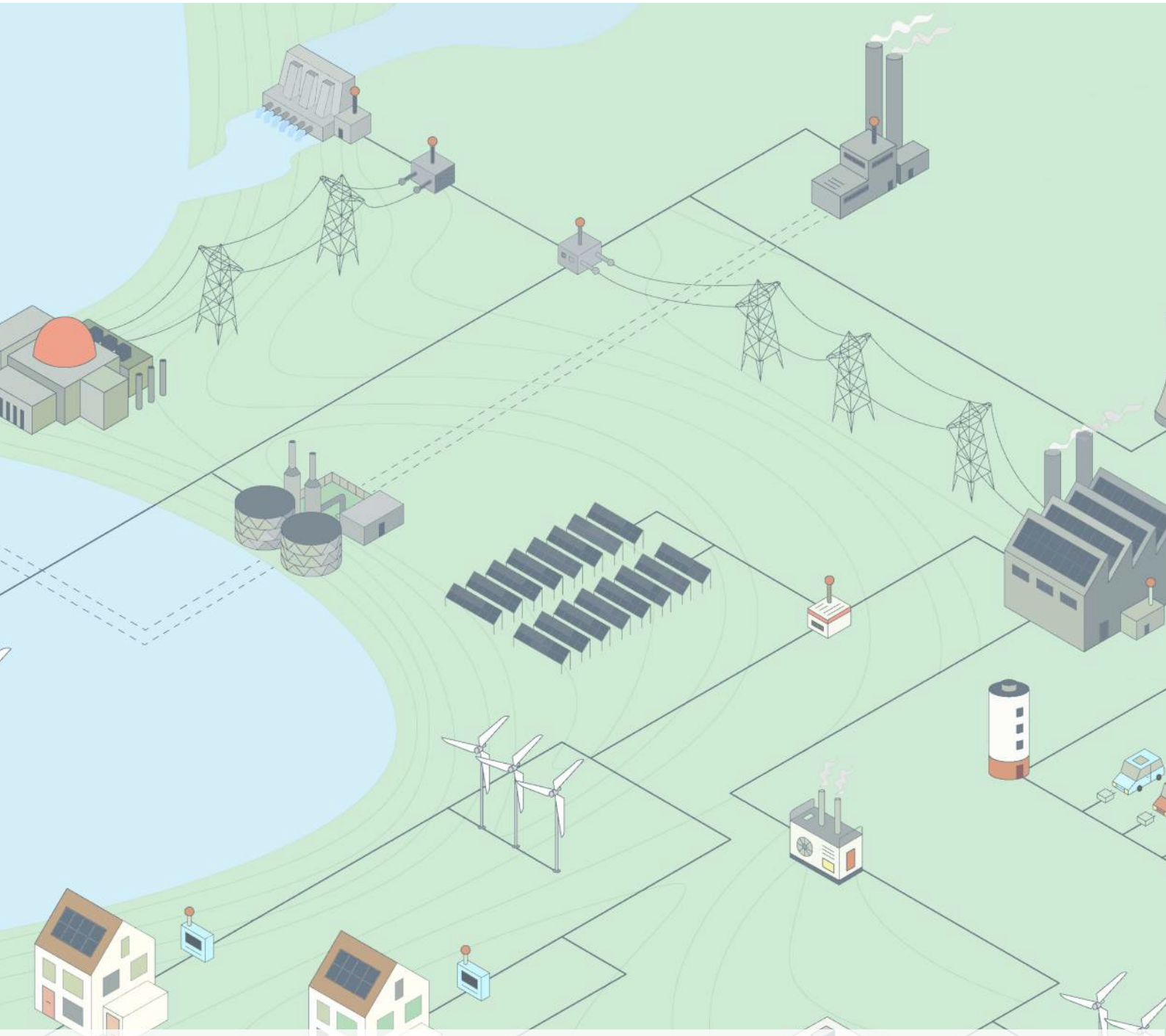
ENERGY HUB



Local Energy Guide

Executive Summary prepared by Pixie Energy

ABOUT

This executive summary contains key messages from the Local Energy Guide prepared by Pixie Energy for the South West Energy Hub, hosted by the West of England Combined Authority. Alongside the full Local Energy Guide, a Step-by-Step Guide to Local Energy has also been produced.

