ESB NETWORKS

MICROGENERATION FRAMEWORK CONSULTATION

Enabling the Transition from Consumer to Prosumer

DOC-300420-FSI

May 2020

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SECTION 1
INTRODUCTION

Microgeneration Framework Consultation
Enabling the Transition from Consumer to Prosumer

1.1 Changing Landscape: A Transformation of the Energy System as We Know It

The power sector is undergoing transformative change with the growth of low carbon technology and changing consumer preferences. European policy, such as the Clean Energy Package (CEP) and the revised Renewable Energy Directive (RED II), are driving a change in behaviour and supporting the decarbonisation of the European power sector.

The Irish Government recently published the Climate Action Plan (CAP) which sets ambitious targets to facilitate and enable the transformation to a low carbon future. This ambition includes the goal of reaching 70% of electricity generated from renewable energy by 2030. Renewable energy of all scales, from large-scale to small-scale renewable generation, community energy renewable energy projects, and microgeneration, will all play a part in contributing to Ireland's decarbonisation goals. The CAP[1] had a dedicated section to microgeneration where "The Government strongly supports enabling people to sell excess electricity they have produced back to the grid". Developments in policy and technologies are likely to evolve and advance to facilitate this goal, for example the forecasted increasing development of large off-shore wind generation and the increased roll-out of community energy schemes.

There are many actors involved in delivering Ireland's decarbonisation objectives. ESB Networks is one actor within this group of actors and we seek to proactively contribute towards Ireland's decarbonisation targets. This framework focuses on microgeneration which is a form of renewable energy generation that may be more accessible to the ordinary energy customer compared to large scale renewable energy generation. Through this framework, ESB Networks hopes to inform the energy customer of some aspects of microgeneration, to collect and collate their views regarding this topic and to use this feedback when considering areas relevant to microgeneration.

In a 2016 briefing from the European Parliament, 'prosumer' is described as a relatively new term that, in the energy field, most often denotes consumers who both produce and consume electricity.[2] This document refers to consumers who wish to install microgeneration and export excess electricity onto the electricity network as prosumers.

This strong ambition from the Irish government aligns with RED II which brings the prosumer into the centre of EU energy policy. Due to a combination of current building regulations, SEAI grants, the rise of the active, engaged consumer and the future provision of a microgeneration support scheme, ESB Networks anticipates increased future levels of microgeneration connecting to the distribution network. Consumers have been recognised as playing a major role in this transition and have been identified as a key player in Ireland's ability to achieve its 2030 renewable energy goals. The actions relating to microgeneration in the CAP are extracted for review in a later section. These actions provide a comprehensive overview of the necessary steps, timelines and relevant stakeholders in order to establish a robust framework to enable the transition from consumer to prosumer.

It is important to note when considering microgeneration, that as there is a capital cost associated with the purchase, installation and future operation and maintenance of the microgeneration equipment (e.g. solar PV panels), certain customer classes i.e. fuel poor customers or vulnerable customers may feel that they cannot equitably participate in the microgeneration journey. It is vital that any holistic review of microgeneration considers the issue of equity to all users of the electricity network and seeks to identify and minimise unintended cross-subsidisation between customers i.e. customers with a form of microgeneration and customers without any form of microgeneration. In this context, relevant stakeholders should be cognisant of the need to ensure that the range of processes, incentives and rules relating to microgeneration encourage an economically efficient future level of microgeneration.

As Distribution System Operator (DSO), ESB Networks has an important role to play in facilitating this transformation. We aim to support our customers along each stage of the process as they adopt small-scale low-carbon technologies and make the transition towards being active participants in the energy system.

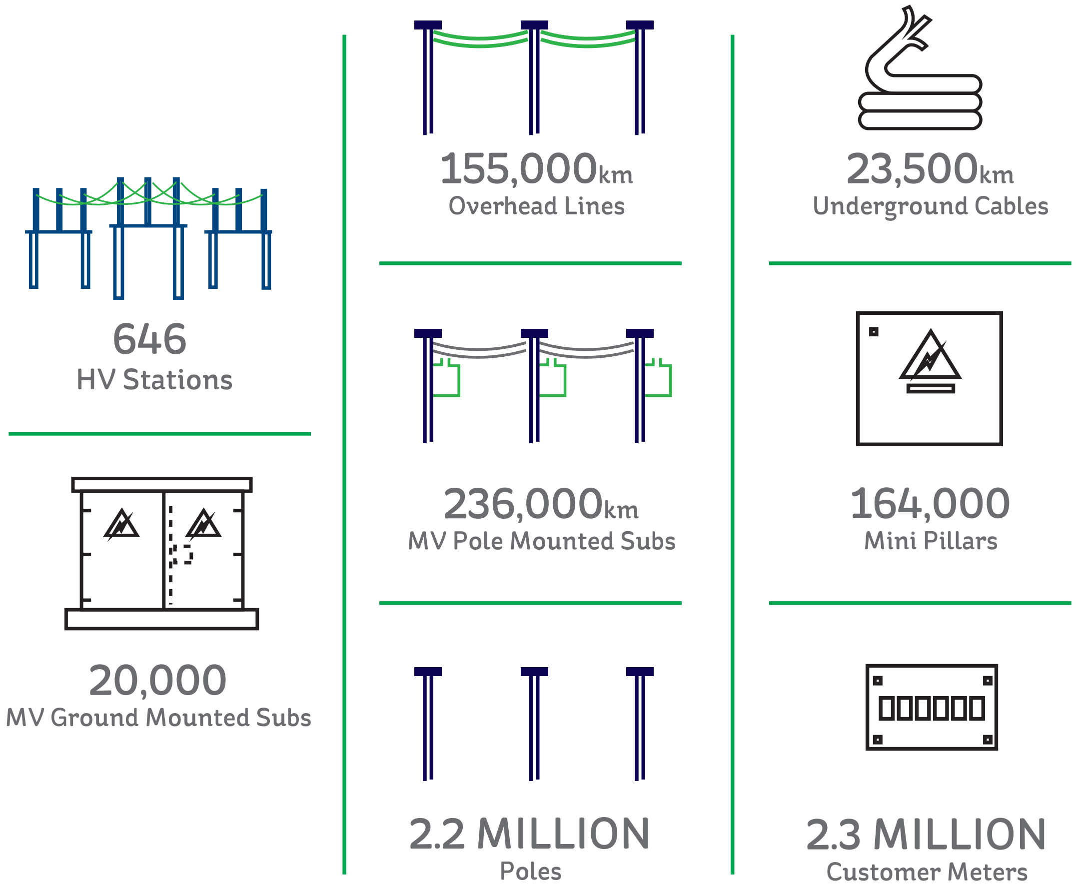
1 https://www.gov.ie/en/publication/5350ae-climate-action-plan/

2 http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2016)593518

1.2 About ESB Networks

ESB Networks provides the electricity infrastructure that transports electricity to all customers in Ireland. Our assets cover the entire country and include a range of overhead lines, underground cables and associated technical equipment to safely convey electricity to more than 2.3 million customers. We have served Irish customers for over 90 years and have provided the electrical infrastructure on which our society has developed. We now have one of the most progressive electricity systems in the world.

We carry out all the functions relating to the electricity distribution system. This includes financing, planning, construction, maintenance and operation of the high, medium and low voltage distribution networks. ESB Networks fills a number of different market roles through the Metering and Registration System Operator (MRSO) function, it is responsible for providing meter registration, data processing and data aggregation services. ESB Networks also delivers the data collector, meter operator and DSO roles. ESB Networks finance, build and maintain the high voltage transmission system through which electricity flows from generation stations to bulk supply points near cities and towns across Ireland. ESB Networks has connected over 2,000 MW of renewable energy generation to the distribution network at present.



3 https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-plan/Pages/climate-action.aspx

4 https://www.esbnetworks.ie/who-we-are/innovation/our-innovation-strategy/our-innovation-roadmaps

1.3 ESB Networks Role in Facilitating Microgeneration

Customer service is at the heart of everything we do at ESB Networks. We provide services to every electricity customer irrespective of their electricity supplier. Our countrywide staff are committed to making excellence the hallmark of all aspects of our dealings with our customers.

We are committed to facilitating the move towards low carbon technologies and want to support our customers, not only through the process of installing microgeneration but also strive to enable them to participate in the energy market. This framework document seeks to examine options available to facilitate the transformation of our customers from consumers of electricity to active prosumers.

The framework contains a number of questions where we welcome feedback from you, the customer. This feedback will then be studied and incorporated into further refinement of developing possible solutions to enable the transition from energy consumer to energy prosumer. ESB Networks will incorporate the feedback received to this publication into any review of its microgeneration processes.

The Commission for Regulation of Utilities (CRU) is Ireland's independent energy and water regulator. This paper, along with all feedback received, will be provided to CRU to support their decision-making process on microgeneration. CRU's aim is to protect the interests of energy customers, maintain security of supply, and to promote competition covering the generation and supply of electricity and supply of natural gas. This paper will also be provided to the Department of Communications, Climate Action and Environment (DCCAE) in the hope that it may provide useful information in achieving the microgeneration goals as set out in the governmental CAP.[3]

ESB Networks is committed to leading the transition to a low carbon future as evident through ESB Networks Innovation Strategy which can be found on the ESB Networks website.[4]

The ability of electricity networks to adapt and innovate in this changing and uncertain environment will be crucial to their future success. This changing environment provides us with challenges but also provides great opportunities for innovation. By 2030 our network will support, through the identification of innovative opportunities, huge changes in electricity generation and consumption.

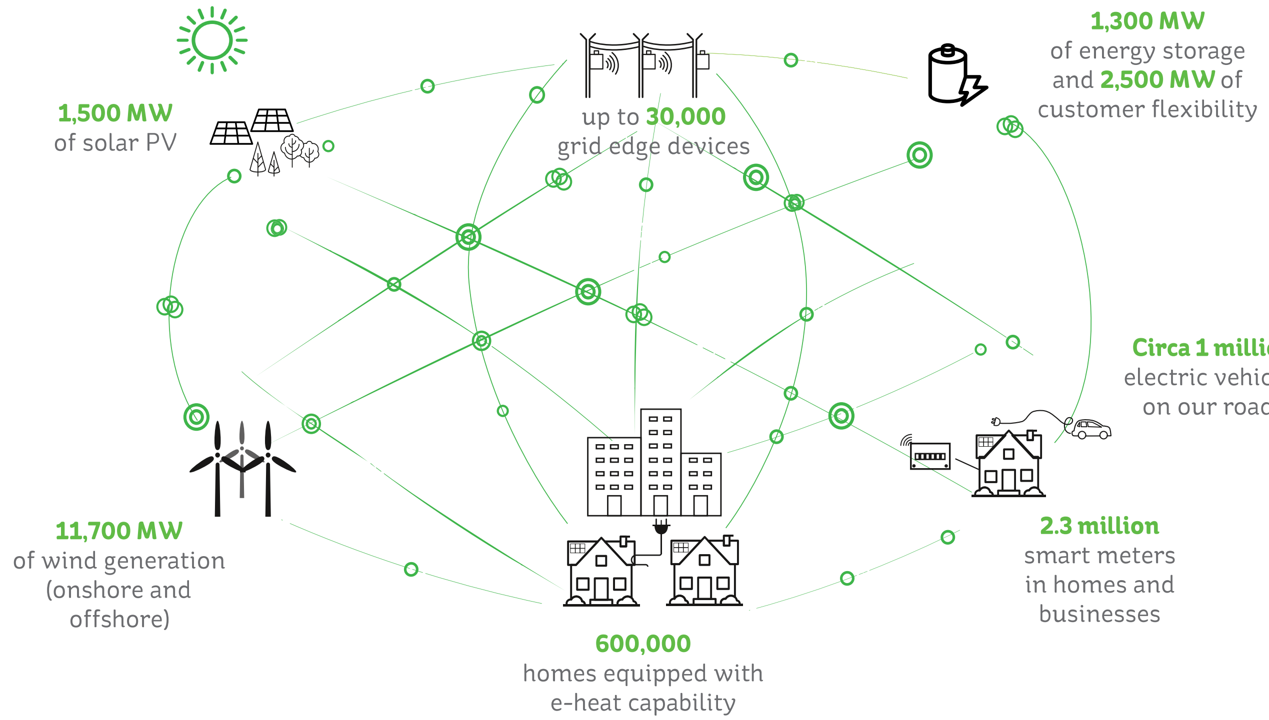


Figure 1 ESB Networks Innovation Strategy - What will the Network Support in 2030

SECTION 2
MICROGENERATION GRID CONNECTION PROCESS

Microgeneration Framework Consultation
Enabling the Transition from Consumer to Prosumer

ESB Networks[5] defines microgeneration as a source of electrical energy and all associated equipment, rated up to and including:

- 6 kW, when the DSO network connection is single-phase
- 11 kW, when the DSO network connection is three-phase

and designed to operate in parallel with the ESB Networks low voltage (LV) system. Full details and conditions can be found on the ESB Networks website.[6]

This definition makes no explicit reference to any specific form of generating technology. The following are examples of different types of microgenerators:

- Wind-power (Turbines)
- Solar-power (Photovoltaic (PV) panels)
- Small hydroelectric schemes
- Micro combined heat-and-power (CHP)
- Combined renewable microgenerator and storage systems[7]

This framework consultation is technology agnostic i.e. does not differentiate between microgeneration from a roof mounted solar PV panel, a wind turbine or small hydro schemes. For information, please note that there are technical differences between inverter based generation (e.g. PV), which is inherently less onerous on the network than other technologies.

