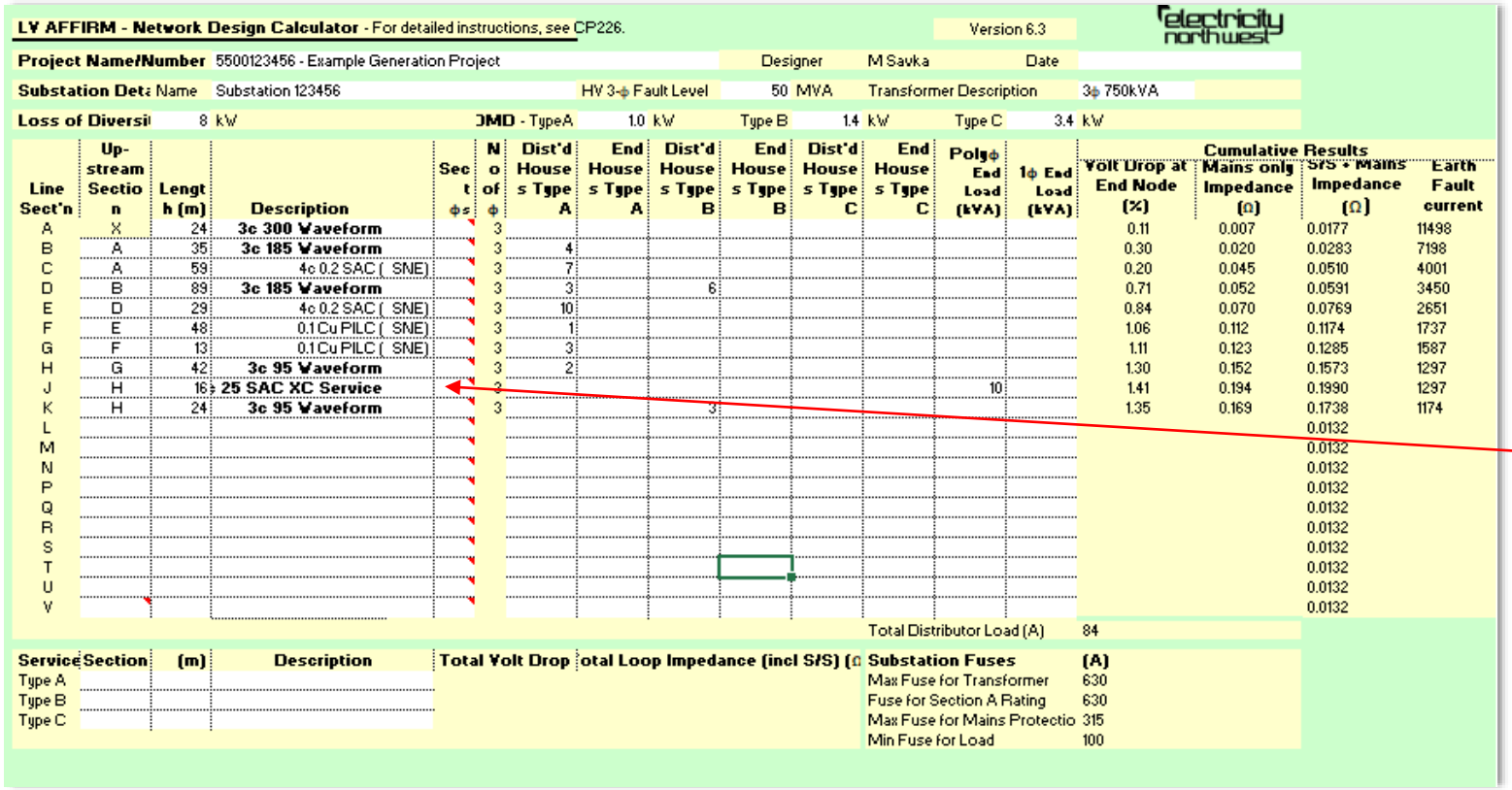
- The study process begins with modelling the LV network using our network analysis tool.
- We trace the network from your generation location (i.e. the house) back to the feeding substation.
- The network fed from the substation is then modelled in full to provide the full load details of that section.
- We can then use this tool to model the proposed generation.

Study Process - LV



Study Process - LV

The following example is of a 30kW generation system added to a three phase supply



LV AFFIRM - Network Design Calculator - For detailed instructions, see CP226. Version 6.3 — electricity northwest

Project Name/Number 5500123456 - Example Generation Project — Designer M Savka — Date

Substation Deta Name Substation 123456 — HV 3-ϕ Fault Level 50 MVA — Transformer Description 3ϕ 750kVA

Loss of Diversi 8 kW — **ADMD** - TypeA 1.0 kW — Type B 1.4 kW — Type C 3.4 kW

Line Sect'n	Up-stream Section	Length (m)	Description	Sect ϕs	No of ϕ	Dist'd Houses Type A	End Houses Type A	Dist'd Houses Type B	End Houses Type B	Dist'd Houses Type C	End Houses Type C	Poly ϕ End Load (kVA)	1ϕ End Load (kVA)	Cumulative Results: Volt Drop at End Node (%)	Mains only Impedance (Ω)	S/S + Mains Impedance (Ω)	Earth Fault current
A	X	24	**3c 300 Waveform**		3									0.11	0.007	0.0177	11498
B	A	35	**3c 185 Waveform**		3	4								0.30	0.020	0.0283	7198
C	A	59	4c 0.2 SAC (SNE)		3	7								0.20	0.045	0.0510	4001
D	B	89	**3c 185 Waveform**		3	3		6						0.71	0.052	0.0591	3450
E	D	29	4c 0.2 SAC (SNE)		3	10								0.84	0.070	0.0769	2651
F	E	48	0.1 Cu PILC (SNE)		3	1								1.06	0.112	0.1174	1737
G	F	13	0.1 Cu PILC (SNE)		3	3								1.11	0.123	0.1285	1587
H	G	42	**3c 95 Waveform**		3	2								1.30	0.152	0.1573	1297
J	H	16	**25 SAC XC Service**		3							10		1.41	0.194	0.1990	1297
K	H	24	**3c 95 Waveform**		3			3						1.35	0.169	0.1738	1174
L																0.0132	
M																0.0132	
N																0.0132	
P																0.0132	
Q																0.0132	
R																0.0132	
S																0.0132	
T																0.0132	
U																0.0132	
V																0.0132	

Total Distributor Load (A) 84

Service	Section	(m)	Description	Total Volt Drop	Total Loop Impedance (incl S/S) (Ω
Type A					
Type B					
Type C					

Substation Fuses	(A)
Max Fuse for Transformer	630
Fuse for Section A Rating	630
Max Fuse for Mains Protectio	315
Min Fuse for Load	100

The image shown is of a section of network inputted into the network modelling tool.

Section J is where the new generation will be added to. A 3 phase service cable is feeding the building.

Study Process – LV

LV AFFIRM - Network Design Calculator - For detailed instructions, see CP226. Version 6.3

Project Name/Number 5500123456 - Example Generation Project | Designer M Savka | Date

Substation Det: Name Substation 123456 | HV 3-ϕ Fault Level 50 MVA | Transformer Description 3ϕ 750kVA

Loss of Diversi 8 kW | **DMD** - TypeA 1.0 kW | Type B 1.4 kW | Type C 3.4 kW

Line Sect'n	Up-stream Section	Length (m)	Description	Sect ϕs	No of ϕ	Dist'd Houses Type A	End Houses Type A	Dist'd Houses Type B	End Houses Type B	Dist'd Houses Type C	End Houses Type C	Poly ϕ End Load (kVA)	1ϕ End Load (kVA)	Cumulative Results: Volt Drop at End Node (%)	Mains only Impedance (Ω)	S/S + Mains Impedance (Ω)	Earth Fault current
A	X	24	**3c 300 Waveform**		3									0.11	0.007	0.0177	11498
B	A	35	**3c 185 Waveform**		3	4								0.30	0.020	0.0283	7198
C	A	59	4c 0.2 SAC (SNE)		3	7								0.20	0.045	0.0510	4001
D	B	89	**3c 185 Waveform**		3	3		6						0.71	0.052	0.0591	3450
E	D	29	4c 0.2 SAC (SNE)		3	10								0.84	0.070	0.0769	2651
F	E	48	0.1 Cu PILC (SNE)		3	1								1.06	0.112	0.1174	1737
G	F	13	0.1 Cu PILC (SNE)		3	3								1.11	0.123	0.1285	1587
H	G	42	**3c 95 Waveform**		3	2								1.30	0.152	0.1573	1297
J	H	16	**25 SAC XC Service**		3							10		1.41	0.194	0.1990	1297
K	H	24	**3c 95 Waveform**		3			3						1.35	0.169	0.1738	1174
L																0.0132	
M																0.0132	
N																0.0132	
P																0.0132	
Q																0.0132	
R																0.0132	
S																0.0132	
T																0.0132	
U																0.0132	
V																0.0132	

A split is made within the network study. This allows us to model that exact point on the network.

Service	Section	(m)	Description	Total Volt Drop	otal Loop Impedance (incl S/S) (Ω
Type A					
Type B					
Type C					

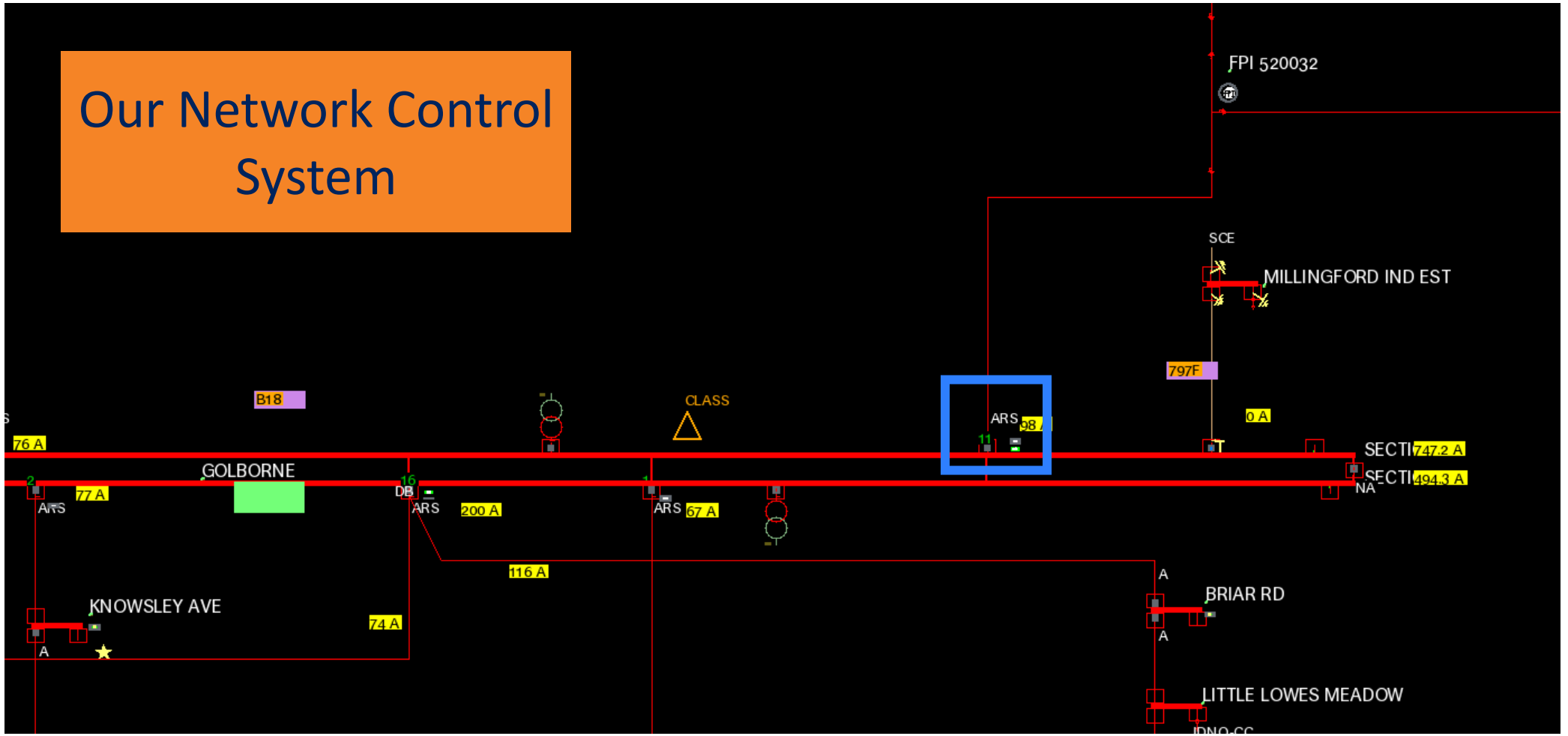
Substation Fuses	(A)
Max Fuse for Transformer	630
Fuse for Section A Rating	630
Max Fuse for Mains Protectio	315
Min Fuse for Load	100

Study Process – HV

- Once we have the LV network modelled, we look at our HV network.
- For the HV network, we are obtaining ‘voltage drop values’ this allows us to accurately asses the voltage that is feeding the distribution substation.
- The higher the HV voltage drop, the lower the LV voltage will be. From a generation perspective, this allows further room for export back onto the network.