ENERGY HUBS

The Local Energy Guide is provided for the benefit of local authorities (LAs) and other public or private bodies looking to develop local energy projects. It includes an update on the status of the sector and explains where and how interested parties can get involved, along with the benefits and risks to potential market participants.

The South West Energy Hub is one of five regional bodies established by BEIS to support the local energy agenda across England.

PIXIE ENERGY

Pixie Energy is part of Cornwall Insight Group. It is tasked with developing innovation ideas and initiatives, focusing on place-bounded, decentralised energy markets, and local transformation through innovative new commercial models. Through its East Anglian Energy Market Innovation Project, it has built up a comprehensive understanding of all elements of the energy value chain, and delivered projects to clients including investors, developers, generation and storage operators, aggregators, local authorities (LAs), local enterprise partnerships (LEPs), energy networks, energy suppliers, central and devolved government departments, and the energy sector regulator. Its knowledge of the sector is underpinned by a range of subscription reports and consultancy assignments.

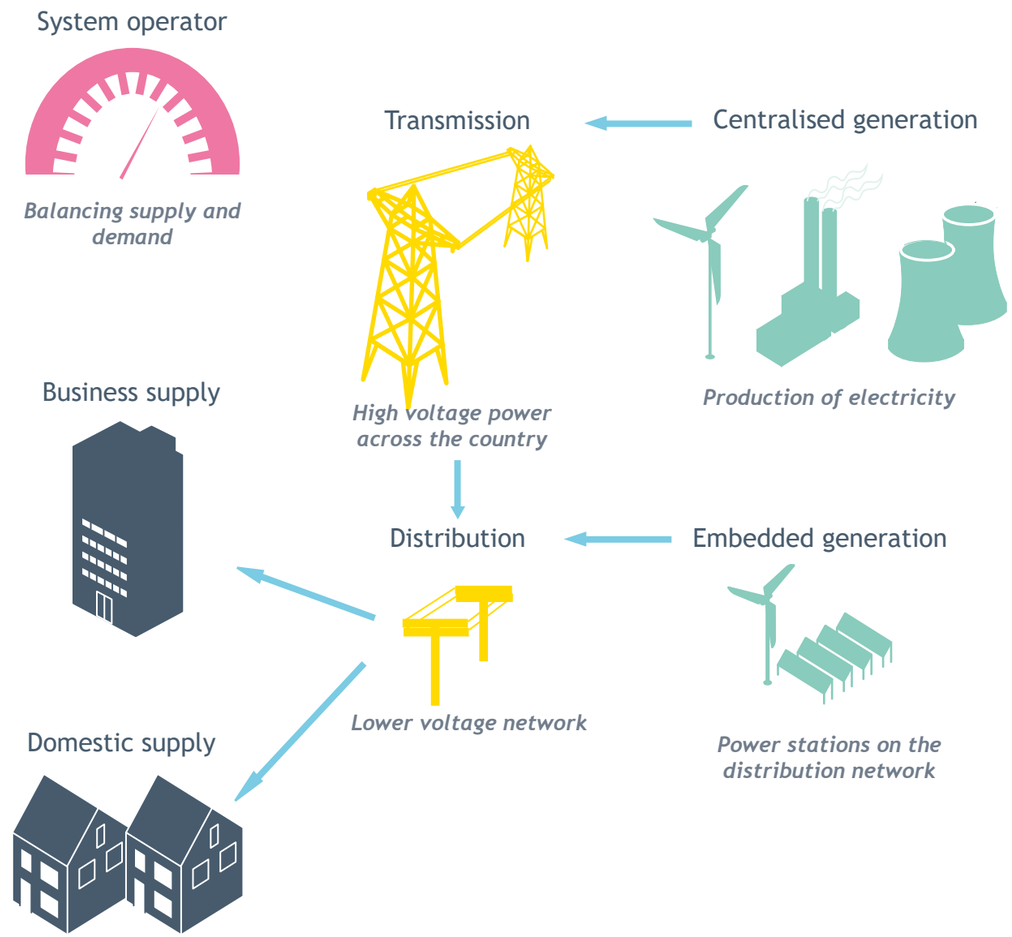
OVERVIEW

OVERVIEW

The GB electricity and gas markets have numerous roles and functions encompassing infrastructure, competitive activities, and regulatory and policy authorities.