The vast majority of domestic connections in Ireland are single-phase connections. ESB Networks charges a connection fee for all types of business and domestic connections, and a full list of these regulatory approved charges can be found in the ESB Networks Statement of Charges.[8] Each connection is calculated using the least cost technically acceptable connection method.

If a customer wishes to upgrade their connection from a single-phase to a three-phase connection this can be done, however, higher connection charges will apply. These arise because the physical conductor connecting the customer to the network needs to be replaced and connected to a three-phase circuit. In an urban location this will most likely involve street excavation, but in rural areas would most likely involve building some new MV overhead line. The level of network capacity required by the customer will determine the actual connection point the customer wishes to connect to. The distance between the connection point and the network, as well as various other works that may need to be carried out, additional charges will be apportioned to the customer as per the regulatory approved Basis of Charges for Connection to the Distribution System.[9]

ESB Networks is committed to facilitating microgeneration connection applications to the grid. Since 2016, ESB Networks has facilitated over 15,000 microgeneration connection applications to the electricity network.

5 Further information relating to the regulatory basis defining microgeneration is outlined in Section 3.2

6 https://www.esbnetworks.ie/docs/default-source/publications/conditions-governing-connection-and-operation-of-micro-generation-policy.pdf?sfvrsn=ad5c33f0_8

7 https://www.esbnetworks.ie/new-connections/generator-connections/connect-a-micro-generator

8 https://esbnetworks.ie/docs/default-source/publications/approved-statement-of-charges-2019-2020.pdf?sfvrsn=224533f0_33

9 https://esbnetworks.ie/docs/default-source/publications/basis-of-charges-for-connection-to-the-distribution-system.pdf?sfvrsn=5e5d33f0_4

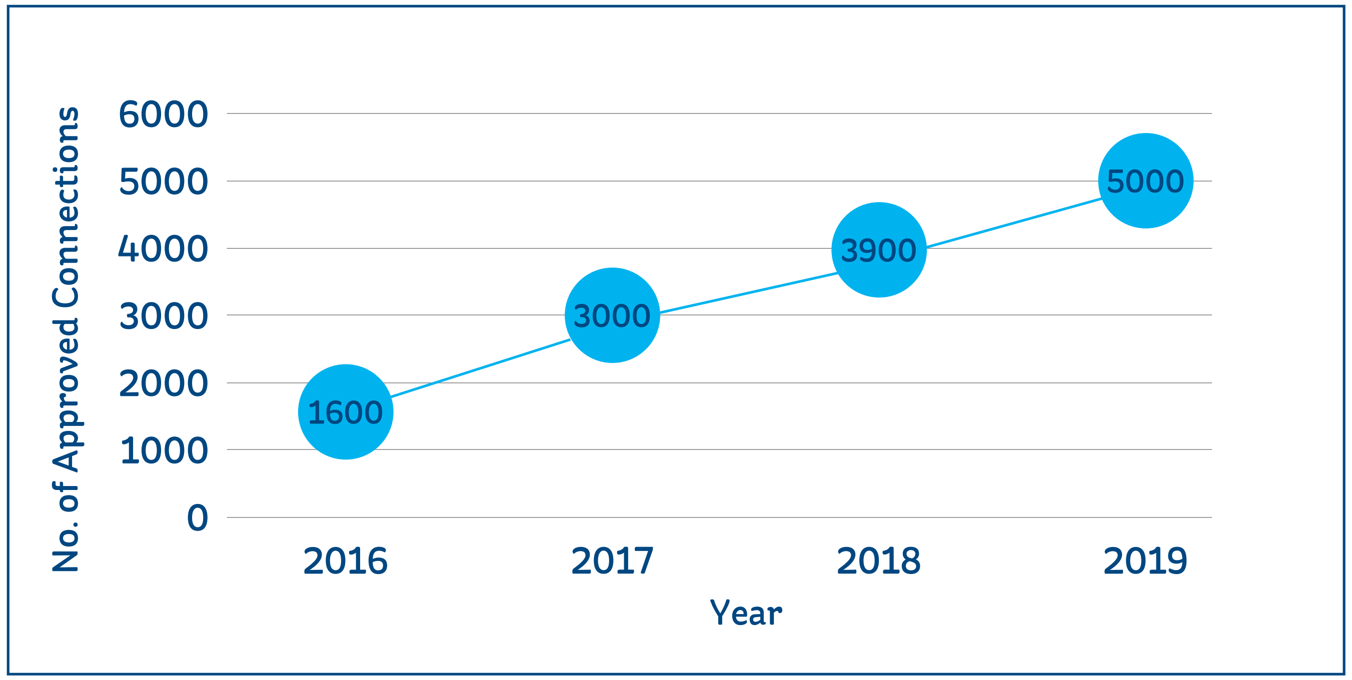


Figure 2 ESB Networks Approved Microgeneration Connection Applications

The section below outlines the current process and policy for installing a microgeneration unit.

2.1 Microgeneration Grid Connection Process

Details on the current connection arrangements for microgenerators connecting at a domestic level are detailed below and further information on microgeneration connection policy can be found on the ESB Networks website.[10]

Current Process for a Single Application:

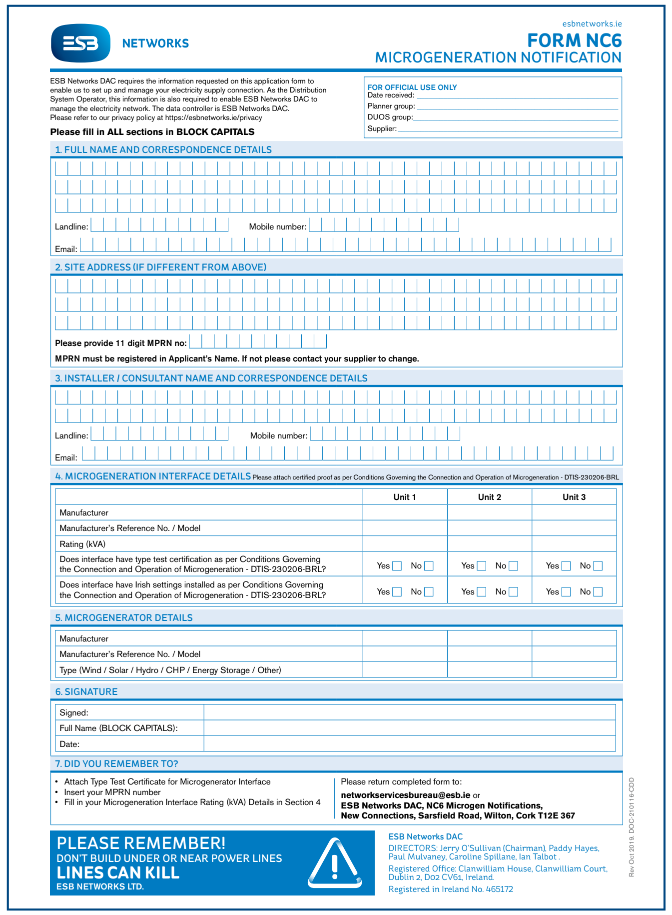
A sporadic once-off installation is defined as follows:

- Only one customer is involved
- Only one installation is involved
- Where multiple customers on the same site or housing scheme are involved, and the penetration level achieved is less than 40%[11] of the capacity in kVA of the existing MV/LV substation that supplies the site or scheme.

For sporadic once-off installations in existing premises, as defined above, the customer shall complete the Microgeneration Installation Notification Form. (Application Form NC6)

This should be sent to ESB Networks DAC, NC6 Microgen Notifications, New Connections, Sarsfield Road, Wilton, Cork, T12E 367. Type-test certification for the interface[s] associated with the microgenerator[s] in question should also accompany this notification. The equipment supplier is able to provide the relevant certification. Customers can also send their NC6 applications to NetworkServicesBureau@esb.ie.

ESB Networks understand that microgeneration is primarily for the purpose of self-consumption with excess electricity being exported to the distribution network and believes that the existing ESB Networks microgeneration export thresholds of 6 kW (single-phase) and 11 kW (three-phase) are sufficient to encourage the transition from consumer to prosumer.



NETWORKS
esbnetworks.ie
FORM NC6
MICROGENERATION NOTIFICATION

ESB Networks DAC requires the information requested on this application form to enable us to set up and manage your electricity supply connection. As the Distribution System Operator, this information is also required to enable ESB Networks DAC to manage the electricity network. The data controller is ESB Networks DAC. Please refer to our privacy policy at https://esbnetworks.ie/privacy

Please fill in ALL sections in BLOCK CAPITALS

FOR OFFICIAL USE ONLY
Date received:
Planner group:
DUOS group:
Supplier:

1. FULL NAME AND CORRESPONDENCE DETAILS

Landline: Mobile number:
Email:

2. SITE ADDRESS (IF DIFFERENT FROM ABOVE)

Please provide 11 digit MPRN no:
MPRN must be registered in Applicant's Name. If not please contact your supplier to change.

3. INSTALLER / CONSULTANT NAME AND CORRESPONDENCE DETAILS

Landline: Mobile number:
Email:

4. MICROGENERATION INTERFACE DETAILS Please attach certified proof as per Conditions Governing the Connection and Operation of Microgeneration - DTIS-230206-BRL

	Unit 1	Unit 2	Unit 3
Manufacturer			
Manufacturer's Reference No. / Model			
Rating (kVA)			
Does interface have type test certification as per Conditions Governing the Connection and Operation of Microgeneration - DTIS-230206-BRL?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
Does interface have Irish settings installed as per Conditions Governing the Connection and Operation of Microgeneration - DTIS-230206-BRL?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

5. MICROGENERATOR DETAILS

Manufacturer			
Manufacturer's Reference No. / Model			
Type (Wind / Solar / Hydro / CHP / Energy Storage / Other)			

6. SIGNATURE

Signed:	
Full Name (BLOCK CAPITALS):	
Date:	

7. DID YOU REMEMBER TO?

- Attach Type Test Certificate for Microgenerator Interface
- Insert your MPRN number
- Fill in your Microgeneration Interface Rating (kVA) Details in Section 4

Please return completed form to:
networkservicesbureau@esb.ie or
ESB Networks DAC, NC6 Microgen Notifications, New Connections, Sarsfield Road, Wilton, Cork T12E 367

PLEASE REMEMBER!
DON'T BUILD UNDER OR NEAR POWER LINES
LINES CAN KILL
ESB NETWORKS LTD.

ESB Networks DAC
DIRECTORS: Jerry O'Sullivan (Chairman), Paddy Hayes, Paul Mulvaney, Caroline Spillane, Ian Talbot .
Registered Office: Clanwilliam House, Clanwilliam Court, Dublin 2, D02 CV61, Ireland.
Registered in Ireland No. 465172

Rev Oct 2019. DOC-210116-CDD

Figure 3 NC6 Application Form

If ESB Networks become aware of any other technical or location specific reason why installation should not proceed, then ESB Networks shall inform the customer within 20 working days of receipt of the notification.

If no such notice or request for type test certification or instruction to suspend installation is received by the customer within this time-frame, then the installation can proceed without any further correspondence with ESB Networks.