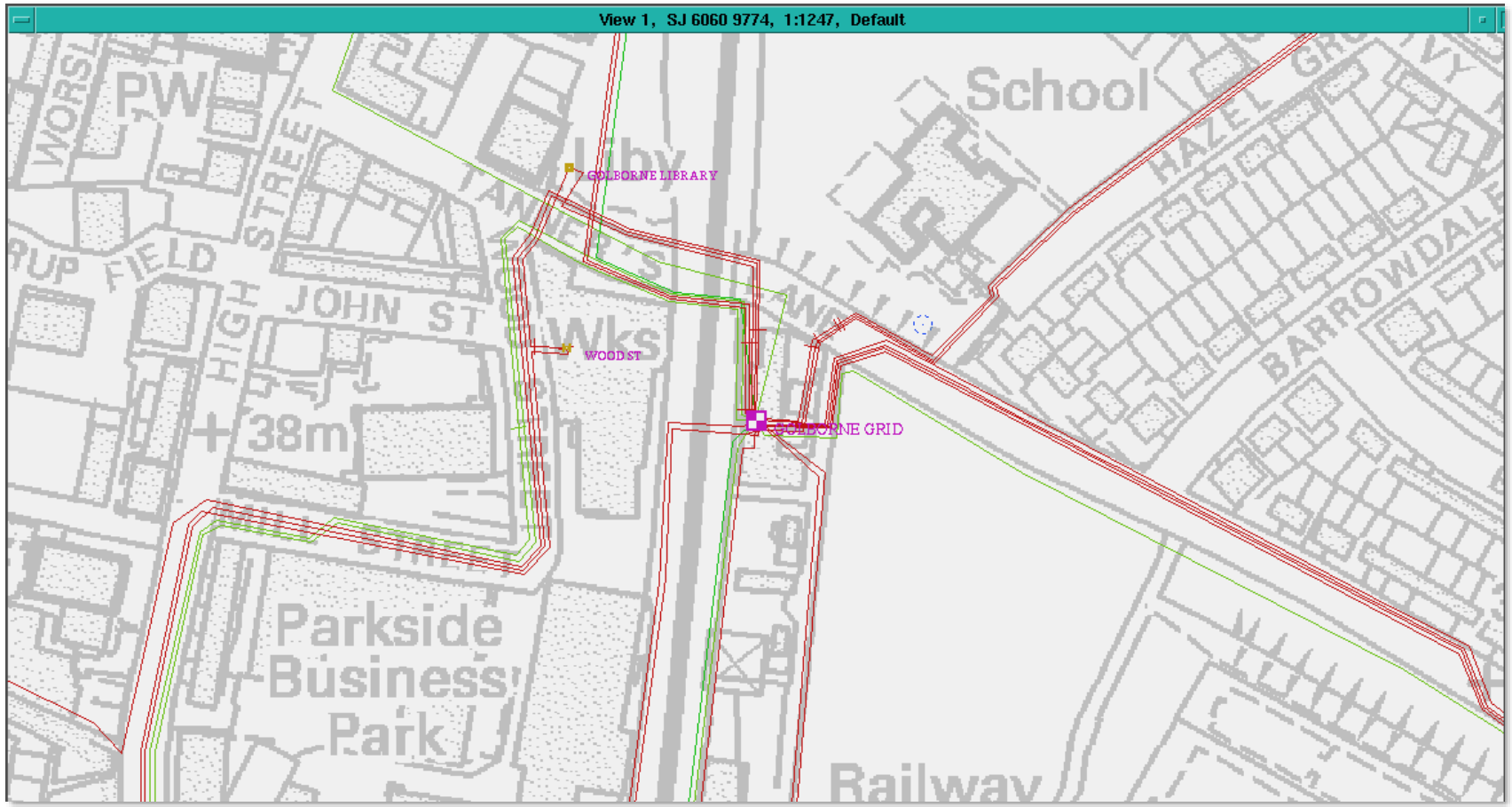
Study Process - HV

The HV voltage drop assessment begins by assessing the load value from the HV Primary substation.



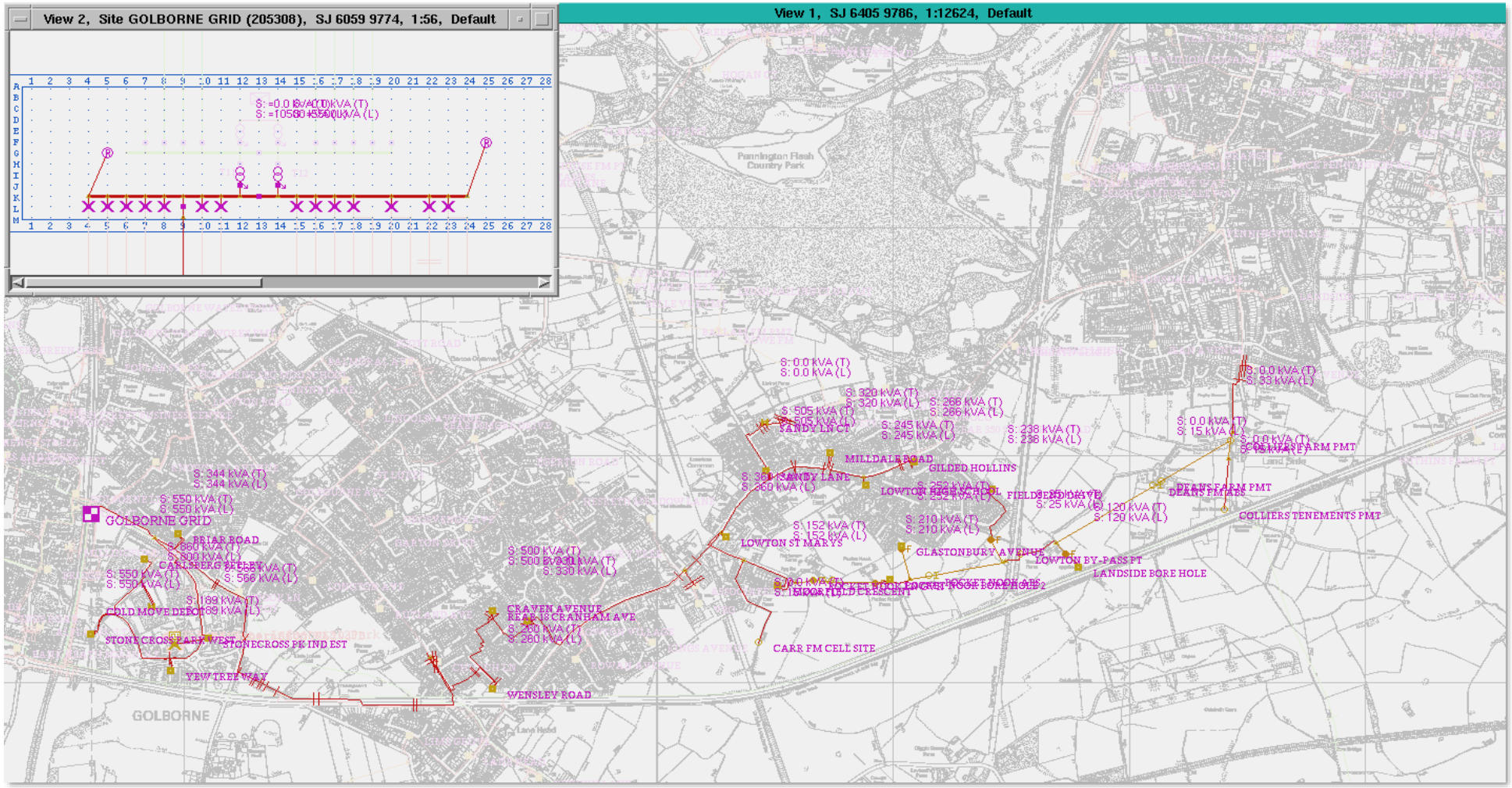
Study Process - HV

With these values, we can create a load profile on the HV network. Using a model of the HV network, the current value will provide a volt drop at each distribution substation



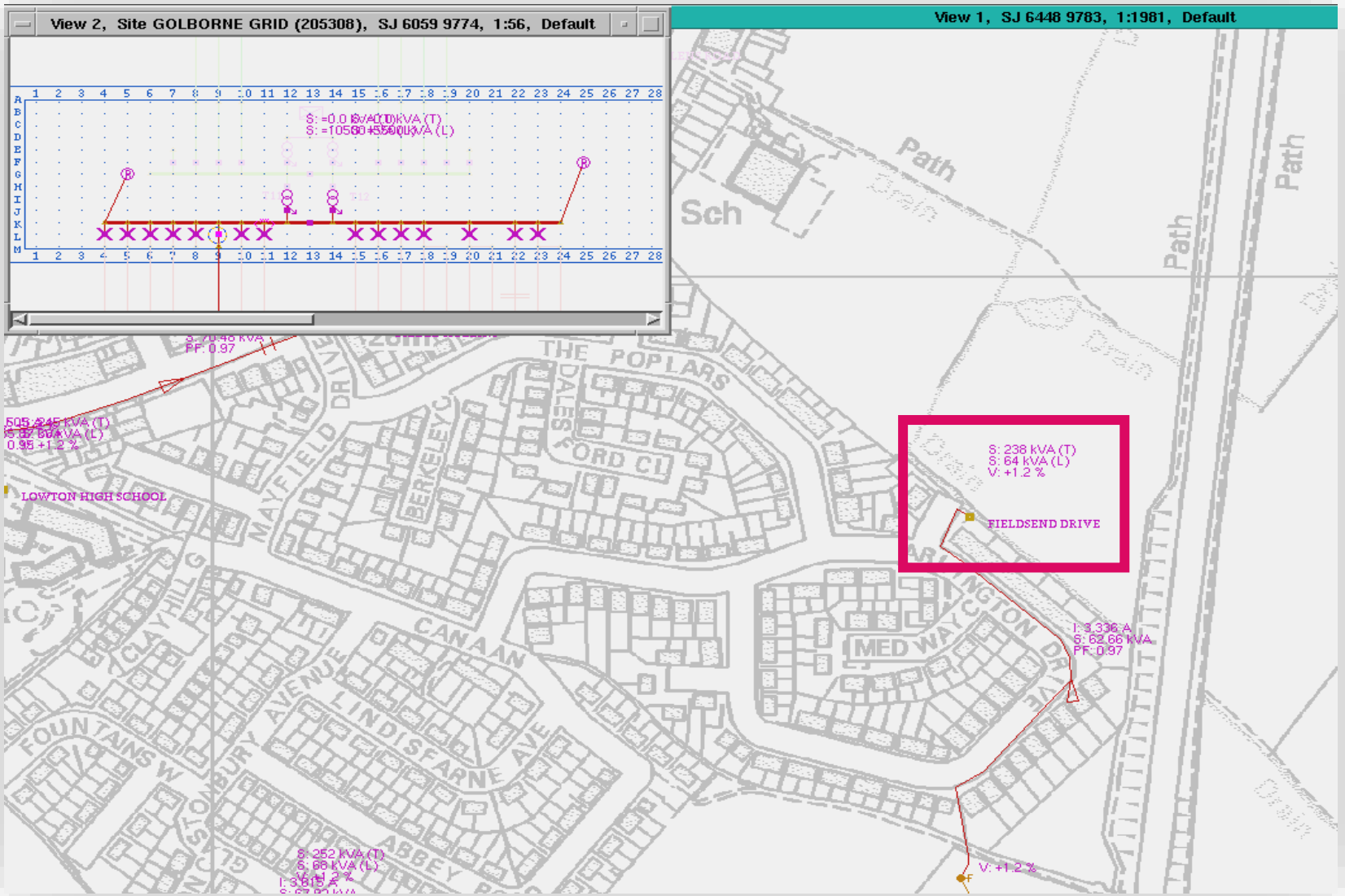
Study Process – HV

Isolating the HV feeder, we then model the current flow through that section of network.



Study Process - HV

A voltage drop value is given on each distribution substation



Study Process – End result

With all of the gathered information from both of the studies. Our network modelling tool provides an end voltage figure and a Pass/Fail result.