A simplified overview of the electricity market roles is shown below in Figure 2. The physical infrastructure of the GB electricity market is made up of sources of energy input (electricity generators) and networks (transmission and distribution) to transport the energy to where it is consumed by final users (demand).

Figure 2: GB electricity physical infrastructure



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PRODUCERS

Put gas into the networks through entry points, typically from UK Continental Shelf production or via liquefied natural gas (LNG) terminals, though increasingly biogases are being injected and hydrogen may be in the future

GENERATORS

Own electricity generating assets and produce electricity onto the public network for transport to customers

TRANSMISSION OWNER (TO)

Own and maintains electricity transmission facilities. This is National Grid TO across all of England and Wales

GAS TRANSPORTER (GT)

Own and maintains the gas transmission pipelines. This is National Grid Gas Transmission in GB

DISTRIBUTION NETWORK OPERATOR (DNO)

Own and maintains the 14 local electricity distribution networks, examples include Western Power Distribution and UK Power Networks

OVERVIEW

GAS DISTRIBUTION NETWORK (GDN)

Own and maintains the eight local gas distribution networks, examples include Cadent and Wales and West Utilities

SHIPPERS

Book capacity on the transmission networks to move energy. The shipper function only exists in the gas market. It books capacity on the networks to move gas to users

SUPPLIERS

Licensed to retail electricity and gas to end consumers. Examples include British Gas, Ovo Energy and Scottish Power

OFGEM

Economic regulator tasked with assessing market power, preventing predatory pricing, assessing the effects of inter-company agreements on competition and ensuring compliance with legal requirements

BEIS

Government department responsible for energy and setting the strategic direction for the sector

SYSTEM OPERATOR (SO)

Singular operators in the electricity and gas markets responsible for ensuring that the transmission systems operate safely in real time, and accounting for any over- or under-delivery of energy compared with trading

ENERGY POLICY

The GB energy markets have seen increasing levels of intervention from policymakers over the decades since liberalisation

The "trilemma", shown in Figure 3, has traditionally been used to present the inherent challenges in setting energy policy.

The interventions most relevant for the purposes of local energy are low-carbon targets, and subsidy mechanisms. Under the latter, note that while there is no longer a subsidy mechanism for small-scale renewable generation, the Renewable Heat Incentive (RHI) continues to offer support to low-carbonheat production.

In a related sector, the Road Transport Fuel Obligation (RTFO) can offer some subsidy to producers of bio gases and liquids from some feedstocks.

We consider the RHI and RTFO further in Section 5.3.

ROUTES TO MARKET FOR WHOLESALE ENERGY

There are four main routes to market for generators:

- *Power purchase agreements (PPAs)*
- *Corporate PPAs (CPPAs)*
- *Self-consumption*
- *Private wire supply*

Power produced by generating stations must be sold to earn revenues. Most local generators will not have sufficient size to warrant interaction with the wholesale energy markets. Therefore most local projects will sell directly to a supplier or "offtaker". Projects can also sell direct to end users (termed "sleeving") but this will still require a supplier to facilitate.

POWER PURCHASE AGREEMENTS (PPAS)

Traditional PPA contracts typically take the form of bilateral agreements between generators and licensed suppliers, sometimes known as offtakers. Agreements usually stipulate:

- 100% of generation output is sold to the supplier
- The supplier has responsibility for trading, notifications and meter registration
- Responsibilities are agreed on forecasting of output from intermittent renewables
- Parties will agree how to account for costs arising from differences between forecast and actual generation
- The benefit share on all revenue streams: wholesale power and embedded benefits

Short term PPAs are often negotiated through brokers, including mechanisms such as NFPA's e-POWER auctions or the Renewable Exchange. However, value retention for generators smaller than 500kW tends to be low. Generators will not produce sufficient power per annum to interest suppliers in directly negotiating a PPA for offtake, though this is beginning to change. This may make securing long-term revenues to enable an investment decision difficult for small-scale generators.