The microgeneration connection application process is the same for new builds as it is for customers who choose to add microgeneration to an existing connection.[12] There is no application fee or charge to the customer when sending an NC6 form to ESB Networks for processing. Technical studies are largely not required for microgeneration grid connection applications to date, unlike grid connection applications for larger generators, although this does not mean that studies would not be required in particular circumstances.

Current Process for Planned Multiple Installations:

The application process for planned multiple installations, applies to planned (green field) multiple installations such as new housing schemes, where it is planned to have microgeneration installed in every house or premises.

Within an existing housing estate, if the total capacity of the installed microgeneration on the transformer is 50 kVA or if the penetration levels is greater than 40% of the transformer then ESB Networks needs to do a more refined network study before connection.[13]

For new connections, application for connection will be made in the normal way but the intention to install microgeneration, shall be flagged by the applicant in the application form.

10 https://www.esbnetworks.ie/new-connections/generator-connections/connect-a-micro-generator.

11 At a penetration level of 40% of the transformer capacity it is possible that power quality and loading issues may arise, and consequently such proposed installations would need to be reviewed in advance by ESB Networks

12 https://www.esbnetworks.ie/docs/default-source/publications/conditions-governing-connection-and-operation-of-micro-generation-policy.pdf?sfvrsn=ad5c33f0_8

13 https://www.esbnetworks.ie/docs/default-source/publications/conditions-governing-connection-and-operation-of-micro-generation-policy.pdf?sfvrsn=ad5c33f0_8

2.2 ESB Networks Review of the Connection Process

To ensure the connection process works for our customers and in anticipation of the large increase in the numbers of microgeneration forecasted to connect to the network, we see it appropriate to review the current microgeneration application process. We have received initial feedback from stakeholders that the current NC6 process is working well, however, we strive for continuous improvement. We welcome your input and feedback relating to the existing application process.

Question 1:
Do you have any feedback in relation to the existing grid connection process for microgeneration (up to 6 kW single-phase and 11 kW three-phase)?

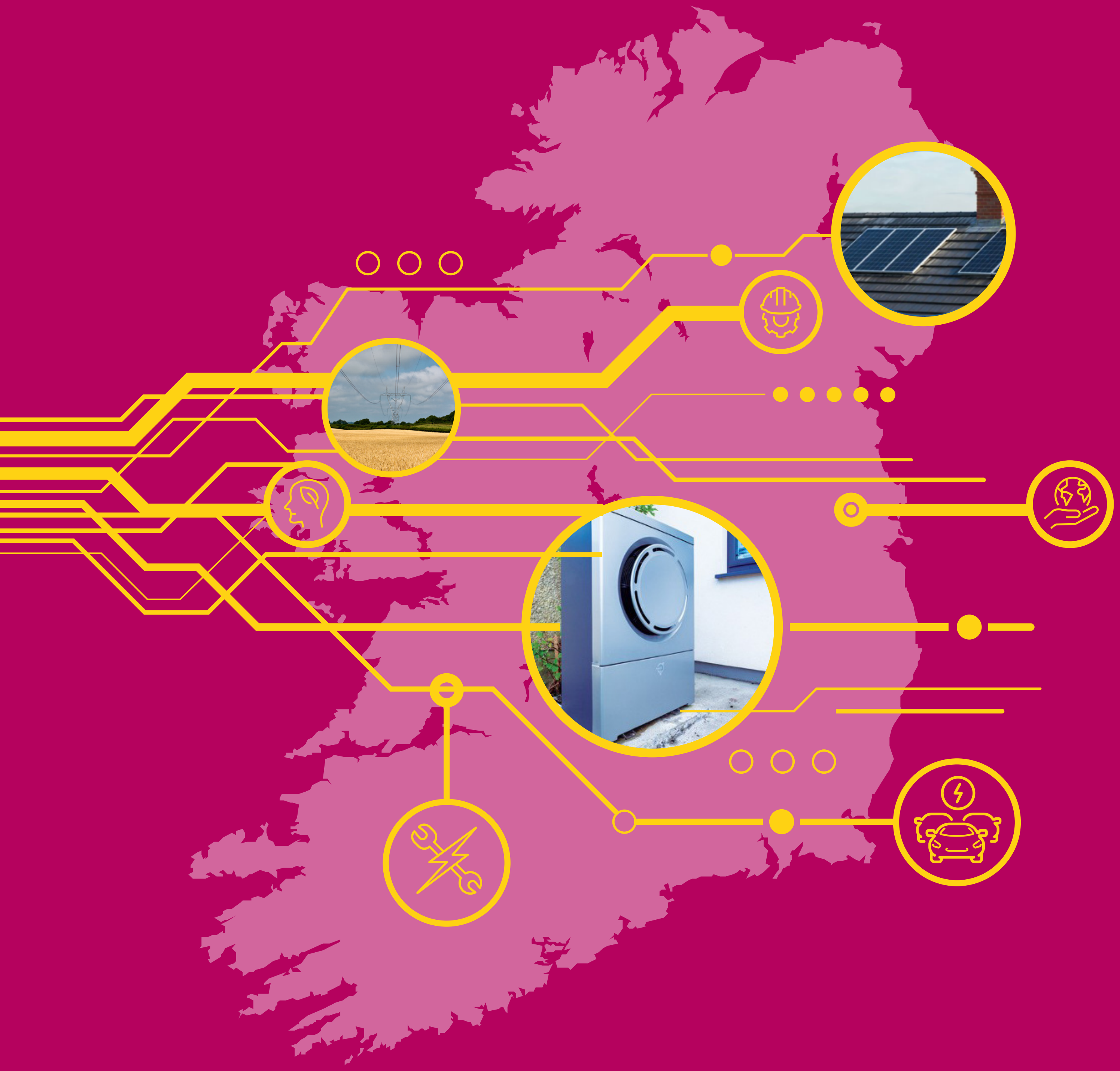
2.3 Grid Connection Process for Generation Greater than 6 kW (single-phase), 11 kW (three-phase)

Article 17 of the Renewables Directive requires establishment of simple notification procedure for grid connections where installation or aggregated production units of renewables self-consumers with an electrical capacity of 10, 8 kW or less are to be connected to the grid. Member States may allow a simple-notification procedure for installations or aggregated production units with an electrical capacity of above 10, 8 kW and up to 50 kW, provided that grid stability, grid reliability and grid safety are maintained.

The grid connection process for generators greater than 6 kW (single-phase) and 11 kW (three-phase) is outlined under CRU's Enduring Connection Policy (ECP).[14] As per regulated grid connection policy, this range of export capability is not considered as microgeneration however, we feel it may be useful information for the reader. In 2018, the CRU published a decision on Enduring Connection Policy – Stage 1 (ECP-1) with the intent of allowing projects which were 'shovel ready' to have an opportunity to connect to the network. As per ECP-1, generators in the range of 12-500 kW are processed outside the batch in a non-batch process. At present, as per ECP-1, 30 applications per year in this range as well as autoproducers and DS3 system services qualifying trial projects are being processed outside the batch in the non-batch process. The processing of such applications required a technical study to be carried out to establish what works and equipment are required to facilitate the connection of those generator applications on to the network. CRU published an ECP-2 consultation in Q4 2019. Responses from industry and interested stakeholders were received by CRU in Q1 2020 and CRU is currently considering Enduring Connection Policy Stage 2 (ECP-2). Any changes to regulated policy within ECP-2 will be implemented by ESB Networks.

14 https://www.cru.ie/document_group/electricity-connection-policy-2/

SECTION 3
LEGISLATIVE BASIS



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3.1 Clean Energy Package / Renewable Energy Directive

The Clean Energy Package (CEP) is a package of measures designed to keep the European Union (EU) competitive as the clean energy transition changes the global energy markets.[15] The package is aimed at keeping the EU a global leader in renewables and, more broadly, helping the EU to meet its emissions reduction commitments under the Paris Agreement.[16]

Figure 4 Clean Energy for All Europeans package

The CEP contains specific provisions dealing with the issue of 'renewable self-consumers' and microgeneration. Further details on the CEP can be found on the European Commission's website here.

In December 2018, the revised Renewable Energy Directive 2018/2001/EU (RED II) entered into force, as part of the Clean Energy for all Europeans package. The Directive establishes a new binding renewable energy target for the EU for 2030 of at least 32%, with a clause for a possible upwards revision by 2023.[17]

15 http://europa.eu/rapid/press-release_IP-16-4009_en.htm

16 https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive

17 https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive

18 https://www.cru.ie/wp-content/uploads/2007/07/cer07208.pdf

19 https://www.cru.ie/wp-content/uploads/2009/07/cer09033.pdf

20 https://www.cru.ie/wp-content/uploads/2007/07/cer07208.pdf

3.2 CRU Regulatory Decisions

As mentioned in the introduction, CRU are the decision makers for a wide array of energy related areas. Existing determinations from CRU that are relevant to microgeneration are detailed within this section. In 2007, the CRU published a Decision *(CER/07/208) Arrangements for Microgeneration* which outlined the technical and commercial arrangements for microgeneration including installation, safety, notifications to ESB Networks and metering for microgenerators that rate at or below 11 kW. Within this decision the CRU encouraged electricity suppliers to develop payment arrangements for microgenerators.[18]

In 2008, ESB Customer Supply (ESBCS), as the Public Electricity Supplier at the time, made a submission to facilitate the payment for output of micro generators. CRU published the *ESBCS Domestic Micro-generator Export Tariff Decision Paper (CER/09/033)* in February 2008 in which it published details of the interim export tariff. ESBCS offered a payment of 9.00 cent per kWh of exported electricity.[19] The scheme was open until 31st December 2014 and ESBCS (now Electric Ireland) continue to offer the payment of 9.00 cent per kWh to those customers who signed up before the closing date.

3.3 Government Climate Action Plan

In June 2019, the Irish Government published a CAP[20] which sets out an ambitious course of action to address the issue of climate change.

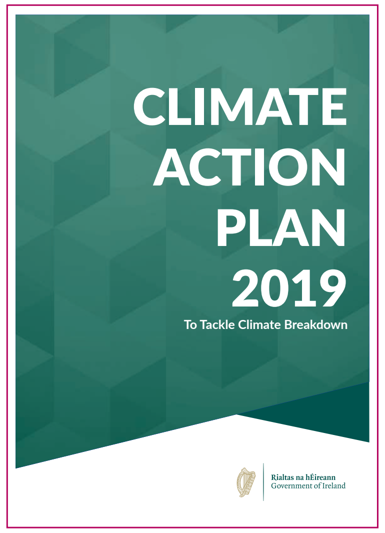

Figure 5 Government Climate Action Plan 2019

Figure 6 is an extract from Section 7.3 of the governmental CAP, entitled, "Measures to Deliver Targets".[21] The snippet outlines the government's plan for supporting microgeneration over the coming years.

3. Micro-generation

The Government strongly supports enabling people to sell excess electricity they have produced back to the grid. To enable this, we will have to make a number of changes.

- We have established a pilot micro-generation grant scheme for solar Photovoltaics (PV), targeting self-consumption, which provides a grant of circa 30% of the installation costs for individual homes.Building on the pilot, we will put an ongoing support scheme in place for micro-generation by 2021 at the latest, focusing on a number of key pillars, including: equity and accessibility for all, ongoing technology cost and remuneration analysis, addressing technical barriers and planning constraints, a clear grid connection policy, and supporting community participation in micro-generation. This will be further supported by measures in building regulations
- Mechanical electricity meters will be replaced in every house by 2024 under the Smart Metering Programme. This will facilitate better demand management and cost savings for consumers, particularly when closely aligned with the ambitious roll-out of retrofitting programmes and micro-generation capacity for homes and small enterprises
- Change the electricity market rules in early 2020 in order to enable micro-generated electricity to be sold to the grid. This should include provision for a feed-in tariff for micro-generation to be set at least at the wholesale price point
- Design market mechanisms, network tariffs, competitive auctions for renewables and the public service obligation in a way that distributes costs fairly, including in terms of competiveness

Figure 6 Government Climate Action Plan Section

The CAP requires changes to the electricity market rules to allow for a "feed-in-tariff for microgeneration to be set at least at the wholesale price point". This makes provision for payment to prosumers who export electricity produced from microgeneration to the grid.