LV AFFIRM - Network Design Calculator - Microgeneration

Version 6.3

electricity northwest

Project Name/Number	5500123456 - Example Generation Project	Designer M Savka	Date

HV System (kV)	11	**Distribution Substation and Network**		**Single-Phase Connections**	MAD (kW)	Gen (kW)	Others on S/S
Actual High from FLA (kV)	11.132	Transformer Tap No	3	Type A	0.31		
Actual Low from FLA (kV)	11	Power Factor of Transformer power flow	1.00	Type B	0.31		
Low Load HV Drop (%)		Total Gen on Other Distrib'rs (kW per φ)		Type C	0.31		
High Load HV Drop (%)	1.2	Unbalance Factor	1.00				

Results

High V	Low V	Pass/Fail
259.1	246.4	

Line Sect'n	3φ End MAD (kW)	3φ End Gen (kW)	1φ End Node MAD	1φ End Node Gen (kW)	Dist'd MAD (kW)	End Node MAD (kW)	High V at End Node (V)
A							253.4
B					0.413		253.8
C					0.723		253.3
D					0.93		255.2
E					1.033		255.8
F				3.68	0.103		257.2
G					0.31		257.4
H					0.207		258.4
J	3.21	30				1.07	259.1
K					0.31		258.4
L							
M							

Line Sect'n	3φ End MAD (kW)	3φ End Gen (kW)	1φ End Node MAD	1φ End Node Gen	Dist'd MAD (kW)	End Node MAD (kW)	High V at End Node (V)
ZA							
ZB							
ZC							
ZD							
ZE							
ZF							
ZG							
ZH							
ZJ							
ZK							
ZL							
ZM							

Outcomes and Options

Ok to connect

Tap Change

Export limitation

Service upgrade

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Outcomes and Options

Ok to connect

Tap Change

Export limitation

Service Upgrade

Outcomes and Options – Ok to connect

If there is no alteration needed to the network, the generation system can be added straight away.

Once the acceptance is returned, the commissioning documents should be returned within 10 days of that date.

The commissioning paperwork is then sent to our compliance team.

Outcomes and Options – Tap Change

- The transformers tap allows us to alter the windings of the transformer, this reduces the output voltage by a 2.5% decrease/increase.

- A transformers nominal tap position is ‘3’. This provides an output voltage of 230/400V should the network be running at nominal. To reduce the output, we can amend the tap position to tap ‘2’. This will provide more ‘room’ for generation capacity on the network.

- As generation increases the voltage of the network, by reducing the tap position, and therefore the voltage this provides more availability to add the generation to the network.

- We do not charge for tap changes whereby if the feeding primary HV network was operating at “nominal” voltage the proposed generation would be able to connect without causing “disturbance” to the Low Voltage network.

Outcomes and Options – Export limitation

- After a Tap change, should the network voltage still be above statutory limits, a G100 export limitation scheme can be used to limit the amount of export below the statutory voltage value of 253V.

- However with this, the maximum total generation installed regardless of the export limitation can't exceed 255.3V (253V+1%). This is due to protecting the network should the export limitation fail or not operate correctly.

- The export limitation can also be used to avoid the cost of a tap change should it be chargeable.

Outcomes and Options – Service Upgrade

As a last resort, we can look into further options to upgrade the service cable.

For example this may be a case of upgrading from a single phase service to a three phase service.

Service upgrades are rare, and only used once all of the other options have been exhausted.

Commissioning

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Commissioning

Once you have sent your acceptance in to Electricity North West we will require the commissioning paper work for the generation system.

Should the scheme require a Tap Change, there will be a waiting period whilst we carry out these works before you are able to commission and turn on the system.

There are different commissioning forms dependant on the type of application.

Commissioning – Integrated Micro-Generation

For applications under the Integrated Micro-Generation Application.

The commissioning form required is:

Form A3-2

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- Form C	If fully type tested but not registered with the ENA- Form C	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected ger	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested- Form A2-2 synchronous Form A2-3 inverter connected gen	PGMD** Form B2-1	PGMD** Form C2-1	
Site Compliance and Commissioning Checks					Form A2-4 if the Interface Protection is not Type Tested or for other site compliance tests	Form B2-2 if the Interface Protection is not Type Tested or for other site compliance tests	Form C2-2 if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						Form B3	Form C3	

*Standard Application Form

**Power Generating Module Document

Commissioning – Less than 50kW

For applications under the G99 Form A1-1, up to 17kW 1ph or 50kW 3ph.

The commissioning form required is: **Form A3-1**

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- Form C	If fully type tested but not registered with the ENA- Form C	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested- Form A2-2 synchronous Form A2-3 inverter connected gen	PGMD** Form B2-1	PGMD** Form C2-1	
Site Compliance and Commissioning Checks					Form A2-4 if the Interface Protection is not Type Tested or for other site compliance tests	Form B2-2 if the Interface Protection is not Type Tested or for other site compliance tests	Form C2-2 if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						Form B3	Form C3	

*Standard Application Form

**Power Generating Module Document

Commissioning – Above 50kW

For applications under the G99 Form A1-1, up to 17kW 1ph or 50kW 3ph.

The commissioning form required is: **Form A3-1**

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- Form C	If fully type tested but not registered with the ENA- Form C	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested – Form A2-1 synchronous <50kW, Form A2-2 synchronous >50kW or Form A2-3 inverter connected gen	If not type tested- Form A2-2 synchronous Form A2-3 inverter connected ger	PGMD** Form B2-1	PGMD** Form C2-1	
Site Compliance and Commissioning Checks					Form A2-4 if the Interface Protection is not Type Tested or for other site compliance tests	Form B2-2 if the Interface Protection is not Type Tested or for other site compliance tests	Form C2-2 if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						Form B3	Form C3	

*Standard Application Form

**Power Generating Module Document

Commissioning

Commissioning paperwork should be sent to the below mailbox.
This will be checked by the compliance team.

G98G99ComplianceCheck@enwl.co.uk

Useful Links

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Useful Links

All of the correct forms can be found within the ENA Resource Library.

ENA Resource Library - https://www.energynetworks.org/industry-hub/resource-library/

Inverter details can be found using the ENA Type Test Register, however we may still require further information for them.

ENA Type Test Register - https://www.ena-eng.org/gen-ttr/

Any questions?

G5/5 for LV DG

Peter Twomey

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Agenda

1. Introduction to Engineering Recommendation G5
2. Reminder of the structure of G5
3. Stage 1 – differences between G5/4 and G5/5
4. Stage 1 – information requirements
5. Stage 2 – information requirements
6. Approximately 10 minutes
7. Summary of changes
8. Changes to limits in G5/5

Introduction

Engineering Recommendation G5

Issue 5 2020

Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom

Implementation – 17th June 2020

There are major changes affecting Electricity North West and our customers

Reminder: G5 assessment have 3 Stages:

Stage 1

- ✓ Simplest
- ✓ Only for LV connections

Stage 2

- ✓ More detailed
- ✓ Site measurements
- ✓ LV and HV

Stage 3

- ✓ Very detailed
- ✓ Site measurements
- ✓ Detailed studies
- ✓ Mainly EHV

Today's webinar considers Stage 1 and Stage 2 only

It gives and overview and summarises information required. It is not intended to demonstrate the detailed workings of G5.

Stage 1 - Summary of changes introduced in G5/5

G 5/5

Stage 1 and 2 split into substages

Up to 100th Harmonic

Generic equipment type introduced

Other G5/4 requirements remain

Stage 1- new process

LV only

Substages 1A, 1B, 1C and 1D

ONLY:

Three-phase six-pulse converters

Three-phase active-front-end converters

Three-phase twelve-pulse converters

Single-phase rectifiers

1A

Assessment by compliance with IEC 61000-3-2

Less than 16Amps

1B

Assessment by compliance with IEC 61000-3-12

Less than 75Amps

1C

Assessment based on aggregate equipment rated power, short-circuit power at the PCC and technology type

1D

Assessment based on aggregate equipment rated power, short-circuit power at the PCC, technology type and background harmonic level

Stage 1A and 1B – Information Required

Stage 1A information

- Declaration of conformity with IEC 61000-3-2
- Unconditional connection – no network information needed
- Applies to equipment <16A

Stage 1B information

Declaration of conformity with IEC 61000-3-12, either:

1. ‘Compliant with IEC 61000-3-12’, or
2. ‘Compliant with IEC 61000-3-12 if short circuit power $S_{sc\ pcc}$ is greater or equal to xx’

Conditional connection – needs network assessment

This is not new – this approach has been used for many years

Stage 1C – Information Required & overview

Stage 1C information

Confirmation of equipment type:

- 3 phase 6 pulse converter
- 3 phase 12 pulse converter
- Single phase rectifiers
- 3 phase active front end converter

Assessment is based on **equipment type** rather than harmonic current emissions of each device

Stage 1D

- Very similar to Stage 1C
- Based on the same equipment type categories
- Uses **measured background harmonic voltages** rather than assumed

Stage 2

Substages 2A, 2B and 2C

HV and those connections failing to comply via Stage 1

2A

Assessment based on aggregate equipment rated power, short-circuit power at the PCC and [illegible]ology type

HV Only

2B

Assessment based on aggregate equipme[illegible]t rated power, short-cir[illegible]wer at the PCC, t[illegible]pe and meas[illegible]and harmo[illegible]

HV Only

2C

Prediction of the harmonic voltage distortion post-connection based on current emissions and a simple reactance model for the source with a multiplication factor to allow for any low-order harmonic resonance

Summary of G5/5

Stage	Substage	Information required	Site Background measurements?	Voltage
1	1A	Compliance statement IEC61000-3-2	✗	LV
	1B	Compliance statement IEC61000-3-12	✗	LV
	1C	Equipment Type (3 phase 6 pulse etc)	✗	LV
	1D	Equipment Type	✓	LV
2	2A	Equipment Type	✗	HV
	2B	Equipment Type	✓	HV
	2C	Harmonic current emissions	✓	LV & HV
3	-	Impedance profile, limits for incremental harmonic voltages and total harmonic voltages	✓	EHV

Planning and Compatibility Limits simplify table

Planning and Compatibility limits are now defined using voltages aligned to GB system

For us…	THD Planning Limit %FDN	Comment on G5/5 planning limits
LV	5%	Slight increase to some higher orders
HV: 11kV & 6.6kV	4.5% (previously 4%)	Slight increase to some higher orders

There have been some increases in planning and compatibility limits to match international standards. G5/ 5 now allows assessment up to the 100th harmonic:
ENWL will only use up to the 50th of stage 1 and 2.

Incentive on Connections Engagement (ICE) Update

Ami Mathieson

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ICE 2020-21 Workplan Performance

➢ We will provide guidance on the application process.	✓ On track ✓ Online event November 2020
➢ We will communicate with our stakeholders on Engineering Recommendation G98 & G99 requirements for the connection of generation equipment.	✓ Online event November 2020
➢ We will continue to target improved customer satisfaction.	✓ 95% average customer satisfaction obtained by Q2
➢ We will provide updates on activity to support the transition to green energy and the wider green economy	✓ Online event November 2020
➢ We will provide stakeholders with the opportunity to receive detailed briefings on industry level changes	✓ G5-5 Policy briefing
➢ We will improve access to Network Information	✓ Complete – training material available on website
➢ We will improve information available on battery storage.	✓ Improvements to webpage

ICE 2020-21 Workplan Performance

➢ We will clarify the process followed when connecting LV generation.	✓ Online workshop November 2020
➢ We will keep stakeholders informed on the transition of Distribution Network Operators (DNO) to carrying out enhanced Distribution System Operation (DSO) functionality	✓ Online workshop November 2020
➢ We will endeavour to offer alternative flexible connections solutions to customers where it is appropriate to do so.	✓ On track
➢ We aim to outperform the regulatory standard by providing quotes on average in **22 working days** (compared to the guaranteed standard of 35 working days)	➢ Year to date average of **18 working days**
➢ We will strive to improve our Time to Connect for DG LV connections where on site works are required.	➢ No applicable projects so far this year.

ICE 2020-21 Workplan Performance

➢ We will continue to offer opportunities for stakeholders to engage with us.	➢ Online workshop November 2020, plus specific webinars hosted and more to come.
➢ We will engage with community & local energy stakeholders.	➢ 2 online events delivered – more to come.
➢ We will continue to communicate with our stakeholders.	➢ 2 x quarterly newsletters plus specific communications delivered to our distribution list

Any comments please contact ice@enwl.co.uk

We would love to hear your feedback, please get in touch with either Ami or Hannah should you have anything to discuss after the session.