SELF-CONSUMPTION AND PRIVATE WIRE SUPPLY

Consuming the power produced behind the meter can be much more economically efficient than selling to other users. By avoiding the public networks, the generator/consumer avoids network charges and final consumption levies which make up around half of the energy bill. It is important to remember that maximising self-consumption will maximise economic value.

Private wire systems are small local electricity grids, connecting private generation and consumption off the public networks. There are similar savings to self-consumption, though the cost of building and maintaining the private wire has to be considered. A private wire can be used to connect generation to larger consumption sites than might otherwise be possible.

While normally, the distribution and supply of power is a licensed activity, it is possible to use exemptions, especially when working with non-domestic consumers. The value of avoided costs can be shared between the consumer and the generator, benefiting both.

Whenever considering self-consumption or private wire supply, the creditworthiness of the consuming organisation and whether it is likely to exist and require power over the payback period of the generating asset should be considered.

CORPORATE POWER PURCHASE AGREEMENTS

Corporate PPA contracts are tri-party deals between a generator, a consumer and an energy supplier, as shown in Figure 4. Typically, the generator and end user agree a fixed price for a set duration for power output. Most CPPA contracts tend to be a minimum of five years in length to deliver price certainty, a key benefit to the end user.

Inclusion of a supplier is required in a CPPA, taking a role managing central market systems. A supplier is also needed to ensure generation and demand volumes are managed. The supplier will charge a fee for this service, usually as a fixed £/MWh value or a percentage of the agreed power price.

ROUTES TO MARKET FOR WHOLESALE ENERGY

Figure 4: Typical corporate PPA contract structure

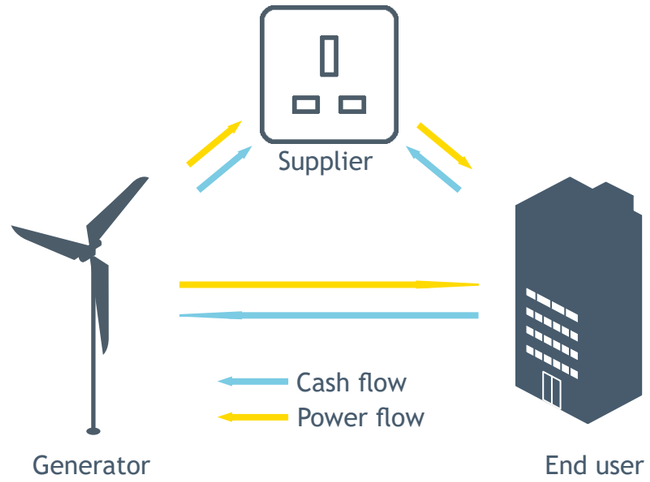
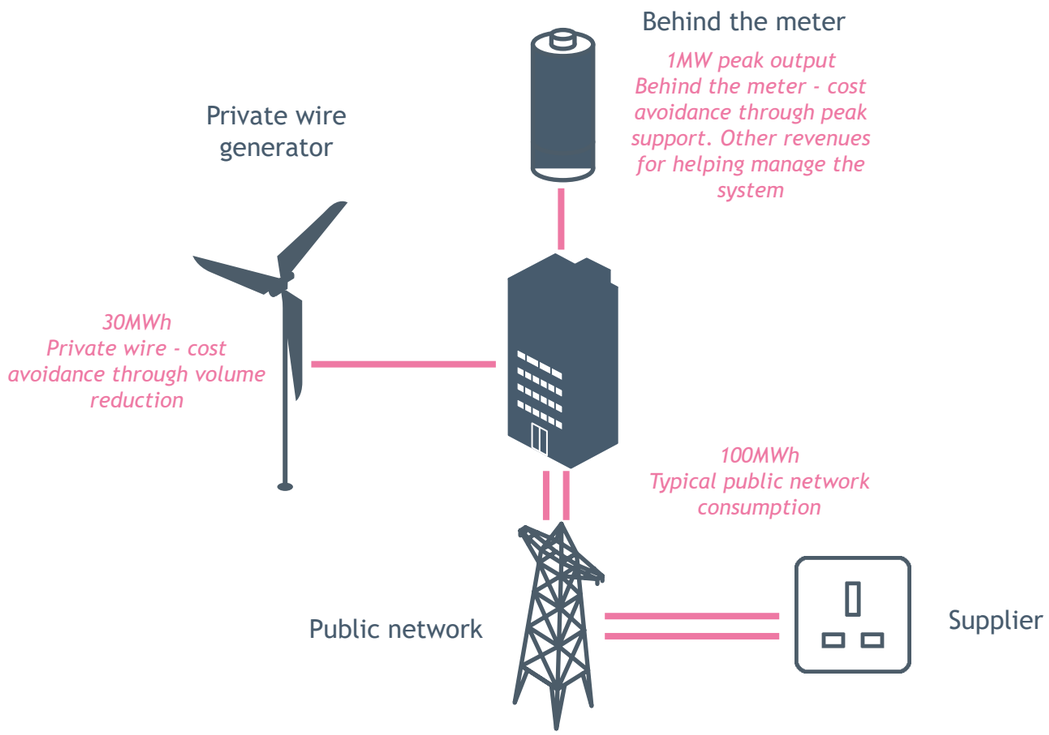