The CAP contains actions to assist Ireland in meeting its ambitious objectives for climate action. The actions relating to microgeneration in the CAP are extracted for review in the following table. These actions provide a comprehensive overview of the necessary steps, timelines and relevant stakeholders in order to establish a robust framework to enable the transition from consumer to prosumer.

21 https://www.cru.ie/wp-content/uploads/2009/07/cer09033.pdf

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Action 30: Develop an enabling framework for micro-generation which tackles existing barriers and establishes suitable supports within relevant market segments

Steps Necessary for Delivery	Timeline by Quarter	Lead	Other Key Stakeholders
Establish a working group on micro-generation and renewable self-consumption and agree terms of reference e.g. appropriate definitions, policy objectives, engage with the CEP transposition project etc.	Q3 2019	DCCAE	CRU, SEAI, DHPLG, ESBN
Begin review of requirements for resolving market settlement issues for renewable self-consumers exporting to the grid	Q3 2019	CRU	
Conclude review of the current exemptions relating to solar panels as provided for in the Planning and Development Regulations, in consultation with the Department of Communications, Climate Action and the Environment and implement amendments arising from review	Q4 2019	DHPLG	DCCAE
Determination of appropriate grid connection policy to facilitate renewable self-consumers and access for micro-generation	Q4 2019	CRU	ESBN
Assess potential implications for distribution network of defined higher penetrations of distributed generators	Q4 2019	ESBN	
Assess possible support mechanisms for micro-generation/renewable self-consumption differentiated by segment (public sector, including schools, residential, community, farming, commercial and industrial etc.), ensuring principles of equity, self-consumption and 'energy efficiency first' are incorporated	Q1 2020	DCCAE	SEAI, DBEI, DAFM
Public consultation/call-for-evidence on basis of above assessment	Q3 2020	DCCAE	CRU
Assessment of the impact of the current structure of electricity bill charges (including PSO and standing charges) on renewable self-consumers and other consumers	Q3 2020	CRU	DBEI, DCCAE
Functionality to enable smart services in place, subject to initial review	Q2 2021	CRU	
Launch finalised policy and pricing support regime for micro-generation	Q2 2021	DCCAE	SEAI

Action 31: Deliver pilot solar PV micro-generation scheme with a view to commencement of enduring support scheme by 2021, at the latest, to ensure that people can sell excess electricity they produce back to the grid			
Steps Necessary for Delivery	**Timeline by Quarter**	**Lead**	**Other Key Stakeholders**
Review of scheme (incl. budget) and potential for new technologies and sectors to be included in broadened scope	Q3 2019	SEAI	
Decision following review of pilot scheme	Q4 2019	DCCAE	SEAI
Allocation of appropriate budget	Q4 2019	DCCAE	SEAI

Action 32: Deliver Smart Metering Programme in line with current planned timelines that will support the market for micro-generation			
Steps Necessary for Delivery	**Timeline by Quarter**	**Lead**	**Other Key Stakeholders**
Commence review of requirements for resolving market settlement issues for renewables self-consumers	Q3 2019	CRU	
Support research and demonstration projects with a focus on enabling the 'smart home' (e.g. demand side management, storage, communication protocols, automated control, etc.)	Q3 2019	SEAI	EirGrid, ESBN

ESB Networks has been assigned actions in the CAP (either as lead entity or as key stakeholder) with respect to microgeneration. These actions are:

- Assess what are the implications for the distribution network of defined higher penetrations of distributed generators.
- Assess whether there is appropriate grid connection policy to facilitate renewable self-consumers and access for microgeneration.
- Support research and demonstration projects with a focus on enabling the "smart home" (e.g. demand side management, storage, communication protocols, automated control, etc.)

ESB Networks is actively contributing to the DCCAE led microgeneration working group which seeks to remove existing barriers and establish suitable supports for microgeneration.

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3.4 Private Member's Bill

The Microgeneration Support Scheme Bill 2017 is currently before Dáil Éireann. The bill is entitled "An Act to provide for the growth of electricity production from micro-generators through a Supplier obligation to provide a tariff for electricity exported to the grid". If introduced as proposed, the bill would see electricity suppliers above 10 per cent market share obliged to provide a payment for kWhs of electricity exported to the grid from domestic microgenerators. There would also be an obligation on suppliers to provide at least 5 per cent of their electricity from microgeneration.[22]

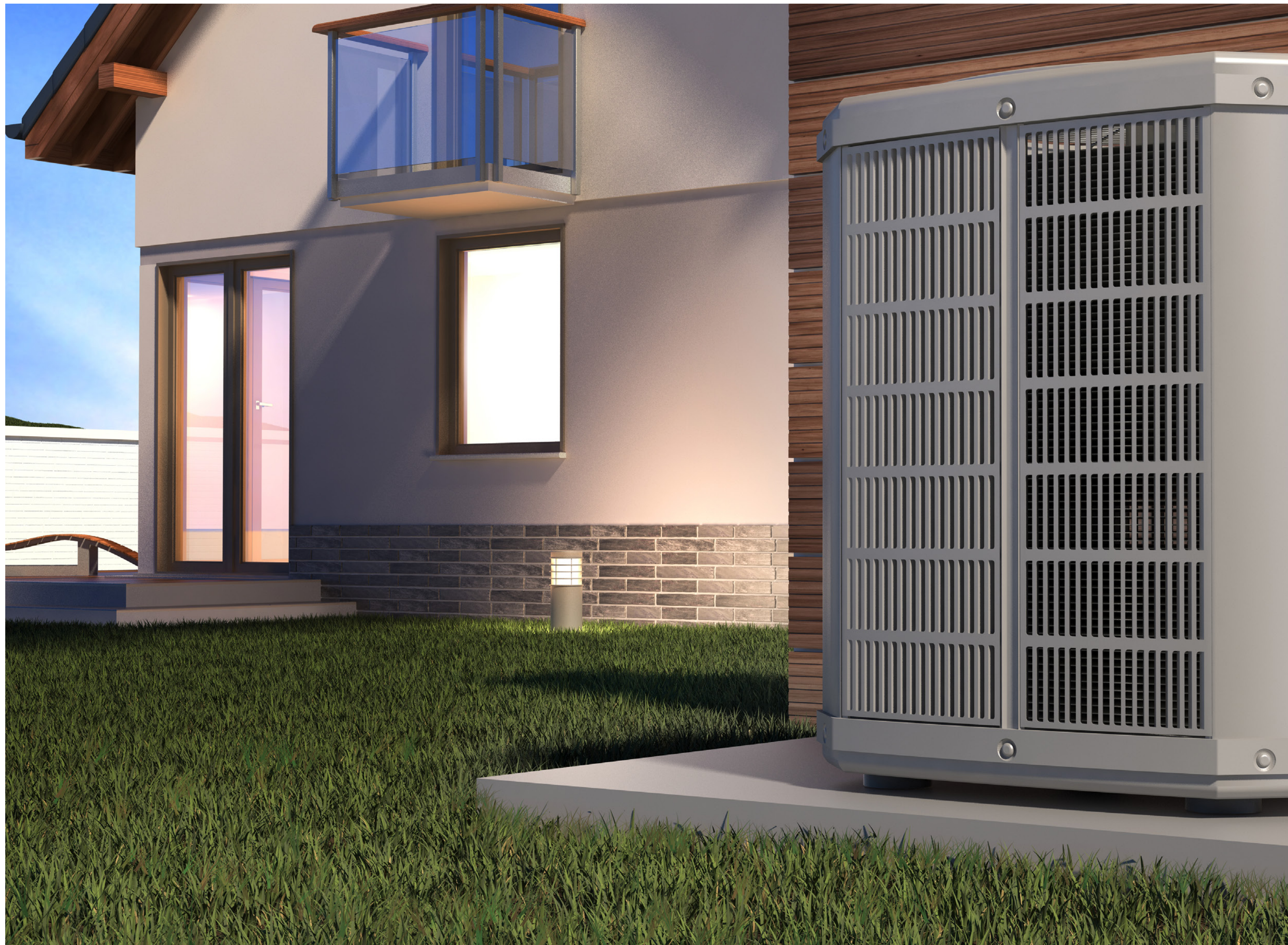
3.5 Building and Planning Regulation

Solar Planning Exemptions:

Currently rooftop solar PV installations (across all rooftop installations including domestic, industrial, agricultural etc.) are subject to planning requirements with an exemption for installations up to 12sq. m (domestic), 50sq.m (industrial or agricultural) or 50% of the total roof area, whichever is the lesser.[23] A review of Building and Planning Regulations could be considered timely given the publication of the CAP and the desire to facilitate microgeneration.

22 https://www.oireachtas.ie/en/bills/bill/2017/155/?tab=debates

23 https://www.housing.gov.ie/planning/legislation/solar-panelsmicro-renewable-technology/exemptions-solar-panels-and-other-micro



SECTION 4
TECHNICAL NETWORK IMPLICATIONS

Microgeneration Framework Consultation
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4.1 Technical Analysis of Solar PV Microgeneration on the Distribution Network

PV based microgeneration potentially impacts on LV distribution networks principally in terms of:

(a) Voltage Rise

(b) Thermal Loading on Network infrastructure

(c) Harmonics

For the impact to be of significance it is the cumulative impact of ***all*** connected generation on that section of network which is important, as the effect of an individual PV microgeneration unit up to 6 kW_p, acting alone connected under ESB Networks *The Conditions Governing the Connection and Operation of Microgeneration* (DTIS-230206-BRL) [24] should not cause material disturbance.

Note: The principal impact to voltage and thermal loading arises from microgeneration exports, not from self-consumption. Harmonic generation arises from installed capacity but is a much less significant effect.

The impact of PV microgeneration export on the network therefore depends on the strength of the network and the amount of PV microgeneration connected in terms of PV unit size and numbers (penetration level). Typically, the worst-case scenario is a hot summers day with the PV generating fully, load being at minimum and network already operating at a high summer ambient temperature. Unlike domestic loads there is no diversity with PV, that is within a local area maximum generation from each microgenerator will tend to occur simultaneously. This typically occurs around midday where solar irradiance is greatest on a clear day.

There are also variations in the strength of networks to which customers are connected so that what might not cause problems on one area of the network could be an issue on another (likely older) network. This is the reason why ESB Networks reviews connection groups where planned capacity is 50 kVA or 40% of transformer capacity in more detail than smaller groups of individual connections.

There are significant differences between urban and rural networks – in broad terms, urban networks tend to have large numbers of customers (around 200) connected to a ground mounted substation housing a transformer with a typical capacity of 400 kVA and connected to customers using large underground cables. In contrast, rural networks typically consist of small pole mounted 15 kVA transformers feeding up to 8 customers, but with about 50% feeding only one or two customers.

Urban:

In general terms, most housing estates in the last 30 years have been planned for using an After Diversity Maximum Demand (ADMD)[25] of 2.5 kW per customer so that typical PV installations of 2 kW_p should neither create voltage rise or thermal issues. Harmonics could become an issue, although voltage rise and thermal loading would normally be expected to arise in advance, and the reinforcement to address these issues would largely alleviate any harmonics issues.

At over 2 kW_p PV per house on a modern housing estate the issue is what cumulative value of PV exists i.e. the number (penetration rate) of PV x Size of PV unit. In general, installations of up to 3 – 4 kW_p PV on up to 50% of houses would not in be expected to cause any significant issues on the local LV network. However if there is sufficient LV microgeneration in an area it will accumulate on the upstream higher voltage networks feeding these areas and could driver reinforcement there, particularly if it added to existing generation already present.

With the predicted future electrification of heat and transport, ESB Networks has examined the ADMD requirements of domestic units (in keeping with Action 174 of the CAP). Future housing schemes will be designed to an ADMD of 5.5 kW per customer and it is currently believed that greater penetrations of PV of 3 – 4 kW_p (up to near 100%) would not be expected to cause issues of voltage rise or thermal issues on the local LV network, although there might be issues with some higher harmonic frequencies which would require harmonic filtering. ESB Networks understands that CRU will review this item in late 2020.