Wrap up - Morning session

Lunch Break

11:45 – 12:30

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Update on Transition to DSO

Keith Evans

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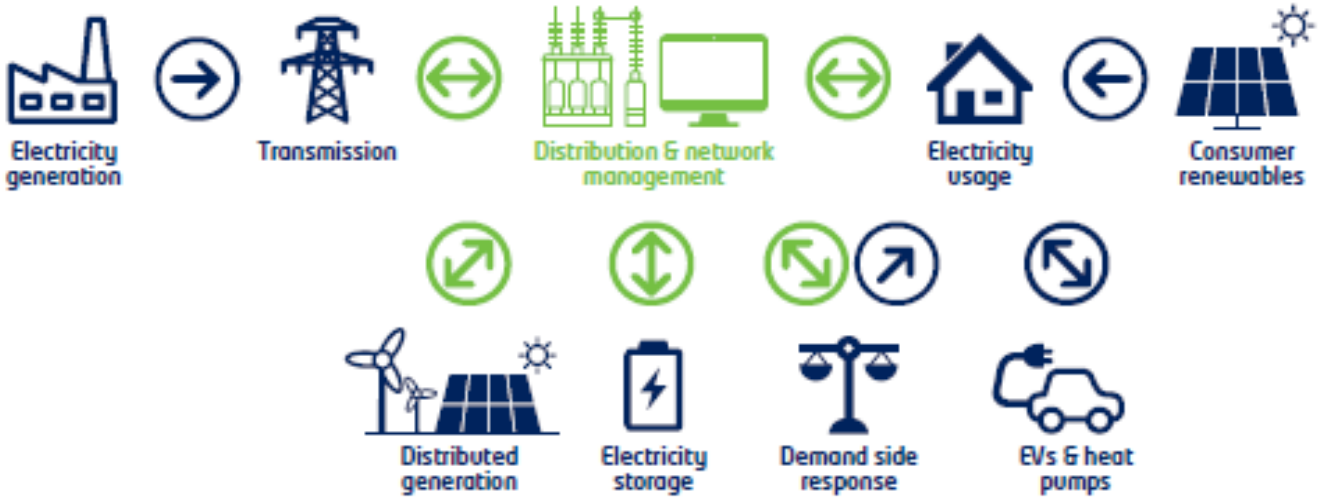
Electricity distribution has changed

What used to be relatively simple...

...is becoming far more complex and multi-directional



- Electricity - historically a centralised model that changed little
- Now more complicated and multi-directional
- Encouraging and enabling low carbon technologies to connect
- Electricity demand set to double by 2050
- All customers need cleaner, greener energy to enable and enhance 21st century living

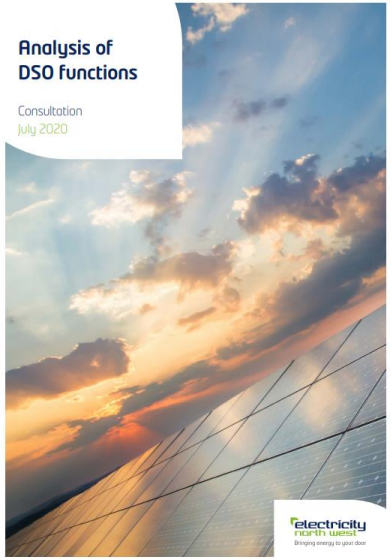
Benefits of DSO transition

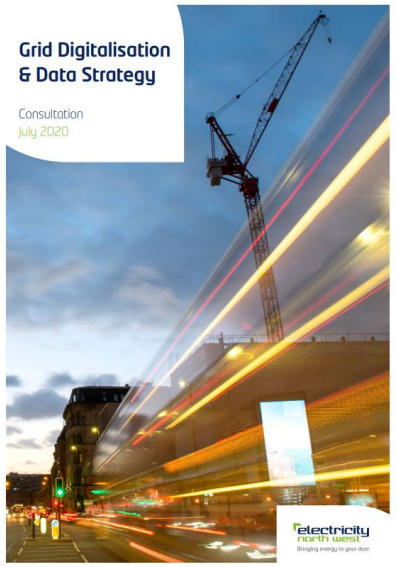
Improved customer experience	• Improved customer experience though sharing of best practice within the ENA Open Networks project
Efficiency savings	• Increase utilisation of networks assets allowing for efficiency savings
Whole system investment	• Improved whole system investment decisions through closer working relationships with other network providers
Low carbon economy	• Facilitating the transition to a low carbon economy.
Increased flexibility	• Allowing all customers the ability, independent of size, to participate in energy trading and balancing
Increased productivity	• Increased productivity as a result of developing new modelling tools, implementing new systems, and improved automation

What have we done to so far

ENWL DSO consultations

- In May 2020 we launched 3 DSO related consultations.
- The feedback was broadly supportive of our DSO strategies
- We will now review the plans based upon feedback and re-publish
- The feedback will also be used to inform our ED2 business plans
- We are still open to more feedback
  https://www.enwl.co.uk/go-net-zero/our-plans-to-go-net-zero/dso/

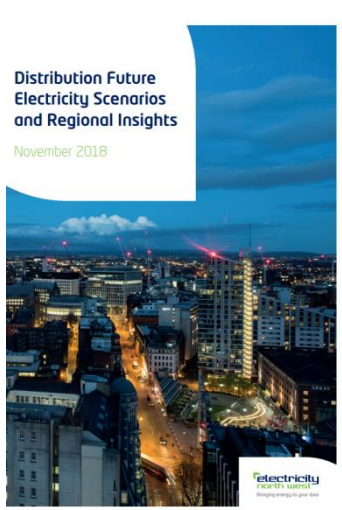


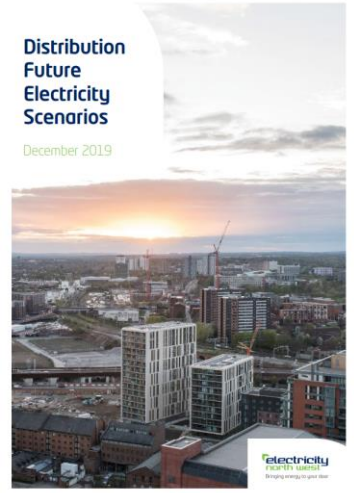


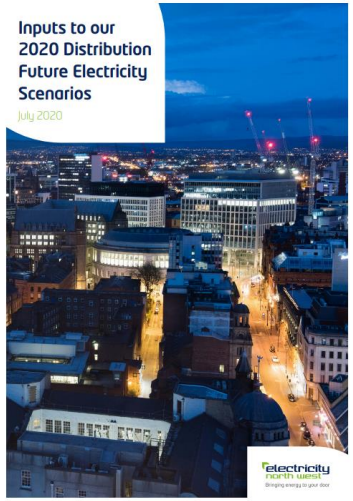
What have we done to so far

Distribution Future Electricity Scenarios Documents

- 2 years of DFES publications
- The data is now available in an excel workbook
- In July 2020 we consulted on our DFES inputs
  https://www.enwl.co.uk/get-connected/network-information/dfes/

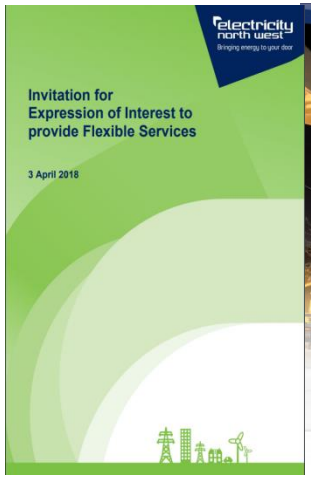


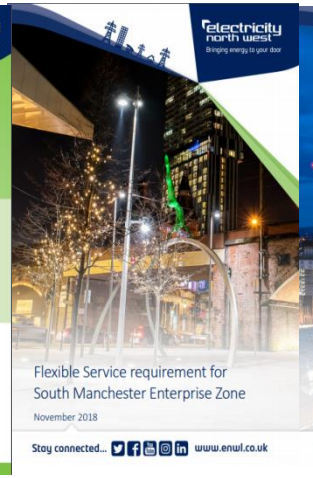




Requests of Flexible Services

- 19 Requirements published
- 6 Tenders undertaken
- 68.85MW asked for
  https://www.enwl.co.uk/go-net-zero/flexible-services/

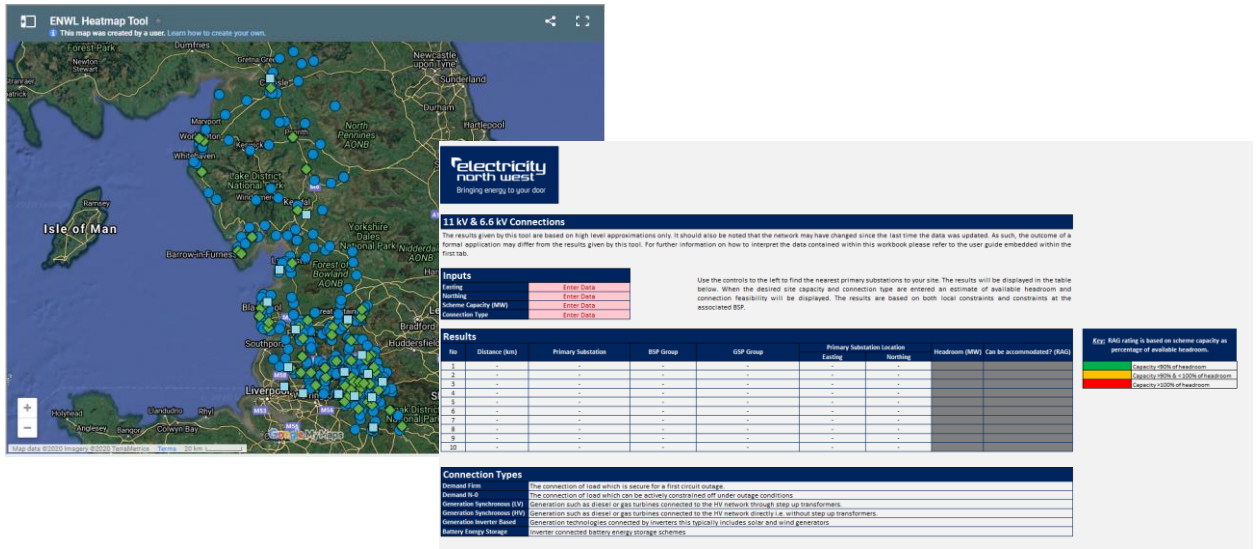




What have we done to so far

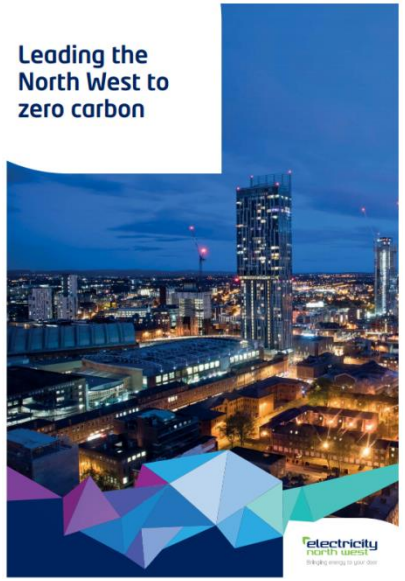
Heat Mapping Tools

- Available in geographical and tabular formats.
- Regular updates to reflect the most up to date information
  https://www.enwl.co.uk/get-connected/network-information/heatmap-tool/



Carbon Plan

- Publication of the carbon plan in 2019
- Maps out how we intend to reduce emissions 10% year on year.
  https://www.enwl.co.uk/go-net-zero/our-plans-to-go-net-zero/leading-the-north-west-to-net-zero/