Figure 5: Typical private wire structure



REVENUES

There are five ways of earning revenues from generation

- *Wholesale market revenues*
- *Embedded benefits*
- *Renewable Energy Guarantees of Origin*
- *Balancing Services and flexibility revenues*
- *Subsidies*

Power sold to through PPAs or CPPAs earns revenue from a range of sources. In order to maximise their project's viability, generators should be aware of each of the potential revenue streams outlined further in this section.

WHOLESALE MARKET REVENUES

Wholesale power prices are highly volatile. Figure 13 illustrates the variance over the past four years. Power prices have ranged from £35/MWh to over £65/MWh for year-ahead power and gas – the more stable products. Volatility is much higher in short-term markets. The chart also illustrates the linkage of power and gas prices to oil and coal prices.

This instability of pricing aillustrates the difficulty of building new generation relying solely on wholesale market revenues.

Figure 6: GB wholesale market trends for oil, coal, and year-ahead power and gas

RENEWABLE ENERGY GUARANTEES OF ORIGIN

Renewable Energy Guarantees of Origin (REGO) scheme provides transparency to consumers about the proportion of electricity suppliers source from renewable generation. These guarantees now have some value attached to them, typically between 20p and 40p each in PPAs, and as such represent a modest but potentially growing value stream.

REVENUES

EMBEDDED BENEFITS

Electricity network charges are levied to end users for their use of the electricity networks, via suppliers. These are set on the principle that electricity travels down through the transmission and distribution networks to the meter at the site. Distributed generation, embedded in the local networks, is treated as negative demand at the connection of the distribution to the transmission system. This reduces the supplier's bill for network charges, providing "embedded benefits" which can be significant for some generators.

These benefits are currently under review by Ofgem in its Targeted Charging Review Significant Code Review (TCR SCR) and the Forward-Looking Charges and Network Access SCR (FLCNA SCR). At a high level:

- Balancing Services benefits of around ~£2.50/MWh are likely to be lost or become a charge for embedded generation
- Benefits from distribution charging may be changed, with charging on a more granular and potentially cost-reflective basis
- Benefits for transmission charges could be reformed further

Overall the changes represent a significant risk to revenues for embedded generation.

BALANCING SERVICES AND FLEXIBILITY

There are a range of potential balancing services that a flexible asset can bid to provide to the ESO or local DNO. These services are typically procured by National Grid ESO through auctions or tender rounds. The services include:

- Frequency Response services, which responsed quickly to changes in frequency and supports the network for a short time
    - Suitable technologies include pumped hydro, batteries and demand-side response
    - Prices per MWh are generally higher, but fewer MWh will be called on
- Reserve services are slower to respond to need, but provide support on an ongoing basis
    - Suitable technologies include gas reciprocating engines and turbines and other fuelled plant like coal
    - Prices per MWh are generally lower, but more MWh will be called on

Intermittent renewable generators will seldom be suitable to deliver balancing services, though local energy schemes incorporating batteries, fuelled generation such as biomass generators or Combined Heat and Power (CHP) engines, or flexible consumption like heat pumps and EV chargers should consider offering services.

Though small generators will often struggle to access these revenue streams, aggregators exist to help parties participate, control their assets, and optimise returns.