24 *The Conditions Governing the Connection and Operation of Microgeneration* (DTIS-230206-BRL) is currently under review to reflect the changes necessitated by the adoption of *European Network Code on the Requirement for Generators* and the resultant transition from I.S. EN50438:2013, which has been withdrawn, and the introduction I.S. EN50549:2019

25 After diversity maximum demand (ADMD) is used in the design of electricity distribution networks where demand is aggregated over a large number of customers. ADMD accounts for the coincident peak load a network is likely to experience over its lifetime and as such is an overestimation of typical demand http://www.networkrevolution.co.uk/project-library/diversity-maximum-demand-admd-report/

In practice the size of the suitable roof space available and suitable for PV would itself determine the quantity of PV installed per house e.g. a typical semi-detached house might have 21m² of roof space and assuming no legislative restrictions (currently 50% of areas or 12m²) could support about 2 kW_p of PV. A larger detached bungalow might have a roof area of 30m² and support 4 kW_p of PV.

Obviously if PV were installed on the opposite side of the roof, which by definition will be less exposed to the sun, then there would be physical space for more panels although less economic to install as they generate less. In the UK, PV is typically less than 4 kW per house as the G98 process,[26] which is 'fit and inform', applies to unit with generation less than 16A per phase. Units larger than this are subject to evaluation by Distribution Network Operators (DNOs), the UK equivalent of the DSO, and cannot be connected until they are approved by the DNO. Additionally, whilst the Irish conditions allows up to 6 kW_p PV on single-phase (which is much larger than the 3.68 kW_p limit in the UK), once this is exceeded the protection requirements become more complex and expensive. There can obviously be older urban networks which have less capacity and can accommodate less PV without reinforcement, which is why ESB Networks require notification of any significant groups of planned installations.

In summary, if customers are generally installing PV for own use, the amount installed will be about 2 – 4 kW_p per customer and unlikely to move the system outside of operational limits in general up to penetrations of 50% and possibly beyond.

Rural:

About 40% of customers live in rural areas and supplied mainly from 15 kVA single-phase pole mounted transformers, so it is much easier to encounter limits as the size of the transformer is small, the distance to the customer could be large and there could be a relatively large number of customers and associated PV per transformer.

Typically, it would be expected that up to 2 kW_p of PV per customer would seldom cause problems, but once the amount of PV exceeds the transformer rating there will be an impact, especially because with solar PV the transformer will be operating in high summer ambient temperatures when this generation occurs. For self-supply and installation of 2-3 kW_p most networks would be able to cope, but at 4 kW_p per customer, then four customers with PV begin to overload the transformer, and at 6 kW_p over two such customers will overload the transformer and result in reinforcement being required. Potential resulting implications of this may include the requirement to add additional transformers or source larger transformers than are currently used. Additionally, the MV rural network is not designed to cope with significant single-phase loading as this causes unbalance when feeding into the three-phase network. These would have an associated potential increase in costs and future consideration will need to be given to the distributional impacts of these costs and options surrounding how these costs will be recovered from both existing and new customers of the network.

Export Limiting Schemes:

As technical issues with generation arise generally from the export of power onto the grid, it should be possible to increase the size of generation installed if the export were restricted. This would facilitate greater levels of self-consumption and could be arranged through the development of an export limiting scheme. There are such schemes in operation in the UK but require an analysis of the network before installation. Voltage control by limitation on kW exports to avoid excessive voltage rise (as in Australia) is also being considered. For maximising self consumption it could be possible to develop an export limiting scheme which prevented export of more than 3-4 kW_p but allowed more PV to be installed by the customer to facilitate self-consumption.

ESB Networks is now examining the use of an export limiting control which would facilitate larger installed capacity as long as the export was limited. In addition, ESB Networks is considering the use of type tested equipment to simplify connections of packaged installations up to 50 kW installed on three-phase network conections.

26 Engineering Recommendation G98 - Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019

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Question 2: Do you have any feedback in relation to the examination of possible export limiting controls to facilitate self-consumption?

4.2 Interaction of Electric Vehicle (EV) and Heat Pumps (HP) Loads

Customers mainly install PV to use the electricity generated to feed their own household loads. It is expected that household load will increase appreciably with additional electrification of heat and transport. Consequently, in any community the mix of PV and additional load will tend to net off against each other and on average usually reduce the load on the transformer at these times.

However, this will not prevent network reinforcement being required when there is extra PV or electrification. This is because the worst-case conditions for each technology occur at separate times – the determining scenario for PV is a hot summers week day with customers at work, and low loads so that PV generated is at a maximum and all is exported through the transformer. In contrast, for electrification of heat and transport the worst-case scenario is likely to be in winter during the later afternoon/evening when PV is at minimum but electrified heat and EV loads are a maximum.

Consequently, the interaction between PV and electrification of heat and transport arises as a result of either one or both of them stressing the system and requiring reinforcement – once the system has been reinforced for either, then there is some extra network capability to cope with the other. It is also likely that areas likely to require reinforcement will have both PV and electrification of heat and transport, simply because reinforcement will only be required where there are enough customers to load the transformer sufficiently and sufficient numbers to then add Low Carbon Technologies such as PV or Electrification (EV/HP). However, the uprating on networks to accommodate LCT will only provide modest additional capacity for extra microgeneration export, as LCT loads are spread throughout the day/week and hence require less peak capacity than the same amount of installed PV, which has no diversity. The addition of LCT loads would provide greater scope for self-consumption of microgeneration but not for additional export.

In summary, at 2-3 kW_p PV per rural house it is unlikely that PV would force significant reinforcement, but at higher levels on transformers with over 4 customers, either PV or electrification of heat and transport will drive reinforcement. The nature of the reinforcement will either be the installation of a larger transformer of the splitting of the group by dividing the group into two using an additional transformer. Further consideration is likely to be required as to the most equitable means of recovering these additional costs.

4.3 System Impact of PV at MV and Above

In system terms and for high penetration rates:

- PV microgeneration at LV may at times displace imports of electricity from MV connected generators upstream, requiring them to export more of their generation upstream. This could cause an increase in voltage at MV above required limits. However, this would require high penetration levels at LV which could take a significant time to develop.
- Additionally, significant PV export from widespread microgeneration may also interact with other larger scale generation exports on associated upstream high voltage networks and hence require significant reinforcement.
- PV microgeneration protections settings may be difficult to change in the future (if required) as there would be so many small generators that it would be impractical to each domestic residence and change the protection settings. This is an issue for the EU in general and ESB Networks *Conditions Governing the Connection and Operation of Microgeneration* specifies these for Ireland. These settings are generally set by the DSO however some e.g. Rate of Change of Frequency (RoCoF) are determined in conjunction with the TSO. A possibility could be that each PV unit has a facility to accept a remote-control device, (which might also be used to control export levels) although the associated economics and practicalities are not established.

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- Note under/over frequency, under/over voltage and RoCoF are protection requirements for microgenerators under ESB Networks *Conditions Governing the Connection and Operation of Microgeneration.*
- The provision of a digital input to cease generation from microgeneration is part the EU Network Code Requirements for Generators (RfG) which is now in force for all generators. However, to enable this capability the DSO requires communications at the microgenerator.

There may also be Transmission System Operation (TSO) implications of high levels of microgeneration which would impact on the TSO and are outside the scope of this paper, however, we welcome engagement with the TSO at a future date to review this issue in more detail.

SECTION 5 MICROGENERATION SUPPORT SCHEMES

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ESB Networks is committed to leading the transition to a low carbon future. As evident through ESB Networks Innovation Strategy, we have set out a clear vision of how we intend to deliver a world class electricity network for the future.

We are aware of three microgeneration support schemes which were at one stage operational or currently operational in the market – one historic support scheme from ESB Networks, one current support scheme from Electric Ireland and a recent introduction to the market from Glanbia and SSE Airtricity. Under these schemes, prosumers received payment for electricity they exported to the grid. While the Electric Ireland and ESB Networks schemes are now closed to new applicants, in some cases customers who signed up to these schemes before the closing date continue to receive payment for any excess electricity they export.

Further details on these schemes can be found below.

5.1 ESB Networks Microgeneration Support Package

As an initiative to support microgeneration, ESB Networks offered a support package for microgenerators which launched in February 2009. Customers who signed up for the scheme got a complimentary import/export meter installed free of charge and a support payment 10 cent/kWh applied to the first 3,000 kWh exported annually. This payment lasted for a period of five years and ended on the 5th anniversary of the contract start date. The scheme closed to new applicants on the 29th February 2012.

5.2 Electric Ireland Microgeneration Pilot Scheme

Electric Ireland (formerly ESB Customer Supply) launched its microgeneration support scheme in February 2009. Customers who signed up for the scheme received an export payment rate of 9.0 cent/kWh.

The scheme has been closed to new customers since the 31st December 2014, however customers already signed up for the scheme continue to receive payment. Under the scheme, payment is made to the prosumer within their Electric Ireland bill. In 2018, Electric Ireland announced that it would extend the payment rate of 9.0 cent per kWh to its existing domestic customers already signed up to the scheme until 31st December 2020. This is the tenth year that Electric Ireland continue to pay its Microgen Pilot Scheme customers the prevailing Electric Ireland rate once their contract continues to be active.[27]

5.3 FarmGen Solar PV

Glanbia Ireland and SSE Airtricity have recently launched a microgeneration scheme, FarmGen, in July 2019. This renewable energy initiative is based around bringing solar powered energy solution to Glanbia Ireland farmers only. FarmGen's 6 kW solar PV system will assist in powering energy intensive processes in order to reduce the costs to the farmer. Farms will also have export meters installed that will measure their exported electricity to the distribution network. SSE Airtricity are providing an annual export rebate to FarmGen customers.[28] Farmers can receive financing for the FarmGen initiative through the existing Glanbia Ireland FundEquip scheme and can also apply for TAMS II (Target Agricultural Modernisation Schemes) or SEAI.

We have had some initial engagement with various suppliers and are not aware of any other pilot programmes or feed-in-tariff schemes that are currently or were historically available to prosumers.

27 https://www.electricireland.ie/residential/help/micro-generation/electric-ireland-micro-generation-pilot-scheme

28 https://www.sseairtricity.com/news/glanbia-announce-farmgen-sseairtricity-activ8-solar/

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5.4 SEAI Grants

A government funded support scheme was launched by SEAI in July 2018 to assist homeowners in installing microgeneration systems in their home. This scheme provides a grant towards the purchase and installation of a solar PV system and/or battery energy storage system. The grant takes the form of a once-off payment to a homeowner based on the installation of products which meet the requirements of the scheme.

The scheme is expected to operate for two years with regular reviews expected every six months. Residential homes will be eligible for support once per technology. Solar PV Pilot incentives are not retroactive. If equipment was purchased or installed prior to 31st July 2018, it is not eligible for support.

As per the SEAI website,[29] the current grant support levels are as follows:

Grant amounts available

Solar PV grant	Example
€900 per kWp Up to 2kWp	You will receive €1800 for 2kWp solar panels (ie 6/7 solar panels)
€300 for every additional kWp up to 4kWp if you get a battery. Total grant available capped at €2400	For 3kWp: You will receive €2100 for 3kWp solar panels plus €600 for the battery system. For 4kWp: You will receive €2400 for 4kWp solar panels plus €600 for the battery system.

29 https://www.seai.ie/grants/home-energy-grants/solar-electricity-grant/

SECTION 6
SMART METERING

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Enabling the Transition from Consumer to Prosumer

The National Smart Metering Programme (NSMP) was established by CRU, working closely with the DCCAE. The NSMP endeavours to deliver a national installation of smart electricity and gas meters to replace existing legacy meters. The ESB Networks Smart Metering Project (SMP) is part of the broader NSMP which involves other market participants such as electricity suppliers, EirGrid, Gas Networks Ireland (GNI) and gas suppliers.

In 2019, ESB Networks commenced a meter replacement programme which will result in the upgrade of 2.4 million meters to modern smart ready digital technology meters. These new generation electricity meters, which are being rolled out internationally, will be installed in every domestic and business premise when the programme completes in 2024. ESB Networks as the meter asset owner and DSO are responsible for the allocation, rollout and installation of smart meters.

Smart meters will be installed in three-phases with Phase 1, having commenced in 2019, will see an initial installation of 250,000 meters. Both Phase 1 and 2 are focused on domestic single-phase connections and beginning in those locations where the majority of existing meters are reaching the end of their technical life and a replacement is required. In 2021, the rate of installation of smart meters will increase considerably with an additional 2,000,000 meters to be installed by the end of 2024.

The NSMP is being delivered over three-phases, see Figure 7 below, and as agreed in 2017.[30] Any changes to the approved delivery programme would need to be considered by impacted stakeholders and approved by CRU.