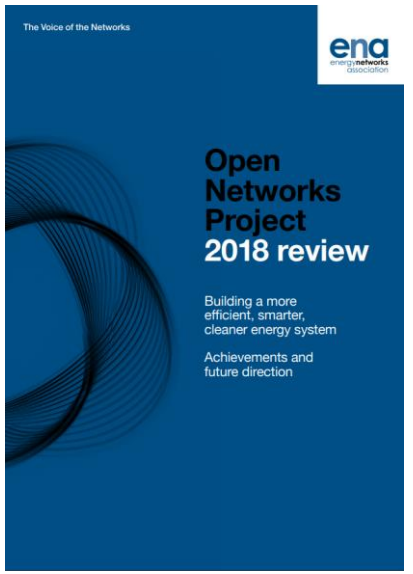


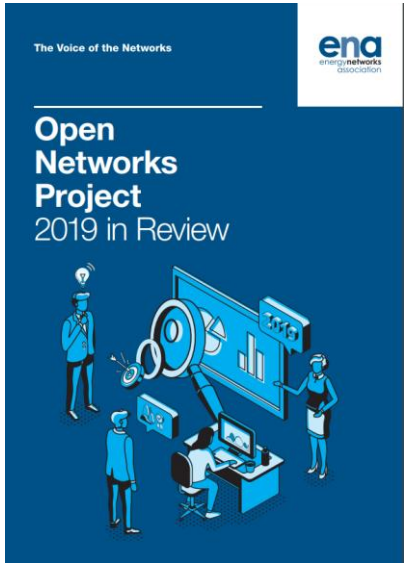
What have we done to so far

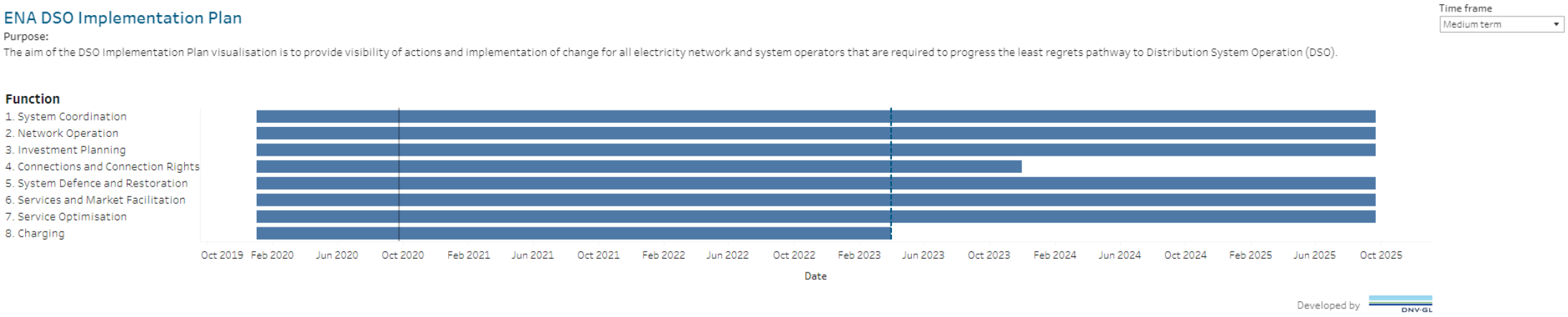
Open Networks Project

- Standardised flexible services agreements and product naming
- Developed joint FES methodologies
- Developed and consulted upon new interactivity and queue management processes
- Developed heat mapping good practice
- Created a DSO roadmap for UK's transition to DSO (including DNOs, TOs, ESO, ENA, BEIS, and Ofgem)

https://www.energynetworks.org/creating-tomorrows-networks/open-networks







What have we done to so far

Flexible Connections

- ENWL offer a range of flexible connections options:
  - **System Normal Connection** - A system normal connection is disconnected or constrained when there is a First Circuit Outage affecting the circuit dedicated to supplying the customer or the local Distribution System. This connection could be managed either remotely or via an intertripping scheme.
  - **Export Limited Connection** - A connection where the installed generation equipment has a greater export capability than that which has been agreed to be exported onto the Electricity North West distribution system.

- We are also offering limited trials of:
  - **Timed Connection** - A connection arrangement where connection capacity is subject to restrictions within specific time periods.
  - **Import Limited Connection** - A connection where the installed equipment has a greater import capability than that which has been agreed to be imported from the Electricity North West distribution system.

It is not always possible to technically or financially facilitate a flexible connection to all sites. Your designer will be able to advise on a site by site basis.

https://www.enwl.co.uk/get-connected/apply-for-a-new-connection/flexible-connections/

Highlights of current work

- The development of operational IT systems for managing power flows (ANM)
- Establishment of a neutral market trading system to facilitate trading of flexible services in near real time.
- Establishment of a DSO control desk within the existing control centre
- Improving the quality and quantity of information available to stakeholders
- Reducing ENWLs carbon emissions and encouraging others to do the same
- Offering a greater range of connections options with a range of flexibility
- Updating of policies and procedures
- Improving forecasting techniques, and publishing our data in the form of heat maps, DFES, and flexible services requests
- Developing enhanced modelling tools and techniques and introducing automated connections processes.

Accelerated Loss of Mains Change Programme (ALoMCP)

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Background

G59 requires UK Generation owners to install loss of mains (LoM) protection at their generation sites. This is to ensure that, following a fault that isolates sections of the distribution system to which they are connected from the rest of the electricity system, distributed generation does not form an autonomous power island with the remaining local demand.

The two most commons forms of LoM protection are rate of change of frequency (RoCoF) relays and vector shift (VS) relays.

By September 2022 to comply with the latest requirements, it will be necessary to revise the LoM protection settings for all the existing non-type tested embedded generation fleet to:

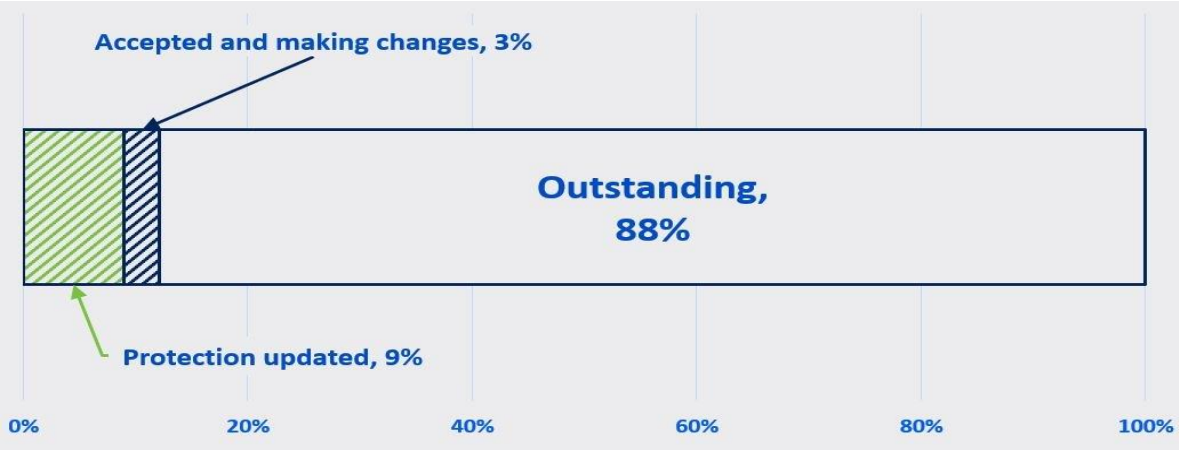
Ensure that where rate of change of frequency (RoCoF) protection relays are used, as part of Loss of Mains protection, the applied setting should be 1Hz/s with a definite time delay of 500ms.

Ensure that vector shift (VS) protection technique should be removed where it is in use

Remove LoM protection from all generation except synchronous and DFIG where a suitable RoCoF setting cannot be made without additional investment.

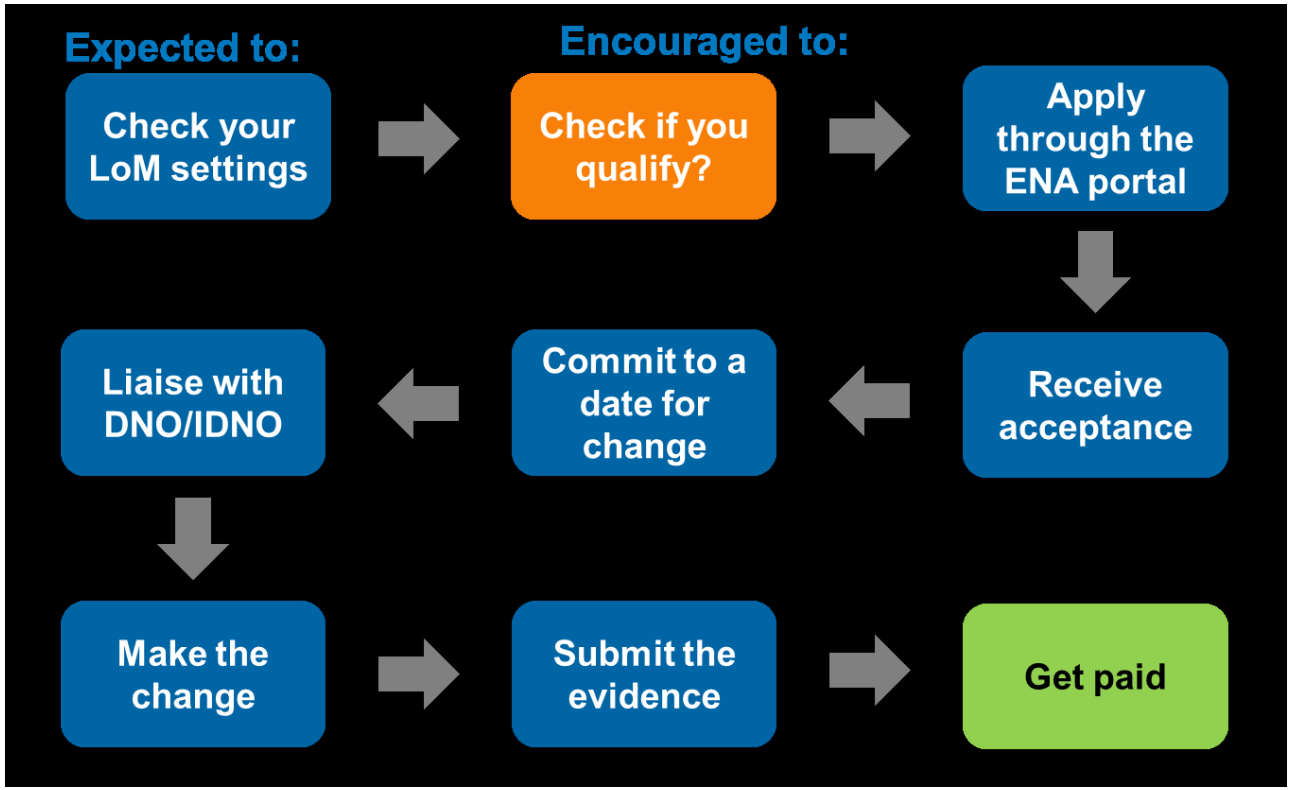
Progress

4/6	224	178	224MW	£570k
application windows complete	accepted applications	confirmed changes to protection	generation capacity updated	In payments made



Percentage of generators on our network with updated protection

Get involved



Window 6 opened on 11/11/20 and will run for 3 calendar months.

Applications can be made at: https://www.ena-eng.org/ALoMCP/

For help and assistance please contact: ALoMCP@enwl.co.uk

Further information can be found at: https://www.enwl.co.uk/get-connected/network-information/accelerated-loss-of-mains-change-programme/

RIIO ED2 – Ofgem Proposals for Connections

Hannah Sharratt / Brian Hoy

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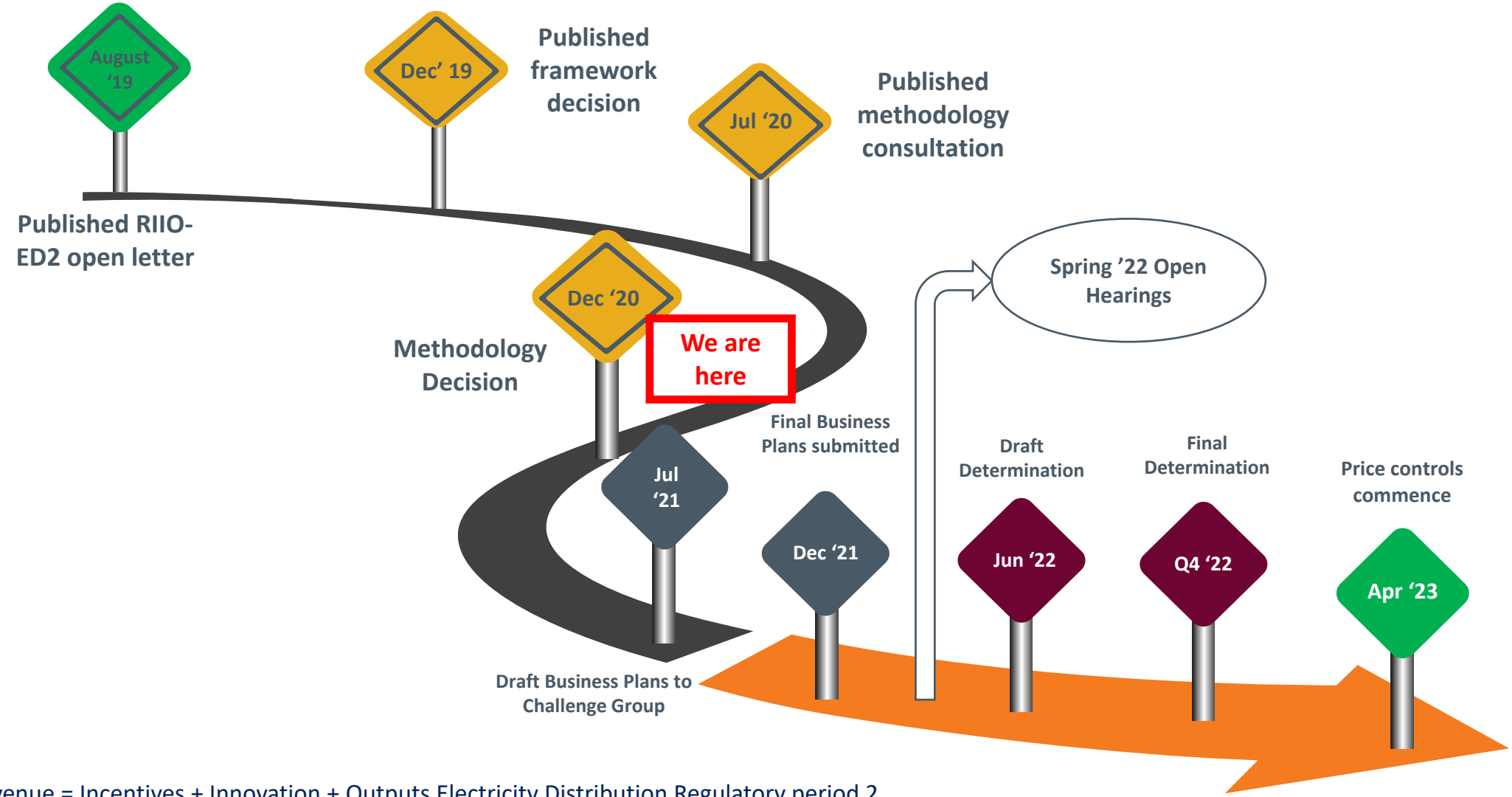
Agenda