REVENUES

SUBSIDY

Subsidies for small-scale low carbon generation in GB have largely come to an end. The exceptions are the RHI, which provides subsidy for renewable heat production, and the RTFO, which subsidises low-carbon transport fuel.

The Smart Export Guarantee (SEG) is not a subsidy but is discussed here as it provides a similar route-to-market and guarantee of an offtake as a subsidy might.

ROAD TRANSPORT FUEL OBLIGATION

The Road Transport Fuel Obligation (RTFO) requires fuel suppliers to ensure that at least 5% of the fuel which they provide is renewable. Renewable fuels include bioliquids and gas, including biomethane. This means biomethane – production of which can itself benefit from RHI subsidy – has an added value to fuel suppliers, to meet their obligations.

This opportunity may grow if greater proportions of the road transport fleet are powered by gas in the future, and if the government increases the percentage of road transport fuel which is required to be renewable. It may shrink if proposed amendments to the scheme which will grant certificates for electricity used to charge electric vehicles are implemented.

RENEWABLE HEAT INCENTIVE

The RHI is a government incentive introduced to encourage the roll-out of renewable heat. The Renewable Heat Incentive is split by application; domestic and non-domestic. The schemes have separate tariffs, joining conditions, rules and application processes. Ofgem administers both schemes in GB.

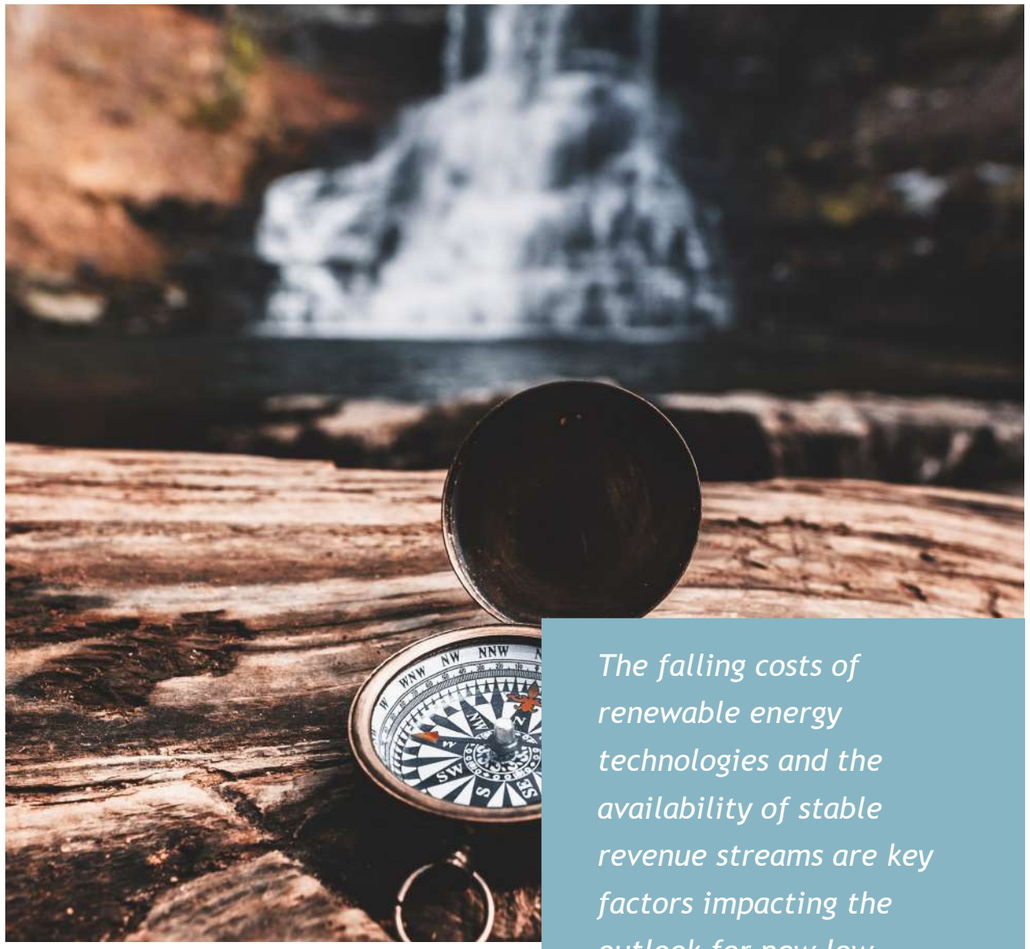
The incentive provides payments based on installation of heat pumps, solar thermal panels, biomass boilers, stoves and CHP engines, geothermal energy and energy from waste. It also