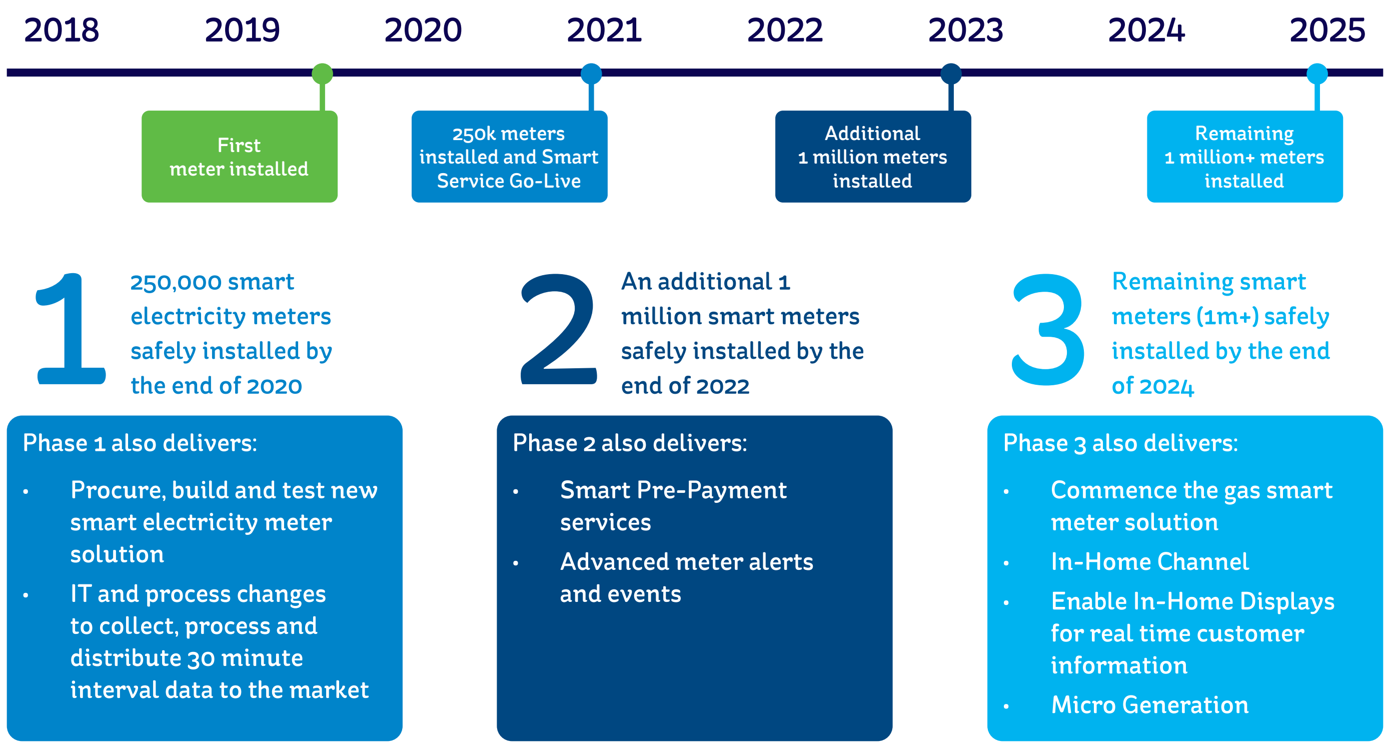

Figure 7 Smart Metering Programme Timeline

30 https://www.cru.ie/wp-content/uploads/2016/11/CER17279-NSMP-Info-Note.pdf

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Smart meters will assist the migration to a carbon free electricity network and will support smart grids, the electrification of heat and transport, local renewable generation and microgeneration. Smart meters will be available in every home from 2024 onwards and are a key tool in enabling the prosumer and facilitating payment of microgeneration and will be a key component of any enduring settlement process.

The smart meter will be provided to the customer by ESB Networks at no up-front charge to the customer.

6.1 Benefits of Smart Metering

When fully operational, smart meters will bring benefits to the consumer, the environment and the economy. Smart meters will reduce the need for estimated bills. Consumers will be able to access the information they need to make more informed choices about their consumption and the best tariff option for them. Accurate information about energy usage across the day will allow customers manage their bills with greater accuracy.

The environment will benefit because smart metering will encourage energy efficiency and support an increase in renewable power on the electricity system. The upgrade programme will help to cut CO_2 emissions and lower Ireland's reliance on fossil fuel imports. The economy will benefit because smart meters will help us to more efficiently manage energy flows at times of high demand. They will also enhance competition and improve customer experience, customer choice and the range of products and services available to customers.

6.2 Smart Metering Programme and Microgeneration

In line with the regulatory approved phased implementation plan outlined above, the smart metering programme will deliver microgeneration capability during Phase 3 (2023-24). The government's CAP calls for customers to receive support for microgeneration by 2021. ESB Networks is proactively evaluating the microgeneration capability within the smart metering programme to enable microgeneration support by 2021. A number of features scheduled for delivery in Phase 3 will need to be brought forward, including the ability to manually read the export registers and Day/Night meter exchanges.

Further consideration is required on metering solutions for generation greater than 6 kW (single-phase) and 11 kW (three-phase) and up to 50 kW in advance of the full smart metering programme rollout.

Further information on smart meters is available on the ESB Networks website.[31]

31 https://www.esbnetworks.ie/existing-connection/meters-readings/smart-meter-upgrade

SECTION 7 **ENABLING THE TRANSITION FROM CONSUMERS TO PROSUMERS**

Microgeneration Framework Consultation
Enabling the Transition from Consumer to Prosumer

A high-level overview of the future microgeneration process is provided in Figure 8. The process consists of four broad building blocks which are detailed below (using solar PV panels installed in a domestic dwelling in the illustrative outline):

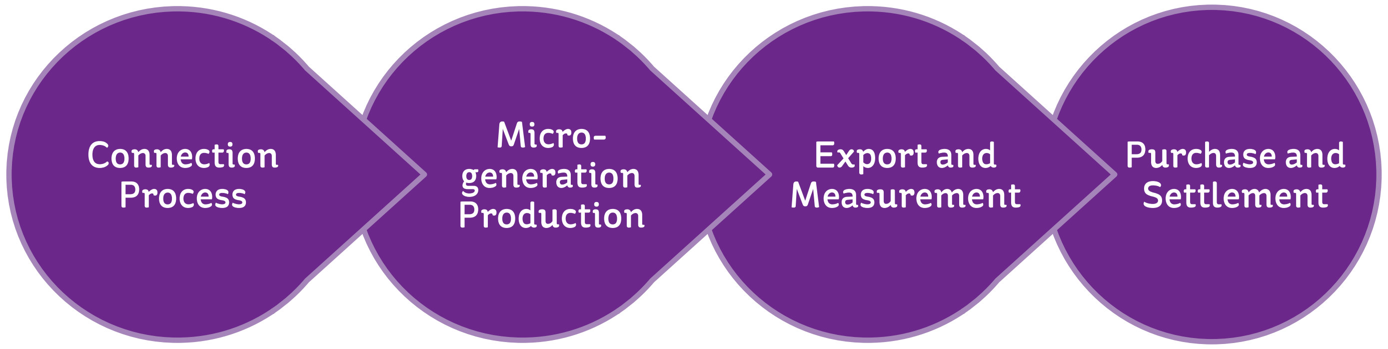


Figure 8 Building Blocks of Microgeneration Process

1. Connection process:

Customers who wish to transition to prosumers complete the ESB Networks microgeneration connection process as outlined in Section 2 of this framework document.

2. Microgeneration electricity produced:

Solar PV panels produce electricity at a prosumer's residence. Microgeneration is primarily for self-consumption but at times excess electricity will be exported to the grid.

3. Export and measurement of excess electricity:

Excess electricity produced by the prosumer is exported to the distribution network.

4. Purchase of microgeneration and settlement:

This exported electricity is then available to be purchased by a supplier. A settlement process for this purchase is required that enables payment of the prosumer for domestic households, schools, farms and commercial sectors among others.

7.1 Recommendations

Lessons learned from the existing pilot microgeneration support scheme, this review and recommendations for consideration in relation to any future scheme are captured below:

- Customers should complete an NC6 form and send to ESB Networks. This ensures ESB Networks has visibility regarding the location of microgeneration installations and provides a basis for ESB Networks to assess any technical implications. Customers should be requested to provide evidence of the NC6 form to the supplier/other entity to ensure that this there is good take up of this condition. ESB Networks need to have full visibility of where microgeneration is being installed to be able to accurately study and operate the distribution network.
- If a customer's export capacity exceeds 6 kW (single-phase) and 11 kW (three-phase), customers must complete the appropriate grid connection application and send to ESB Networks and be assessed accordingly.
- Customers, where appropriate, require a smart meter capable of measuring their imported electricity and their exported electricity.

7.2 Loss Adjustment Factor

For larger scale generation in the I-SEM, a Loss Adjustment Factor (LAF) is applied to all metered generation at a notional trading point. Suppliers purchase electricity based on the loss adjusted amounts. Large scale generators each have a site-specific loss adjustment factor. For microgeneration, it is being considered that one LAF applies to all such locations i.e. not a site specific LAF. A LAF for urban and a LAF for rural locations may also be considered.

Question 3: Do you have any feedback in relation to the application of LAF's for exported microgeneration?

7.3 Interim Solution

The interim period is defined as the period mid 2021 - end 2024, due to the phased rollout of the smart metering programme which will be ongoing during this time. The main difference between the enduring and interim solution is that during the interim period the smart metering programme is not fully rolled out and any market redesign necessitated by microgeneration requirements will not be complete i.e. review of retail and wholesale market design to identify and implement any modifications to market Codes, market rules or market messages. For this reason, an interim solution is considered appropriate.

As this is an interim phase of short duration, it is prudent that any interim settlement solution is workable within the existing retail and wholesale market structures and delivers four key objectives:

1. Establishes a transparent payment mechanism for exported microgeneration to enable payment to prosumers.
2. Allows suppliers to be made whole.
3. Minimises market set-up and/or governance costs to the final customer.
4. Settlement capability is in place and ready for June 2021.

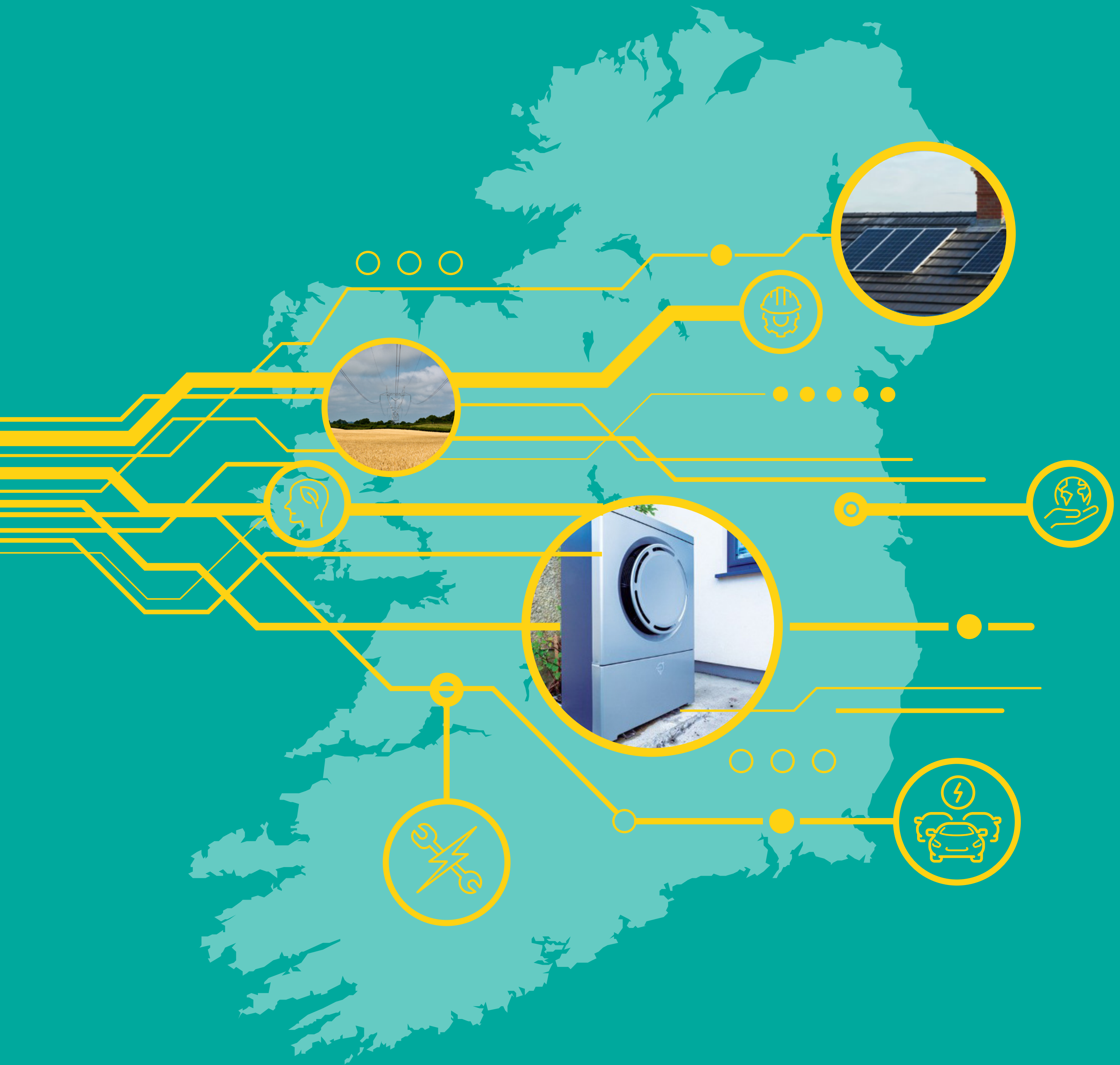
As a microgeneration support scheme is due to be in place in mid-2021, an interim settlement scheme is required to facilitate this. It is ESB Networks' understanding that CRU are to publish an Information Note relating to microgeneration which will include further information in relation to any interim settlement solution pertinent to microgeneration during the period mid 2021-2024.