- RIIO-ED2 Timeline
- The Ofgem Proposals for Major Connections
- Discussion
  - Key priorities
  - Baseline Standards
- Summary & Next Steps

RIIO-ED2 timeline

RIIO-ED2* is the next regulatory period (2023-2028).



*RIIO-ED2 : Revenue = Incentives + Innovation + Outputs Electricity Distribution Regulatory period 2

Incentive on Connections Engagement (ICE) Replacement

As part of its **Sector Specific Methodology Consultation (SSMC)** Ofgem consulted on removing ICE and replacing with new mechanism.

- Details sections 5.37 to 5.61 of Annex 1
  https://www.ofgem.gov.uk/system/files/docs/2020/07/ed2_ssmc_annex_1_delivering_value_for_money_services_for_customers.pdf

Ofgem proposal :

- New framework that doesn't apply to market segments that passed Competition Tests
- Based on connections strategies in Business Plan
  - Potential for penalty or reward through Business Plan Incentive
- Ex post assessment of performance
  - Potential for penalties & rewards
- Incentive 0.1% base revenue per market segment in scope

Overview of new connections mechanism

Connections strategies

- DNO's vision for meeting customers needs aligned to three high level principles
- Tangible links between deliverables, outcomes/benefits & comparison to existing provision
- Encourage common metrics
- Funded through baseline allowances to deliver strategies

Ex post assessment

- Hold to account for delivery of strategies
- Assess delivery of strategies and met performance targets
- Assessed once in price control & at end
- Potential for reward and penalties

Development of our business plan

- Whist Ofgem hasn’t yet decided on the framework for ED2 we are keen to get your input to develop our thinking
- We expect to have to submit a Business Plan next summer which will include our Connections Strategy for the DG LV market segment

- We would like to understand:
  - Your priorities
  - Your feedback on the key stages of the connections process

Feedback

To help us get feedback from everyone, please open
www.menti.com
on your phone or your desktop and to answer these questions.

Enter code 26 13 88 4

Your responses will form the basis for group discussion.

Key Priorities

- Over the next 5-10 years…

What areas for improvement in performance are most important?

What are your 3 biggest challenges?

As a DSO, how should we enable Net Zero Carbon for DG LV connections?

The Customer Journey Approach

Discussion – Minimum Requirements

Pre-application

Baseline Standard	Reported Evidence
Provide access to graphical network records that show the location, size and type of assets	• Description of how access is gained eg, online, registration process etc • Description of information provided
Provide information on capacity that is available	• Transparent, good quality and frequency of updates
Communicate a clear and simple connections process that includes clarity of DNO, customer and third party responsibilities	• Clear information on how to apply etc for infrequent customers
Provide access to support via relevant experts	• Make various platforms available for customers to contact

How important / relevant is this to you? (1-10)

How would you rate ENWL's current performance? (1-10)

Application

Baseline Standard	Reported Evidence
Clearly communicate the range of options available for customers to apply for new connections	• Easy online access to application forms and technical standards • Online application process
Discuss the customer needs to ensure accurate quotation and design	• Number of times options discussed • Volume of requotes due to design errors
Provide quotes in a timely manner	• Measure and report on average time to quote • Performance against Guaranteed Standards
Provide and appropriate level of cost breakdowns in quotes	• Clear breakdown of itemised costings and assumptions/caveats

How important / relevant is this to you? (1-10)

How would you rate ENWL's current performance? (1-10)

Delivery

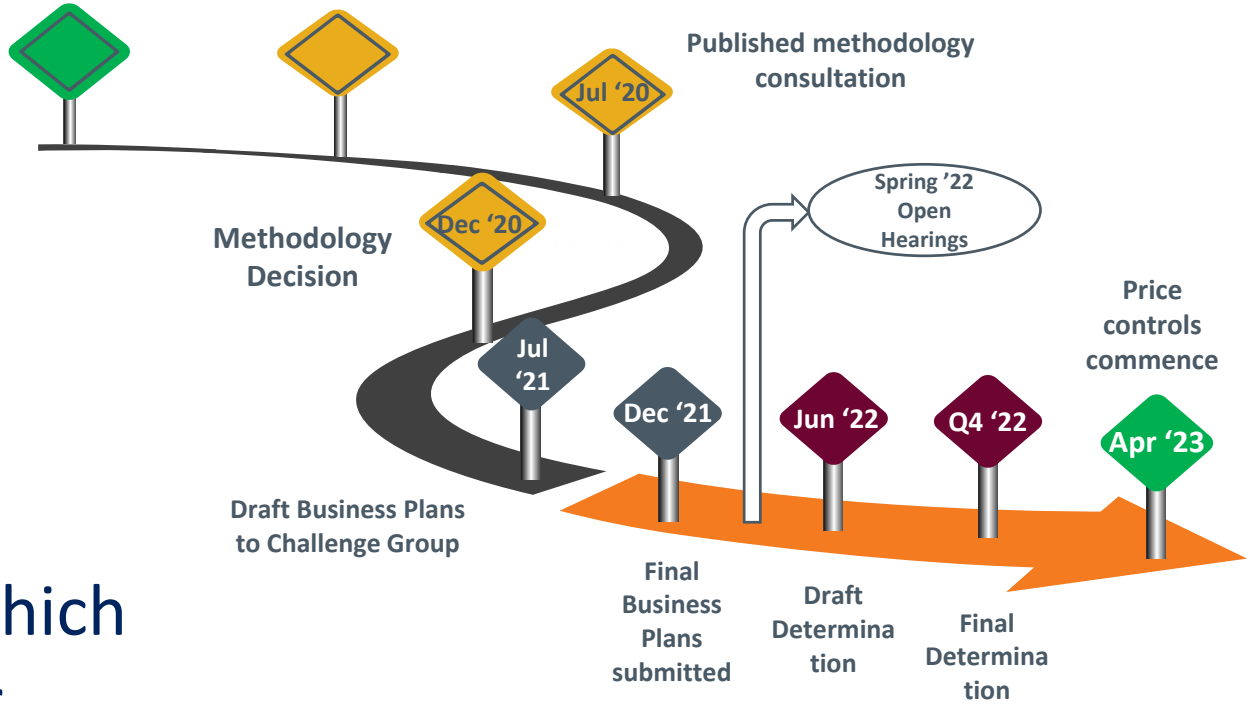
Baseline Standard	Reported Evidence
Provide connection in a timely manner	• Variance from the agreed delivery programme • Timescales for witness testing
Provide clear communication of G98 & G99 requirements	• Clear communication of requirements • Provide FAQ, training, access to experts etc
Provide timely updates on the progress of connections	• Details of frequency of updates (may only be for account/portfolio)
Provide updates on any changes that impact on the costs or timescales of the connection	• Prompt discussion and visibility of changes required to cost/timescales/design

How important / relevant is this to you?

How would you rate ENWL's current performance? (1-10)

Summary & Next Steps

- Collate feedback
- Summarise results
- Develop draft strategy
- Review & validate outcomes



- Write Connection Strategies which feed into our Business Plan for 2023-2028.

The road to Net Zero

Lynn Tracey

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Leading the way to the zero carbon future

Launched our Leading the North West to zero carbon plan in March 2019

- Presenting how we'll spend £63.5m decarbonising our own operations and helping businesses, colleagues and customers to do the same

Carbon literacy training to SLT & WLT

Two net-zero carbon depots

Four electric mini diggers

Two net-zero carbon subs

Lighting replaced with LEDs

Electric Vehicles (EVs)

Smart Street

Strategic investment for low carbon techs (LCTs)

Trialling Mobile Asset Assessment vehicle (MAAV)

Renewable energy tariff

Our strategy

DELIVERING REGIONAL NET ZERO CARBON

Stimulate LCT adoption

Facilitate LCT adoption

Efficient and timely capacity provision

Carbon Plan
Exemplars
trusted information
stakeholder engagement

DSO
Long term planning
strategic infrastructure
Markets
Visibility

Rolling ED2 engagement plan

Strategic infrastructure, ENW carbon footprint

DSO transition plan, Digital and Data strategy, ED2 Capacity Plan

Purpose of our strategy documents

Energy master plans

Collaborating with Cadent to provide Energy Master Plans for GM, Lancs and Cumbria

Energy blueprints

Pathways to net zero

Provides certainty to others to invest now

Dfes

Forecasts the network capacity requirements arising from the growth of LCTs

Gathering stakeholders' views for Dfes 2020

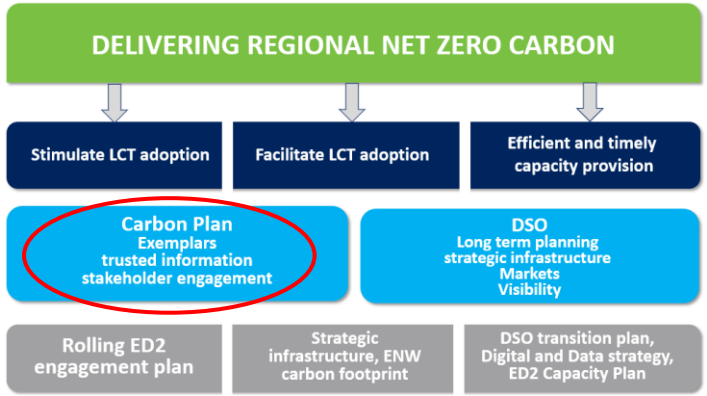
Informs our investment plans and provides visibility of flexibility opportunities

DSO transition document

Implementation plan for Ofgem approved DSO functions.
Sets out the commercial framework to allow others to participate in the flexibility market