SMART EXPORT GUARANTEE

The SEG was introduced to create a route to market for small-scale low-carbon generators to sell power. It requires large and medium energy suppliers to offer to purchase power from renewable generators under 5MW in size, where the export is smart metered. The SEG, which will commence from January 2020, mandates suppliers above a certain size to offer terms to small generating stations. They must offer tariffs above 0p/kWh."

It is too early to say what prices will be offered, but Octopus Energy has offered a “SEG-like” tariff at 5.5p/kWh and the Solar Trade Association provides a regularly updated League Table here.

OUTLOOK FOR LOW-CARBON TECHNOLOGY INVESTMENT



The falling costs of renewable energy technologies and the availability of stable revenue streams are key factors impacting the outlook for new low-carbon power project investment.

Technology costs

The cost of building low carbon projects has fallen dramatically in recent years, and is expected to continue to do so. The levelised cost of energy (LCOE) is a standard benchmark for assessing the costs of power generation over the lifetime of a scheme. BEIS defines levelised cost as "...the average cost of the lifetime of the plant per MWh of electricity generated. " It is calculated by dividing the total lifetime construction and operational costs of the generation plant, by the total lifetime volume of electricity generated by the plant.

Note that the data for many available sources is based on utility scale installations. As a comparable benchmark, Lazard's latest annual LCOE shows a continuing decline in the cost of generation, particularly at a utility scale, presented in Figure 5 below.

NETWORK CHARGING REFORMS

Ofgem is undertaking two network charging reviews, the TCR SCR and the FLNAC SCR. Both have significant implications for network access rights and charging policies. The TCR SCR focuses on the recovery of residual charges, the sunk costs of the network, and proposes to recover these charges on a fixed or capacity basis going forwards. These charges can equate to 80% of the total cost of networks and changes are likely to reduce the benefit of generation behind the meter. Changes are likely to be implemented in April 2022.

The FLNA SCR will impact on embedded generation and demand tariffs, as well as fees for network access. This workstream is less well developed and proposals have not yet been finalised.

Ofgem and BEIS are undertaking a number of workstreams which could lead to fundamental changes, looking to improve efficiency of industry processes, as well as data quality, reduce prescription to permit greater freedom for suppliers, and ensure that regulation is fit for purpose moving forwards to allow for market innovation.

SMART METERING AND HH SETTLEMENT

Suppliers are responsible for the accurate metering of customer premises and are required to install smart meters in all homes and businesses. Smart meters will enable half-hourly (HH) settlement of all electricity users in GB, enabling more accurate and faster settlement of electricity consumption for all users.

This will enable suppliers to offer customers a range of energy tariffs including time of use pricing or dynamic tariffs that charge different rates across the day, which could create new values and enable new business models.

DNO TO DSO TRANSITION

Distribution networks are running projects to investigate and procure flexibility services, to help them better manage their networks in a transition to a Distribution System Operator (DSO) model.

This could reduce costs to consumers by paying generators, consumers and storage providers to change the ways in which they use and produce energy.

Distribution networks are procuring services on a regional basis and a controllable flexible asset can earn additional revenues by taking part.

SUPPLIER HUB

Ofgem is considering if the supplier hub concept, which places the supplier at the heart of the market, is still fit for purpose with new actors and technology emerging in the market.

Following a call for evidence, the regulator has determined that the principle needs consideration and that it will assess and redesign the retail energy market to ensure best consumer outcomes.

CODE GOVERNANCE REVIEW

Ofgem is reviewing the process for making amendments to the energy codes. Codes are managed in a number of different ways and it can be hard for market participants to keep track of code change and modifications, especially for smaller parties with limited resources.

This can result in poor outcome for these parties, as their views and the interests of their customers are not represented. The code governance review aims to standardise how codes operate and create oversight, to help drive all codes in the same strategic direction.