7.4 Next Steps

As mentioned previously in the framework, the introduction of a support scheme for microgeneration customers represents an important and welcome development in the Irish energy market. To date, domestic customers have traditionally imported electricity from the distribution network and did not export electricity. The existing market settlement systems are based on this structure and hence, an evaluation is required to determine the most appropriate settlement mechanisms available to allow for settlement of exported electricity within any new microgeneration support scheme in 2021. Any solution that is put in place should ideally allow for the market to develop innovative and competitive solutions as the market matures and the actors involved become more familiar with microgeneration.

ESB Networks understands that as per the Action 32 in the CAP, that CRU is reviewing market settlement issues for renewable self-consumers. As per Action 30 in the CAP, DCCAE are assessing possible support mechanisms for microgenerators/renewable self-consumers. ESB Networks seeks to assist both DCCAE and CRU where appropriate in developing solutions to facilitate prosumers.

SECTION 8
ENDURING SOLUTION FOR MICROGENERATION

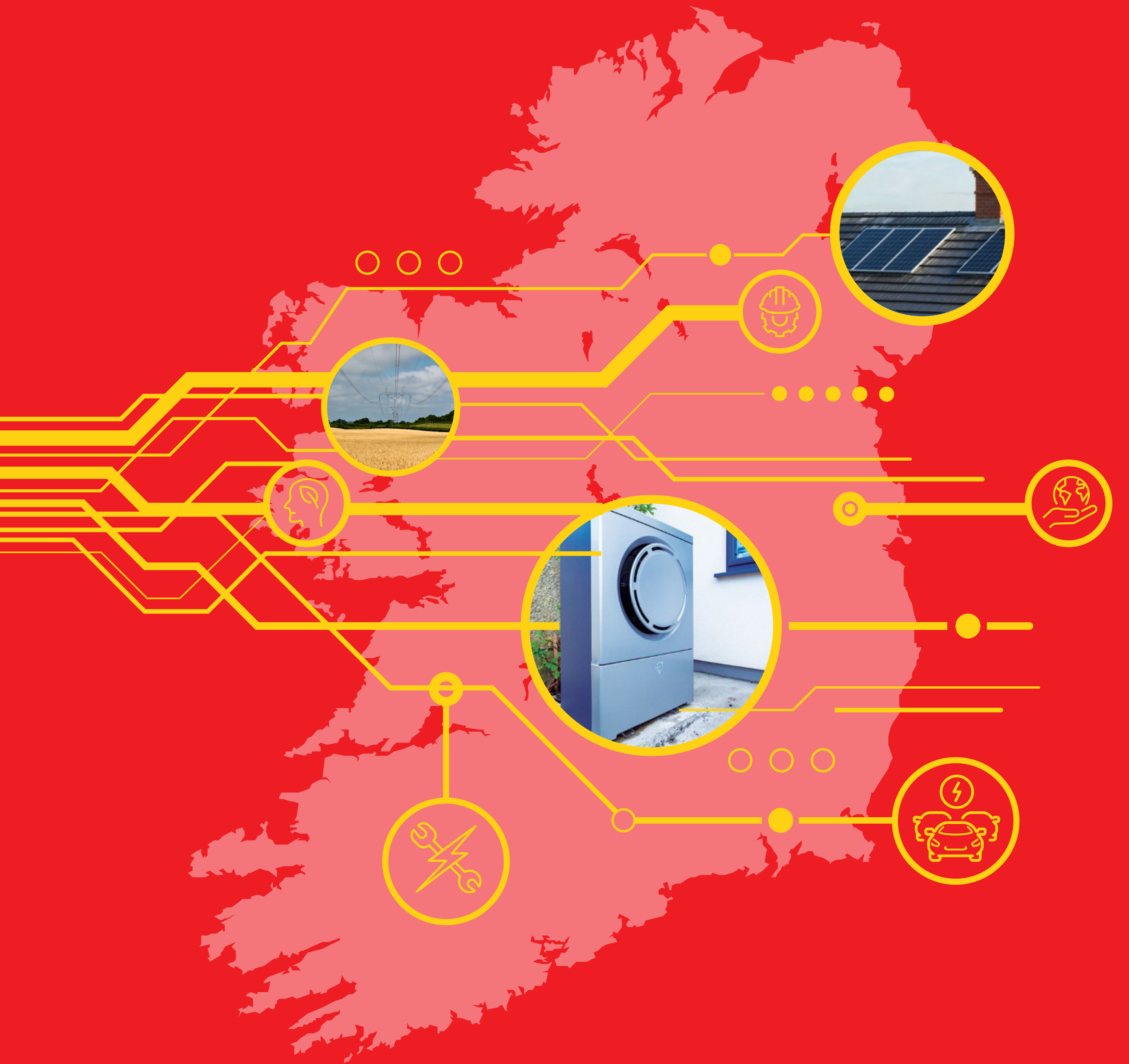


Engaging energy customers in the decarbonisation of the energy market forms a key part of European energy policy. Microgeneration provides a mechanism for customers to become engaged in the energy transition that is currently underway. The enduring solution for microgeneration should involve engagement from a wide variety of actors within the energy market including consumers who wish to embark on their prosumer journey. It is envisioned that the enduring solution establishes a long term, stable, transparent process which assists Ireland's energy customers on their transition from consumers to prosumers. This enduring solution is viewed as the most appropriate solution which can accommodate the four building blocks for microgeneration as referenced earlier in Figure 8.

By end of 2024, the ESB Networks smart metering programme will have installed 2.4 million smart meters. The capability of these meters to read import and exported electricity is an integral facet of any enduring solution as the ability to measure exported electricity is a key requirement of any microgeneration support scheme. As outlined earlier in this document, the interim solution is viewed as the period June 2021 – 2024, with the enduring solution commencing when the smart metering programme concludes in 2024.

ESB Networks believes that the existing grid connection process (NC6) for prosumers connecting microgeneration units to the distribution network is suitable for the enduring process as it is simple, quick and economically efficient for customers. However, ESB Networks welcomes feedback on the connection process through this consultation document. The enduring market settlement for microgeneration is forecast to be a long term, stable and robust process having undergone a rigorous market design process. Updates to existing market codes such as the Trading and Settlement Code will most likely be required. As the microgeneration sector evolves in terms of prosumer behaviour and the market matures, it is possible that new market offerings may be available to prosumers from suppliers or aggregators. Lessons learned from the interim solution may also provide useful guidance in establishing equitable and transparent regulatory and market processes which can assist in delivering Ireland's decarbonisation ambitions.

SECTION 9
SAFETY REVIEW



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All components of any microgeneration system must be in compliance with all applicable Irish/EU legislation, building regulations and applicable guidance, which may or may not be included in this microgeneration framework. Electrical safety standards for microgenerators are not set by ESB Networks. Such standards are out in a range of documents including legislation, building regulations and the national rules for electrical installations. There are risks associated with any microgeneration installation that is connected to an additional supply source, and these risks must be identified and mitigated against.

9.1 SEAI Domestic Solar Photovoltaic Code of Practice for Installers

As per the SEAI Code of Practice for Solar PV installation,[32] the below are additional requirements that must be met by any party who is engaging as a microgenerator/ installing a microgenerator with the DSO.

The Installer must satisfy and certify themselves that the microgenerator system has been designed, installed, tested and commissioned in accordance with these standard building regulations. Any installer must provide, at his/ her cost, any information that SEAI require for audit or inspection.

- All microgeneration (<6kW/25Amps AC for single phase connections) must complete a NC6 form from ESB Networks and submit by email or post to ESB Networks in advance of the installation.
- All micro generation must comply with ESB Networks Conditions Governing the Connection and Operation of Micro-generation.
- ESB Networks may reject the application within 20 working days of receipt
- The completed NC6 form and the record of issuing the form to ESB Networks must be retained for the PV system.
- Where an AC connected battery is included in the system, this battery is also considered a microgenerator for ESB Networks purposes and should be included in the NC6 application as an additional generator to the PV generator.

Figure 9 SEAI Code of Practice for Solar PV installation

9.2 Electrical Safety

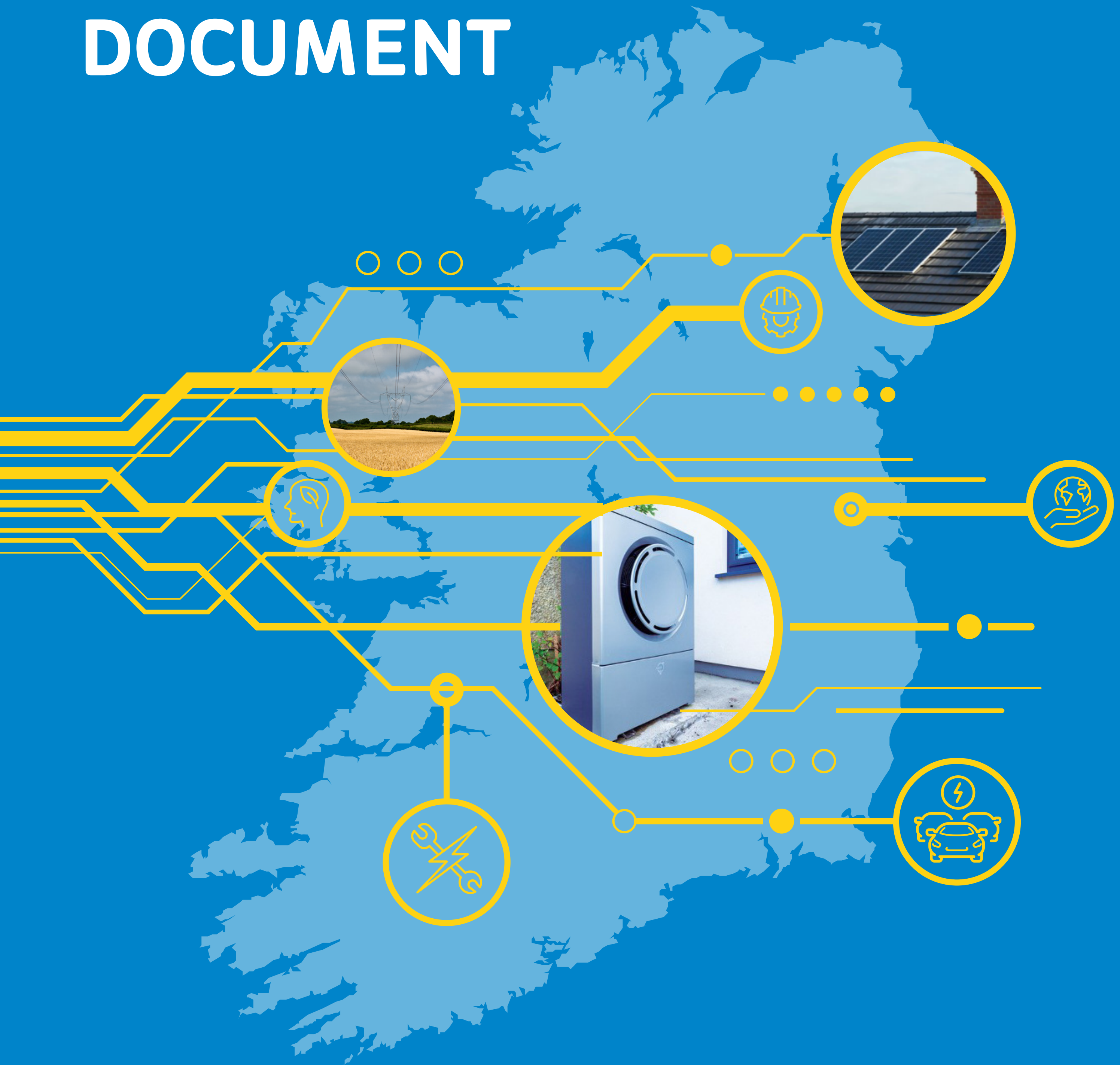
The electrical safety of a microgeneration connection as part of an electrical installation is covered in the current version of the "National Rules for Electrical Installations".