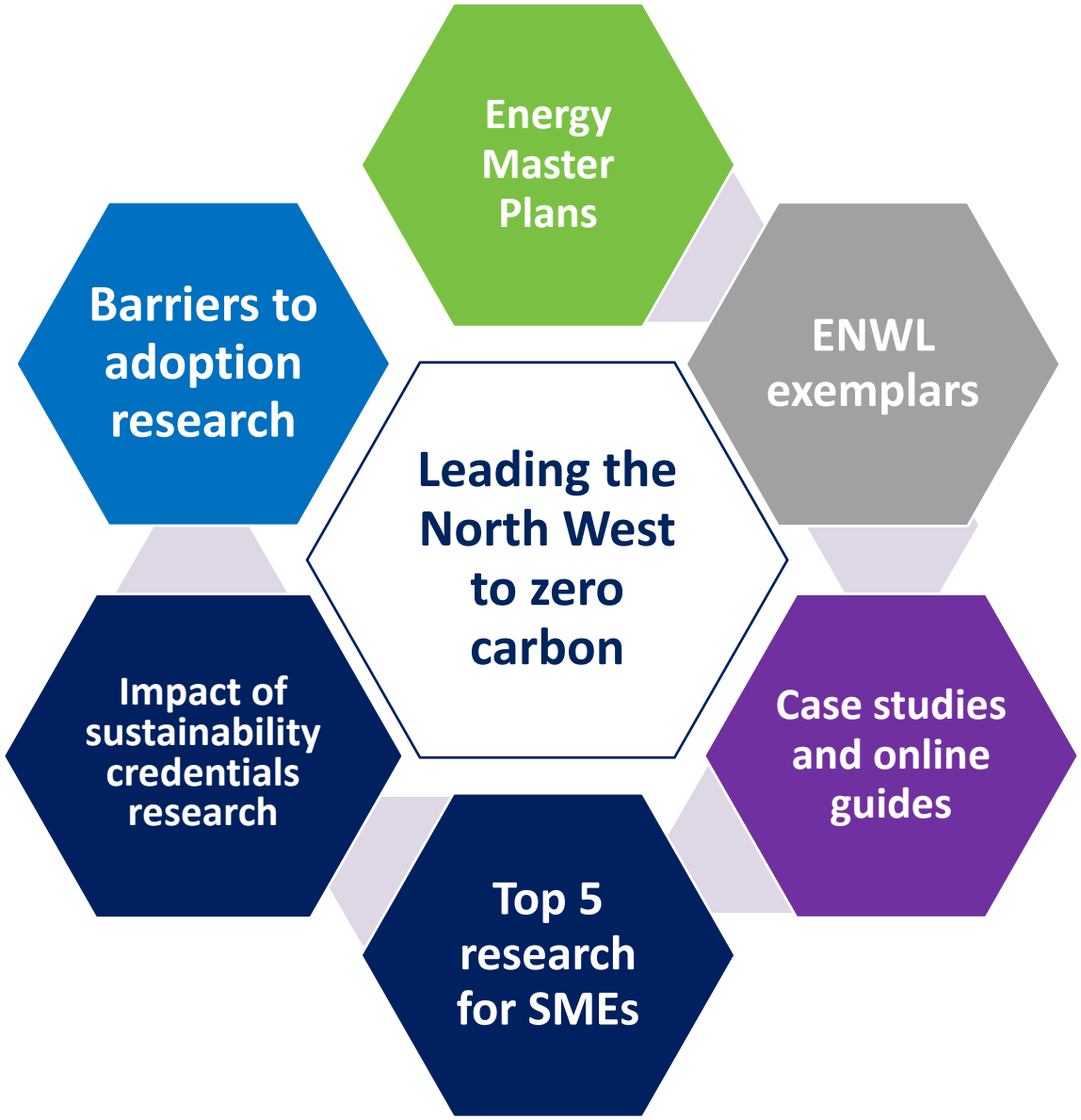
Digital and data strategy
ED2 capacity plan £

Stimulating LCT adoption

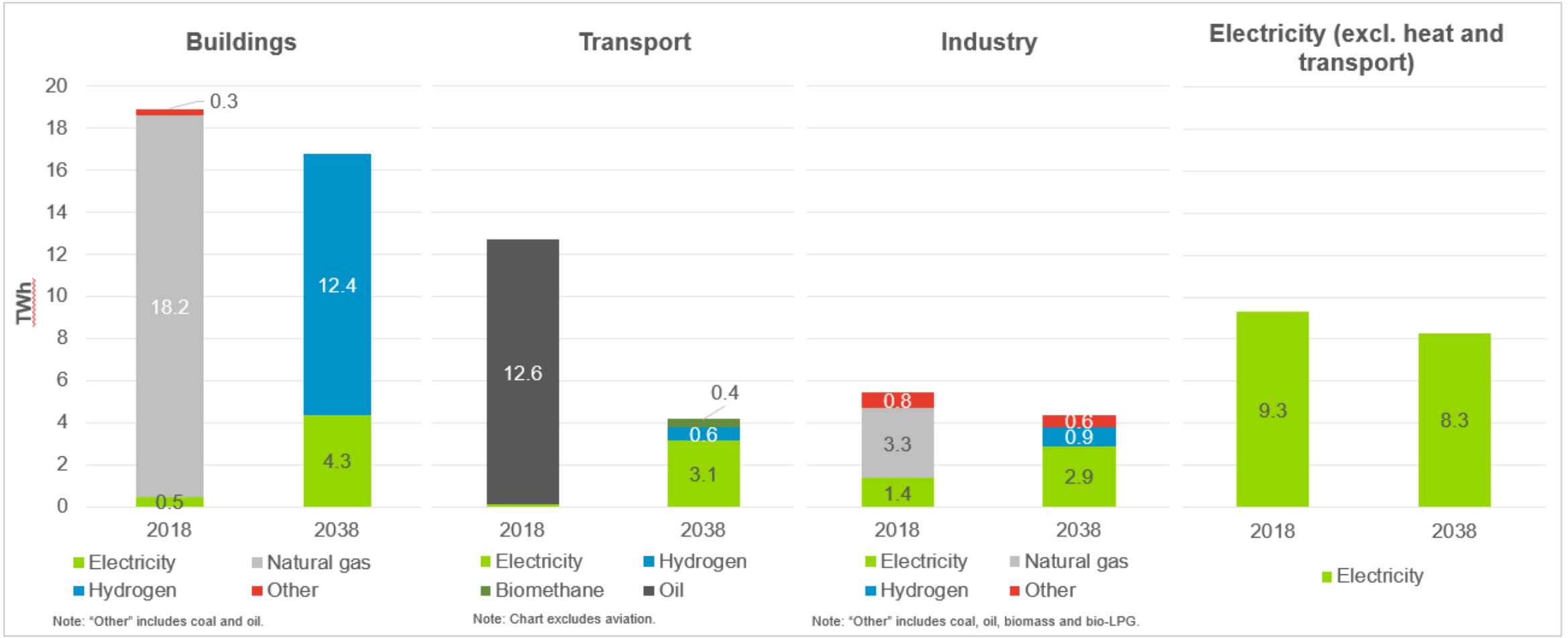


Responding to what we heard from stakeholders:

- Exemplars – trusted case studies
- What businesses can and should do now and why?
- Building independent trusted advisor brand



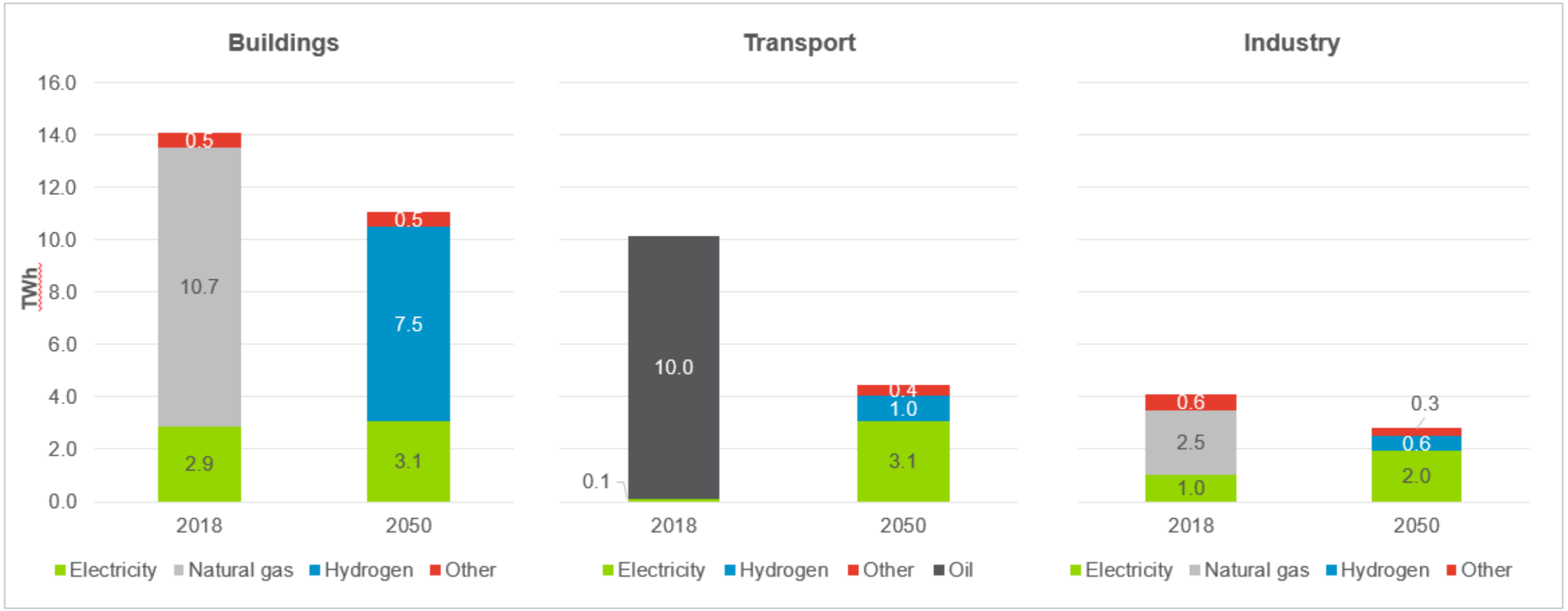
Greater Manchester energy master plan



- Total demand drops from 51 to 39TWh
- Elec demand increases from 11 to 18.6TWh
- Hybrid heating and hydrogen boilers will be dominant tech

- Transport electrifies. Role for hydrogen in HGVs
- Low temp industrial processes electrify
- Hydrogen becomes viable from 2025

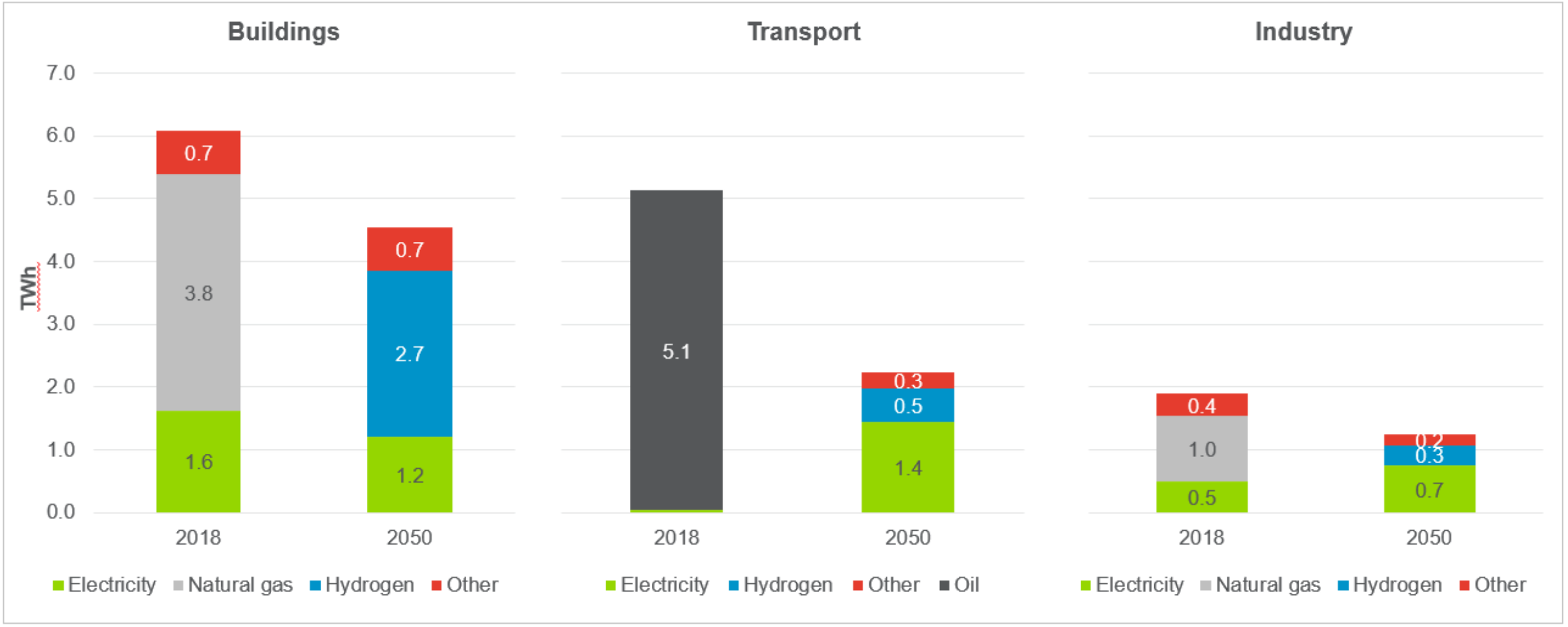
Lancashire energy master plan



- Total demand drops to 22TWh
- Buildings > to 51%
- Transport < to 21%

- Large potential for on and offshore wind
- From mid-2030s can produce significant amount of green hydrogen

Cumbria energy master plan



- By 2050 demand falls to 9.5TWh due to energy efficiency

- Buildings > to 47% of demand
- Transport < to 23% of demand
- Hydrogen will reach Cumbria later than GM