Specifically, Part 551-Low Voltage Generating Sets and Part 712 Photovoltaic Systems (PV Generator) deal with the electrical safety requirements for the connection of a microgenerator in a premise.

ESB Networks require that for a microgenerator to be connected to the ESB Networks LV system, the microgenerator shall comply with the *ESB Networks Conditions Governing the Connection and Operation of Microgeneration Policy.*

32 https://www.seai.ie/publications/Code-of-Practice-Solar-PV-Grant.pdf

SECTION 10 **CONCLUSION AND SUMMARY OF QUESTIONS IN FRAMEWORK DOCUMENT**



Microgeneration Framework Consultation
Enabling the Transition from Consumer to Prosumer

This consultation provides a lot of relevant information to assist consumers understand what's involved in the transition from consumer to prosumer and aims to kick-start a discussion on the topic of microgeneration whilst seeking input from a wide range of stakeholders to the questions posed throughout the consultation. ESB Networks will review the responses received and use them to best guide the further development of this microgeneration framework.

The framework seeks to identify and examine the building blocks in the microgeneration process in further detail. The grid connection process, legislative basis and existing microgeneration support schemes are outlined to try and provide a comprehensive, single source of relevant information for the reader. The importance of the smart metering programme where 2.4 million smart meters will be rolled out in the period 2019-2024 is outlined, as well as the main components of the smart metering programme that are pertinent to the development of a microgeneration support scheme.

The technical impacts of increasing levels of exported electricity on the LV network are considered. It is important to appreciate that the most significant impact of microgeneration on the network arises from the power exported, not from the microgeneration used to supply the consumer's own power requirements. This technical review outlines the potential impacts of microgeneration on the LV network including possible voltage rises, thermal overloading of the network infrastructure and harmonics. However, these impacts depend on the export capacity of the microgeneration units (kW) as well as the number of customers with microgeneration that are connected to an individual transformer. The suggested establishment of an interim and enduring solution for this support scheme provides a practical, customer-focused solution which facilitates the prosumer. Safety considerations are an important element of any microgeneration review process and a safety review is contained within this framework.

The questions contained within this framework are summarised in the table below and ESB Networks welcome your feedback in relation to these. It is hoped that further development of this framework, following input and responses from relevant stakeholders, assists in establishing a useful tool for inclusion in the ESB Networks review of its' grid connection application process for microgenerators, technical implications of increased microgeneration and other areas. It is also hoped that this framework is beneficial for you, the reader, as well as the wider industry and associated stakeholders.

Question 4: Is there any other feedback you would like to provide in relation to the topic of microgeneration?

Microgeneration Framework Consultation
Enabling the Transition from Consumer to Prosumer

QUESTIONS FOR RESPONSE

Question 1:

Do you have any feedback in relation to the existing grid connection process for microgeneration (up to 6 kW single-phase and 11 kW three-phase)?

Question 2:

Do you have any feedback in relation to the examination of possible export limiting controls to facilitate self-consumption?

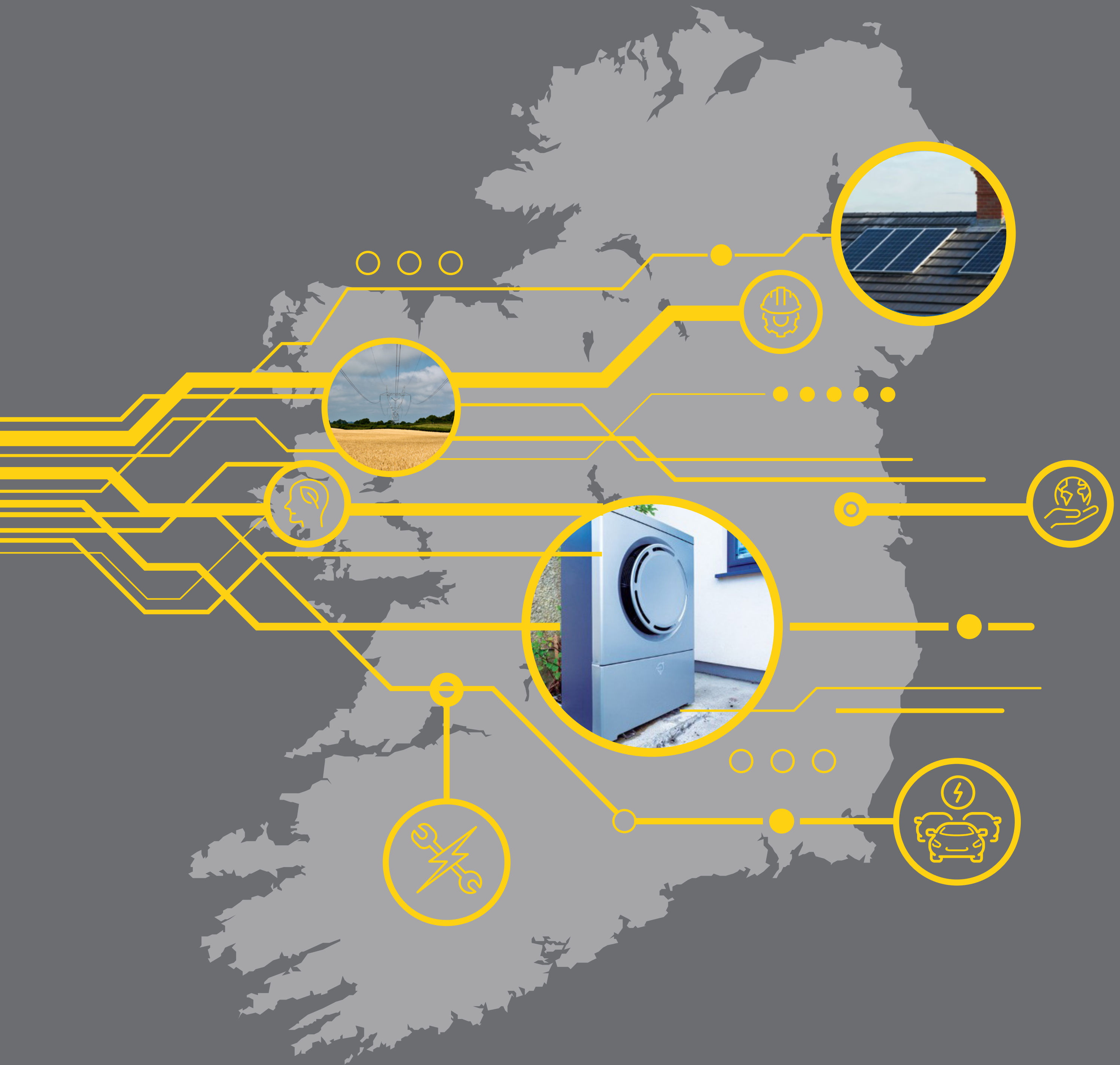
Question 3:

Do you have any feedback in relation to the application of LAF's for exported microgeneration?

Question 4:

Is there any other feedback you would like to provide in relation to the topic of microgeneration?

ACRONYMS AND GLOSSARY – EXPLANATION OF KEY TERMS



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Acronyms

ADMD	After Diversity Maximum Demand
CAP	Climate Action Plan
CEP	Clean Energy Package
CHP	Combined Heat and Power
CRU	Commission for Regulation of Utilities in Ireland
DCCAE	Department of Communication, Climate Action and Environment
DNO	Distribution Network Operator
DSO	Distribution System Operator
ESB	Electricity Supply Board
ESBN	ESB Networks
ESBCS	ESB Customer Supply
EV	Electric Vehicle
FiT	Feed-in-Tariff
GNI	Gas Networks Ireland
HP	Heat Pump
kVA	Kilo voltampere. (1,000 voltamperes). (The kVA value is equal to the kW value divided by the power factor)
kW	Kilowatt (1,000 watts)
kWh	Kilowatt-hours (1,000 watt-hours)
kW_p	Kilowatt-peak
LAF	Loss Adjustment Factor
LCT	Low Carbon Technology
LV	Low Voltage
MPRN	Meter Point Reference Number
MRSO	Meter Registration System Operator
MV	Medium voltage
MW	Megawatt
NSMP	National Smart Metering Project
PV	Photovoltaic
RED II	Renewable Energy Directive 2018/2001/EU
SEAI	Sustainable Energy Authority of Ireland
SMP	Smart Metering Project
SONI	System Operator for Northern Ireland
TAMS II	Target Agricultural Modernisation Schemes
TIC	Total Installed Capacity
TSO	Transmission System Operator

Glossary – Explanation of Key Terms

Microgeneration	Microgeneration is the term which applies when a private individual (e.g. a householder) installs a small generator on his/her property for the purpose of producing electricity for his/her own use.
The Electricity Distribution Network	The electricity distribution network includes all distribution stations, overhead electricity lines, poles and underground cables that are used to bring power to Ireland's 2.3 million domestic, commercial and industrial customers.
The Electricity Grid	The electrical grid is the system designed to provide electricity all the way from its generation to the customers that use it for their daily needs.
Imported electricity	Imported electricity refers to electricity received in from the grid. Customers import electricity from the grid for use in their home.
Exported electricity	Exported electricity refers to electricity delivered out to the grid. Generators export electricity on to the grid for use by customers. In the case of microgeneration, customers can export any access electricity generated from their microgenerator on to the grid for use by others.
High Voltage	A voltage, used for the supply of electricity, whose nominal RMS value lies above 38 kV.
Import/Export Meter	An import/export meter has the capability to measure both the electricity imported from the grid, as well as any electricity generated onsite that is exported to the grid.
Low Voltage	A voltage, used for the supply of electricity, whose upper limit of nominal RMS value is 230V for single-phase and 400V for 3 phase.

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Medium Voltage	A voltage, used for the supply of electricity, whose nominal RMS value lies between 1 kV and 35 kV.
MRSO	Meter Registration System Operator (MRSO) is a "ringfenced" function within ESB Networks responsible for the Change of Supplier process and the processing/aggregation of meter data required to support Trading and Settlement in the competitive electricity market.
Prosumer	Prosumers are active energy consumers who both consume and produce electricity.
SEMO	The Single Electricity Market (SEM) is the wholesale electricity market operating in Ireland and Northern Ireland. The Single Electricity Market Operator (SEMO) facilitates the continuous operation and administration of the Single Electricity Market. SEMO is a joint venture between EirGrid plc and SONI Limited.
Smart Meter	Smart meters are the next generation of electricity meters. Using digital technology, the meters give customers and suppliers accurate information on energy usage throughout the day.
Supplier	A person authorised by licence under section 14(1)(b), (c) or (d) or Section 14(2) of the Act to supply electricity to the Connection Point under a supply agreement.
Transmission System	The nationwide electricity transmission system allows for the transport of large volumes of electricity from generation stations, including wind farms, to bulk supply points near the main population centres where it interconnects with the distribution system.

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