62 actions for GMCA and its key stakeholders make up the Pathway

Pathway actions illustrate the need for GMCA to act now to achieve its decarbonisation target by 2038

2021-2025	2026-2030	2031-2035	2036-2038
S1: Shorten planning processes			
D25: Create incentives for EE in industry			
D14: Create incentives to switch buses to BEV			
D13: Implement the Bee Network			
D2: Promote H2-ready devices			
D1: Enforce mandatory building codes			
K8: Conduct detailed building stock inventory			
K7: Form a shared planning and monitoring hub		**S17:** Include H2 storage in spatial planning	
K3: Leverage policy sandboxes	**S4:** Incentivize rooftop PV	**S8:** Assess options offsetting NG imports	
K2: Decarbonise GMCA's own operations	**D18:** Stimulate shift to sustainable public transport	**S7:** Realize full potential local generation	**S11:** Manage impact NG imports
K1: Make ambition part of GM's identity	**D5:** Enforce all-electric ready for new buildings	**D21:** Introduce a scrappage scheme ICE vehicles	**D24:** Ensure the zero-emission zone for HGVs
K4: Influence national policy development	**K10:** Plan with BEIS for long-term supply of biofuels	**D8:** Expand large-scale upgrading of buildings	**D11:** Complete upgrading of building stock
K5: Establish innovation and scale-up agency	**D6:** Start large-scale upgrading building stock	**D22:** Complete public EV charging network	**S12:** Accelerate conversion Carrington
K6: Build-out transition workforce	**D19:** Expand the EV charging network	**D23:** Ensure whole bus fleet is decarbonised	**D12:** Continue switching devices to 100% H2
K9: Create detail gas network planning for H2	**D20:** Decarbonise at least 50% of bus fleet	**S9:** Coordinate procurement smart solutions	**D33:** Capture remaining emissions from industry
D3: Execute large-scale building upgrade trials	**S5:** Expand behind-the-meter storage	**S18:** H2 switching residential gas grid	**S13:** Continue network reinforcement
D15: Coordinate development of bus charging	**S15:** Coordinate switching industry to H2	**D9:** Start converting H2-ready device to H2	**S19:** Move green H2 production to demand centres
D16: Plan network of 100K public EV chargers	**S16:** Plan for H2 storage capacities	**D10:** Expand use of demand side technologies	
D17: Assess refuelling/charging needs for HGVs	**D7:** Start deployment of B2G and V2G	**D31:** Accelerate H2 switching in industry	
S2: Trial Local Energy Markets	**D28:** Supply industry with H2 from HyNet	**D32:** Continue industrial equipement replacement	
S14: Coordinate H2 supply with HyNet	**D29:** Make industry H2-ready	**S10:** Continue network reinforcement	
D4: Pilot BEMS for in-home optimisation	**D30:** Continue electrification in industry		
D26: Select decarb. options for industry	**S6:** Enable Demand Response at scale		
D27: Start electrification of industry			
S3: Expand LV monitoring			

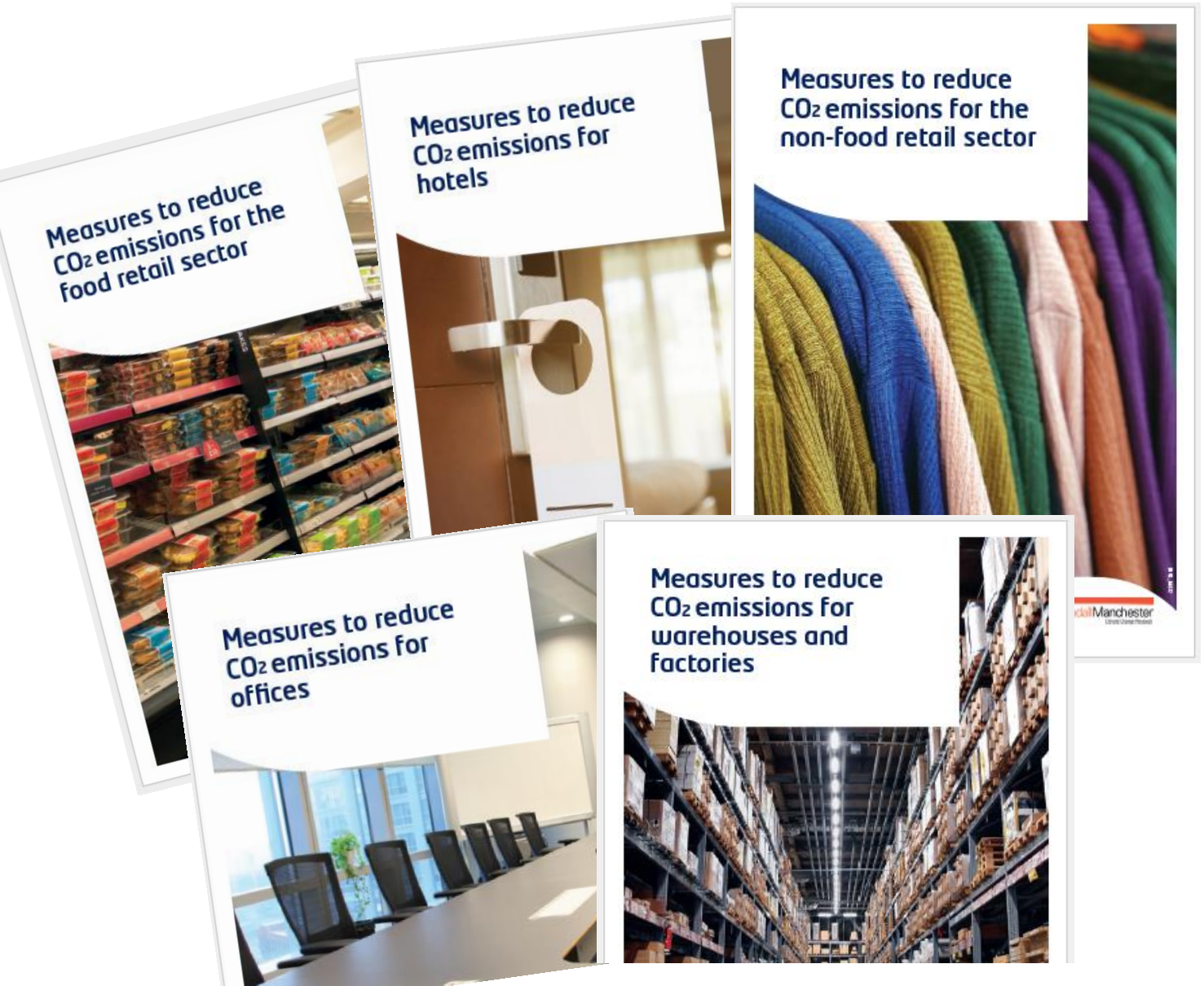
Led by, or under the responsibility of, GMCA

GMCA to influence/collaborate with key stakeholders

GMCA to monitor/be aware of

*) Descriptions of pathway actions have been shortened. See full report for more details.

Key messages for SMEs in our region



- Research for five SME sectors into ‘Top 5 things to do now to decarbonise’
- Supporting research underway into sustainability credentials’ affect on consumers’ views
- Engagement campaign launch in Spring 21:
  - Existing business networks
  - GMCA’s ‘Nature at the heart of…’ engagement campaign
- ‘You and your business’ section on our website with online connections guides
- Creation of online information hub – Launch Dec

Barriers to adoption of PV and EVs by big businesses

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Solar PV – benefits and barriers

Benefits

ROI expected over 5-7 years
Counter to rising electricity costs
Part of carbon reduction strategy
Positive reputational impact
Efficient use of roof space/unused land
Increase in sustainable procurement
Opportunity for positive PR

Barriers

Planning process
Lack of trusted information and case studies
Landlord consent
Roof strength/reinforcement costs
Uncertainty over financing options
Myths and uncertainty over ROI and amount of sunlight needed

Chargers for EVs – benefits and barriers

Benefits

Supports positive cultural change
Financial benefits if fleet is electrified
Business miles savings
Part of carbon reduction strategy – brand halo
Positive impact on employer brand – attracting and retaining talent

Barriers

Lack of trusted information over choice of chargers
Possible network reinforcement costs
Lack of awareness over EV owners' charging patterns
Lack of current EV demand

How can ENWL help?

ENWL online information hub

Exemplars and case studies	Signposts to possible funding
Available financing options	Framework of suppliers
Engagement on regional net zero targets	Supporting research

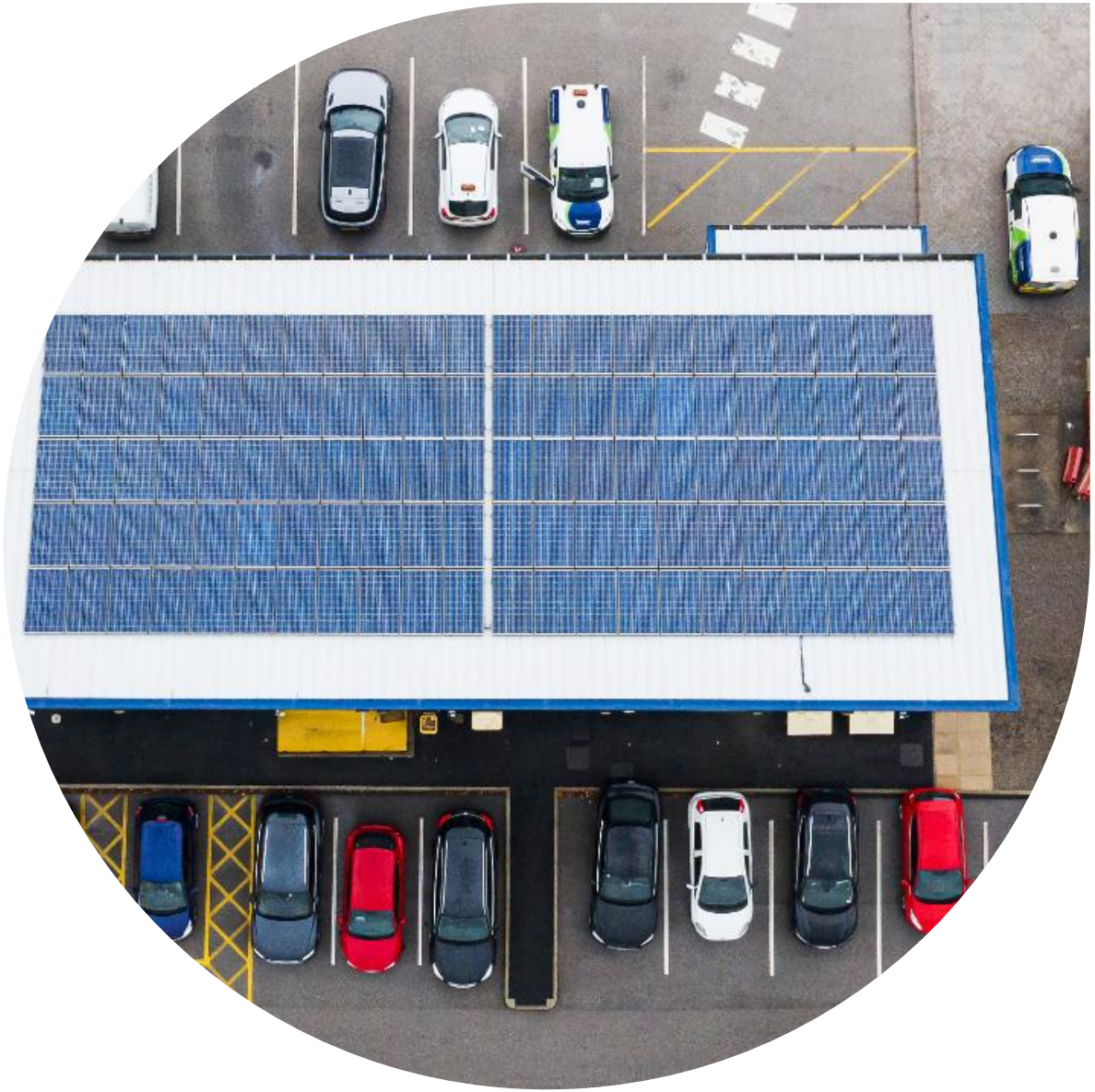
Business to business engagement campaign

Engage LAs to remove barriers

Informs our RIIO ED2 plan

How can you help?

- Case Studies
- Encouraging businesses to follow
- zerocarbon@enwl.co.uk



Wrap up and Close

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Wrap Up & Close

- Please give us your honest feedback either email ICE or leave your feedback in the chat 
- Presentation slides will be available via our website shortly. 
- Future events, including webinars are available here
- Don't forget to get in touch with us at ICE@enwl.co.uk
- Thank you for your attendance.